April 25, 2022

Via Electronic and Overnight Mail

Ms. Lauren Otani
Senior Environmental Scientist
California Department of Pesticide Regulation
1001 I Street
P.O. Box 4015
Sacramento, CA 95812-4015
dpr22001@cdpr.ca.gov

Re: Comments on Proposed Control Measures to Protect Pollinator Health (DPR 22-001 Neonicotinoid Exposure Protection)

Dear Ms. Otani:

Pollinator Stewardship Council and American Beekeeping Federation appreciate the opportunity to comment on the proposed control measures to protect pollinator health published by the California Department of Pesticide Regulation (DPR) on February 25, 2022.

Pollinator Stewardship Council is a non-profit organization of beekeepers founded in 2012 to defend managed and native pollinators vital to a sustainable and affordable food supply from the adverse impacts of pesticides. American Beekeeping Federation is the largest beekeeping organization in the United States. Collectively, the Pollinator Stewardship Council and American Beekeeping Federation bring decades of commercial and sideline beekeeping experience to our perspectives on issues involving pollinator health. As beekeepers, our interest is in helping DPR to develop informed policies and regulations that allow pollinators to thrive.

The proposed regulations DPR has made available for public review and comment are little different than the draft mitigation measures DPR circulated for public review in August 2020. Substantive changes to the proposed regulations include modified rate and timing restrictions for several crop groups; updated language exempting applications intended to control a quarantine pest or address a local emergency; a new exemption for applications made to agricultural commodities grown in enclosed spaces or exclusionary structures or netting; and the removal of restrictions limiting yearly applications.

In our view, the minimal changes to proposed regulations do not address concerns and shortcomings detailed in our comments on the draft regulations. We therefore attach as Exhibit A hereto and reiterate our October 30, 2020 comments on the draft regulations, which set forth the following major problems associated with DPR's proposed approach for protecting pollinator health:

1) Seed treatments contribute the majority of neonicotinoid use in California, but their use and subsequent impacts are addressed by DPR's proposed regulations;

2) Adverse effects on honey bee queen viability are not solved by the proposed regulations;

3) The proposed distinctions between commercially pollinated crops and crops not hosting managed pollinators do not provide protection for pollinators;

4) Restricting applications to blooming plants is not sufficient to protect pollinators; and

5) DPR needs to include all systemic, persistent insecticides in these regulations, not just the four nitroguanidine neonicotinoids.

Systemic insecticides like the four nitroguanidine neonicotinoids are absorbed by plants and contaminate soil and ground water, which often results in chronic, low-level exposure to pollinators. Chronic exposure, even at low levels over time, have been proven to be as dangerous and impactful as acute exposure at high levels. DPR's proposed regulations do not address the danger posed to pollinators through low level chronic exposure over time.

We are also attaching as Exhibit B hereto a scientific review of the proposed regulations prepared by Professor James C. Nieh at U.C. San Diego. We urge DPR to address the significant issues and questions identified Dr. Nieh's review. Similarly, we ask DPR to review and consider the scientific studies listed in Exhibit C, which include the work of Dr. Henk Tennekes which illustrates the damage of low-level chronic exposure supported by the Druckrey-Kupfmuller equation. We are providing DPR with a thumb drive containing electronic .pdf copies of studies listed in Exhibit C.

Ultimately, the combination of toxicity, high water solubility, and persistence in the environment for these pesticides ensures that pollinators will experience both acute and chronic exposures through nectar, pollen, and water. Colony health will continue to be compromised. Our bees and our beekeeping operations are suffering from the widespread use of these pesticides. To best protect pollinators and California's agricultural economy, DPR should eliminate all agricultural and outdoor residential uses of systemic persistent insecticides, including neonicotinoids.

