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Statement of
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in Support of
HB229, Pesticides - Use of Chlorpyrifos – Prohibition
before the
Environment and Transportation Committee
Maryland House of Delegates
Annapolis, Maryland

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Honorable members of the Committee. Thank you for the opportunity to provide input to the Maryland House of Delegates Environment and Transportation Committee. On behalf of our members and supporters who are residents of the state of Maryland, we urge the passage of HB229 to stop the use of the highly neurotoxic insecticide chlorpyrifos.

Beyond Pesticides is a national, grassroots, membership organization that represents community-based organizations and a range of people seeking to improve protections from pesticides and promote alternative pest management strategies that reduce or eliminate a reliance on toxic pesticides. Our membership spans the 50 states, the District of Columbia, and groups around the world.

The widely used organophosphate (OP) insecticide, chlorpyrifos is binds irreversibly to the active site of an essential enzyme for normal nerve impulse transmission, acetylcholine esterase (AchE), inactivating the enzyme. For that reason, it is a cholinesterase inhibitor. The scientific evidence of neurotoxic dangers associated with chlorpyrifos exposure is extensive and consistent, with particular adverse effect to children and brain development. Epidemiological data also points to subpopulations that are disproportionately affected by chlorpyrifos exposures. Low-income African-American and Latino families, including farmworker families, continue to suffer the most, and this disproportionate impact creates an environmental justice issue that the state must not ignore. Given the serious toxicological issues associated with chlorpyrifos use and exposures, and the U.S. Environmental Protection Agency's (EPA) reversal on its decision to complete rulemaking revoking the food tolerance for chlorpyrifos, it is left to the state to take action to eliminate exposure to this hazardous insecticide.

HB229's prohibition of chlorpyrifos is an important public health measure at the same time that it ensures that farmers and pesticide applicators have the resources they need to transition to safer ecological pest management practices, rather than substitute one toxic chemical for another.

Chlorpyrifos Is Neurotoxic and Endangers Children's Health

A study from the Columbia Children's Center for Environmental Health (CCCEH) at Columbia University, which provides important information on the neurological outcomes of children exposed to chlorpyrifos, found that children exposed to high levels of chlorpyrifos exhibit developmental delays, attention deficiencies, attention-deficit/hyperactivity disorder problems, and pervasive developmental disorder problems at three years of age.[1] Concentrations of chlorpyrifos in umbilical cord blood also correspond to a decrease in the psychomotor development and a decrease in the mental development in three-year-olds.[2] A follow-up study in 2012 finds that children with high exposure levels of chlorpyrifos have changes to the brain, including enlargement of superior temporal, posterior middle temporal, and inferior postcentral gyri bilaterally, and enlarged superior frontal gyrus, gyrus rectus, cuneus, and precuneus along the mesial wall of the right hemisphere.[3]

Recent studies add additional evidence that chlorpyrifos affects the developing brain. Using data from California's records of autism disorder diagnosis and birth rates from 1998 to 2010, as well as records from California's pesticide use reporting system, researchers sought to determine associations between early life ambient exposure to a range of pesticides, including chlorpyrifos.[4] Results show, when compared to a control group unexposed to the same pesticides during birth and infancy, modest increases in autism risk for exposure to chlorpyrifos. For cases of autism with co-occurring intellectual disabilities, the link between chlorpyrifos and these disorders was even more robust.[5]

In its 2016 review of chlorpyrifos, EPA concludes that there is "sufficient evidence that there are neurodevelopmental effects occurring at chlorpyrifos exposure levels below that required for

AChE inhibition," and that EPA's current approach for evaluating chlorpyrifos' neurological impact is "not sufficiently health protective." [6] This statement was made as a result of evidence that chlorpyrifos has effects below that which is observed for typical acetylcholinesterase (AChE) inhibition. Data has shown that chlorpyrifos can alter neuronal function outside of, and

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1 Rauh VA. 2006. Impact of prenatal chlorpyrifos exposure on neurodevelopment in the first 3 years of life among inner-city children. *Pediatrics*. 118(6):e1845-59.

[2] Lovasi, GS, et al. 2011. Chlorpyrifos Exposure and Urban Residential Environment Characteristics as Determinants of Early Childhood Neurodevelopment. *Am J Public Health;* 101(1):63-70.

[3] Rauh VA, Perera FP, Horton MK, et al. 2012. Brain anomalies in children exposed prenatally to a common organophosphate pesticide. *Proc Natl Acad Sci U S A*. 109(20):7871-6.

[4] Von Ehrenstein et al. 2019. Prenatal and infant exposure to ambient pesticides and autism spectrum disorder in children: population based case-control study. BMJ 2019; 364 doi: https://doi.org/10.1136/bmj.l962.

