



**Testimony in Support of SB 300  
Pesticides – Use of Chlorpyrifos - Prohibition**

**Education, Health, and Environmental Affairs Committee  
Maryland State Senate  
February 11, 2020**

Chairman Pinsky and Members of the Committee,

Thank you for the opportunity to testify. My name is Tyler Smith. I am a scientist appearing on behalf of Earthjustice, the largest nonprofit, environmental law organization in the country. Earthjustice strongly supports **SB 300**, which would ban chlorpyrifos in Maryland.

**EPA Proposed Banning Chlorpyrifos**

In 2015, EPA concluded that using chlorpyrifos on food does not meet the federal safety standard of a “reasonable certainty of no harm” and proposed a ban.<sup>1</sup> This ban would have eliminated nearly all uses of this pesticide across the country.

EPA’s conclusion is consistent with decades of scientific research. Indeed, almost 20 years ago, EPA banned home and garden uses of chlorpyrifos because studies indicated harm to children.<sup>2</sup> But at that time, EPA allowed the continued use of chlorpyrifos on our food and for other applications, such as pest control on turf grass at golf courses.

After years of further study, EPA’s scientists concluded that there is no safe use of chlorpyrifos.<sup>3</sup> They reviewed thousands of studies and examined the hundreds of ways that chlorpyrifos may be used under current law. They found that all of these uses result in unsafe levels of exposure — even when handlers follow pesticide labels and wear personal protective equipment.<sup>4</sup>

EPA’s scientists also found that the continued use of chlorpyrifos on food can harm those who eat the food. The uses on food expose infants to 93 times what the agency considers safe and expose children 1 to 2 years of age to 140 times what the agency considers safe.<sup>5</sup> Moreover, according to agency, there is no safe level of chlorpyrifos in drinking water.<sup>6</sup>

EPA's scientists likewise found that using chlorpyrifos on turf grass at golf courses puts the adults and children who visit these courses at risk.<sup>7</sup> Their analysis indicates that exposures to chlorpyrifos on golf courses are hundreds of times what the agency believes is safe.<sup>8</sup>

### **EPA's Proposal to Ban Chlorpyrifos Followed a Rigorous Process**

EPA's conclusions followed years of careful study. The evidence that exposure to chlorpyrifos harms children<sup>9</sup> was reviewed again and again by EPA's scientists and by independent experts who serve on the agency's Scientific Advisory Panel. The agency and the Panel found that the weight of the evidence — that is, the best available science weighed and judged by experts — supports the conclusion that chlorpyrifos is a neurodevelopmental toxicant. Specifically:

- In 2012, the Panel concluded that epidemiologic and animal studies “suggest that chlorpyrifos can affect neurodevelopment at levels lower than those associated with” acute poisoning.<sup>10</sup>
- In 2016, the Panel stated, “The Panel agrees that both epidemiology and toxicology studies suggest there is evidence for adverse health outcomes associated with chlorpyrifos exposures below levels that result in” acute poisoning.<sup>11</sup>
- In 2016, EPA wrote, “The agency agrees with the 2016 [Panel] (and previous [Panels]) that there is a potential for neurodevelopmental effects associated with chlorpyrifos exposure to occur at levels below” those associated with acute poisoning.<sup>12</sup>

In short, even low levels of exposure to chlorpyrifos can harm the developing brain.

The Panel praised a study of chlorpyrifos exposure in children conducted by scientists at Columbia University. The Panel stated, “the Columbia study is the most robust and appropriate for informing risk assessment”, “the Columbia study is epidemiologically sound”, and “the Columbia study was indeed quite strong and provided extremely valuable information.”<sup>13</sup>

The Panel also concluded that the results of the Columbia study were generally consistent with those reached by other scientists across the country. The Panel stated that, overall, epidemiologic studies have found “consistent associations relating exposure measures to abnormal reflexes in the newborn, pervasive development disorder at 24 or 36 months, mental development at 7-9 years, and attention and behavior problems at 3 and 5 years of age.”<sup>14</sup>

Yet, despite these studies and the conclusions of experts, in March 2017, the Trump administration announced that it would not finalize the proposed ban.<sup>15</sup> The administration did not present any new scientific evidence. It disregarded the best available science and left millions of people exposed to a toxic chemical.

