



March 15, 2018

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Office of Pesticide Programs (OPP)  
Regulatory Public Docket Center (28221T)  
U.S. Environmental Protection Agency (EPA)  
1200 Pennsylvania Ave., NW.  
Washington, DC 20460-0001

**Subject: Pyriproxyfen – Preliminary Ecological Risk Assessment (EPA-HQ-OPP-2011-0677)**

Dear Mr. Snyderman:

On behalf of the Bay Area Clean Water Agencies (BACWA), we thank you for the opportunity to comment on the Preliminary Ecological Risk Assessment (ERA) for pyriproxyfen. BACWA's members include 55 publicly owned wastewater treatment facilities ("POTWs") and collection system agencies serving 7.1 million San Francisco Bay Area residents. We take our responsibilities for safeguarding receiving waters seriously. BACWA is especially interested in pesticides that are used in manners that have transport pathways to the sanitary sewer, as even the most sophisticated wastewater treatment plants cannot fully remove complex chemicals like pesticides.

Every day, BACWA members treat millions of gallons of wastewater that is then discharged to fresh or salt water bodies, including local creeks and rivers, bays, and the Pacific Ocean. These waterways provide crucial habitat to a wide array of aquatic species and waterfowl. In some cases, waters receiving POTW discharges ("receiving waters") may be effluent-dominated in that there is little to no dilution, either because the receiving water is small or there is a lack of mixing at certain times due to thermal or saline stratification.

BACWA has a strong interest in pyriproxyfen due to its high toxicity to aquatic invertebrates. The primary purpose of this letter is to request that (1) the ERA invertebrate toxicity analysis adequately represents POTW toxicity test screening and (2) the ERA be expanded to include an evaluation of sewer discharges from pet flea control products and other indoor pyriproxyfen uses. Several studies, including a recent study involving several of our member agencies, suggest that pet flea control products have a direct pathway, via sewer collection systems, to municipal wastewater treatment plants.

BACWA appreciates that OPP has started to conduct evaluation of risks associated with pesticide discharges to the sewer system ("down the drain" risk assessments). OPP's pyriproxyfen risk assessment did not include a down-the-drain assessment. Omitting evaluation of the sewer discharge environmental exposure pathway can be harmful to the environment and prove costly for POTWs, as detailed below.

In almost every US state – including California – state law precludes any local regulation of pesticide sales or use. As we have no local option to control use of pesticides consumer products, it is essential to us that OPP's Registration Review adequately evaluates potential impacts to wastewater quality, and results in mitigation measures ensuring that impacts to the beneficial uses of the receiving water are *prevented*.

For these reasons, it is of utmost importance to BACWA that pet flea control products and all other pyriproxyfen -containing products with pathways to the sewer be carefully and thoroughly evaluated.

In addition to commenting on the preliminary ecological risk assessment, we are also taking this opportunity to provide input on possible mitigation strategies for EPA to discuss with pyriproxyfen registrants. We are providing this input at this time because mitigation measures may be necessary and we understand that the next opportunity for public comment will be after such discussions and after EPA has prepared its proposed decision.

Thank you for this opportunity to present our input on each of these topics.

### **Background – Pesticide discharges to the sewer can harm the environment and be costly**

Pesticide discharges to the sewer system can prove costly for POTWs, due to the potential for pesticides to cause or contribute to wastewater treatment process interference, NPDES permit compliance issues, adverse impacts to receiving waters, degradation of recycled water quality and/or ability to reuse biosolids, in addition to exposing POTWs to the potential for third party lawsuits under the Federal Clean Water Act (CWA).

Of particular concern is the ability of a specific pesticide to cause exceedance of a POTW's effluent toxicity limits. One universal water quality standard in the U.S., which stems directly from the CWA, is that surface waters cannot be toxic to aquatic life. NPDES permits require POTWs to demonstrate that they meet this standard by evaluating acute and chronic toxicity using EPA standard methods (set forth in 40 CFR Part 136). To evaluate toxicity, every POTW must (1) conduct toxicity screening tests with a range of species, (2) select the most sensitive species, and (3) perform routine monitoring (typically monthly or quarterly). These monitoring data are used to determine whether the discharger has a *reasonable potential* to cause or contribute to toxicity in the receiving water. If it does, the CWA requires that numeric effluent limits be imposed, otherwise POTWs may be given numeric effluent triggers for further action. In the event that routine monitoring *does exceed* a toxicity limit or trigger, the POTW must perform accelerated monitoring (e.g., monthly); and if there is still evidence of consistent toxicity, the discharger must do a Toxicity Reduction Evaluation (TRE) to get back into compliance. The TRE requires dischargers to evaluate options to optimize their treatment plants and conduct a Toxicity Identification Evaluation (TIE), the cost of which can vary from \$10,000 to well over \$100,000 depending on complexity and persistence of the toxicant. The goal of the TIE is to identify the substance or combination of substances causing the observed toxicity. If a POTW's effluent is toxic because of a pesticide, it may not have any practical means to comply with CWA-mandated toxicity permit limits.

