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Submitted via email

RE: Proposed Decision to Renew Pesticide Products for 2025, Notice 2024-21
Reevaluation of Paraquat Dichloride, Notice 2024-20

The Center for Biological Diversity, Pesticide Action Network, Environmental Working Group, and Californians for Pesticide Reform urge the California Department of Pesticide Regulation ("DPR") to suspend and begin cancellation proceedings for pesticide products containing paraquat dichloride ("paraquat") because of the significant adverse impacts of these products. 3 Cal. Code Regs. §§ 6220, 6221; Food & Ag. Code § 12825, 12826. DPR's notice of the initiation of the reevaluation of paraquat in accordance with Assembly Bill 1963 (2024) emphasizes the importance of timely action by DPR to reduce the significant adverse impacts of paraquat. Food & Ag. Code § 14086.

As described in the comments submitted in 2022 and 2023, and included with the additional scientific literature provided with these comments, paraquat poses serious and uncontrollable adverse impacts to public health and the environment, and there are reasonable, effective, and practicable alternatives that do not pose a greater detriment to the environment. Recent studies in 2023 and 2024 continue to provide additional evidence of how dangerous paraquat is for human health and the environment.

I. Paraquat presents significant adverse impacts to human health

Paraquat is "one of the most acutely lethal pesticides still in use today, [and] is implicated in around 100 poisoning incidents in the USA each year, resulting in at least one death per year since 2012." (Donley 2019). The Environmental Protection Agency webpage "One Sip Can Kill"[1] details a collection of stories of people who died from accidental ingestion of paraquat ranging from 15-months to 70-years old and the symptoms they experienced are horrific. The science is well established on the dangers posed by both off-label use and on-label use of paraquat, leading to short and long-term impacts to public health and the environment.

a. Paraquat exposure causes immediate and severe effects and can lead to death

Less than a teaspoon of concentrated paraquat is fatal (Tan et al. 2013) and immediate effects from direct exposure include pulmonary edema, where the lungs fill with fluid, and cardiogenic shock where the heart suddenly cannot pump blood throughout the body and leads to multiorgan failure (WebMD 2024). In a few hours to a few days after exposure someone can develop acute Kidney failure, confusion, coma, fast heart rate, injury to the heart, liver failure, lung scarring (evolves more quickly than when small to medium amounts have been ingested), muscle weakness, and seizures (CDC 2024). The odds of survival are low and those with acute poisoning often die within two weeks from acute respiratory distress syndrome or multiple organ failure (Fan et al. 2023). In 2008, paraquat was the cause for more deaths than any other pesticide in the US (Tan et al. 2013).

b. Paraquat is linked to Parkinsonism

When paraquat was first discovered, researchers used it as a model for Parkinson's disease because of its molecular similarity to the active form of the neurotoxin MPTP which can cause Parkinson-like symptoms in both animal and human models (Sharma & Mittal 2024; Zhang et al. 2016). Traditional toxicology studies have investigated the threats to human health and have found associations with Parkinsonism and other central and peripheral nervous system disorders. The study of Parkinson's has suggested that there are multifactorial causes for Parkinson's that involve genetic and environmental factors and genetic predisposition cannot explain all Parkinson's cases

[1] https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-one-sip-can-kill

(Ben-Shlomo et al. 2024; Tanner et al. 1999; Spillantini et al. 1997). Paraquat travels to the brain via a transport chain and the accumulation of paraquat has been implicated as a risk factor for developing Parkinson's disease (Silva 2024).

i. Paraquat is linked to other nervous system disorders

Parkinson's disease and some other nervous system disorders develop when the insulating sheath of nerve fibers (myelin) are either damaged or unable to form properly during development. Studies have reported that paraquat can exert direct toxic effects on the myelin, influence gene expression of myelin producing genes, alter myelin structure, and induce neuroinflammation which damages myelin (Silva et al. 2024; Imam et al. 2024; Sun et al. 2021; Huang et al. 2019; Sun et al. 2018; Hichor et al. 2017; Bajo-Grañeras et al. 2011; Ernst et al. 2004). Along with inflammation, paraquat exposure causes oxidative stress (da Silva et al. 2024; Chang & Chen 2020; Lucio et al. 2024; Alizadeh et al. 2022; Zhang et al. 2016), influences programmed cell death (See et al. 2024; See et al. 2022; González-Polo et al. 2004), and damages mitochondria (Lee et al. 2024).

c. Paraquat has carcinogenic effects

Paraquat has carcinogenic effects (García Carrillo et al. 2024) that derive from its toxicity at the cellular level. Paraquat can cause the termination of DNA strands and DNA damage is one of the biomarkers for oxidative stress and carcinogenesis (Apriyarni et al. 2024). Paraquat exposure in vitro results in oxidative stress indicators and can combine with trace elements such as lead and copper that naturally occur in agricultural soils, accumulating with multiple applications of fertilizers and macronutrients (Adhikari et al. 2024, Chang et al. 2004, Epstein & Bassein 2001), and the paraquat and heavy metal compound results in higher concentrations of a biomarker of DNA damage (Syuja et al. 2024). Additional evidence for damage at the cellular level includes genetic damage (DNA breaks) (Petrovská & Dušinská 1999), increased presence of reactive oxygen species (ROS) paired with decreased antioxidant defenses (Drechsel and Patel 2009; Mitsopoulos & Suntres 2010), endoplasmic reticulum stress (Chen et al., 2012), cytoskeletal disruption (Cappelletti et al. 1994), and deregulation of programmed cell death (Takeyama et al. 2004). Many of these mechanisms play a key role in carcinogenesis (Bernstein et al., 2013; Hayes et al., 2020; Urra et al., 2016; Fife et al., 2014; Olsson & Zhivotovsky, 2011).

d. Paraquat poisoning survivors experience a lifetime of lung scarring and other disorders

If someone survives paraquat poisoning from inhalation, scarring of the lungs is highly likely (CDC 2024). A five-year follow-up study of individual survivors of moderate to severe paraquat poisoning found that those patients had lesions and other structural

changes to their lungs, low exercise endurance, and a higher presence of serum immunoglobulin E which is an antibody that is produced during allergic reactions (Fan et al. 2023) and results in inflammation. Other long-term effects could include kidney and heart failure and scarring of the esophagus, which makes it hard to swallow (CDC 2024).

e. Paraquat exposure and harm are expansive in agricultural areas

In Thailand, women's urine samples detected paraquat at 28 weeks of pregnancy, delivery, and two months postpartum from three different hospitals in agricultural areas, and 55% of newborns meconium samples had concentrations of paraquat (Konthonbut et al. 2018). One of the notable findings of the study was that paraquat was detected in both farm and non-farm workers. Living close to an agricultural area, living with family members that were agricultural workers, or drinking well water resulted in inadvertent exposure (Konthonbut et al. 2018). Findings like this highlight that is it not just applicators that are at risk but also their families and communities and adverse outcome pathways studies can expand our understanding of the harm of paraquat exposure at different life stages (Bal-Price & Meek 2017). With the certainties of toxicity from ingestion, breathing, or skin contact during application of paraquat, and what we know of the effects of long-term residue exposure, public health officials should be implementing precautionary principles and only permitting use of less dangerous alternatives which are available.

A study of paraquat residues on soya feed imported from Brazil and the U.S. found that 66% of the samples detected paraquat and that 5% of feed was not compliant with European regulations for maximum residue of pesticides on food and feed (Heydebreck 2021). Further investigations of residue levels for livestock-product supply (i.e., crops, feeds, and animal products) found that they need to be re-evaluated to confirm if current upstream maximum residual levels result in safe residues downstream for products that affect animal and human health (Li & Fantke 2023). There is rising concern over the safety of our food and increases in rates of colon cancer and digestive disorders have been linked to paraquat exposure (Rueda-Ruzafa et al. 2023).

II. Paraquat presents significant adverse impacts to the environment

Along with human health impacts, paraquat is a significant threat to the environment and non-target organisms.

a. Paraquat harms vertebrates

Paraquat causes toxic and congenital effects in amphibians (Sartori & Vidrio 2018), and it is very water-soluble, which can potentially facilitate contaminant movement through the water cycle and enable paraquat to reach surface waters through runoff (Donaher & Van den Hurk 2023). This is a concern because aquatic plants and algae are the non-target biota most sensitive to paraquat (Donaher & Van den Hurk 2023). Oxidative

stress, programmed cell death and necrosis, and immune dysfunction from paraquat exposure has been documented in grass carp kidney cells (Shi et al. 2022). These and other organisms are harmed by paraquat.

A comparison study of skin fibroblasts (cells that produce connective tissue) exposed to paraquat found that mammal cells were less resistant to paraquat toxicity compared to other classes of animals (Khan et al. 2014). This is alarming for both mammals living in agricultural areas near application zones and for applicators themselves who are more sensitive if accidental skin exposure occurs.

Paraquat is among the most embryotoxic contaminants for bird eggs (Sartori & Vidrio 2018) and results in reduced hatchability and mortality of eggs (Fry 1995). Paraquat induces programmed cell death in phytoplankton (Bai et al. 2023), other aquatic species (Sartori & Vidrio 2018), and microbial soil communities (Teke et al. 2024). Paraquat also alters the elemental and biochemical composition of non-target microalgal species (Prado et al. 2009).

The harm to amphibians has been investigated in the lab using exposure of environmentally relevant concentrations of paraquat. Graceful dwarf frogs *(Physalaemus gracilis*) had impaired anti-predatory behavior, reduced body mass and malformations of the mouth and intestines, and an increase in enzymatic breakdown of neurotransmitters, cardiotoxicity, and oxidative stress (Pompermaier et al. 2024). Paraquat causes toxic and teratogenic effects in amphibians (Sartori & Vidrio 2018). This is especially relevant since it is very water-soluble and can enter water sources in agricultural areas with greater ease compared to non-water-soluble contaminants.

Despite the investigation of paraquat on some organisms, there are still gaps in the literature regarding the effects of paraquat on some taxonomic groups. Reptiles are significantly underrepresented in the literature. A recent literature review was “unable to identify a single study that examined the toxicity of PQ [paraquat] in reptiles.” (Donaher & Van den Hurk 2023). Reptiles are non-target organisms that are exposed to paraquat in agricultural fields, and we have little to no understanding of methods of mitigation for exposure and treatment of reptiles if an exposure event occurs.

b. Paraquat harms invertebrates

For pollinators, the use of paraquat resulted in decreased predatory and parasitoid wasp species which indirectly influenced other insect populations in agricultural fields (Quandahor et al. 2024). Laboratory studies have found that paraquat affects honey bee larvae and it has been associated with colony losses (UMass Extension Fruit Program 2024). Honey bees exposed to paraquat had declined memory retention when evaluated using the proboscis extension reflex (PER) assay (Khooshe-Bast et al. 2023). Paraquat exposure can also interfere with bees’ nervous system making them more

susceptible to disease and other stressors (Spinozzi et al. 2023). Paraquat can also reduce bee populations through direct toxicity and through reducing available food sources (Flafel et al. 2024; Ratajac et al. 2021; Henríquez-Piskulich et al. 2021; Jung et al. 2020; Sharma et al. 2019).