Sincerely,

Steve Ellis, President
Pollinator Stewardship Council

Dan Winter, President
American Beekeeping Federation

Gregory C. Loarie
Earthjustice
(Counsel for Pollinator Stewardship Council and American Beekeeping Federation)

Exhibit A

Pollinator Stewardship Council
1617 White Water Ct. Berthoud, CO 80513
www.pollinatorstewardship.org
970-213-3099

October 30, 2020

Tulio Macedo, Chief
Pesticide Registration Branch
1001 I Street
Sacramento, CA 95814

Dear Mr. Macedo,

We are writing to comment on the Department of Pesticide Regulation's (DPR) draft proposed pollinator protection regulations regarding continued use of nitroguanidine neonicotinoid insecticides in California. Collectively, we bring many years of commercial and sideline beekeeping experience to our perspectives on this issue. Overall, our experience has shown that the impact of neonicotinoid insecticides on pollinators is extraordinarily difficult to manage using DPR's usual methods of risk reduction. While the proposed regulations begin to address the problems associated with the use of highly toxic, persistent systemic insecticides, they are not sufficient to protect the managed honeybees that contribute to an abundant food supply, nor will they protect the native pollinators. As beekeepers, we are interested in helping DPR develop mitigation strategies that allow pollinators to thrive.

California has a unique responsibility to the beekeeping industry in the U.S. Approximately 90% of the country's commercial bees come to California for at least two months of the year for almond pollination in February and March. Many colonies arrive in the late fall and don't leave until late spring the following year. Over 1,000,000 honey bee queens and more than 200,000 packages of bees are raised commercially in California,[1] primarily in the Sacramento Valley and Sierra foothills. Significantly, at an average price of $18 per queen and $85 per package,[2] the production of queens and packages in California is worth $35,000,000 to the economy. Many queens and packages are either shipped or later moved to many of the other states in the U.S. Thus, the risks associated with bee-toxic pesticide use in California do not just affect California bees and crop production, but bees and crop production nationwide. This fact creates a special obligation for DPR to ensure their regulations adequately protect pollinators. The fact that California has a robust pesticide regulatory system and authority to control pesticide use allows DPR to lead the way in pollinator protection, which we strongly urge you to do.

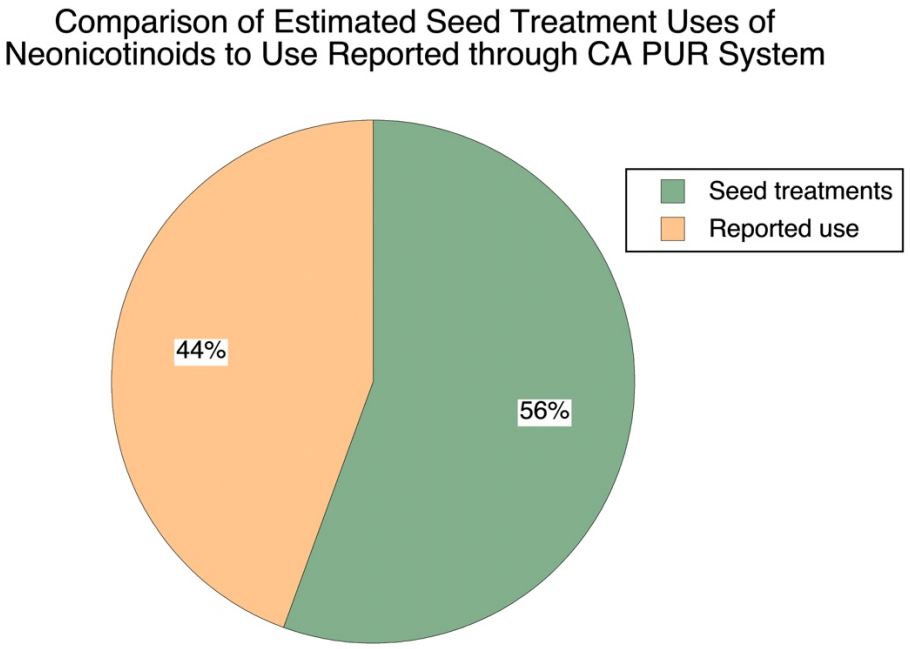
We highlight here our five major concerns with the proposed regulations:

1) Seed treatments contribute the majority of neonicotinoid use in California, but their use and subsequent impacts are not tracked or mitigated by DPR.
2) Adverse effects on honey bee queen viability are not solved by the proposed regulations.
3) The proposed label distinctions between commercially pollinated crops and crops not hosting managed pollinators do not provide protection for pollinators.
4) Restricting applications to blooming plants is not sufficient to protect pollinators
5) DPR needs to include all systemic, persistent insecticides in these regulations, not just the four nitroguanidine neonicotinoids.