[5] Ibid.

[6] USEPA. 2016. Chlorpyrifos: Revised Human Health Risk Assessment for Registration Review. Office of Chemical Safety and Pollution Prevention. Washington DC.

unrelated to the classical cholinesterase mechanism.[7,8,9] However, regardless of the potential for multiple pathways of toxicity, there remains high confidence in the current available and quantifiable evidence of neurological impact.

A study published in late 2018 finds that the scientific conclusions used to support the initial registration of chlorpyrifos are flawed and omitted key health impacts.[10] Scientists first analyzed a study performed in 1997-8, which used laboratory rats exposed to the chemical as a reference for health impacts to prenatal human exposure. Summary reports indicate possible effects to a specific area of the brain known as the cerebellum, which regulates motor control. This led researchers to further investigate the underlying data. The industry-contracted laboratory concluded that at low to medium doses, there are no observed impacts, and, at high doses, impacts are seen but are a result of undernutrition caused by toxicity in the mother rat. These findings led to an overall determination—–accepted by regulators—–that the chemical does not affect developmental neurotoxicity. However, the study indicates that this conclusion is backed up by averaging impacts to the brain, rather than looking at the cerebellum, the specific brain region affected.[11] Although seemingly subtle to those without considerable scientific background, the study notes that such an approach is considered by EPA to be an "inappropriate and inconclusive manipulation of data."[12] Despite this clear-cut abuse of data, regulators never requested that the laboratory correct this approach.

A re-analysis by scientists finds that in low and medium doses, cerebellum height decreased up to 11%, and up to 14% at the highest dose compared to control rats. This indicates "statistically highly significant" effects the authors note are observed in the absence of toxicity in the mother rat.[13] Although a review of this type was not included in the report submitted to regulators, it strongly supports the conclusion that chlorpyrifos is a developmental neurotoxin.

Harm to Children Impacts Economic Development

As a developmental neurotoxin, exposure to chlorpyrifos and other organophosphates in its class results in a lowering of IQ points. A 2011 study examining families in the intensive agricultural region of 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. This

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[7] Lee I, Eriksson P, Fredriksson A, et al. 2015. Developmental neurotoxic effects of two pesticides: Behavior and biomolecular studies on chlorpyrifos and carbaryl. Toxicol Appl Pharmacol. 288(3):429-38.
[8] Androutsopoulos VP, Hernandez AF, Liesivuori J, Tsatsakis AM. 2013. A mechanistic overview of health associated effects of low levels of organochlorine and organophosphorous pesticides. Toxicology. 307:89-94.
[9] Meijer M, Hamers T, Westerink RH. 2014. Acute disturbance of calcium homeostasis in PC12 cells as a novel mechanism of action for (sub)micromolar concentrations of organophosphate insecticides. Neurotoxicology. 43:110-6.
[10] Mie et al. 2018. Safety of Safety Evaluation of Pesticides: developmental neurotoxicity of chlorpyrifos and chlorpyrifos-methyl. Environmental Health volume 17, Article number: 77 https://doi.org/10.1186/s12940-018-0421-y.
[11] Ibid.
[12] Ibid.
[13] Ibid.

team also found that every tenfold increase in OP exposure during a mother's pregnancy corresponds to a 5.5 point drop in overall IQ scores in seven-year-olds.[14]

A 2020 analysis by a team of scientists at the New York University Grossman School of Medicine identified similar effects to IQ from exposure to organophosphates. Based on a conservative review of available data, researchers determined 4.25 IQ points are lost for every 10-fold increase in organophosphate exposure. The study extrapolates the effect of IQ loss to the impact on the United States economy. Each lost IQ point was assigned a value of $22,268, and each case of intellectual disability (determined to be when IQ drops below 70) resulting from exposure is estimated to result in $1,272,470 in lost productivity. These dollar amounts are all inflation-adjusted to the year 2018.[15]

Despite modest declines in OP use over the study period (2001-2016), the impacts of exposure found to be roughly the same as those currently caused by lead. OPs are estimated to result in over 26 million lost IQ points and over 110,000 cases of intellectual disability, totaling roughly $735 billion in economic costs. The total impact of all the chemicals studied by researchers is estimated at nearly 200 million lost IQ points, and almost 1.2 million cases of intellectual disability, costing the U.S. economy an astounding $7.5 trillion.[16] If even a fraction of this effect is playing out in the state of Maryland, it is incumbent upon lawmakers to stop the brain drain our children's intelligence, and their ability to be productive members of society as a result of chemical poisoning.