### **Any Possible Federal Action to Ban Chlorpyrifos Has Been, and Likely Will Continue to be, Delayed by Litigation**

A coalition of environmental, health, labor, and civil rights organizations has sued the Trump administration, challenging its refusal to ban chlorpyrifos.<sup>16</sup> In August 2018, a federal appeals court ordered the administration to ban all uses of chlorpyrifos, but the agency appealed further.<sup>17</sup> The litigation is ongoing and may continue for years.

For more than two years, EPA political appointees did not even try to dispute the conclusions reached by agency scientists and instead based their legal arguments on unrelated procedural issues. As a federal court observed in August 2018, “The EPA presents no arguments in defense of its decision. Accordingly, the EPA has forfeited any merits-based argument.”<sup>18</sup>

There simply is no debate about the science of chlorpyrifos — except from the people who make money off chlorpyrifos. But unless Maryland takes action, chlorpyrifos will remain on the market and people here will remain exposed while the federal litigation continues. Given the tactics available to the Trump administration, it may take years to resolve all of the potential litigation even if the plaintiffs ultimately prevail.

### **Maryland Farmers Have Less Toxic Alternatives**

Maryland farmers and businesses have alternatives to chlorpyrifos. These include less toxic options for controlling borers and spotted lantern fly at orchards, cabbage maggots and onion maggots at vegetable farms, and annual bluegrass weevil on turf grass at golf courses.<sup>19</sup> To the extent a ban would present challenges to growers, the best response is to assist their transition to safer production methods, not to continue jeopardizing children’s health.

### **Maryland Should Ban Chlorpyrifos Now**

Frankly, we should not be here today. In 2015, EPA concluded that chlorpyrifos did not meet the federal safety standard and proposed to ban this toxic pesticide. The agency should have finalized the proposed ban, and that should have been the end of it.

Politics, pure and simple, stands in the way. It is only because the Trump administration has abandoned science and abdicated its responsibility to public health that Maryland and other states now must consider bills to prohibit the use of chlorpyrifos. But we *should* take action.

**SB 300** would prohibit the use of chlorpyrifos and make this state a safer place for kids to live. I urge your support and am happy to answer your questions. Thank you.

## References

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<sup>1</sup> EPA wrote, “At this time, the agency is unable to conclude that the risk from aggregate exposure from the use of chlorpyrifos meets the safety standard of [a “reasonable certainty of no harm” contained in] section 408(b)(2) of the Federal Food, Drug, and Cosmetic Act (FFDCA). Accordingly, EPA is proposing to revoke all tolerances for chlorpyrifos.” Chlorpyrifos; Tolerance Revocations, 80 Fed. Reg. 69,080 (November 6, 2015), <https://www.federalregister.gov/documents/2015/11/06/2015-28083/chlorpyrifos-tolerance-revocations>.

<sup>2</sup> As EPA explained, “This action comes after completing the most extensive scientific review of the potential hazards from a pesticide ever conducted. This action -- the result of an agreement with the manufacturers -- will significantly minimize potential health risks from exposure to Dursban, also called chlorpyrifos, for all Americans, especially children.” EPA, Dursban Announcement (2000), <https://archive.epa.gov/epa/aboutepa/dursban-announcement.html>.

<sup>3</sup> EPA wrote, “[A]ll agricultural occupational handler scenarios, all primary seed treatment handler scenarios, and all secondary seed treatment (planter) scenarios are of concern with label-specified and maximum levels of personal protective equipment (PPE) or engineering controls[.]” EPA, Chlorpyrifos: Revised Human Health Risk Assessment for Registration Review 7 (2016), <https://www.regulations.gov/document?D=EPA-HQ-OPP-2015-0653-0454>.

<sup>4</sup> *Id.*

<sup>5</sup> *Id.* at 23.

<sup>6</sup> *Id.* at 24.