Once identified, the cost to treat or remove the toxicity causing compound(s) can vary dramatically. Often, there are few ways for a discharger to mitigate the problem other than extremely costly treatment plant upgrades. Upgrading treatment plants is often ineffective for

organic chemicals like pesticides that appear at sub microgram per liter concentrations, largely because sewage is a complex mixture of natural organic compounds. Regardless of this, the discharger must comply with its CWA permit limits. If a discharger violates a toxicity limit, it can be subject to significant penalties (in California up to \$10/gallon or \$10,000 per day).

In addition, when surface water bodies become impaired by pesticides, wastewater facilities may be subject to additional requirements established as part of Total Maximum Daily Loads (TMDLs) set for the water bodies by EPA and state water quality regulatory agencies. A number of pesticide-related TMDLs have been adopted or are in preparation in California. The cost to wastewater facilities and other dischargers to comply with TMDLs can be up to millions of dollars per water body per pollutant. This process will continue as long as pesticides are approved for uses that result in water quality impacts; it is therefore imperative that EPA conducts a Registration Review focusing on water quality impacts and for EPA to take action to ensure that any impacts are prevented or fully mitigated.

### **BACWA seeks to ensure that the ERA's freshwater invertebrate toxicity analysis adequately represents POTW toxicity screening**

To evaluate POTW effluent acute and chronic freshwater toxicity, many agencies are required to use *Ceriodaphnia dubia* (*C. dubia*) as their test species based on US EPA Office of Water toxicity testing guidance cited in Federal regulations implementing the NPDES permit program.<sup>1</sup> The ERA provided toxicity data for *Daphnia magna* (*D. magna*), which was the most sensitive species tested. *C. dubia* toxicity data do not appear to be available. These two invertebrates are known to have different sensitivities to persistent organic pollutants. If *C. dubia* is more sensitive, it is possible that the results in the ERA could underestimate risks of POTW toxicity testing failures.

BACWA requests that EPA seek to obtain chronic toxicity data for *C. dubia* and incorporate the findings in the proposed decision in order to ensure that any associated mitigation measures are sufficient to prevent POTW effluent toxicity. Chronic toxicity data are recommended for two reasons:

- 1) POTWs continuously discharge to surface waters.
- 2) Use of acute toxicity data and the common default assumption that the acute-to-chronic toxicity ratio is 10 might significantly underestimate chronic toxicity for pyriproxyfen. based on the data in the ERA, the *D. magna* lowest acute toxicity value (LC50) is 80 ug/L while the chronic values are 0.015 (NOAEC) and 0.031 ug/L (LOAEC) – more than 1,000-fold lower concentrations.

### **BACWA requests that the ERA be expanded to include an evaluation of sewer discharges from pet flea control treatments and other indoor Pyriproxyfen uses**

BACWA is concerned that risks associated with indoor pyriproxyfen use were not examined in the ERA and respectfully asks the EPA to include this analysis (a “down the drain” risk assessment) in the revised assessment. EPA has POTW predictive modeling tools which are

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<sup>1</sup> See US EPA Office of Water (2002). *Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms*. EPA-821-R-02-013. This manual describes chronic toxicity tests used to determine compliance with NPDES permit toxicity limits. The methods included in this manual are referenced in Table IA, 40 CFR Part 136 regulations.

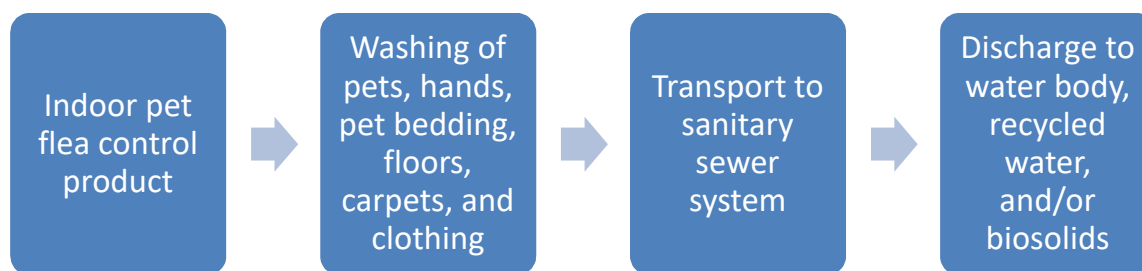
suitable for conducting this assessment and has conducted similar assessments for many other pesticides.