Air and Water Contamination

EPA assessments find that the chlorpyrifos oxon (derivative), transformed from the parent during chlorination in drinking water treatment, poses a dangerous exposure through drinking water.[17] The chlorpyrifos oxon persists through water treatment and thus remains in drinking water for at least 72 hours.[18] The United States Geological Society's National Water Quality Assessment Program identifies widespread contamination of the nation's waterways from chlorpyrifos use.[19]

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[14] Bouchard MF, Chevrier J, Harley KG, Kogut K, Vedar M, Calderon N, et al. 2011. Prenatal Exposure to Organophosphate Pesticides and IQ in 7-Year-Old Children. *Environ Health Perspect*. 119:1189-1195.
[15] Gaylord et al. 2020. Trends in neurodevelopmental disability burden due to early life chemical exposure in the USA from 2001 to 2016: A population-based disease burden and cost analysis. Molecular and Cellular Endocrinology Volume 502, https://doi.org/10.1016/j.mce.2019.110666.
[16] Ibid.
[17] USEPA. 2014. Chlorpyrifos: Updated Drinking Water Assessment for Registration Review. Office of Chemical Safety and Pollution Prevention. Washington DC.
[18] Kamel A, et al. 2009. Oxidation of selected organophosphate pesticides during chlorination of simulated drinking water. *Water Res*; 43(2):522-34.
[19] USGS. 2020. National Water Quality Assessment Program. Pesticides. https://www.usgs.gov/mission-areas/water-resources/science/pesticides?qt-science_center_objects=0#qt-science_center_objects.

Residues of chlorpyrifos have been detected in indoor air, including childcare centers. [20] Air monitoring reports have found chlorpyrifos at levels exceeding federal guidelines.[21] Vapor phase chlorpyrifos emitted from treated fields could cause adverse effects, especially to those nearby.

Environmental Impacts

The adverse effects of chlorpyrifos are not limited to direct impacts on public health. The chemical is highly toxic to mammals, fish, and aquatic invertebrates. A biological opinion conducted by the Fish and Wildlife Service found that chlorpyrifos is "likely to adversely affect" 97% of species listed under the *Endangered Species Act*.[22] This count includes a "likely to adversely affect" determination for the following endangered species: 39 amphibians, 219 aquatic invertebrates, 91 birds, 188 fish, 87 mammals, 959 plants, 48 reptiles, and 147 terrestrial invertebrates. A 2016 study found that chlorpyrifos results in adverse impacts to pollinators at levels well below its lethal dose.[23] Specifically, the chemical is found to slow learning and memory recall in honey bees, with the study authors noting that these impacts have the ability to threaten the success and survival of pollinators.

European Union and U.S. States Show that Prohibition Is the Appropriate Response

Section 408(b)(2)(A)(i) of the *Federal Food Drug and Cosmetics Act* (FFDCA) states that EPA can establish a tolerance for a pesticide chemical residue in or on food only if EPA determines that the tolerance is safe. "Safe" is then defined as a "reasonable certainty that no harm will result from aggregate exposure to the pesticide chemical residue, including all anticipated dietary exposures and all other exposures." In 2016, EPA stated that its revised analysis indicates that "expected residues of chlorpyrifos on most individual food crops exceed the 'reasonable certainty of no harm' safety standard under the *Federal Food, Drug, and Cosmetic Act* (FFDCA)." Additionally, the agency also points out that "risk from the potential aggregate exposure does not meet the FFDCA safety standard." Based on this, and in light of the deleterious impact of chlorpyrifos exposure on children, EPA had no choice other than to eliminate use of the chemical in agriculture.

However, one of the first decisions under the new administration was to reverse course on

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[20] Morgan, M. K., Wilson, N. K., and Chuang, J. C. 2014. Exposures of 129 Preschool Children to Organochlorines, Organophosphates, Pyrethroids, and Acid Herbicides at Their Homes and Daycares in North Carolina. *International Journal of Environmental Research and Public Health*, *11*(4), 3743–3764. doi:10.3390/ijerph110403743

[21] CDPR. 2017. AIR MONITORING NETWORK RESULTS FOR 2016. Environmental Monitoring Branch. Sacramento, CA.

[22] EPA. 2016. EPA Releases Draft Biological Evaluations of Three Chemicals' Impacts on Endangered Species. https://web.archive.org/web/20170120193643/https://www.epa.gov/pesticides/epa-releases-draft-biological-evaluations-three-chemicals-impacts-endangered-species.