<sup>7</sup> EPA wrote, “All residential post-application exposure scenarios assessed for playing golf on chlorpyrifos-treated courses, including all relevant populations and in consideration of all TTR data state sites, result in risks of concern (i.e., MOEs are < 100).” EPA, *supra* note 3 at 27.

<sup>8</sup> *Id.* In EPA’s risk assessment, the factor by which exposure at a golf course exceeded the safe level ranged from 373 to 923. The factor may be calculated from inputs in EPA’s risk assessment as follows: Factor = Dose / (Point of Departure / Uncertainty Factor), where Dose is given by Table 7.2.2, Point of Departure is given by Table 5.3.3.3, and Uncertainty Factor is stated on page 5.

<sup>9</sup> For recent reviews of the evidence that chlorpyrifos harms children, see Irva Hertz-Picciotto, Jennifer B. Sass, Stephanie Engel, *et al.*, Organophosphate Exposures During Pregnancy and Child Neurodevelopment: Recommendations for Essential Policy Reforms, 15 *PLoS Medicine* e1002671 (2018), <https://journals.plos.org/plosmedicine/article/file?id=10.1371/journal.pmed.1002671&type=printable>; Maria Teresa Munoz-Quezada, Boris A. Lucero, Dana B. Barr, *et al.*, Neurodevelopmental Effects in Children Associated with Exposure to Organophosphate Pesticides: A Systematic Review, 39 *NeuroToxicology* 158 (2013), <https://www.sciencedirect.com/science/article/pii/S0161813X13001514>.

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<sup>10</sup> EPA, Transmittal of Meeting Minutes of the FIFRA Scientific Advisory Panel Meeting held April 10-12, 2012 on “Chlorpyrifos Health Effects” 53 (2012), <https://www.epa.gov/sites/production/files/2015-06/documents/041012minutes.pdf>.

<sup>11</sup> EPA, Transmittal of Meeting Minutes of the April 19-21, 2016 FIFRA SAP Meeting Held to Consider and Review Scientific Issues Associated with “Chlorpyrifos: Analysis of Biomonitoring Data” 18 (2016), <https://www.epa.gov/sites/production/files/2015-06/documents/041012minutes.pdf>.

<sup>12</sup> Chlorpyrifos; Tolerance Revocations; Notice of Data Availability and Request for Comment, 81 Fed. Reg. 81,049, 81,050 (November 17, 2016), <https://www.federalregister.gov/documents/2016/11/17/2016-27552/chlorpyrifos-tolerance-revocations-notice-of-data-availability-and-request-for-comment>.

<sup>13</sup> EPA, Transmittal of Meeting Minutes of the FIFRA Scientific Advisory Panel Meeting Held September 16-18, 2008 on the Agency’s Evaluation of the Toxicity Profile of Chlorpyrifos 31, 32, 35 (2012), <https://www.regulations.gov/document?D=EPA-HQ-OPP-2008-0274-0064>.

<sup>14</sup> EPA, *supra* note 10 at 17.

<sup>15</sup> Eric Lipton, “E.P.A. Chief, Rejecting Agency’s Science, Chooses Not to Ban Insecticide,” *The New York Times* (March 29, 2017), <https://www.nytimes.com/2017/03/29/us/politics/epa-insecticide-chlorpyrifos.html>.

<sup>16</sup> The organizations are: Pineros y Campesinos Unidos del Noroeste, League of United Latin American Citizens, United Farm Workers, Farmworker Association of Florida, Labor Council for Latin American Advancement, Farmworker Justice, GreenLatinos, National Hispanic Medical Association, Learning Disability Association of America, California Rural Legal Assistance Foundation, Pesticide Action Network North America, and Natural Resources Defense Council. For more information, *see* Earthjustice, Groups Appeal EPA’s Refusal to Ban Dangerous Pesticide (June 6, 2017), <https://earthjustice.org/news/press/2017/groups-appeal-epa-s-refusal-to-ban-dangerous-pesticide>.

<sup>17</sup> League of United Latin American Citizens et al. v. Wheeler (2018), <https://earthjustice.org/sites/default/files/files/chlorpyrifos%20opinion%208.9.2018.pdf>.