We request that EPA specifically analyze sewer discharge sources such as:

- Pet spot-ons, collars, and topical drops
- Pet shampoos
- Carpet and upholstery sprays, powders, and foams
- Home treatment aerosols, sprays and foggers

As explained in Appendix 1, pet flea control products contribute to POTW influent pesticides loads. Pet flea control chemicals are transported within a home to an indoor drain that flows to a POTW via the pathways illustrated in Figure 1.

**Figure 1. Pyriproxyfen Pathway: From Pet Treatments to Wastewater Discharge**



Scientific studies detailed in Appendix 1 examined the pathways that transport active ingredients from pet flea control products to the sewer system, both directly (through dog washing) and indirectly (such as after transfer onto human hands, socks, or clothing that are subsequently washed).

Based on the data from these studies and pet population data, it is clear that pet flea control products are significant sources of pesticides to POTWs that should be accounted for in the ERA. Monitoring data for pet flea control chemicals in POTW influents and effluents show higher concentrations in northern California POTWs (Sadaria et al 2017).<sup>2</sup> These data likely reflect real differences between these communities and those monitored in the nationwide study. The Sadaria et al. 2017 northern California study was conducted during a severe drought that triggered water use restrictions throughout the study area and significant reductions in POTW influent flows. Its September timing coincides with what may be the peak pet flea control season in the study area. According to Sadaria et al 2017:

“Higher overall concentrations and detection frequencies in effluent from northern California may reflect regional, seasonal, and/or climate-related differences from other sampled facilities, such as lower dilution caused by drought-related water use reductions, presence of pests during all seasons because of the mild coastal climate, and pesticide use

<sup>2</sup> Sadaria, A.M., Sutton, R., Moran, K.D., Teerlink, J., Brown, J.V., Halden, R.U., 2017. Passage of fiproles and imidacloprid from urban pest control uses through wastewater treatment plants in northern California, USA. *Environ. Toxicol. Chem.* 36:6 1473-1482.

responding to regional pest pressures (e.g., high flea populations in California coastal areas).”

BACWA requests that EPA pyriproxyfen modeling and mitigation approaches account for these factors. Please see Appendix 2 of BACWA’s comments on the Preliminary Ecological Risk Assessment for the Pyrethroid Insecticides (enclosed), where we detail potential approaches for addressing these factors within EPA’s current POTW model. BACWA has developed an approach for evaluating both acute and chronic toxicity of pet flea control treatments in the face of limited sales volume data, based on treatment frequency, per capita pet ownership, concentration of active ingredient, and estimated POTW removal efficiency (see BACWA’s Revised Appendix 4 of the Comments on the Preliminary Ecological Risk Assessment for the Pyrethroid Insecticides, October 20, 2017, attached).

### **BACWA requests that EPA consider risk mitigation for pyriproxyfen**

Given findings for other pet flea control products, the “down-the-drain” risk assessment for pyriproxyfen may conclude that risk mitigation is warranted to reduce POTW pyriproxyfen discharges and associated invertebrate toxicity. Because 100% of POTWs must comply with the Federal Clean Water Act 100% of the time, whenever EPA identifies significant risks from pesticides discharged to POTWs, BACWA believes that a robust exploration of risk mitigation is imperative.

In response to the finding that pet flea control products are major sources of pesticides to POTWs, BACWA completed an assessment of pet flea control alternatives. This assessment, which is summarized in Appendix 2, identified multiple practical, effective, non-pesticide alternatives.

In light of these findings, BACWA requests that OPP conduct its risk-benefit evaluation for pet flea control products as a group (i.e. considering pyrethroids, imidacloprid, indoxacarb, and fipronil, which are also undergoing Registration Review) and in the context of the broad range of available non-pesticide alternatives, including FDA-approved oral medications and mechanical controls (e.g., vacuuming, washing of pet bedding).

While we agree that pet flea and tick control has societal benefits, our review of control options detailed in Appendix 2 identified many alternatives that are likely far less environmentally problematic than on-pet or indoor pesticide treatments. For example, the new generation of FDA-approved orals seems to be more convenient, equally or more effective, and well accepted by pet owners and veterinarians. Mechanical controls (vacuuming, washing of pet bedding) offer lower cost and greater long-term control, as these are the sole option that addresses all life cycle stages of fleas. Finally, we emphasize that we do not believe that fipronil, imidacloprid, indoxacarb, or pyrethroids are acceptable alternatives to pyriproxyfen.