We elaborate on these comments below. In brief, the proposed restrictions will not protect pollinators. The combination of toxicity, high water solubility, and persistence in the environment for these pesticides ensures that pollinators will experience both acute and chronic exposures through nectar, pollen, and water. Colony health will continue to be compromised. Our bees and our beekeeping operations are suffering from the widespread use of these pesticides. To best protect pollinators from systemic, persistent insecticides, DPR should eliminate all agricultural and outdoor residential uses of systemic persistent pesticides.

1) Neonicotinoid seed treatments are not tracked or mitigated

A recent report by Mineau,[3] in which nitroguanidine neonicotinoid seed treatment use in CA was estimated based on seeding rates, typical coating amounts, and the proportion of seed that is typically treated for specific crops, provides an estimate of 512,000 pounds of neonicotinoids used for seed treatments in 2016. Use of these pesticides reported through the Pesticide Use Reporting (PUR) system for foliar or soil applications was 410,000 lbs. Thus, DPR's proposed regulations only address 44% of total use of these pesticides.



The presence of this additional burden of neonicotinoids in the environment provides an additional exposure source for pollinators from pollen and nectar in plants grown from treated seed and further contaminates blooming field-side weeds from planting dust or runoff. Woody perennial plants take up these pesticides and express them in pollen and nectar for several years after a single exposure. The persistence of these compounds allows concentrations to build up in soils planted with treated seed year after year, increasing the amounts available for uptake by blooming plants on which pollinators forage. Waterways can act as a chronic exposure source, as these chemicals are slowly leached out with irrigation water runoff and pollinators gather water to cool the hive or dilute honey for food.

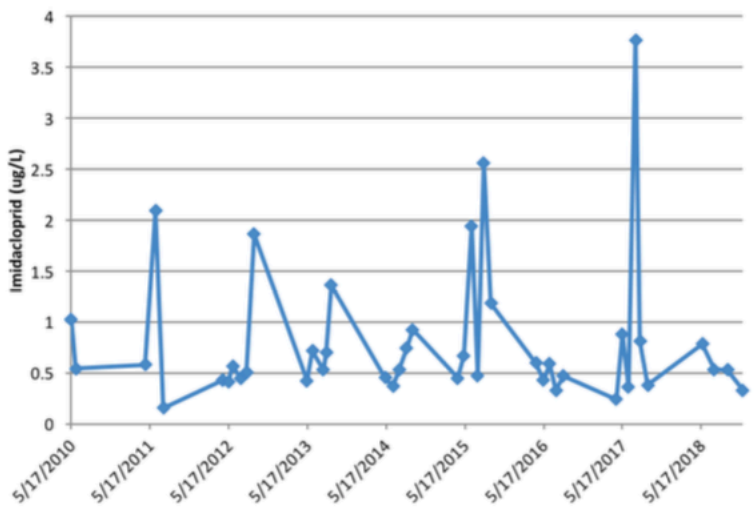
The proposed regulations include restrictions on total amounts applied, applications during bloom, and applications to fields under contract for commercial pollination. However, the fact that 56% of total use is for unregulated seed treatments indicates that the proposed risk reduction measures will not be comprehensive, resulting in additional risks to pollinators.

Risk reduction by restrictions on annual amounts used must account for ALL uses, not just 44% of use. Because of their high water solubility and persistence, the contamination of aquatic resources used by pollinators with neonicotinoids is of special concern. In particular, exposure of honey bee queens to water brought back to the hive, as well as pollen and nectar from seed-treated crops are a significant, unexamined exposure pathway. We will address issues that pollinators face from this contamination in the next section.