<sup>18</sup> *Id.* at 30.

<sup>19</sup> Please contact me for a summary of information obtained from state extensions in the Northeast.

DECEMBER 10, 2019  
Albany, NY

# Governor Cuomo Directs DEC to Ban the Use of Chlorpyrifos

## DEC Will Take Immediate Action to Ban Aerial Use of Chlorpyrifos

Regulations to Ban Chlorpyrifos Will be in Effect by December 2020 for all Uses Except Spraying Apple Tree Trunks, Which Will be Banned by July 2021

New Restrictions on Pesticide Will Protect New Yorkers from Significant Adverse Public Health Impacts, Especially for Children

Governor Andrew M. Cuomo today directed DEC to take immediate action to ban aerial use of chlorpyrifos. DEC will also have regulations in place to ban chlorpyrifos for all uses, except spraying apple tree trunks, by December 2020. Chlorpyrifos will be banned for all uses by July 2021. These actions will protect New Yorkers from significant adverse public health impacts, especially for children.

"Chlorpyrifos is a pesticide that has the potential to cause serious health problems in people who ingest it," **Governor Cuomo said**. "I am directing the state department of environmental conservation to ban the use of this toxic substance to help ensure New York families aren't needlessly exposed to a dangerous chemical."

While organophosphate pesticide chlorpyrifos has been banned for residential use since 2001, it is still currently approved for use in fifty different products, the majority of which are registered for use in agricultural production. The largest agricultural market for chlorpyrifos in terms of total pounds of active ingredient is corn. It is also used on soybeans, fruit and nut trees, Brussels sprouts, broccoli, and cauliflower, seed treatments, as well as other row crops. Non-agricultural uses include golf courses, turf, green houses, and on non-structural wood treatments such as utility poles and fence posts. Scientific research has shown that chlorpyrifos can harm the development of nervous systems of infants and young children. Prenatal exposure to organophosphates can result in diminished cognitive ability, delays in motor development and Attention Deficit/Hyperactivity Disorder (ADHD).

Chlorpyrifos is in some cases the only product available labeled for use against certain pests. It is particularly effective against the American plum borer and rosy apple aphid. Chlorpyrifos can also be used in rotation with other methods of pest management, such as treated seeds, as a means to manage pesticide resistance. As New York and nearby states are infiltrated by invasive species, such as the black stem borer, pest management tools are needed to prevent their spread and the ensuing damage.

The application of pesticides must be done in a manner that is protective of public health and the environment and New York State is one of a few states in the country with a regulatory program designed specifically to review and register pesticides, implement regulatory controls, and enforce worker protection standards. State law affords DEC with a broad range of regulatory powers including the ability to restrict the use of a pesticide to certain crops, limit application to specific conditions, and revocation of a product's registration.

Contact the Governor's Press Office  
Albany: (518) 474 - 8418  
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[Press.Office@exec.ny.gov](mailto:Press.Office@exec.ny.gov)



Agreement Reached to End Sale of Chlorpyrifos in California by February 2020  
*Use in agriculture to be prohibited after next year*  
*Alternatives to Chlorpyrifos Work Group to hold public meeting in January*

**For Immediate Release:**

October 9, 2019

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**SACRAMENTO** – The California Environmental Protection Agency announced today that virtually all use of the pesticide chlorpyrifos in California will end next year following an agreement between the Department of Pesticide Regulation (DPR) and pesticide manufacturers to withdraw their products.

“For years, environmental justice advocates have fought to get the harmful pesticide chlorpyrifos out of our communities,” said Governor Gavin Newsom. “Thanks to their tenacity and the work of countless others, this will now occur faster than originally envisioned. This is a big win for children, workers and public health in California.”

“The swift end to the sale of chlorpyrifos protects vulnerable communities by taking a harmful pesticide off the market,” said California Secretary for Environmental Protection Jared Blumenfeld. “This agreement avoids a protracted legal process while providing a clear timeline for California farmers as we look toward developing alternative pest management practices.”