[23] Urlacher et al. 2016. Measurements of Chlorpyrifos Levels in Forager Bees and Comparison with Levels that Disrupt Honey Bee Odor-Mediated Learning Under Laboratory Conditions. Journal of Chemical Ecology volume 42, pages127–138.

chlorpyrifos and extend its use.[24] In 2017, shortly before making this decision, then-EPA Administrator Scott Pruitt met privately with the CEO of Dow Chemical, the primary registrant for chlorpyrifos.[25] When asked by the Associated Press to provide details on the agency's decision making process, "Pruitt's office responded with quotes from media releases from trade groups and the U.S. Department of Agriculture attesting to the chemicals usefulness to farmers, but did not offer scientific studies on its safety."[26] Despite further litigation requiring EPA to issue a final decision on the chemical, EPA has kept chlorpyrifos on the market.

EPA's approach can be starkly contrasted with the European Union's decision to stop chlorpyrifos use. After comprehensive reviews from the European Food Safety Authority, "Experts concluded that concerns related to human health exist, in particular in relation to possible genotoxicity and developmental neurotoxicity."[27] Regulators confirmed in a statement that, ". . .concerns for human health have been identified and that safe levels of exposure cannot be determined based on the available data."[28]

In the absence of EPA action, U.S. states have the power to protect their residents from harmful exposure to toxic pesticides. Many states have now accepted that charge and are putting in place prohibitions on the use of chlorpyrifos. In 2018, Hawaii legislators, acknowledging the failure of EPA to protect its residents, passed legislation phasing out chlorpyrifos use.[29] In April 2019, the New York state legislature passed legislation to ban chlorpyrifos within the next two years.[30] Although vetoed by the Governor, the chemical will nonetheless be eliminated from use in New York through a regulatory process mandated by the Governor. In May 2019, California followed suit, using regulatory mechanisms to eliminate the use of the hazardous organophosphate.[31] The state also established an *Alternatives to Chlorpyrifos Working Group* to help ease farmers through a transition period.[32] In this sense, Maryland's chlorpyrifos legislation, which, in addition to prohibiting the pesticide's use , includes provisions to assist farmers in transitioning away from chlorpyrifos, represents the best practice for a state wishing to protect its children, waterways, and wildlife from toxic pesticides.

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[24] Levin, Sam. 2019. Trump Administration won't ban pesticide tied to childhood rain damage. The Guardian. https://www.theguardian.com/us-news/2019/jul/18/epa-chlorpyrifos-ban-children-brain-damage-trump

[25] Associated Press. EPA chief met with Dow CEO before deciding on pesticide ban. https://apnews.com/2350d7be5e24469ab445089bf663cdcb

[26] Ibid

[27] European Commission. 2019. Chlorpyrifos and Chlorpyrifos-methyl. https://ec.europa.eu/food/plant/pesticides/approval_active_substances/chlorpyrifos_chlorpyrifos-methyl_en

[28] Ibid

[29] Kay, Robert, 2018. First in the nation chlorpyrifos ban. http://www.hawaiireporter.com/first-nation-chlorpyrifos-ban/.

[30] Earthjustice. 2019. New York Bans Brain-Damaging Pesticide Chlorpyrifos. https://earthjustice.org/news/press/2019/new-york-bans-brain-damaging-pesticide-chlorpyrifos.

[31] Ibarra, Nick. 2019. https://www.mercurynews.com/2019/05/09/california-moves-to-ban-chlorpyrifos-a-controversial-pesticide-linked-to-developmental-harms/.

[32] CDPR. 2019. Alternatives to Chlorpyrifos Work Group Announced. https://www.cdpr.ca.gov/docs/pressrls/2019/081419.htm.

Conclusion

The path is clear for Maryland lawmakers. The science is unequivocal: chlorpyrifos exposures result in developmental delays, low birth weights, and other serious neurological health effects.[33] Chlorpyrifos is an incredibly neurotoxic organophosphate that has no place in modern agriculture, as it poses dangers to pollinators, and endangers wildlife and the wider environment, farmworkers, farm families, especially vulnerable children,[34] and others living near agricultural areas—causing calculable damage to the state and national economy.[35] There are alternatives available for farmers and other users that ensure that there will be no disruption in food production and practices once the chemical is removed, and we are supportive of the legislation providing assistance to farmers in moving to ecological alternatives protective of public health. We believe that given the serious risks involved, Maryland lawmakers must eliminate the public health threat associated with chlorpyrifos use and not delay in passing HB229.

Thank you for your consideration of our testimony.

[33] Venerosi, A et al. 2010. Gestational exposure to the organophosphate chlorpyrifos alters social-emotional behaviour and impairs responsiveness to the serotonin transporter inhibitor fluvoxamine in mice *Psychopharmacology*. 2010 Jan;208(1):99-107.

[34] Beamer, PI, et al. 2009 Farmworker children's residential non-dietary exposure estimates from micro-level activity time series. *Environ Int* ;35(8):1202-9.

[35] Harnly, ME, et al. 2009. Pesticides in dust from homes in an agricultural area. *Environ Sci Technol*;43(23):8767-74.