DPR already has data that indicate a substantial and growing amount of soil-applied neonicotinoids end up in California waterways. Mineau[3] used DPR's Surface Water Database (SURF)[4] of water sampling data to demonstrate common detections of neonicotinoids in CA

surface waters in agricultural areas. Figure 7 from this report (reference 3) is reproduced below as a representative example, showing that for the Salinas Valley agricultural area, nearly all samples showed detections of imidacloprid over the benchmark for protecting aquatic life of 0.1 μg/L. Insufficient sampling of clothianidin and thiamethoxam has been done, but as these two pesticides are the ones most used in seed treatments, they are contributing to exposure.

Figure 7. Imidacloprid residues at site 27-7 (Quail creek), a tributary to the Salinas River, Monterey County.



2) Adverse effects on honey bee queen viability are not solved by the proposed regulations

The use of the 410,000 pounds of nitroguanidine insecticides as foliar or soil applications plus the estimated 512,000 pounds used in seed treatments comprise a hefty pesticide burden for pollinators. As documented above, many of these applied pesticides end up in our waterways, as well as in the pollen and nectar that our bees use for food, leading to exposures for every member of a honey bee colony. The queen is the most important member of the colony, and her reproductive success or failure determines the fate of the colony.

Since "Colony Collapse Disorder" (CCD) was first documented in 2006, the nature of colony failures has changed. CCD is characterized by an empty hive with a few worker bees left surrounding the queen and the rest of the colony just gone. Today, it is queen failures that dominate the landscape. Often a newly installed queen will not live for more than a few months before she is superseded or dies. Queens used to be viable for several years, but no longer. In this same time frame, neonicotinoid use has increased, as has the use of several other bee-toxic pesticides. Several studies have shown that queen failure is directly associated with exposure to neonicotinoid pesticides.

Sandrock, *et al.*[5] exposed honeybee colonies to sublethal levels of thiamethoxam (5 ppb) and clothianidin (2 ppb) in pollen over two brood cycles, compared side-by-side with unexposed

control colonies. The exposed colonies exhibited decreased performance in the short-term resulting in fewer adult bees and brood, as well as a reduction in honey production and pollen collection. While this reduction in performance did not necessarily correlate with overwintering losses, the neonicotinoid-treated colonies were significantly associated with queen failures the following spring, with queen supersedure observed for 60% of the neonicotinoid-exposed colonies within a one-year period, but not for control colonies.

Wu-Smart and Spivak[6] evaluated the impact of sublethal levels of imidacloprid (0, 10, 20, 50 and 100 ppb in sugar syrup) on queen fecundity, finding reduced egg-laying and locomotor activity in queens, as well as impaired foraging and hygienic behavior in worker bees.

DPR's proposed regulations do little to protect queens. With nearly a million pounds of the nitroguanidine insecticides used each year in areas where queen rearing operations place their colonies, exposures through contaminated nectar, pollen and water are inevitable. Elimination of all outdoor uses of these pesticides is the best solution to reduce the damage.

3) Restricting applications to blooming plants is not sufficient to protect pollinators

Insecticides that are highly toxic to bees, water soluble, and persistent in the environment are incompatible with pollinator health, since these characteristics lead to exposure through pollen, nectar and water consumed by honey bee colonies. The neonicotinoids addressed in the proposed regulations are among the most toxic to bees, the most persistent (aerobic half-lives: 51 days (dinotefuran), 214 days (clothianidin), 229 days (thiamethoxam), 997 days (imidacloprid)) [7], and are highly water soluble, making exposure through pollen and nectar highly likely, even with the newly added restrictions on applications to blooming crops.

With this set of physical properties, the idea that DPR's proposal to restrict applications " . . . up until bud break" would protect pollinators is simply not tenable. Soil applications are particularly problematic, as a number of studies indicate that concentrations in pollen and nectar continue to increase over time as the pesticide is continually absorbed from the soil. Below we highlight a few representative studies. A summary of these and other studies demonstrating the presence of residues in pollen and nectar long after the application date can be found in reference 8.