Earlier this year, DPR announced it was acting to ban use of chlorpyrifos by canceling the pesticide’s product registrations. The decision follows [mounting evidence](#) that chlorpyrifos is associated with serious health effects in children and other sensitive populations at lower levels of exposure than previously understood, including impaired brain and neurological development.

At the same time, DPR and the California Department of Food and Agriculture ([CDFA](#)) have established a cross-sector working group to identify, evaluate and recommend safer, more sustainable pest management alternatives to chlorpyrifos. It will hold its first meeting this month and will hold three public workshops beginning in January.

The agreement with Dow AgroSciences and other companies means that use of chlorpyrifos will end sooner than anticipated had the companies pursued administrative hearings and potential appeals process, which could have taken up to two years. Under the settlement, the companies agreed that:

- All sales of chlorpyrifos products to growers in California will end on Feb. 6, 2020.
- Growers will no longer be allowed to possess or use chlorpyrifos products in California after Dec. 31, 2020.
- Until then, all uses must comply with existing restrictions, including a ban on aerial spraying, quarter-mile buffer zones and limiting use to crop-pest combinations that lack alternatives. DPR will support aggressive enforcement of these restrictions.

To ensure consistency for growers and for enforcement purposes, DPR is applying the terms and deadlines in the settlements to seven other companies that are not part of the settlement agreement but are subject to DPR’s cancellation orders.



A few products that apply chlorpyrifos in granular form, representing less than one percent of agricultural use of chlorpyrifos, will be allowed to remain on the market. These products are not associated with detrimental health effects. DPR will continue to monitor for any exposures associated with these products. The development of safe, more sustainable alternatives to chlorpyrifos is being supported through the current state budget, which appropriates more than \$5 million in grant funding for the purpose.

- DPR will award [more than \\$2.1 million in grants to](#) fund projects that identify, develop, and implement safer, practical, and sustainable pest management alternatives to chlorpyrifos.
- CDFA will award [approximately \\$2 million in grants](#) to expand outreach about innovative, biologically integrated farming systems that reduce chemical insecticide inputs. Crops that have used chlorpyrifos will be a priority.
- CDFA will also fund approximately \$1.5 million in research to develop alternatives to chlorpyrifos that provide safer, more sustainable pest management solutions.

Quick facts:

- Chlorpyrifos is used to control pests on a variety of crops, including alfalfa, almonds, citrus, cotton, grapes and walnuts. It has declined in use over the past decade as California growers have shifted to safer alternatives.
- Use of the pesticide dropped more than 50 percent from two million pounds in 2005 to just over 900,000 pounds in 2017.
- In 2015, DPR designated chlorpyrifos as a “restricted material” that requires a permit from the county agricultural commissioner for its application. In addition, application of chlorpyrifos must be recommended by a licensed pest control advisor and supervised by a licensed certified applicator.
- Following DPR’s designation of chlorpyrifos as a toxic air contaminant in 2018, DPR recommended that county agricultural commissioners apply additional permit restrictions, including a ban on aerial spraying, quarter-mile buffer zones and limiting use to crop-pest combinations that lack alternatives.

###

February 10, 2020

The Honorable Paul G. Pinsky  
Senator  
Miller Senate Office Building, 2 West Wing  
11 Bladen Street  
Annapolis, MD 21401

The Honorable Kumar P. Barve  
Delegate  
House Office Building, Room 251  
6 Bladen Street  
Annapolis, MD 21401

**Re: SB 300 / HB 229; Pesticides – Use of Chlorpyrifos – Prohibition  
Scientific Evidence of the Relationship Between Prenatal Exposure to Chlorpyrifos and  
Neurodevelopmental Harm in Children**

Dear Chairman Pinsky and Chairman Barve,

We are scientists and health professionals with expertise in toxic chemicals that harm the developing brain. Many of us are affiliated with Project TENDR, a collaboration of leading scientists, health professionals, and children's health and environmental advocates who came together out of concern over the substantial evidence linking toxic chemicals to neurodevelopmental disorders, such as autism spectrum disorder, attention deficits, hyperactivity, intellectual disability, and learning disorders.<sup>1</sup>

In 2016, Project TENDR published a consensus statement that reviewed the scientific evidence and identified organophosphate pesticides, such as chlorpyrifos, as prime examples of chemicals that contribute to intellectual impairments and specific neurodevelopmental disorders.<sup>2</sup> There is clear evidence that the continued use of chlorpyrifos is harmful to brain development, with persistent consequences.