A comparative analysis of the toxicity of tunicamycin, thapsigargin, metformin, paraquat, hydrogen peroxide, and imidacloprid on honeybees found paraquat to cause the most chronic toxicity, even at sublethal concentrations, and significant protein damage (Tahir 2024). LD_{50} values for honey bees was determined in 2024 and that paraquat impaired mitochondrial function (Phokasem et al. 2024). The study stresses the importance of the need for screening of toxicity across bee species since paraquat was found to be moderately toxic for *A. mellifera* but highly toxic to *A. cerana* (Phokasem et al. 2024). This study was a rare, but necessary, example of comparative analysis for different bee species and more studies are desperately needed to continue to quantify the harm from paraquat and other herbicides.

c. Paraquat harms non-target plants

Since paraquat is a non-selective, contact herbicide and almost all plants are susceptible to it – unintended plant injury can occur. Unintended herbicide injury to grape vines from spray drift has been known to completely defoliate the vine and cause plant death (Ohio State University Extension 2023). Nontarget plants that are exposed to nonselective broad-spectrum herbicides will experience yellowing foliage, dieback, and can eventually die (Purdue Extension 2008). Along with non-target plants being damaged from unintended exposure, our understanding of the compounding effects from simultaneous multi-herbicide use is inadequate to deal with the consequences of “bystander” damage to plants and animals.

III. Gaps in paraquat knowledge lead to underestimates of harm

a. On-label use of mixed herbicides has not been evaluated for harm to non-target species

There is a lack of investigation of synergism between paraquat and other herbicides and it merits additional study (Donaher & Van den Hurk 2023). The label for Gramoxone SL 3.0 (the trademark name of paraquat) instructs applicants that “Gramoxone SL 3.0 can be tank mixed with other herbicides… applied by the same methods and at the same timing” for sixty-eight kinds of applications (Paraquat label). The label does provide specific mixing instructions based on the crop the herbicide is applied to, but the scientific literature has not examined many of these combinations. A recent study on the impacts of dual exposure of atrazine and paraquat to fruit flies was conducted because the authors stated that, “To our knowledge, [] no other study has specifically examined the combined effects of atrazine and paraquat in vivo.” (Lovejoy & Fiumera 2019). This

is not an unusual circumstance. There is a lack of studies on the synergistic effects of two herbicides on non-target organisms and we cannot yet quantify the specific harms of "on-label" use to non-target plant and animal species, but understanding the general mode of action per pesticide does lead to a conclusion that applying more pesticides would result in an increase in possible damage to non-target organisms.

b. The amount of paraquat in the environment and exposure for non-target species will increase because of changes in management techniques

The frequency and concentration of paraquat application on crops will increase with changes to the "double knock" strategy. This is a method of herbicide application where traditionally glyphosate and then paraquat would be applied to fallow or pre-sowing fields. Now, a new "double knock" method of paraquat followed by paraquat is being used as a management strategy (Crop Smart 2023). Studies that have investigated this technique have evaluated efficacy for killing the target plant, e.g., (Borger & Hashem 2007), but have not evaluated the potential environmental or health effects. The literature falls short in understanding the potential outcomes of this new management method and at the very least, the risks should be quantified and mitigated before new registrations are issued.

IV. DPR should immediately suspend registrations for paraquat and pursue cancellation of paraquat

DPR has initiated the process for reevaluation for paraquat and we encourage DPR to immediately suspend registration of paraquat because of the accumulated harm that would occur during the lengthy reevaluation process which could last until January 1, 2029. Food & Ag. Code § 14086. California's agricultural workers and environment deserve immediate action to protect public health and welfare. DPR should suspend a pesticide registration because paraquat triggers conditions warranting cancellation under Food & Ag. Code § 12826, and the continued use of the pesticide poses an "immediate substantial danger."

In addition to suspending registrations, DPR should also pursue cancellation proceedings for paraquat because of the well documented hazards to public health and wildlife identified in the scientific literature. Recent studies continue to confirm that paraquat meets the conditions for cancellation under Food & Ag. Code § 12825 (a), (b), (c), (d), and only one of nine need to apply to warrant cancellation of a pesticide registration.

This comment letter supplements the attached comments previously submitted in 2022 and 2023. Those comments and referenced studies can be found in the following online

folder.[2] If you have difficulties accessing those documents, please contact Jonathan Evans at the contact information provided below.

Thank you for your consideration of these comments.

Sincerely,

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[2] https://centerforbiologicald-my.sharepoint.com/:f:/g/personal/jevans_biologicaldiversity_org/EiFI6Twl-6ZDo3e3QIih4soBidFiiUgJuIZ1OMQ5x2CWDA . Studies will also be sent separately via email.

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November 4, 2022

Department of Pesticide Regulation
Pesticide Registration Branch
Department of Pesticide Regulation
P. O. Box 4015
Sacramento, California 95812-4015
Registration.Comments@cdpr.ca.gov

RE: Proposed Decision to Renew Paraquat Registrations for 2023 - California Notice 2022-18

Dear Mr. Macedo:

The Center for Biological Diversity and Californians for Pesticide Reform urge the California Department of Pesticide Regulation ("DPR") to begin reevaluation, suspension, and cancellation proceedings for pesticide products containing paraquat because of the significant adverse impacts of these products. 3 Cal. Code Regs. §§ 6220, 6221; Food & Ag. Code § 12825, 12826. Despite paraquat being a restricted use pesticide, such restrictions are not sufficient to prevent significant adverse impacts to human health and the environment.

Paraquat is "one of the most acutely lethal pesticides still in use today, [and] is implicated in around 100 poisoning incidents in the USA each year, resulting in at least one death per year since 2012."[1] The U.S. EPA even has a webpage detailing the dangers of paraquat exposure titled "Paraquat Dichloride: One Sip Can Kill".[2] In 2013, paraquat caused a series of 50

[1] Donley, N. (2019). The USA lags behind other agricultural nations in banning harmful pesticides. *Environmental Health*, 18(1). Available here: doi:10.1186/s12940-019-0488-0.
[2] *Paraquat Dichloride: One Sip Can Kill*, U.S. EPA https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-one-sip-can-kill (last visited Oct. 21, 2022).

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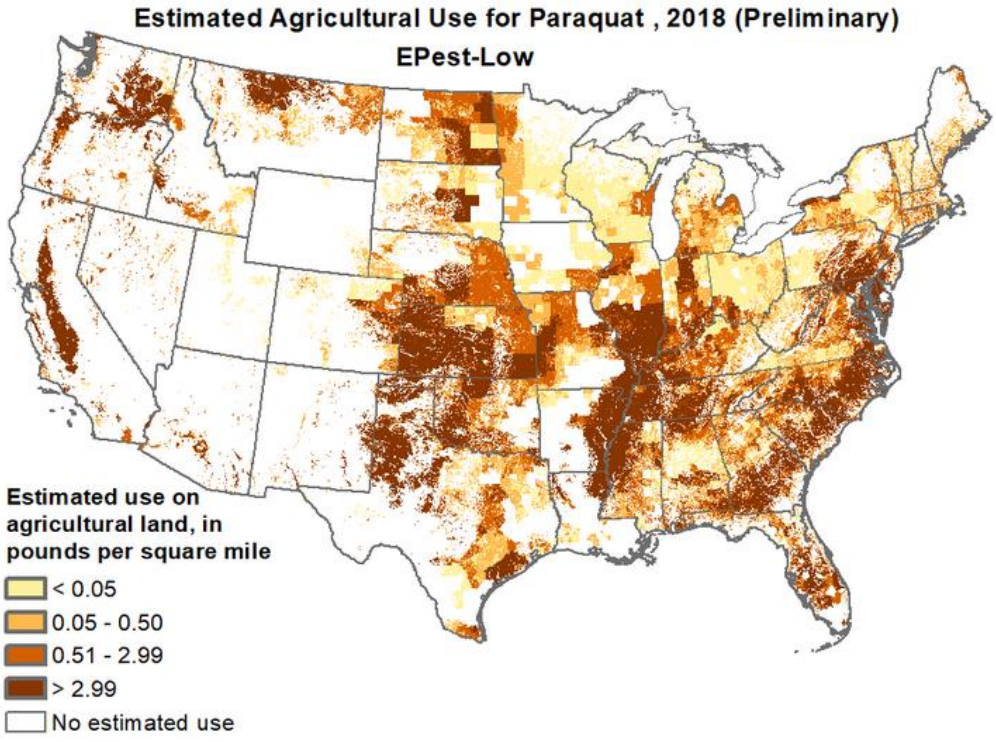
accidental deaths in the San Joaquin Valley, with 12 of these deaths due to accidental ingestion of paraquat.[3] In 2014, there were 27 deaths attributed to paraquat poisoning nationwide.[4]

Due to its high toxicity, nearly 60 countries,[5] including large agricultural producers like China, Brazil, and members of the European Union have banned paraquat.[6] Yet, over the past decade, paraquat use in the U.S. has doubled and it is used extensively throughout the U.S.[7] Now, paraquat use is the highest it's ever been since 1992.[8] In California, paraquat is one of the top five herbicides in terms of pounds applied and acres treated,[9] with over a million pounds applied and acres treated in 2018.[10]