BACWA suggests that EPA consider the following additional risk mitigation strategies for indoor pyriproxyfen products:

- Determine the minimum application rate necessary to achieve pest control for indoor uses like pet flea control. This would eliminate unnecessary overuse and minimize POTW discharge quantities.
- Consider adding wastewater-protective use restrictions to product labels—such as dissuading pet owners from washing their pets for two weeks after applying

treatments.

Thank you for the opportunity to provide this feedback regarding both the risk assessment and subsequent mitigation strategies. We ask that OPP evaluate pyriproxyfen discharges to POTWs and the subsequent potential impacts to effluent toxicity, and explore mitigation options, particularly for pet flea control products. BACWA requests that EPA coordinate with the California Department of Pesticide Regulation (CDPR) (which has extensive relevant information and expertise), veterinarians, and registrants; and bring in the latest scientific information – including CDPR scientific studies and modeling that are currently underway.

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Respectfully Submitted,



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Enclosures:

1. Sadaria, A.M. et al. 2017. Passage of Fiproles and Imidacloprid from Urban Pest Control Uses Through Wastewater Treatment Plants in Northern California. *Environmental Toxicology and Chemistry*. 36 (6), 1473-1482.
2. Bigelow Dyk, M. et al. (2012). Fate and distribution of fipronil on companion animals and in their indoor residences following spot-on flea treatments, *Journal of Environmental Science and Health, Part B: Pesticides, Food Contaminants, and Agricultural Wastes*, 47(10): 913-924
3. Halos, L. et al. 2014. Flea Control Failure? Myths and Realities. *Trends in Parasitology*, 30:5 228-233.
4. Blagburn, B., and Dryden, M., Biology, Treatment, and Control of Flea and Tick Infestations, *Vet Clin Small Anim*, 2009, Vol 39, pp 1173-1200.
5. Litchfield et al., Safety Evaluation of Permethrin and Indoxacarb in Dogs Topically Exposed to Activyl® Tick Plus, *J Veterinar Sci Technology* 2015, 6:2.
6. Teerlink, J., J. Hernandez, R Budd. 2017. Fipronil washoff to municipal wastewater from dogs treated with spot-on products. *Sci Total Environ* 599-600: 960-966.
7. Bay Area Clean Water Agencies (BACWA). July 7, 2017. Appendix 2 - Comment Letter on EPA Preliminary Ecological Risk Assessment for the Pyrethroid Insecticides.
8. BACWA. October 20, 2017. Revised Appendix 4 – Comment Letter on the Preliminary Ecological Risk Assessment for the Pyrethroid Insecticides.

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## Appendix 1

### Pet Flea Treatments: Evidence for the Pathway to the Sewer

#### Part I – Evidence for the Pathway to the Sewer

There is mounting evidence that pesticides from on-pet flea control products (spot-ons and collars) and indoor foggers and sprays have exposure pathways to the sewer. The research summary below is organized first by the consumer use, followed by specific studies throughout a sewage collection system and at POTWs.

#### Topical Pet Flea Control Products - Background

Pet topical treatments are designed to impact one or more stages of the flea cycle through direct contact with the pesticide (rather than an adult flea biting the pet and obtaining the pesticide systemically with the consumed blood). Therefore, pesticides in topicals are not meant to enter the pet's bloodstream but rather are meant to stay on the pet's fur in order to be effective.

#### Pet Washing Discharge Pathway

Pet washing is likely a major discharge pathway for pet flea control products. A study by California Department of Pesticide Regulation (CDPR) (Teerlink et al. 2017; enclosed)<sup>3</sup> measured the washoff of fipronil spot-on products when bathing treated dogs. Fipronil was detected in all samples – even those collected 28 days post-application. According to the authors of the study:

“Results confirm a direct pathway of pesticides to municipal wastewater through the use of spot-on products on dogs and subsequent bathing by either professional groomers or by pet owners in the home. Comparisons of mass loading calculated using California sales data and recent wastewater monitoring results suggest fipronil-containing spot-on products are a potentially important source of fipronil to wastewater treatment systems in California. This study highlights the potential for other active ingredients (i.e., bifenthrin, permethrin, etofenprox, imidacloprid) contained in spot-on and other pet products (i.e., shampoos, sprays) to enter wastewater catchments through bathing activities, posing a potential risk to the aquatic organisms downstream of wastewater discharge.”<sup>4</sup>

#### Indirect Sewer Discharge Pathways

Several scientific studies have examined the transport of active ingredients from pet flea control products onto surfaces, such as human hands, that are subsequently washed, completing a transfer pathway to the sewer system.