1) Byrne *et al.*[9] studied the persistence of imidacloprid in citrus trees. Imidacloprid residues in nectar from trees treated 50 or 55 days before bloom via soil drench at 0.5 lbs/ac were documented between 2.9 and 39.4 µg/L. Imidacloprid was present in nectar with residues between 2 and 16 µg/L in citrus trees treated either 227 or 232 days before bloom.
2) Stoner and Eitzer[10] studied squash plants treated five days after transplant with imidacloprid via soil application and found that nectar contained 5–14 µg/L of imidacloprid; pollen showed concentrations ranging from 6–28 µg/L.

Limiting application to just before bloom will not prevent exposure. The only way to protect pollinators from adverse effects associated with persistent, systemic insecticides in pollen and nectar is to not use them at all in outdoor settings.

4) The proposed label distinctions between commercially pollinated crops and crops not hosting managed pollinators do not provide protection for pollinators

The new proposed regulations change some of the application rates and timing of applications to crops under contract pollination. However, the bees do not distinguish between the melon field being commercially pollinated and nearby melon field that is *not* being commercially pollinated, thus exposures will not be mitigated. Additionally, the proposed label mitigations for crops under contract pollination are rarely different than the blanket prohibition on applications to blooming crops in section YYYY.1. This is an artificial distinction and will have minimal effect on risk mitigation.

5) DPR needs to include all systemic, persistent insecticides in these regulations, not just the four nitroguanidine neonicotinoids.

The proposed regulations only address four nitroguanidine insecticides. While these are among the most acutely toxic insecticides to bees, there are others that are also toxic at levels found in pollen and nectar and are also highly water soluble and persistent in the environment. Sulfoxaflor and flupyradifurone are recent additions to the list of registered pesticides that fall in this category. DPR should be applying restrictions or eliminating uses of all such pesticides.

To summarize, DPR has proposed new regulations to protect pollinators. These regulations do not actually protect pollinators, omit major use patterns and their effects from consideration and propose actions that the available data clearly show will not mitigate exposures significantly. We urge DPR to prevent harm to pollinators by prohibiting outdoor uses of all bee-toxic systemic, persistent pesticides. Attached please find the Pollinator Stewardship Council's June 2020 comment letters, shared with the EPA, urging the same thing.

Prepared by: Pollinator Stewardship Council and Dr. Susan E. Kegley, Principal Scientist, Pesticide Research Institute

Endorsed by:

American Beekeeping Federation
Joan Gunter
President
500 Discovery Parkway, Suite 125
Superior, Colorado 80027

References

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[3] Pierre Mineau, *Neonicotinoids in California: Their Use and Threats to the State's Aquatic Ecosystems and Pollinators, with a Focus on Neonic-Treated Seeds*, (Sep. 16, 2020) https://on.nrdc.org/2HhTlRw

[4] DPR, 2020. Surface Water Database (SURF). https://www.cdpr.ca.gov/docs/emon/surfwtr/surfdata.htm

[5] Sandrock C, Tanadini M, Tanadini LG, Fauser-Misslin A, Potts SG, Neumann P. Impact of Chronic Neonicotinoid Exposure on Honeybee Colony Performance and Queen Supersedure. Desneux N, editor. PLoS ONE. 2014;9: e103592. doi:10.1371/journal.pone.0103592

[6] Wu-Smart J, Spivak M. Sub-lethal effects of dietary neonicotinoid insecticide exposure on honey bee queen fecundity and colony development. *Scientific Reports.* 2016;6: 32108. doi:10.1038/srep32108

[7] DPR, 2019. *Status Report 2018: Pesticide Contamination Prevention Act*, https://www.cdpr.ca.gov/docs/emon/grndwtr/chem_data.htm

[8] See Chapter 6 in Hopwood J, Code A, Vaughan M, Biddinger D, Shepherd M. 2016. *How Neonicotinoids Can Kill Bees*. Xerces Society for Invertebrate Conservation. https://xerces.org/publications/scientific-reports/how-neonicotinoids-can-kill-bees

[9] Byrne FJ, Visscher PK, Leimkueler B, Fischer D, Grafton-Cardwell EE, Morse JG, 2013. Determination of exposure levels of honey bees foraging on flowers of mature citrus trees previously treated with imidacloprid. *Pest Management Science* 70(3):470–82.