[3] *Paraquat Dichloride: One Sip Can Kill*, U.S. EPA, https://www.epa.gov/pesticide-worker-safety/paraquat-dichloride-one-sip-can-kill (last visited Oct. 21, 2022).
[4] *Id.*
[5] Pesticide Action Network. PAN INTERNATIONAL CONSOLIDATED LIST OF BANNED PESTICIDES. Accessed 10/12/2022. Available here: https://pan-international.org/pan-international-consolidated-list-of-banned-pesticides/.
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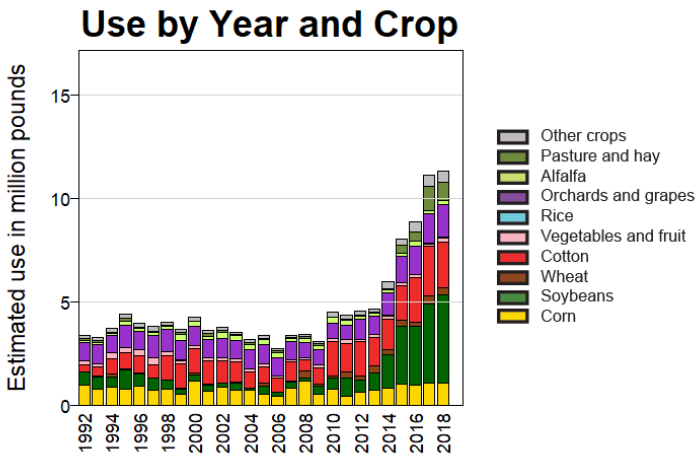
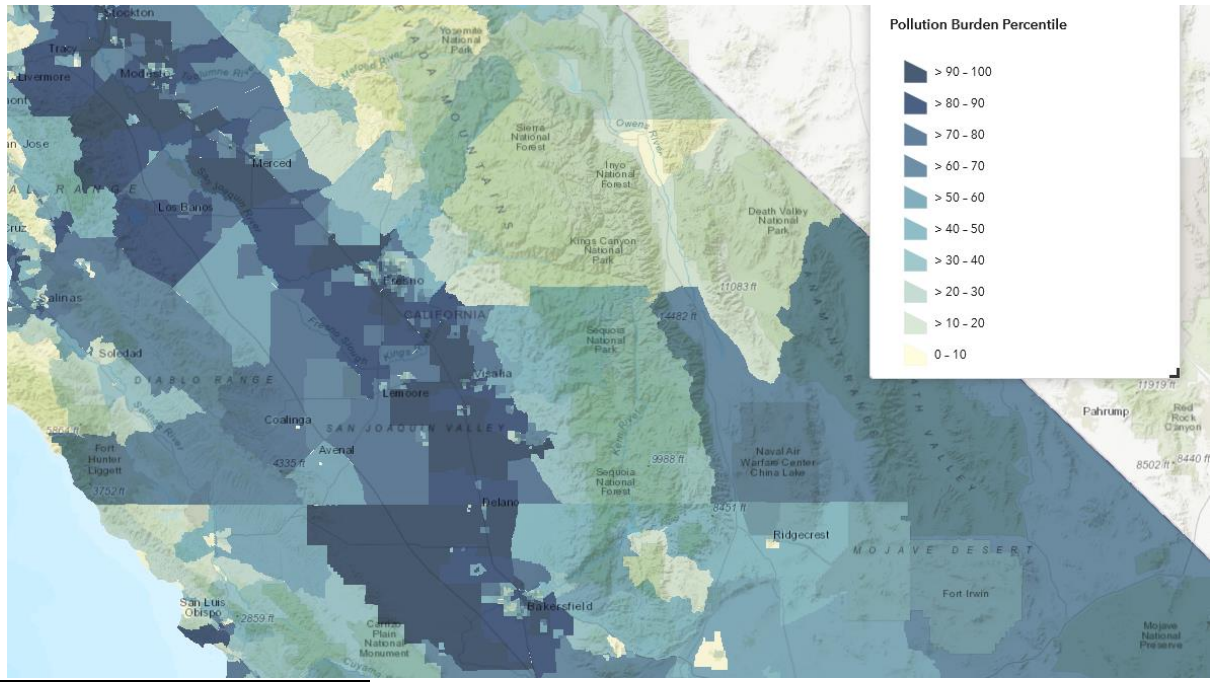
[8] *Id.*
[9] California Department of Pesticide Regulation, Summary of Pesticide Use Report Data 88, June 2020. Available here: https://www.cdpr.ca.gov/docs/pur/pur18rep/pur_data_summary_2018.pdf.
[10] California Department of Pesticide Regulation, The Top 100 Chemicals by Pounds in Total Statewide Pesticide Use in 2018. Available here: https://www.cdpr.ca.gov/docs/pur/pur18rep/top100lists/top_100_pesticides_by_pounds.pdf.



Paraquat is predominantly used in California's Central Valley. In 2018, Kern County had the highest paraquat use, with 304,162.3 pounds applied and 250,555.2 acres treated.[11] Other counties with considerable paraquat use include: Fresno, with 182, 892.63 pounds applied and 185,755.67 acres treated; Kings, with 165, 588.95 pounds applied and 182,741.26 acres treated; Merced, with 87,777.58 pounds applied and 87,376.64 acres treated; and Tulare, with 88, 289.99 pounds applied and 82,158.45 acres treated. These counties also carry the highest pollution burdens in the state.[12]



[11] California Department of Pesticide Regulation, Total Pounds, Applications, and Acres Treated by County and Chemical: 2018. Available here: https://www.cdpr.ca.gov/docs/pur/pur18rep/totals/county_subtotals_chemical.pdf.

[12] *CalEnviroScreen 4.0 Indicator Maps*, California Office of Environmental Health Hazard Assessment, https://experience.arcgis.com/experience/ed5953d89038431dbf4f22ab9abfe40d/page/Indicators/?views=Pollution-Burden (last visited Nov. 1, 2022).

We urge DPR to take steps to begin cancellation proceedings because the serious uncontrollable adverse effects of paraquat. Food & Ag. Code § 12825. And in the interim, DPR should immediately suspend paraquat because the continued use of this pesticide presents immediate substantial danger to human health and the environment. Food & Ag. Code § 12826. These steps are consistent with DPR's mandate to "eliminate from use in the state any pesticide that endangers the agricultural or nonagricultural environment." Food & Ag. Code § 12824.

The Center for Biological Diversity is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center for Biological Diversity has over 1.7 million members and supporters throughout the United States, including 211,061 residents in California and has worked for many years to reduce the significant adverse effects of pesticides, including paraquat.

Californians for Pesticide Reform is a statewide coalition of more than 190 organizations, founded in 1996 to fundamentally shift the way pesticides are used in California. CPR has built a diverse, multi-interest coalition to challenge the powerful political and economic forces opposing change. Californians for Pesticide Reform's member organizations include public health, children's health, educational and environmental advocates, clean air and water organizations, health practitioners, environmental justice groups, labor organizations, farmers, and sustainable agriculture advocates.

I. DPR should promptly reevaluate paraquat

A pesticide must be reevaluated when it presents significant adverse impacts, including but not limited to hazards to public or worker health and/or fish and wildlife. 3 Cal. Code Regs §§ 6220, 6221. The health risks of paraquat exposure through the skin, ingestion, or inhalation are well documented and range from heart failure, kidney failure, liver failure, and lung scarring.[13] Multiple scientific studies have also found links between paraquat exposure and diseases such as Parkinson's and cancer. These health risks fall disproportionately on farmworkers and farming communities within California. There are also several state and federally protected species that are harmed by paraquat and occur in areas where there is high paraquat use. Therefore, paraquat should be reevaluated due to its significant adverse impacts on human health and protected wildlife.

a. Paraquat presents significant adverse impacts to human health

i. Paraquat exposure has been linked to Parkinson's disease

Parkinson's disease is a neurological condition that "stems from a loss of nerve cells in a particular region of the brain that produces dopamine, the brain chemical that helps control

[13] *Facts About Paraquat*, CDC, https://emergency.cdc.gov/agent/paraquat/basics/facts.asp (last visited Nov. 1, 2022).

movements such as walking."[14] Those with Parkinson's experience "tremors, slowness in movement, stiffness, and difficulties with balance and walking."[15] There is currently no cure for Parkinson's.[16]

We urge DPR to consider the "plethora of studies [that] have shown that exposure to paraquat is correlated positively within parkinsonism in humans."[17] A 2019 meta-analysis found that "there is a statistically significant association between paraquat exposure and [Parkinson's disease]."[18] In addition to Parkinson's disease being linked to paraquat exposure, human epidemiological studies have also found that the "incidence of the disease and the extent of paraquat exposure can sometimes strongly correlate."[19] Even animal studies "demonstrate that paraquat can elicit the hallmark symptoms of Parkinson's in mice."[20]

Studies have also found that when environmental or genetic risk factors are combined with paraquat exposure, the risk of developing Parkinson's disease is increased. For example, a 2012 study found that the risk of developing Parkinson's disease was three times higher in those who had a traumatic brain injury in addition to being exposed to paraquat.[21] Another study in 2009 also found that those with certain genetic markers have an increased risk of developing Parkinson's after being exposed to paraquat.[22] In this study, participants who faced high paraquat exposure and carried one "susceptibility allele" were three times more likely to develop Parkinson's, and those who carried two "susceptibility alleles" were four times more likely to develop Parkinson's.[23]

ii. Paraquat exposure has been linked to thyroid cancer

A recent study investigating thyroid cancer in agricultural areas in Central California found that pesticide exposure, including paraquat, is associated with an increased risk of thyroid

[14] Dorsey, R., Sherer, T., Okun, M., Bloem, B, Ending Parkinson's Disease 2 (2020).
[15] *Id.*
[16] *Id.* at 3.
[17] Anselmi, L., Bove, C., Coleman, F. H., Le, K., Subramanian, M. P., Venkiteswaran, K., Subramanian, T., & Travagli, R. A. (2018). Ingestion of subthreshold doses of environmental toxins induces ascending Parkinsonism in the rat. *NPJ Parkinson's disease*, *4*, 30. Available here: https://doi.org/10.1038/s41531-018-0066-0.
[18] Tangamornsuksan, W., Lohitnavy, O., Sruamsiri, R., Chaiyakunapruk, N., Norman Scholfield, C., Reisfeld, B., & Lohitnavy, M. (2019). Paraquat exposure and Parkinson's disease: A systematic review and meta-analysis. *Archives of environmental & occupational health*, *74*(5), 225–238. Available here: https://doi.org/10.1080/19338244.2018.1492894.
[19] Nandipati, S., & Litvan, I. (2016). Environmental Exposures and Parkinson's Disease. *International journal of environmental research and public health*, *13*(9), 881. Available here: https://doi.org/10.3390/ijerph13090881.
[20] Brief for Timothy Greenamyre et al. as Amici Curiae Supporting Petitioners, *California Rural Legal Assistance et al. v. U.S. Environmental Protection Agency*, (2021) (No. 21-71287).
[21] Lee, P. C., Bordelon, Y., Bronstein, J., & Ritz, B. (2012). Traumatic brain injury, paraquat exposure, and their relationship to Parkinson disease. *Neurology*, *79*(20), 2061–2066. Available here: https://doi.org/10.1212/WNL.0b013e3182749f28.
[22] Ritz, B. R., Manthripragada, A. D., Costello, S., Lincoln, S. J., Farrer, M. J., Cockburn, M., & Bronstein, J. (2009). Dopamine transporter genetic variants and pesticides in Parkinson's disease. *Environmental health perspectives*, *117*(6), 964–969. Available here: https://doi.org/10.1289/ehp.0800277.
[23] *Id.*

cancer.[24] The study documented "consistent positive associations" between paraquat exposure and thyroid cancer.[25] In light of this recent study, DPR should reevaluate paraquat to further investigate its carcinogenic effects.

iii. Agricultural workers and those living in agricultural areas are most at risk for paraquat exposure

Given the high use of paraquat in much of California's Central Valley, agricultural workers and residents living in these high exposure areas are at greater risk of developing Parkinson's disease and other illnesses caused by this extremely toxic herbicide. Thus, it is imperative that DPR consider the disproportionate impact that paraquat exposure has on farming communities in the state.