Many studies in the United States and other countries, spanning diverse populations in both urban and agricultural settings, have linked low-level exposure to chlorpyrifos and other organophosphates during pregnancy with poorer cognitive, behavioral, and social development in children.<sup>3,4,5</sup> In one review, adverse effects on neurodevelopment were seen in all but one of the 27 studies evaluated.<sup>6</sup>

The toxic effects of organophosphate pesticides include abnormal reflexes in newborns; mental and psychomotor delays in preschoolers; and decreases in working and visual memory, processing speed, verbal comprehension, perceptual reasoning, and IQ in elementary school-age children. These pesticides are associated with symptoms or diagnoses of attention-deficit/hyperactivity disorder (ADHD) and autism spectrum disorder. A study has identified changes in the brain structure of children exposed to chlorpyrifos in the womb, and these changes are consistent with neurodevelopmental deficits reported previously.<sup>7</sup> In many of these studies, there was no evidence of a threshold or "safe" level of exposure.

In addition to the epidemiologic findings in children, effects on cognition, motor activity, and social behaviors were repeatedly demonstrated in rodents dosed with low levels of chlorpyrifos and other organophosphates in early life.<sup>8,9</sup> The weight of the scientific evidence clearly indicates that chlorpyrifos is a neurodevelopmental toxicant.

Importantly, the developmental toxicity of chlorpyrifos occurs at levels of exposure that do not cause acute poisoning.<sup>10</sup> The absence of poisoning symptoms does *not* mean that neurologic damage has not occurred.<sup>11</sup> As explained above, the developmental effects do not manifest until months or years after prenatal exposure. The evidence therefore indicates that chlorpyrifos can interfere with brain development at levels previously thought to be safe.

In 2016, US EPA concluded that exposure to chlorpyrifos from food or drinking water could lead to unacceptably high exposures and determined that some reproductive-aged women, infants, and children consume levels of chlorpyrifos on food that are substantially above what the agency deemed an acceptable level for these vulnerable life stages.<sup>12</sup> The agency reviewed hundreds of uses of chlorpyrifos and determined that all of them could result in unsafe exposures for agricultural workers.<sup>13</sup>

US EPA concluded that chlorpyrifos does not meet the federal safety standard of a “reasonable certainty of no harm” and proposed banning uses of chlorpyrifos on food crops.<sup>14</sup> This would have eliminated nearly all of the remaining uses of this pesticide. However, in March 2017, despite the overwhelming evidence of harm and US EPA’s own conclusions, the Trump administration announced that it would not ban any uses of chlorpyrifos.<sup>15</sup> It is unfortunate that US EPA did not finalize the proposed ban. However, states can act to protect children where the federal government has stalled.

For additional information, please see a review of the scientific evidence that organophosphates harm child neurodevelopment, which was published in October 2018 by eight scientists affiliated with Project TENDR.<sup>16</sup> This letter draws primarily from that review. If you have any questions, please contact Maureen Swanson, MPA, Co-Director, Project TENDR, at [swanson@thearc.org](mailto:swanson@thearc.org).