[10] Stoner KA, Eitzer BD. 2012. Movement of soil-applied imidacloprid and thiamethoxam into nectar and pollen of squash (*Cucurbita pepo*). *PloS ONE* 7(6):e39114.

Exhibit B

UNIVERSITY OF CALIFORNIA, SAN DIEGO

UCSD

BERKELEY • DAVIS • IRVINE • LOS ANGELES • RIVERSIDE • SAN DIEGO • SAN FRANCISCO SANTA BARBARA • SANTA CRUZ

Nieh Bee Laboratory
Felix qui potuit rerum cognoscere causas

DEPARTMENT OF ECOLOGY, BEHAVIOR, & EVOLUTION
PROFESSOR
JAMES C. NIEH

SCHOOL OF BIOLOGICAL SCIENCES
9500 GILMAN DRIVE
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LA JOLLA, CA 92093

April 19, 2022

To: Department of Pesticide Regulation, CEPA

I am writing in response to the proposed neonicotinoid regulations, the Notice of Proposed Regulatory Action. As a Professor of Biological Sciences in the School of Biological Sciences at UC San Diego, I have spent over 22 years studying honey bee behavior and, over the past decade, have dedicated half of my research effort into investigating honey bee health with a focus on pesticides (Bell et al., 2019; Bell et al., 2020; Eiri and Nieh, 2012; Ludicke and Nieh, 2020; Tan et al., 2014; Tan et al., 2017; Tong et al., 2019; Tosi et al., 2017a; Tosi and Nieh, 2017; Tosi and Nieh, 2019; Tosi et al., 2021; Wu et al., 2021; Zhang and Nieh, 2015).

The Notice of Proposed Regulatory Action goes into substantial detail about the appropriate rates and application of different neonicotinoid pesticides on different crops, which is appropriate, but my comments are addressed at the fundamental risk assessments that have been used to ensure that these pesticides can be safely used and their overall harms. The harms shown even at low, field realistic and sublethal concentrations of neonicotinoids can apply to bees via contact and the consumption of pollen, nectar, and water (soil water or guttation droplets). Neonicotinoids can persist for over a year in soil. Thus, if sprayed or applied when plants are not blooming or even for non-blooming plants, neonicotinoids pose problems for pollinators that can be exposed via water foraging and the entry of residual pesticides into new crops grown on the same soil (Sanchez-Bayo, 2014). *Therefore, the harmful concentrations and doses listed below should be considered with respect to the biology of multiple crops and the soil and groundwater contamination associated with pesticide application.*

I pose nine questions that I hope CEPA will address.

1. INADEQUACY OF CURRENT RISK ASSESSMENTS

Risk assessments of the effects of pesticides on honey bees and other pollinators use highly limited methods and periods of times. These methods have been shown to be inadequate (Fisher, 2021) because measuring the effects on bee survival over a few days or simply quantifying the LD50 is not sufficient given the long term effects of pesticides on bees, particularly honey bees, that live in highly social colonies in which pesticides can accumulate over multiple bee generations. Recent research has demonstrated that neonicotinoid pesticide toxicity is *time-cumulative,* increasing over exposure time, a factor that is not considered in current risk assessments (Sanchez-Bayo and Tennekes, 2020; Tennekes, 2010). The *persistence* of neonicotinoids is problematic. Most can remain in soils for over a year, and 80-98% of residues from the soils of treated crops will leach into ground waters (surveys from nine nations show that the 80% of surface waters are contaminated with neonicotinoids at levels ranging from 0.14 to 18 ppb) (Sanchez-Bayo, 2014). Please see below for a detailed discussion of the problems caused by water contamination. (**Q1**) *How will the proposed regulatory action consider the time-cumulative toxicity of neonicotinoids and their environmental persistence?*