In 2019 EPA identified risks of concern for agricultural workers who engaged in mixing, loading, and application of paraquat.[26] EPA also identified risks of concern for bystanders who were not engaged in agricultural work but would otherwise be exposed to paraquat due to spray drift occurring at the field edge.[27] In performing its risk assessment, EPA also assumed workers would be wearing the required level of personal protective equipment (PPE).[28] Still, for mixers and loaders EPA found inhalation risks of concern for 13 out of 26 exposure scenarios.[29] For applicators, there were inhalation risks of concern for 19 out of 26 exposure scenarios.[30] For mixers, loaders, and applicators, there were dermal risks of concern for 6 out of 8 exposure scenarios.[31]

However, data gathered through 2014 by SENSOR-Pesticides showed that most paraquat-related illness and/or injury cases were occupational, with "many cases involve[ing] PPE issues, including spray/splash getting into eyes although wearing safety glasses."[32] The data also showed that many cases also involved application equipment failures and inadequate paraquat application training.[33] Thus, the lack of PPE compliance, equipment failures, and

[24] Omidakhsh, N., Heck, J., Cockburn, M., Ling, C., Hershman, J., & Harari, A. (2022). Thyroid Cancer and Pesticide Use in a Central California Agricultural Area: A Case Control Study. *The Journal of Clinical Endocrinology & Metabolism*, *107*(9), e3574–e3582. Available here: https://doi.org/10.1210/clinem/dgac413.
[25] Cox, J, *Study links use of paraquat, other pesticides to thyroid cancer in southern, central valley*, Bakersfield.com (Sept. 19, 2022), https://www.bakersfield.com/news/study-links-use-of-paraquat-other-pesticides-to-thyroid-cancer-in-southern-central-valley/article_cd6d8eea-3838-11ed-ae09-b7fea4f12e80.html (last visited Nov. 1, 2022).
[26] U.S. EPA, Paraquat Dichloride: Draft Human Health Risk Assessment in Support of Registration Review. June 26,
2019. Pg. 11. Available here: https://www.regulations.gov/document/EPA-HQ-OPP-2011-0855-0121.
[27] *Id.*
[28] *Id.* at 52.
[29] *Id.*
[30] *Id.*
[31] *Id.*
[32] Paraquat Dichloride: Draft Human Health Risk Assessment in Support of Registration Review, *supra* note 26, at 55.
[33] *Id.*

inadequate training adds further risk to agricultural workers who handle this extremely dangerous pesticide.

EPA also identified a risk of concern to bystanders who are indirectly affected by paraquat drift up to 150 feet from the field edge.[34] Therefore, agricultural workers who wear required PPE and bystanders who wear no PPE remain at risk for exposure, and therefore at risk for lung and skin damage,[35] kidney harm,[36] and other illnesses such as Parkinson's disease and cancer.[37]

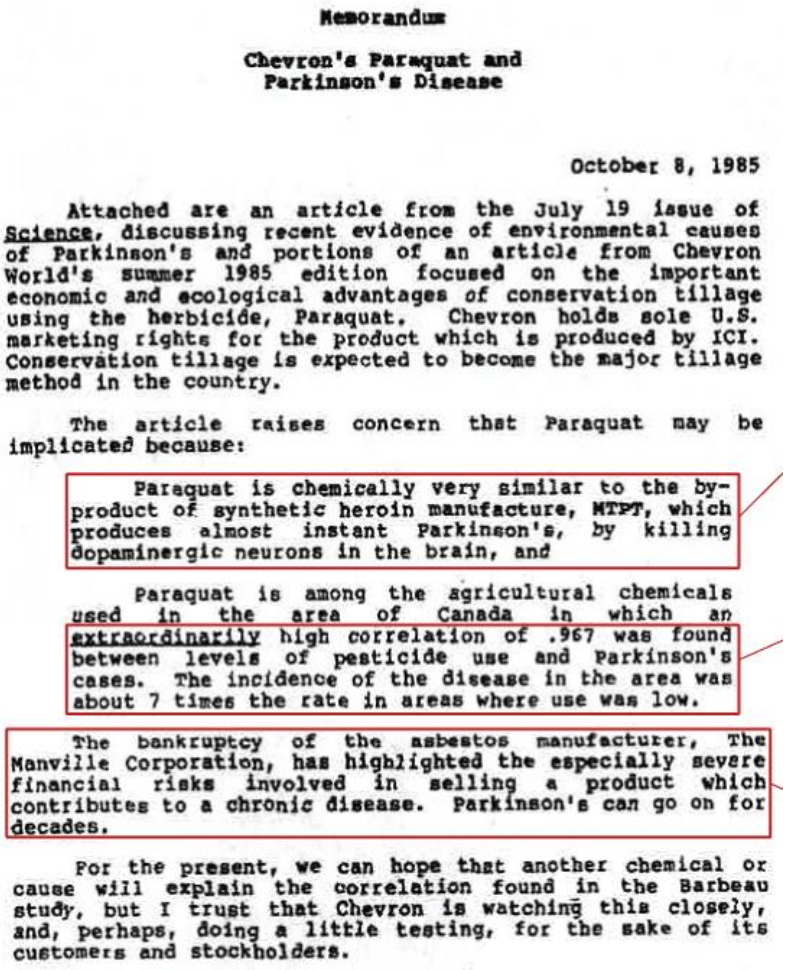
Furthermore, a 2018 study investigating premature deaths from Parkinson's in highly agricultural areas found "sizeable clustering of premature deaths" within 1,000 meters of paraquat application.[38] A study looking at paraquat exposure in the Central Valley found those exposed to both paraquat and maneb, had a greater risk of developing Parkinson's, especially if exposure occurred during teenage years or young adulthood. [39]

iv. Industry has suppressed data and analyses on the causal link between paraquat exposure and Parkinson's disease

A pesticide must also be evaluated if there is a "discovery that data upon which a registration was issued is false, misleading, or incomplete." 3 Cal. Code Regs. §6221(l). Paraquat should be reevaluated due to the recent discovery of evidence that Syngenta, a paraquat manufacturer and registrant, propounded misleading information about the harmful effects of paraquat.[40] Litigation between farmworkers, Syngenta, and Chevron Chemical has revealed internal documents dating back to the 1960s and 70s showing that Syngenta's predecessor and Chevron Chemical knew that paraquat "could impar the central nervous system (CNS), triggering tremors and other symptoms in experimental animals similar to those suffered by people with Parkinson's."[41] In 1985, an internal Chevron Chemical memorandum revealed that corporate officials took special note of a study that found an "extraordinarily high correlation" between Parkinson's and paraquat exposure.[42] The memorandum also expressed concern over future legal liability, similar to the liability that asbestos companies faced when it was revealed

[34] *Id.* at 47.
[35] *Id.* at 6-5.
[36] *Id.*
[37] *See supra*, Section I(a)(i)-(ii).
[38] Caballero, M., Amiri, S., Denney, J. T., Monsivais, P., Hystad, P., & Amram, O. (2018). Estimated Residential Exposure to Agricultural Chemicals and Premature Mortality by Parkinson's Disease in Washington State. *International journal of environmental research and public health*, *15*(12), 2885. Available here: https://doi.org/10.3390/ijerph15122885.
[39] Costello, S., Cockburn, M., Bronstein, J., Zhang, X., & Ritz, B. (2009). Parkinson's disease and residential exposure to maneb and paraquat from agricultural applications in the central valley of California. *American journal of epidemiology*, *169*(8), 919–926. Available here: https://doi.org/10.1093/aje/kwp006.
[40] C. Gillam and A. Uteuova, *Secret files suggest chemical giant feared weedkiller's link to Parkinson's disease*, The Guardian (Oct. 20, 2022), https://www.theguardian.com/us-news/2022/oct/20/syngenta-weedkiller-pesticide-parkinsons-disease-paraquat-documents (last visited Nov. 1, 2022).
[41] *Id.*
[42] *Id.*

that asbestos caused cancer.[43] The memorandum stated that "the bankruptcy of [an asbestos manufacturer] … has highlighted the especially severe financial risks involved in selling a product which contributes to a chronic disease. Parkinson's can go on for decades."[44]



Memorandum

Chevron's Paraquat and
Parkinson's Disease

October 8, 1985

Attached are an article from the July 19 issue of Science, discussing recent evidence of environmental causes of Parkinson's and portions of an article from Chevron World's summer 1985 edition focused on the important economic and ecological advantages of conservation tillage using the herbicide, Paraquat. Chevron holds sole U.S. marketing rights for the product which is produced by ICI. Conservation tillage is expected to become the major tillage method in the country.

The article raises concern that Paraquat may be implicated because:

Paraquat is chemically very similar to the by-product of synthetic heroin manufacture, MTPT, which produces almost instant Parkinson's, by killing dopaminergic neurons in the brain, and

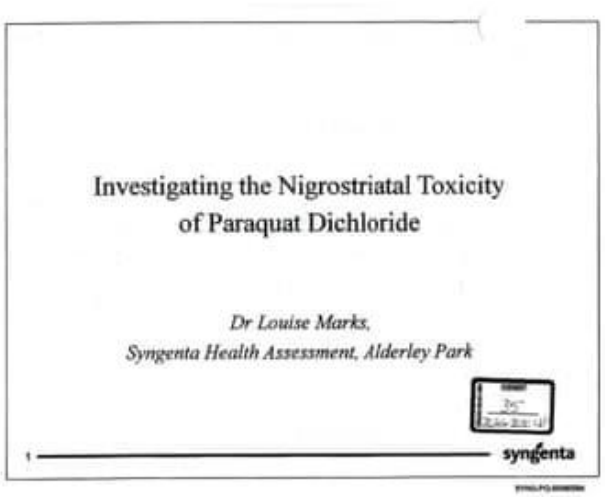
Paraquat is among the agricultural chemicals used in the area of Canada in which an extraordinarily high correlation of .967 was found between levels of pesticide use and Parkinson's cases. The incidence of the disease in the area was about 7 times the rate in areas where use was low.

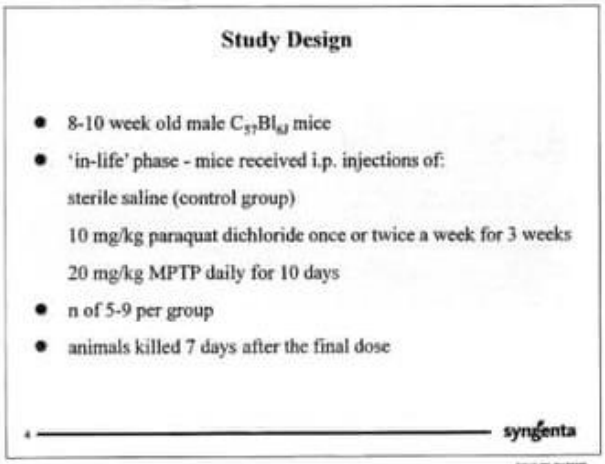
The bankruptcy of the asbestos manufacturer, The Manville Corporation, has highlighted the especially severe financial risks involved in selling a product which contributes to a chronic disease. Parkinson's can go on for decades.

For the present, we can hope that another chemical or cause will explain the correlation found in the Barbeau study, but I trust that Chevron is watching this closely, and, perhaps, doing a little testing, for the sake of its customers and stockholders.

In 2003, Syngenta conducted an internal study to evaluate the effects of paraquat exposure on animal brains but used certain methods which led to a finding that the impacts of paraquat were not statistically significant, which Syngenta publicized.[45] Notably, when Syngenta used the same, more accurate methods as independent scientists, it found that "paraquat actually did result in statistically significant loss of the relevant brain cells – just as the outside scientists had found."[46] However, Syngenta did not disclose these additional findings.[47] Given Syngenta's campaign to mislead the public about the harmful impacts of paraquat, we urge DPR to conduct its own investigation through the reevaluation process.

[43] *Id.*
[44] *Id.*
[45] *Id.*
[46] *Id.*
[47] *Id.*





b. Paraquat presents significant adverse impacts to protected wildlife

Reevaluation must occur when a pesticide poses a hazard to fish and wildlife. 3 Cal. Code Regs § 6221(h). Furthermore, under the California Endangered Species Act (CESA) and the federal Endangered Species Act (ESA), it is the duty of state and federal agencies to "seek to conserve endangered species and threatened species." Cal. Fish & Game Code § 2055; 16 U.S.C. § 1531(c)(1). Endangered, rare, or threatened species including those listed under CESA and/or the ESA. In California, there are additional regulatory protections for certain fully protected species, which prohibit the "take" or possession of "fully protected" fish, mammals, amphibians, reptiles, and birds. Cal. Fish & Game Code §§ 3511, 4700, 5050, 5515.