Sincerely,

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## References

- <sup>1</sup> For additional information on Project TENDR, see <http://projecttendr.com>.
- <sup>2</sup> Bennett D, Bellinger DC, Birnbaum LS, Bradman A, Chen A, Cory-Slechta DA, et al. Project TENDR: Targeting Environmental Neuro-Developmental Risks The TENDR Consensus Statement. *Environ Health Perspect.* 2016; 124(7):A118–22. <https://doi.org/10.1289/EHP358>.
- <sup>3</sup> Gonzalez-Alzaga B, Lacasana M, Aguilar-Garduno C, Rodriguez-Barranco M, Ballester F, Rebagliato M, et al. A systematic review of neurodevelopmental effects of prenatal and postnatal organophosphate pesticide exposure. *Toxicol Lett.* 2014; 230(2):104–21. <https://doi.org/10.1016/j.toxlet.2013.11.019>.
- <sup>4</sup> Koureas M, Tsakalof A, Tsatsakis A, Hadjichristodoulou C. Systematic review of biomonitoring studies to determine the association between exposure to organophosphorus and pyrethroid insecticides and human health outcomes. *Toxicol Lett.* 2012; 210(2):155–68. <https://doi.org/10.1016/j.toxlet.2011.10.007>;
- <sup>5</sup> Munoz-Quezada MT, Lucero BA, Barr DB, Steenland K, Levy K, Ryan PB, et al. Neurodevelopmental effects in children associated with exposure to organophosphate pesticides: a systematic review. *Neurotoxicology.* 2013; 39:158–68. <https://doi.org/10.1016/j.neuro.2013.09.003>.
- <sup>6</sup> *Id.*
- <sup>7</sup> Virginia A. Rauh, Frederica P. Perera, Megan K. Horton, Robin M. Whyatt, Ravi Bansal, Xuejun Hao, et al. Brain anomalies in children exposed prenatally to a common organophosphate pesticide. *Proc Natl Acad Sci U S A.* 2012;109(20):7871–6. Available from: <https://doi.org/10.1073/pnas.1203396109>.
- <sup>8</sup> U.S. EPA. EPA Revised Human Health Risk Assessment on Chlorpyrifos. December 2014. Docket ID EPA-HQ-OPP-2008-0850. Available from: <http://www.epa.gov/ingredients-used-pesticide-products/revised-human-health-risk-assessment-chlorpyrifos>.
- <sup>9</sup> Abreu-Villaca Y, Levin ED. Developmental neurotoxicity of succeeding generations of insecticides. *Environ Int.* 2017; 99:55–77. Epub 2016/12/03. <https://doi.org/10.1016/j.envint.2016.11.019>.
- <sup>10</sup> U.S. EPA. Chlorpyrifos: Revised Human Health Risk Assessment for Registration Review. US Environmental Protection Agency Washington, DC; 2016. Document ID: EPA-HQ-2015-0653-0454. Available from: <https://www.regulations.gov/document?D=EPA-HQ-OPP-2015-0653-0454>.
- <sup>11</sup> Starks SE, Hoppin JA, Kamel F, Lynch CF, Jones MP, Alavanja MC, et al. Peripheral nervous system function and organophosphate pesticide use among licensed pesticide applicators in the Agricultural Health Study. *Environ Health Perspect.* 2012; 120(4):515–20. Epub 2012/01/21. <https://doi.org/10.1289/ehp.1103944>.
- <sup>12</sup> U.S. EPA, *supra* note 10.
- <sup>13</sup> *Id.*
- <sup>14</sup> U.S. EPA. Federal Register for Friday, November 6, 2015 (FR 69079) (FRL-9935-92) EPA-HQ-OPP-2015-0653; Chlorpyrifos; Tolerance Revocations. US Environmental Protection Agency. Washington, DC; 2015. Docket ID EPA-HQ-OPP-2015-0653. Available from: <https://www.federalregister.gov/documents/2015/11/06/2015-28083/chlorpyrifos-tolerance-revocations>.
- <sup>15</sup> Lipton E. E.P.A. Chief, Rejecting Agency’s Science, Chooses Not to Ban Insecticide. *The New York Times.* 29 March 2017 <https://www.nytimes.com/2017/03/29/us/politics/epa-insecticide-chlorpyrifos.html> Cited 2 April 2019.



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<sup>16</sup> Hertz-Picciotto I, Sass JB, Engel S, Bennett DH, Bradman A, Eskenazi B, et al. (2018) Organophosphate exposures during pregnancy and child neurodevelopment: Recommendations for essential policy reforms. PLoS Med 15(10):e1002671. <https://doi.org/10.1371/journal.pmed.1002671>.