2. WHAT IS A SAFE DOSE OR CONCENTRATION?

The determination of a safe dose or concentration for pesticides is non-trivial and depends upon multiple factors. The first issue is recognizing that even sublethal and field realistic doses and exposures can be harmful to honey bees. As an example, just 0.8 ng of **thiamethoxam** per bee reduced honey bee visual learning, which plays a key role in pollination and colony fitness (Ludicke and Nieh, 2020). For **imidacloprid**, just 0.04 ng/bee at the larval stage significantly harmed olfactory learning, which likewise is important for colony pollination and health (Yang et al., 2012). (**Q2**) *Will the proposed regulatory action take this research on the negative effects of sublethal doses on bee health into account?*

3. EXPOSURE TO AGROCHEMICALS FROM MULTIPLE CROPS

Agrochemical safety needs to consider multiple adjacent crops because a single honey bee colony can forage over several square kilometers (Couvillon et al.). Research has now demonstrated multiple negative synergistic effects at sublethal agrochemical doses (Siviter et al., 2021). The combinations of multiple agrochemicals, even at sublethal doses, can be amplified to result in significantly increased bee mortality. In particular, the class of fungicides known as sterol biosynthesis inhibitors (SBI) can significantly decrease bee survival when combined with low levels of neonicotinoids because the SBI fungicides inhibit pesticide detoxification in bees (Haas and Nauen, 2021). These issues have been recognized by the EPA, and certain tank mixes are not allowed. Each crop and pesticide applicator may follow the guidelines, but the bees will likely visit all nearby crops, leading to potentially harmful agrochemical synergistic exposures. (**Q3**) *Given that colonies can forage over very large distances, how will the proposed regulatory action ensure that a colony, a focal center of food gathering will not be exposed to adjacent crops treated with harmful synergistic compounds?*

4. AGROCHEMICAL ADJUVANTS

Compounds that are not currently recognized as harmful to bees and that are therefore allowed in tank mixes or in simultaneous application with neonicotinoids can be harmful. Organosilicone adjuvants are agrochemicals often used in concert with neonicotinoids that also have many harmful effects on honey bee fitness. Adjuvants harm honey bee health (Mullin et al., 2016) and learning (Ciarlo et al., 2012). Additionally, the effects of adjuvants spread throughout the hive, affecting the ability of the colony to rear new queens (Johnson and Percel, 2013). Adjuvants also appear to have synergistic effects and increases the harms caused by viruses in colonies (Fine et al., 2017). (**Q4**) *How will the proposed regulatory action deal with growing evidence that these agrochemical adjuvants are harmful to bees?*

5. BEE NUTRITION

Poor nutrition can synergistically increase the harms of flupyradifurone, which is not a neonicotinoid but also acts on insect nicotinic acetylcholine receptors (Tong et al., 2019). Similarly, nutritional stress, in combination with consumption of field-realistic doses of **clothianidin** (1/5 of LD50) and **thiamethoxam** (1/25 of LD50) reduced bee survival by 50%, food consumption by 48% (thereby exacerbating nutritional deficits), and levels of essential sugars (glucose and trehalose) in bee haemolymph (Tosi et al., 2017b). (**Q5**) *How will the proposed regulatory action consider synergistic stressors that bees face such as poor nutrition when determining bee safe application levels?*