In EPA's Preliminary Ecological Risk Assessment for paraquat, EPA found paraquat to be harmful to mammals, fish, amphibians, birds, and invertebrates.[48] Additionally, there are several state and federally protected species whose ranges overlap with the tremendous amount of paraquat used in the Central Valley. Thus, reevaluation is necessary for DPR to comply with the reevaluation criteria as well as CESA and the ESA. A partial list of the rare, sensitive, threatened, or endangered species significantly and adversely affected is below. DPR's reevaluation process must assess the hazards to all rare, sensitive, threatened, or endangered species affected by paraquat.

i. Mammals

EPA found that paraquat causes acute and chronic harm to mammals and such harm exceeded EPA's level of concern.[49] Therefore, DPR should investigate the harm that paraquat may cause to state and federally protected mammals such as the San Joaquin kit fox (*Vulpes*

[48] U.S. EPA, Paraquat: Preliminary Ecological Risk Assessment for Registration Review. Oct. 14, 2019. Pg. 4-6. Available here: https://www.regulations.gov/document/EPA-HQ-OPP-2011-0855-0128.
[49] *Id.*

macrotis mutica), giant kangaroo rat (*Dipodomys ingens*), and Fresno kangaroo rat (*Dipodomys nitratoides exilis*).

The San Joaquin kit fox is state and federally listed as endangered. 50 C.F.R. § 17.11; 14 Cal. Code Regs. § 670.5. The kit fox's range overlaps with agricultural areas in California, such as the "western portion of the San Joaquin Valley south of San Luis Reservoir to the Buena Vista Valley, in the Panoche and Cuyama Valleys, and Carrizo Plain . . . portion of the Valley around Kern NWR and Semitropic Ecological Reserve, in Bakersfield, and in the southeastern portion of the Valley north to Porterville."[50]

The giant kangaroo rat and Fresno kangaroo rat are both state and federally listed as endangered. 50 C.F.R. § 17.11; 14 Cal. Code Regs. § 670.5. Like the kit fox, the giant and Fresno kangaroo rats' habitat overlaps with agricultural areas in the Central Valley where paraquat is used.[51]

ii. Birds

EPA also found that paraquat causes acute and chronic harm to birds, with both types of harm exceeding EPA's level of concern.[52] The yellow-billed cuckoo (*Coccyzus americanus*) is federally listed as threatened and state listed as endangered. 50 C.F.R. § 17.11; 14 Cal. Code Regs. § 670.5. The yellow-billed cuckoo is known to or believed to occur in Kern and Tulare County.[53]

The Swainson's hawk (*Buteo swainsoni*) and Tricolored blackbird *(Agelaius tricolor)* are state listed as threatened. 14 Cal. Code Regs. § 670.5. The Swainson's hawk and tricolored blackbird occur in the Central Valley where paraquat is frequently used.[54]

The greater sandhill crane is one of California's "fully protected" birds. Cal. Fish & Game Code § 3511(b). This state protected bird is known to winter in the Central Valley where paraquat is used.[55]

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[50] U.S. Fish and Wildlife Service, San Joaquin kit fox (*Vulpes macrotis mutica*) 5-Year Review (Sept. 2020) pp. 2. Available here: https://ecos.fws.gov/docs/tess/species_nonpublish/3127.pdf.

[51] *Specie Profile for Giant kangaroo rat* (*Dipodomys ingens*), USFWS, https://ecos.fws.gov/ecp/species/6051 (last visited Oct. 27, 2022); *Species Profile for Fresno kangaroo rat* (*Dipodomys nitratoides exilis*), USFWShttps://ecos.fws.gov/ecp/species/5150 (last visited Oct. 27, 2022).

[52] Paraquat: Preliminary Ecological Risk Assessment for Registration Review, *supra* note 48.

[53] *Species Profile for Yellow-billed Cuckoo* (*Coccyzus americanus*), USFWS, https://ecos.fws.gov/ecp/species/3911(last visited Oct. 27, 2022).

[54] Cornell Lab of Ornithology, Tricolored Blackbird - Range Map, https://www.allaboutbirds.org/guide/Tricolored_Blackbird/maps-range (last visited Nov. 2, 2022): Cornell Lab of Ornithology, Swainson's hawk - Range Map, https://www.allaboutbirds.org/guide/Swainsons_Hawk/maps-range (last visited Nov. 2, 2022):

[55] California Department of Fish and Game, 5-Year Status Review: GREATER SANDHILL CRANE (*Grus canadensis tabida*) (1994), https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwiC1Kjc6e_6AhVuATQIHYqXDPIQFnoECA0QAQ&url=https%3A%2F%2Fnrm.dfg.ca.gov%2FFileHandler.ashx%3FDocumentID%3D3521&usg=AOvVaw2pT2RjikXaf8Cx4xCZ0-0Z (last visited Oct. 27, 2022).

iii. Invertebrates

EPA found that paraquat causes acute and chronic harm exceeding its level of concern for invertebrates,[56] like the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*). The valley elderberry longhorn beetle is federally listed at threatened. 50 C.F.R. § 17.11. This beetle's range overlaps with several counties in the Central Valley, including San Joaquin, Fresno, and Merced County.[57]

The vernal pool fairy shrimp (*Branchinecta lynchi*), another invertebrate, is federally listed as threatened. 50 C.F.R. § 17.11. Vernal pool fairy shrimp are known to occur throughout the Central Valley.[58]

iv. Fish

A study conducted in 2020 found that paraquat "exposure affects the histology of gills, liver, and kidney, [in freshwater fish] thus impairing the vital functions like respiration, excretion, and metabolic regulation which in turn will affect the fish health and is a serious threat."[59] Paraquat would negatively impact a range of protected fish species including, but not limited to, Chinook salmon (*Oncorhynchus (=Salmo) tshawytscha*), coho salmon (*Oncorhynchus (=Salmo) kisutch*), and steelhead trout (*Oncorhynchus (=Salmo) mykiss*).

Chinook salmon is both state and federally listed as endangered with a spring run through the Central Valley.[60] 50 C.F.R. § 17.11; 14 Cal. Code Regs. § 670.5. Coho salmon is federally listed as endangered, and state listed as threatened. *Id.* Central California Coast coho salmon are a unique population of coho salmon with critical habitat designated along the central coast.[61] Steelhead trout is federally listed as endangered, with a distinct population in the Central Valley.[62] *Id.* Use of paraquat in California adversely affects salmonid species and their habitat.

v. Amphibians

EPA found acute and chronic harm exceeding its level of concern for terrestrial-phase amphibians,[63] like the California tiger salamander (*Ambystoma californiense*) and the California red-legged frog (*Rana draytonii*). The California tiger salamander is federally listed as

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[56] Paraquat: Preliminary Ecological Risk Assessment for Registration Review, *supra* note 48.
[57] *Species Profile for Valley elderberry longhorn beetle* (*Desmocerus californicus dimorphus*), USFWS, https://ecos.fws.gov/ecp/species/7850 (last visited Oct. 27, 2022).
[58] *Species Profile for Vernal pool fairy shrimp* (*Branchinecta lynchi*), USFWS, https://ecos.fws.gov/ecp/species/498 (last visited Oct. 27, 2022).
[59] Badroo, I. A., Nandurkar, H. P., & Khanday, A. H. (2020). Toxicological impacts of herbicide paraquat dichloride on histological profile (gills, liver, and kidney) of freshwater fish Channa punctatus (Bloch). *Environmental science and pollution research international*, *27*(31), 39054–39067. Available here: https://doi.org/10.1007/s11356-020-09931-6.
[60] Species Profile for Chinook salmon (*Oncorhynchus (=Salmo) tshawytscha*), USFWS, https://ecos.fws.gov/ecp/species/E06D (last visited Oct. 27, 2022).
[61] *Species Directory: Coho Salmon (Protected)*, NOAA Fisheries, https://www.fisheries.noaa.gov/species/coho-salmon-protected#spotlight (last visited Oct. 27, 2022).
[62] *California Central Valley Steelhead*, NOAA Fisheries, https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/california-central-valley-steelhead (last visited Oct. 27, 2022).
[63] Paraquat: Preliminary Ecological Risk Assessment for Registration Review, *supra* note 48.

endangered, and state listed as threatened. 50 C.F.R. § 17.11; 14 Cal. Code Regs. § 670.5. The California tiger salamander's range overlaps with a substantial portion of the Central Valley, with critical habitat designated in Merced, San Joaquin, and Fresno County.[64]

The California red-legged frog is federally listed as threatened and is found in the coastal drainages of central California.[65] 50 C.F.R. § 17.11. In 2009, EPA found that paraquat was likely to adversely affect the California red-legged frog.[66] A report on this federally protected amphibian also found paraquat to reduce larval survival and growth rates.[67]

Given EPA's ecological risk assessment and other scientific studies that documented harm to wildlife, DPR should further analyze these impacts through the reevaluation process.

c. EPA decided to reconsider its Interim Registration Decision of paraquat

In addition to the significant adverse health and wildlife impacts paraquat poses, we also urge DPR to reevaluate paraquat because EPA has sought to reevaluate the federal registration of paraquat.[68] In 2021, EPA issued its Interim Registration Decision, approving paraquat use for another 15 years. However, more recently, EPA has decided to reconsider its decision.[69]

In May 2022, California Rural Legal Assistance ("CRLA"), the Center for Biological Diversity, and other groups sued EPA, challenging EPA's interim decision.[70] CRLA argued that EPA's risk-benefit analysis failed to address risks to farmworkers, surrounding communities, and the environment.[71] CRLA argued that EPA's risk-benefit analysis was conclusory and failed to explain why the risk of concerns it had identified to farmworkers, bystanders, and the environment were outweighed by the benefits of paraquat.[72] CLRA also pointed out that EPA failed to fully investigate paraquat's potential to volatize, which is necessary to determine harm to bystanders that may be exposed to paraquat through spray drift.[73]

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[64] *Species Profile for California Tiger Salamander* (*Ambystoma californiense*), USFWS, https://ecos.fws.gov/ecp/species/2076 (last visited Oct. 27, 2022). Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the California tiger salamander, Central Population: Final Rule, 70 Fed. Reg. 49,380 (Aug. 2005). Available here: https://www.govinfo.gov/content/pkg/FR-2005-08-23/pdf/05-16234.pdf#page=2.

[65] *Species Profile for California red-legged frog* (*Rana draytonii*), USFWS, https://ecos.fws.gov/ecp/species/2891 (last visited Oct. 27, 2022).

[66] Office of Pesticide Programs Environmental Fate and Effects Division, Risks of Paraquat Use to Federally Threatened California Red-legged Frog (*Rana aurora draytonii*), June 10, 2009, Pg. 7. Available here: https://www3.epa.gov/pesticides/endanger/litstatus/effects/redleg-frog/paraquat/analysis.pdf.

[67] Anderson, R.B. 2016. Report for Amphibian Management and Monitoring at Palo Corona Regional Park, Garland Ranch Regional Park, and Frog Pond Wetland Preserve Monterey County, CA 20. Available here: https://mprpd.specialdistrict.org/files/c08de688e/AmphibiamMgmtMonitoring_PCRP.2016.pdf.

[68] Pesticide Registration Review; Interim Decision for Paraquat Dichloride; Notice of Availability, 86 Fed. Reg. 41,471 (Aug. 2, 2021). Available here: https://www.govinfo.gov/content/pkg/FR-2021-08-02/pdf/2021-16344.pdf.

[69] Mot. for Voluntary Remand Without Vacatur, Dkt. 42-1, *California Rural Legal Assistance et al. v. EPA*, No. 21-71287 (9th Cir.).

[70] Pet'rs Opening Brief, Dkt. 27, *California Rural Legal Assistance et al. v. EPA*, No. 21-71287 (9th Cir.).

[71] *Id.* at 25.

[72] *Id.*

[73] *Id.*

In response to CRLA's arguments, EPA made a motion for voluntary remand so that it may reconsider its risk-benefit analysis and paraquat's potential for volatilization.[74] EPA admitted that its risk-benefit analysis "could have been more robust."[75] EPA also noted that there was "evidence in the record that paraquat may be likely to volatize" and that it "wishes to consider this issue further."[76] Given EPA's decision to reconsider its registration of paraquat because of deficiencies in its analysis DPR should not rely on EPA's determination and should independently reconsider paraquat's registration through the reevaluation process.

II. DPR should pursue cancellation of paraquat

In addition to initiating the reevaluation process, DPR should also pursue cancellation proceedings for paraquat because of the well documented hazards to public health and wildlife identified by EPA and independent scientists. The Food and Agricultural Code identifies nine conditions that may warrant cancellation of a pesticide registration, any one of which can support cancellation. Food & Ag. Code § 12825. At least four of the conditions triggering cancellation exist for paraquat:

a. Paraquat has "demonstrated serious uncontrollable adverse effects."

b. Paraquat causes greater detriment to the environment than the benefit received.

c. There are reasonable, effective, and practicable alternatives to paraquat that are less destructive to the environment.

d. Even when used properly, paraquat "detrimental … to domestic animals, or the public health and safety."

Food & Ag. Code § 12825(a), (b), (c), (d).

III. Use of paraquat is not necessary because there are adequate alternatives

There are adequate alternatives that obviate the need for paraquat use, including integrated pest management ("IPM") and numerous other herbicides already on the market. DPR understands its "legal mandate to encourage the use of environmentally sound pest management, including integrated pest management (IPM)."[77] DPR recognizes that IPM is an approach to pest control that "focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties."[78] With IPM, "[p]esticides are used only after monitoring indicates they are needed . . . and applied in a manner that minimizes risks to human health, beneficial and

[74] Mot. for Voluntary Remand Without Vacatur, *supra* note 69, at 10.
[75] *Id.*
[76] *Id.*
[77] *Pest Management*, DPR, https://www.cdpr.ca.gov/docs/pestmgt/ipminov/ipmmenu.htm (last visited Oct. 27, 2022).
[78] Berger, L., Farrar, J., Goodell, P., McIntyre, J. (2018). *Roadmap for Integrated Pest Management: Systems Thinking to Build Better IPM for All Californians*, California Department of Pesticide Regulation, p. iv, https://www.cdpr.ca.gov/docs/pestmgt/ipm_roadmap.pdf.

nontarget organisms, and the environment."[79] In addition to IPM, there are several registered herbicides that can be used in place of paraquat, including but not limited to glyphosate, carfentrazone, 2,4-D, bromoxynil, clethodim, hexazinone, iamazamox, and imazethapyr.[80] Therefore, the availability of other herbicides combined with IPM practices shows that using paraquat is unnecessary.

IV. DPR's reevaluation decision must also comply with CEQA

DPR's reevaluation decision must comply with CEQA because DPR's pesticide registration program is a "certified program" subject to CEQA's substantive requirements and policy goals. 14 Cal Code Regs. § 15250. Recently, a California appellate court affirmed that DPR's pesticide reevaluation decisions must comply with CEQA. *See Raptors are the Solution v. The Superior Court of Alameda County*, No. A161787, 2022 Cal. App. Unpub. LEXIS 5902 (Sept. 27, 2022). Therefore, DPR's reevaluation decision must comply with CEQA's "policy of avoiding significant adverse effects on the environment where feasible." 14 Cal Code Regs. § 15250; *see also Pesticide Action Network North America v. Department of Pesticide Regulation* (2017) 16 Cal.App.5th 224, 241 (*PANNA*).

V. DPR should immediately suspend registrations for paraquat

DPR should not wait until the termination of the reevaluation or cancellation process because the immediate suspension of paraquat is necessary and appropriate to prevent substantial harm that would occur during later proceedings. DPR should suspend a pesticide registration if there is "reason to believe" that (1) any one of the nine conditions warranting cancellation applies, and (2) continued use of the pesticide poses an "immediate substantial danger." Food & Ag. Code § 12826. As noted above, at least four conditions justify cancellation of paraquat registrations. And the same adverse impacts that make cancellation necessary also pose "immediate substantial dangers" that cannot be allowed to continue during the time-consuming reevaluation and cancellation proceedings.

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[79] *Id.*

[80] Lanini et al., 2016. Pest Management Guidelines for Agriculture; Tomato Year-Round IPM Program. University of California. UCIPM. Available here: https://www2.ipm.ucanr.edu/agriculture/tomato/Herbicide-Treatment-Table/. Canevari, W.M., Orloff, S.B., Putnam, D.H. 2017c. Alfalfa: Integrated Weed Management in Seedling Alfalfa. University of California Statewide Integrated Pest Management Program. Available here: http://ipm.ucanr.edu/PMG/r1701111.html. R.F. 2019. Asparagus: Herbicide Treatment Table. University of California Statewide Integrated Pest Management Program. Available here: https://www2.ipm.ucanr.edu/agriculture/asparagus/Herbicide-Treatment-Table/.

Thank you for your consideration of these comments.

Sincerely,

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CENTER for BIOLOGICAL DIVERSITY Because life is good.

November 3, 2023

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RE: Proposed Decision to Renew Paraquat Registrations for 2024 - California Notice 2023-12

Dear Mr. Macedo:

The Center for Biological Diversity again urges the California Department of Pesticide Regulation ("DPR") to begin reevaluation, suspension, and cancellation proceedings for pesticide products containing paraquat because of the significant adverse impacts of these products. 3 Cal. Code Regs. §§ 6220, 6221; Food & Ag. Code § 12825, 12826. As described in the comments submitted in November 2022, and included with the additional scientific literature provided with these comments,[1] paraquat poses serious and uncontrollable adverse impacts to public health and the environment, and there are reasonable, effective, and practicable alternatives that do not pose a greater detriment to the environment.

Given the grave dangers posed by paraquat we are disappointed that DPR has not provided a substantive response to the November 2022 request for reevaluation, suspension, and cancellation of paraquat. DPR's February 10, 2023, response noted that the comments and studies were "currently under review by DPR scientists [and that] DPR will respond in writing when its review is complete." While we recognize resource constraints at the agency, the scientific literature documenting the significant adverse impacts of paraquat is robust and only growing. DPR has a wealth of substantial evidence available to initiate reevaluation, suspension, or cancellation proceedings and should be taking immediate steps to reduce the threat paraquat poses to public health and the environment.

[1] https://centerforbiologicald-my.sharepoint.com/:f:/g/personal/jevans_biologicaldiversity_org/EiFI6Twl-6ZDo3e3QIih4soBidFiiUgJuIZ1OMQ5x2CWDA . PDF documents will also be sent separately via email.

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We urge DPR to take steps to begin cancellation proceedings because the serious uncontrollable adverse effects of paraquat. Food & Ag. Code § 12825. And in the interim, DPR should immediately suspend paraquat because the continued use of this pesticide presents immediate substantial danger to human health and the environment. Food & Ag. Code § 12826. These steps are consistent with DPR's mandate to "eliminate from use in the state any pesticide that endangers the agricultural or nonagricultural environment." Food & Ag. Code § 12824.

Paraquat is "one of the most acutely lethal pesticides still in use today, [and] is implicated in around 100 poisoning incidents in the USA each year, resulting in at least one death per year since 2012." [2] While the amount of pounds of paraquat applied in California has been declining over the past several years, it still ranks within the top 100 pesticides used in California with over 426,104 pounds used over 399,445 acres in 2021.[3]

The Center for Biological Diversity is a non-profit environmental organization dedicated to the protection of native species and their habitats through science, policy, and environmental law. The Center for Biological Diversity has over 1.7 million members and supporters throughout the United States, including over 200,000 residents in California and has worked for many years to reduce the significant adverse effects of pesticides, including paraquat.

I. DPR should promptly reevaluate paraquat

A pesticide must be reevaluated when it presents significant adverse impacts, including but not limited to hazards to public or worker health and/or fish and wildlife. 3 Cal. Code Regs §§ 6220, 6221. The health risks of paraquat exposure through the skin, ingestion, or inhalation are well documented and range from heart failure, kidney failure, liver failure, and lung scarring.[4] Multiple scientific studies have also found links between paraquat exposure and diseases such as Parkinson's and cancer. These health risks fall disproportionately on farmworkers and farming communities within California. Therefore, paraquat should be reevaluated due to its significant adverse impacts on human health and protected wildlife.

a. Paraquat presents significant adverse impacts to human health

i. Paraquat exposure has been linked to Parkinson's disease

Parkinson's disease is a neurological condition that "stems from a loss of nerve cells in a particular region of the brain that produces dopamine, the brain chemical that helps control movements such as walking." [5] Those with Parkinson's experience "tremors, slowness in

[2] Donley, N. (2019). The USA lags behind other agricultural nations in banning harmful pesticides. *Environmental Health*, 18(1). Available here: doi:10.1186/s12940-019-0488-0.
[3] California Department of Pesticide Regulation, The Top 100 Chemicals by Acres Treated in Total Statewide Pesticide Use in 2021. Available here: https://www.cdpr.ca.gov/docs/pur/pur21rep/top100lists/top_100_chemicals_by_acres_treated.pdf
[4] *Facts About Paraquat*, CDC, https://emergency.cdc.gov/agent/paraquat/basics/facts.asp.
[5] Dorsey, R., Sherer, T., Okun, M., Bloem, B, Ending Parkinson's Disease 2 (2020).

movement, stiffness, and difficulties with balance and walking." [6] There is currently no cure for Parkinson's. [7]

We urge DPR to consider the "plethora of studies [that] have shown that exposure to paraquat is correlated positively within parkinsonism in humans." [8]An event that contributes to death in patients with Parkinson's is when there is an aggregation of α-Synuclein (αS), a highly soluble unfolded protein, accumulates within the brain. The αS protein forms clumps of protein that spread and eventually damage the brain. [9] Mice that have been exposed to Paraquat also experience an aggregation of αS, which is the same mechanism believed to contribute to the cause of death for Parkinson's patients. [10] Chronic paraquat exposure has been well-documented to selectively induce dopaminergic neuron loss, the hallmark pathologic feature of Parkinson's. [11] In other terms, Parkinson's is a dopamine deficiency disease. There are four major dopamine pathways, and the one that contributes to motor skills is called the nigrostriatal dopamine pathway. [12] Within this pathway, is a structure called the substantia nigra, and it produces dopamine and forms connections through the brain and plays an essential role in the movement of dopamine throughout the brain. [13]