6. WATER CONTAMINATION

Bees need to collect water, and honey bees often forage on water that flows through soil because of the higher salt content, which they also need (Lau and Nieh, 2016). This increases the risk of bee exposure to agricultural runoff water that may contain pesticides such as **imidacloprid**. In addition, a substantial body of scientific literature has demonstrated the harms of **imidacloprid** even at concentrations of 5 ppb or less on bees. Whitehorn et al. (2012) showed that colonies fed 0.7 or 1.5 ppb **imidacloprid** in sugar syrup and then monitored in the field for six weeks had significant deficits: colony weight decreased by 8% and 12%, respectively, and queen production fell by 85% and 90%. Feltham et al. (2014) showed that **imidacloprid** concentrations as low as 6 ppb harmed bumble bee pollen foraging. With respect to honey bees, which are also vital to US agriculture and provide significant ecosystem services, colonies fed 5 ppb **imidacloprid** had less capped brood (fewer offspring) than control colonies (Meikle et al., 2016). Although these studies provided **imidacloprid** to bees via pollen or nectar, there is evidence that even a very low concentration such as 0.7 ppb can pose a threat. Moreover, the amount of water consumption is linked to ambient temperatures since bees collect and evaporate collected water in their mouthparts to cool nests, particularly during summer months when there can be high pesticide use in agricultural crops. In addition are multiple native bumble bee species that are at risk and they, like honey bees, need to collect water. (**Q6**) *How will the proposed regulatory action consider ground water contamination and bee water foraging?*

7. GUTTATION DROPLETS

Pollinators can also be exposed to neonicotinoid pesticides via guttation droplets, which arise from the natural excretion of plant xylem fluids, which, like water, can be attractive to bees, at the margins of leaves. Due to the translocation of neonicotinoids from seed coatings or other application methods, these droplets can achieve remarkably high concentrations of pesticides, up to 100 ppm for **thiamethoxam** and **clothianidin** and up to 200 ppm for **imidacloprid**. These droplets can therefore contain nearly the same concentration of these pesticides as applied in spray form. Bee consuming droplets with such high concentrations of pesticides can die within a few minutes (Girolami et al., 2009). Neonicotinoid residues in **corn** guttation droplets ranged from 8.2 to 345.8 ppm. Cantaloupe guttation water (after soil pesticide application) reached **imidacloprid** concentrations of 373.5 ppm (Schmolke et al., 2018). Although some studies have not found conclusive evidence that the collection of guttation

water by bees is common, they have only focused on honey bees and under limited environmental conditions. Given that the availability of water will strongly control bee water foraging, more research is required. (**Q7**)*How will the proposed regulatory action take into consideration the high neonicotinoids concentrations in guttation droplets that bees collect?*

8. OTHER POLLINATORS

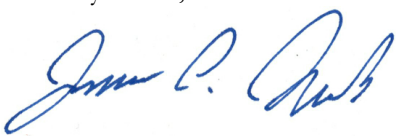
Honey bee studies can be used to predict risks for non-honey bee species (Thompson and Pamminger, 2019). Research demonstrates that multiple native bee species are exposed to pesticides an agrochemicals (Hladik et al., 2016). This is concerning given that the evidence cited above demonstrates strong harms from neonicotinoids and their adjuvants on honey bees that are therefore also applicable to native bees such as bumblebees. Protection from the California Endangered Species Act for four at-risk species of bumble bees has been sought and not obtained (to date), but these species remain at risk and are rapidly declining (Hatfield and Jepsen, 2021). (**Q8**) *How will the proposed regulatory action help to protect these at-risk bee species from further decline given that they are also exposed to neonicotinoids and their adjuvants?*

9. OTHER ANIMALS AND HUMAN EXPOSURE

Finally, the direct threat that neonicotinoids pose to honey bees and other insect pollinators also presents an indirect threat to animals (Sanchez-Bayo, 2014) and to human health (Thompson et al., 2020). These risks include, but are not limited to: cytotoxicity, genotoxicity, reduced immune function, decreased growth, reduced reproductive success, acute respiratory defects, neurological disease symptoms, cardiovascular disease, and birth defects. (**Q9**) *How will the proposed regulatory action consider and mitigate these risks, particularly for California workers who are exposed to neonicotinoid pesticides?*

If I can answer any questions, please feel free to email me at jnieh@ucsd.edu.

Sincerely Yours,



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REFERENCES

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Exhibit C

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