Studies have shown that Parkinson's develops in patients with an 80% or greater loss of dopamine-producing cells in the substantia nigra.[14] Paraquat exposure causes oxidative stress (decomposition) at the dopamine receptor sites in the brain in mice, and in a 2005 study the "systemic treatment of mice with the herbicide paraquat cause[d] the selective loss of nigrostriatal dopaminergic neurons, reproducing the primary neurodegenerative feature of Parkinson's disease" and "further evidence of paraquat-induced oxidative injury derives from the observation of nitrotyrosine [a biomarker for oxidative stress] immunoreactivity [the reaction to oxidative stress] in the substantia nigra of paraquat-treated animals.[15] Additional animal studies

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[6] *Id.*
[7] *Id.* at 3.
[8] Anselmi, L., Bove, C., Coleman, F. H., Le, K., Subramanian, M. P., Venkiteswaran, K., Subramanian, T., & Travagli, R. A. (2018). Ingestion of subthreshold doses of environmental toxins induces ascending Parkinsonism in the rat. *NPJ Parkinson's disease*, *4*, 30. Available here: https://doi.org/10.1038/s41531-018-0066-0.
[9] Mayo Clinic, Parkinson's disease. Available at https://www.mayoclinic.org/diseases-conditions/parkinsons-disease/diagnosis-treatment/drc-20376062.
[10] Nuber, S. and Selkoe, D. (2023). The Parkinson-Associated Toxin Paraquat Shifts Physiological α-Synuclein Tetramers toward Monomers That Can Be Calpain-Truncated and Form Oligomers, *The American Journal of Pathology*, Volume 193, Issue 5, 2023, https://doi.org/10.1016/j.ajpath.2023.01.010.
[11]Duan, W. et al (2023). Upregulation of mitochondrial calcium uniporter contributes to paraquat-induced neuropathology linked to Parkinson's disease via imbalanced OPA1 processing, *Journal of Hazardous Materials*, Volume 453, https://doi.org/10.1016/j.jhazmat.2023.131369.
[12] Sanesco blog. (2016) Dopamine pathways. Available at https://sanescohealth.com/blog/dopamine-pathways/.
[13] Cleveland Clinic. (2023). Substantia Nigra (SN). Available at https://my.clevelandclinic.org/health/body/23010-substantia-nigra-sn.
[14] American Association of Neurological Surgeons. (2003). Parkinson's Disease. Available here: https://www.aans.org/en/Patients/Neurosurgical-Conditions-and-Treatments/Parkinsons-Disease
[15] McCormack, A.L., Atienza, J.G., Johnston, L.C., Andersen, J.K., Vu, S. and Di Monte, D.A. (2005), Role of oxidative stress in paraquat-induced dopaminergic cell degeneration. Journal of Neurochemistry, 93: 1030-1037. https://doi.org/10.1111/j.1471-4159.2005.03088.x.

"demonstrate that paraquat can elicit the hallmark symptoms of Parkinson's in mice." [16] DPR should reevaluate paraquat with consideration of the well-established causal link between Parkinson's and paraquat exposure.

Additionally, there are gender-specific risk factors for Parkinson's disease related to hormonal factors, specifically for men, who are more pre-disposed to developing Parkinson's. This is particularly disastrous for men that are exposed to paraquat, since they are already predisposed to develop Parkinson's. Estrogens have been proven to provide a neuroprotective effect[17] and post-menopausal women that have gone through estrogen replacement therapy have had results including improved cognitive function/mental performance, and delayed onset of neurodegenerative disorders, such as Alzheimer's and possibly Parkinson's disease. [18] It's important to call attention to the protective element of this hormonal difference because it demonstrates the preexisting disposition of men to be more likely to develop Parkinson's. Studies of mice have displayed this gendered disparate adverse impact of paraquat exposure and subsequently developing Parkinson's brain chemistry and symptoms.

Men are twice as likely to develop Parkinson's,[19] to have an earlier onset of the disease and faster disease progression,[20] and more severe dopaminergic demineralization,[21] which is the decomposition of dopamine receptors in the nigrostriatal dopamine pathway. Similar results have been found in animal models of Parkinson's disease. One study of mice found that early-life exposure to paraquat for male mice caused impairment in working memory and cognitive ability in male mice, but not in female mice, exhibiting a sex-specific impairment.[22]

This study also addressed the consequences of re-exposure to paraquat and the gendered disproportionate impact of paraquat exposure. Notably, re-exposure to paraquat exacerbated neurobehavioral disorders and anxiety levels compared to single exposure during different life stages for male mice.[23] It has been determined from the scientific literature that men have

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[16] Brief for Timothy Greenamyre et al. as Amici Curiae Supporting Petitioners, *California Rural Legal Assistance et al. v. U.S. Environmental Protection Agency*, (2021) (No. 21-71287).

[17]Lee, S.J. and McEwen, B.S. (2001). Neurotrophic and Neuroprotective Actions of Estrogens and Their Therapeutic Implications. *Annual Review of Pharmacology & Toxicology*, 41(1):569. https://www.annualreviews.org/doi/10.1146/annurev.pharmtox.41.1.569

[18] *Id.*

[19] M. Baldereschi, A. Di Carlo, W.A. Rocca, P. Vanni, S. Maggi, E. Perissinotto, F. Grigoletto, L. Amaducci, D. Inzitari, Parkinson's disease and parkinsonism in a longitudinal study: Two-fold higher incidence in men, *Neurology* Nov 2000, 55 (9) 1358-1363; DOI: https://doi.org/10.1212/WNL.55.9.1358.

[20] Georgiev, D., Hamberg, K., Hariz, M., Forsgren, L., & Hariz, G. -M. (2017). Gender differences in Parkinson's disease: A clinical perspective. *Acta Neurologica Scandinavica*, *136*(6), 570–584. https://doi-org.libproxy.pcc.edu/10.1111/ane.12796.

[21] Kaasinen, V., Joutsa, J., Noponen, T., Johansson, J., and Seppänen,M. (2015). Effects of aging and gender on striatal and extrastriatal [123I]FP-CIT binding in Parkinson's disease, *Neurobiology of Aging*, Volume 36, Issue 4, https://doi.org/10.1016/j.neurobiolaging.2015.01.016.

[22]Zuo, Z., Li, J., Zhang, B., Hang, A., Wang, Q., Xiong, G., Tang, L., Zhou, Z., and Chang, X. (2023). Early-Life Exposure to Paraquat Aggravates Sex-Specific and Progressive Abnormal Non-Motor Neurobehavior in Aged Mice. Toxics. 11(10):842. https://doi.org/10.3390/toxics11100842.

[23] *Id.*

greater sensitivity and exacerbated health problems from paraquat exposure. DPR should consider the significant disproportionate impact to men who work in industries where they are re-exposed to paraquat on a regular basis as part of their job requirements and have a greater risk of developing Parkinson's.

ii. Paraquat exposure could be linked to other dopamine deficient disorders

The connection between Parkinson's and paraquat exposure is much more developed when compared to the potential influence of exposure in the development of other dopamine deficiency disorders like depression, attention deficit hyperactive disorder (ADHD), and restless leg syndrome. Yet, they have similar expressions in terms of a deficiency of uptake of dopamine in the brain. Depression is a comorbidity (a simultaneous present disease or medical condition) for many Parkinson's patients, "and there is evidence to suggest that depression can actually influence the severity and clinical management of PD [Parkinson's] motor symptoms – and perhaps even affect the progression of the underlying neurodegenerative process."[24] Research has found a link between developmental pesticide exposure and ADHD. One study investigated the development implications from another pesticide, the pyrethroid pesticide deltamethrin, in uteor and while breastfeeding on mice and found that the mice exhibited dysfunctional dopamine signaling in the brain, hyperactivity, issues with working memory, attention deficits, and impulsive behavior which are all characteristics of ADHD.[25] Although deltamethrin is an insecticide and paraquat is a herbicide, this study is relevant because both deltamethrin and paraquat affected the dopamine systems in rats that were treated with the two pesticides.

Additionally, epidemiological evidence demonstrates that exposure to pyrethroid pesticides in children is associated with ADHD and considering the mechanistic application, it appears that these behavioral alterations are driven by disruption of the dopamine system.[26] More research is needed on the impacts of pesticide exposure, specifically paraquat, on the development of other dopamine deficiency disorders. Yet, there is existing literature that leads to an initial conclusion that exposure to pesticides that affect dopamine pathways – like paraquat – can lead to the expression of symptoms of dopamine deficiency disorders.

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[24] Rudyk C, Litteljohn D, Syed S, Dwyer Z, Hayley S. (2015). Paraquat and psychological stressor interactions as pertains to Parkinsonian co-morbidity. *Neurobiol Stress*. Nov 12;2:85-93. doi: 10.1016/j.ynstr.2015.09.001.
[25] Rutgers Today. (2015). Research & Innovation: Common Pesticide May Increase Rick of ADHD. Available at https://www.rutgers.edu/news/common-pesticide-may-increase-risk-adhd.
[26] Richardson, J.R., Taylor, M.M., Shalat, S.L., Guillot, T.S., III, Caudle, W.M., Hossain, M.M., Mathews, T.A., Jones, S.R., Cory-Slechta, D.A. and Miller, G.W. (2015), Developmental pesticide exposure reproduces features of attention deficit hyperactivity disorder. *The FASEB Journal*, 29: 1960-1972. https://doi.org/10.1096/fj.14-260901.

iii. Paraquat exposure has been linked to thyroid cancer

A study investigating thyroid cancer in agricultural areas in Central California found that pesticide exposure, including paraquat, is associated with an increased risk of thyroid cancer.[27] The study documented "consistent positive associations" between paraquat exposure and thyroid cancer.[28] A previous study in 2009, reviewed reports of hypothyroidism and hyperthyroidism among female spouses of pesticide applicators, and applicators, in Iowa and North Carolina from 1993-1997. The study found that spouses (the pesticide applicators) that had ever used paraquat, compared to spouses that had never used paraquat, had increased odds of hyperthyroid disease. [29] Exhibiting hyperthyroidism does not, by default, mean that an individual will develop thyroid cancer, but it is "associated with high incidence[s] of thyroid carcinoma; furthermore, tumors arisen in hyperthyroid tissue show an aggressive behavior."[30] Additionally, hyperthyroidism is not considered one of the primary symptoms of thyroid cancer, but some studies have found that up to 20 percent of people with thyroid cancer may have hyperthyroidism.[31] In light of these studies, DPR should reevaluate paraquat to further investigate its carcinogenic effects.

iv. Agricultural workers and those living in agricultural areas are most at risk for paraquat exposure

Given the high use of paraquat in much of California's Central Valley, agricultural workers and residents living in these high exposure areas are at greater risk of developing Parkinson's disease and other illnesses caused by this extremely toxic herbicide. Thus, it is imperative that DPR consider the disproportionate impact that paraquat exposure has on farming communities in the state.

A study looking at paraquat exposure in the Central Valley found those exposed to both paraquat and maneb, had a greater risk of developing Parkinson's, especially if exposure occurred during teenage years or young adulthood.[32] Additional studies have reported the risk of

[27] Omidakhsh, N., Heck, J., Cockburn, M., Ling, C., Hershman, J., & Harari, A. (2022). Thyroid Cancer and Pesticide Use in a Central California Agricultural Area: A Case Control Study. *The Journal of Clinical Endocrinology & Metabolism*, *107*(9), e3574–e3582. Available here: https://doi.org/10.1210/clinem/dgac413.
[28] Cox, J, *Study links use of paraquat, other pesticides to thyroid cancer in southern, central valley*, Bakersfield.com (Sept. 19, 2022), https://www.bakersfield.com/news/study-links-use-of-paraquat-other-pesticides-to-thyroid-cancer-in-southern-central-valley/article_cd6d8eea-3838-11ed-ae09-b7fea4f12e80.html.
[29] Goldner, Whitney S., et al. (2010). Pesticide Use and Thyroid Disease Among Women in the Agricultural Health Study. *American Journal of Epidemiology*, vol. 171, no. 4, 2010, pp. 455–64, https://doi.org/10.1093/aje/kwp404.
[30] Medas F., Erdas, E., Canu, G.L. et al. (2018). Does hyperthyroidism worsen prognosis of thyroid carcinoma? A retrospective analysis on 2820 consecutive thyroidectomies. *J of Otolaryngol - Head & Neck Surg* 47, 6 https://doi.org/10.1186/s40463-018-0254-2.
[31] Moffitt Cancer Center. (2023). Can Hyperthyroidism Be a Thyroid Cancer Symptom? Available here: https://www.moffitt.org/cancers/thyroid-cancer/faqs/can-hyperthyroidism-be-a-thyroid-cancer-symptom/.
[32] Costello, S., Cockburn, M., Bronstein, J., Zhang, X., & Ritz, B. (2009). Parkinson's disease and residential exposure to maneb and paraquat from agricultural applications in the central valley of California. *American journal of epidemiology*, *169*(8), 919–926. Available here: https://doi.org/10.1093/aje/kwp006.

Parkinson's with the use of pesticides rotenone, dieldrin and paraquat.[33] In a multicenter case-control study comparing lifelong occupational and job tasks histories to determined associations with parkinsonism, occupational pesticide exposure emerged as the most consistent etiologic association with parkinsonism out of 591 cases compared cross-country, some of which were conducted at The Parkinson's Institute in Sunnyvale, CA. The 3 specific pesticides identified (2,4-dichlorophenoxy-acetic acid, paraquat, and permethrin) all had effects on dopaminergic neurons in experimental settings.[34] With the extensive amount of scientific evidence documenting a causal relationship between Parkinson's and paraquat exposure, DPR should initiate the reevaluation process are reexamine the documented significant adverse impacts from paraquat.

v. Agricultural workers and those living in agricultural areas with mental health concerns are known to resort to Paraquat for self-poisoning

Paraquat is used as a method of suicide in rural areas by agricultural workers because of its availability. Approximately 14-20% of global suicides are from pesticide self-poisoning. [35] A lethal dose for an adult by ingestion for Paraquat is only 35 mg/kg b.w., less than a mouthful of a 20% solution, and the case fatality following intentional digestion can be as high at 80% due to a lack of effective treatment.[36, 37] Since the Green Revolution started in the 1950's, an estimated 14 million people have died from suicide self-poisoning. [38]

In California, during 2021, 76.65% of communities (across the state) did not have enough mental health providers to serve residents, according to federal guidelines. [39] It is especially limited in rural California, "where behavioral health provider availability already ranges from limited to nonexistent across large expanses of geography." [40] One example is Inyo County, where there is a federally qualified health care center and an Indian Health Services provider in

[33] Tsalenchuk, M., Gentleman, S.M., and Marz, S.J. (2023). Linking environmental risk factors with epigenetic mechanisms in Parkinson's disease. *Nature*, 123 (2023). DOI: https://doi.org/10.1038/s41531-023-00568-z.
[34] Tanner, C. M., et al. (2009). Occupation and Risk of Parkinsonism: A Multicenter Case-Control Study." *Archives of Neurology (Chicago)*, vol. 66, no. 9, 2009, https://doi.org/10.1001/archneurol.2009.195.
[35] Shu-Sen Chang, Chien-Yu Lin, Ming-Been Lee, Lih-Jong Shen, David Gunnell & Michael Eddleston (2022) The early impact of paraquat ban on suicide in Taiwan, *Clinical Toxicology*, 60:1, 131-135, DOI: 10.1080/15563650.2021.1937642.
[36] Stuart, A.M., Merfield, C.N., Horgan, F.G. *et al.* Agriculture without paraquat is feasible without loss of productivity—lessons learned from phasing out a highly hazardous herbicide. *Environ Sci Pollut Res* **30**, 16984–17008 (2023). https://doi.org/10.1007/s11356-022-24951-0.
[37] Fléchel, Alixe, et al. 2018. Paraquat poisoning in Western French Guyana: a public health problem persisting ten years after its withdrawal from the French market. *Eur Rev Med Pharmacol Sci* 22.20 (2018): 7034-7038. Available here: https://www.europeanreview.org/wp/wp-content/uploads/7034-7038.pdf.
[38] Karunarathne, A., Gunnell, D., Konradsen, F., & Eddleston, M. (2020). How many premature deaths from pesticide suicide have occurred since the agricultural Green Revolution?. *Clinical toxicology*, 58(4), 227-232., https://doi.org/10.1080/15563650.2019.1662433.
[39] CAMS-care. (2023). California Suicide Rate. Available at: https://cams-care.com/state-statistics/california/.
[40] Kingsley, M. (2022). The Sacramento Bee: Opinion. A California crisis: Too many rural communities have no access to mental health treatment. Available at: https://www.sacbee.com/opinion/article268851797.html.

Bishop. The rest of the 10,000 square miles of the county are wither underserved or completely unserved by any kind of mental health organization. [41]

Access to mental health resources is limited in California's agricultural communities and paraquat is too easily accessible for farmworkers that are experiencing a mental health crisis. The availability of paraquat, pared with a lack of access to mental health resources for agricultural workers, and the fact that there is no antidote for paraquat poisoning, are all factors that significantly increase the risk of successful suicide attempts by agricultural workers.

II. DPR should pursue cancellation of paraquat

In addition to initiating the reevaluation process, DPR should also pursue cancellation proceedings for paraquat because of the well documented hazards to public health and wildlife identified by EPA and independent scientists. The Food and Agricultural Code identifies nine conditions that may warrant cancellation of a pesticide registration, any one of which can support cancellation. Food & Ag. Code § 12825. At least four of the conditions triggering cancellation exist for paraquat:

a. Paraquat has "demonstrated serious uncontrollable adverse effects."

b. Paraquat causes greater detriment to the environment than the benefit received.

c. There are reasonable, effective, and practicable alternatives to paraquat that are less destructive to the environment.

d. Even when used properly, paraquat "detrimental … to domestic animals, or the public health and safety."

Food & Ag. Code § 12825(a), (b), (c), (d).

III. Use of paraquat is not necessary because there are adequate alternatives

There are adequate alternatives that obviate the need for paraquat use, including integrated pest management ("IPM") and numerous other herbicides already on the market. DPR understands its "legal mandate to encourage the use of environmentally sound pest management, including integrated pest management (IPM)."[42] DPR recognizes that IPM is an approach to pest control that "focuses on long-term prevention of pests or their damage through a combination of techniques such as biological control, habitat manipulation, modification of cultural practices, and use of resistant varieties."[43] With IPM, "[p]esticides are used only after monitoring indicates they are needed . . . and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the environment."[44] In addition to IPM, there are several registered

[41] *Id.*
[42] *Pest Management*, DPR, https://www.cdpr.ca.gov/docs/pestmgt/ipminov/ipmmenu.htm.
[43] Berger, L., Farrar, J., Goodell, P., McIntyre, J. (2018). *Roadmap for Integrated Pest Management: Systems Thinking to Build Better IPM for All Californians*, California Department of Pesticide Regulation, p. iv, https://www.cdpr.ca.gov/docs/pestmgt/ipm_roadmap.pdf.
[44] *Id.*

herbicides that can be used in place of paraquat, including but not limited to glyphosate, carfentrazone, 2,4-D, bromoxynil, clethodim, hexazinone, iamazamox, and imazethapyr.[45] Therefore, the availability of other herbicides combined with IPM practices shows that using paraquat is unnecessary**.**

IV. DPR's reevaluation decision must also comply with CEQA

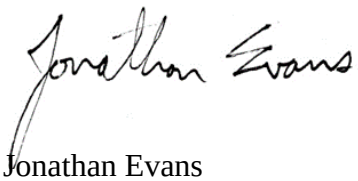
DPR's reevaluation decision must comply with CEQA because DPR's pesticide registration program is a "certified program" subject to CEQA's substantive requirements and policy goals. 14 Cal Code Regs. § 15250. Recently, a California appellate court affirmed that DPR's pesticide reevaluation decisions must comply with CEQA. *See Raptors are the Solution v. The Superior Court of Alameda County*, No. A161787, 2022 Cal. App. Unpub. LEXIS 5902 (Sept. 27, 2022). Therefore, DPR's reevaluation decision must comply with CEQA's "policy of avoiding significant adverse effects on the environment where feasible." 14 Cal Code Regs. § 15250; *see also Pesticide Action Network North America v. Department of Pesticide Regulation* (2017) 16 Cal.App.5th 224, 241 (*PANNA*).

V. DPR should immediately suspend registrations for paraquat

DPR should not wait until the termination of the reevaluation or cancellation process because the immediate suspension of paraquat is necessary and appropriate to prevent substantial harm that would occur during later proceedings. DPR should suspend a pesticide registration if there is "reason to believe" that (1) any one of the nine conditions warranting cancellation applies, and (2) continued use of the pesticide poses an "immediate substantial danger." Food & Ag. Code § 12826. As noted above, at least four conditions justify cancellation of paraquat registrations. And the same adverse impacts that make cancellation necessary also pose "immediate substantial dangers" that cannot be allowed to continue during the time-consuming reevaluation and cancellation proceedings.

Thank you for your consideration of these comments.

Sincerely,



Jonathan Evans
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[45] Lanini et al., 2016. Pest Management Guidelines for Agriculture; Tomato Year-Round IPM Program. University of California. UCIPM. Available here: https://www2.ipm.ucanr.edu/agriculture/tomato/Herbicide-Treatment-Table/. Canevari, W.M., Orloff, S.B., Putnam, D.H. 2017c. Alfalfa: Integrated Weed Management in Seedling Alfalfa. University of California Statewide Integrated Pest Management Program. Available here: http://ipm.ucanr.edu/PMG/r1701111.html. R.F. 2019. Asparagus: Herbicide Treatment Table. University of California Statewide Integrated Pest Management Program. Available here: https://www2.ipm.ucanr.edu/agriculture/asparagus/Herbicide-Treatment-Table/.

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