- *Spot-on treatment product to glove (hands) pathway*: A 2015 study by Litchfield et al. evaluated the transfer of permethrin and indoxacarb from a topical pet flea control treatment to people's hands.<sup>5</sup> In the study, the topical treatment was applied to dogs that

<sup>3</sup> Teerlink, J., J Hernandez, R Budd. 2017. Fipronil washoff to municipal wastewater from dogs treated with spot-on products. *Sci Total Environ* 599-600: 960-966.

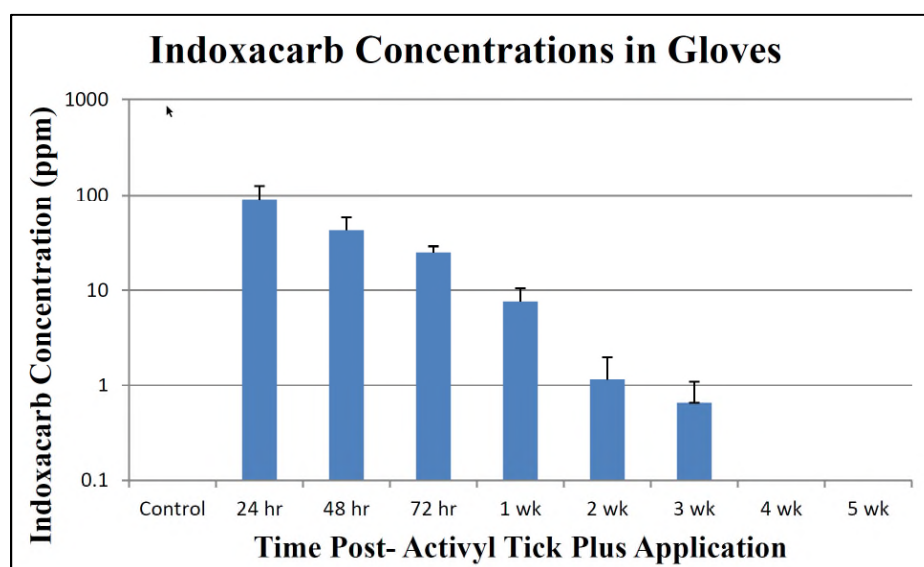
<sup>4</sup> Teerlink, J., J Hernandez, R Budd. 2017. Fipronil washoff to municipal wastewater from dogs treated with spot-on products. *Sci Total Environ* 599-600: 960-966.

<sup>5</sup> Litchfield et al., “Safety Evaluation of Permethrin and Indoxacarb in Dogs Topically Exposed to Activyl® Tick Plus,” *J Veterinar Sci Technology* 2015, 6:2 <http://dx.doi.org/10.4172/2157-7579.1000218>. (enclosed)



had not received a topical treatment for at least two months. To simulate human exposure to the pesticides, “Glove sampling included the wipe sampling technique, which consisted of petting the dog forward and back along its back and sides, while avoiding the application site, for five minutes while wearing a 100% cotton glove.” The cotton glove samples were collected at days 0, 1, 2, 3, 7, 14, 21, 28, and 35. While the results showed that the largest mass of indoxacarb was transported within the first week, there continued to be measurable transfer to the gloves, even at day 21. The study did not measure indoxacarb degradates, which likely formed during the study period.

**Figure 2. (from Litchfield et. al. 2015) Indoxacarb concentrations in gloves after petting dogs who had application of indoxacarb (“Activyl Tick Plus”) spot-on flea control (µg/L)**



- *Spot-on treatment product to glove (hands) pathway:* A 2012 study by Bigelow Dyk et al. presents additional evidence of transport of a pet flea control products onto human hands and through homes.<sup>6</sup> In the study, researchers monitored transfer of fipronil (from a commercially available spot-on product) onto pet owners’ hands and within their homes over a four-week period following spot treatment application. Participants used cotton gloves to pet their dog or cat for 2 minutes at a time at specific intervals after the application (24 hours, 1 week, 2 weeks, 3 weeks, and 4 weeks). Participants also wore cotton socks for 2 hours a night for 7 nights in a row, for four consecutive weeks following application. The gloves, socks, and brushed pet hair were subsequently analyzed for fipronil and its degradates. Bigelow Dyk and colleagues also incorporated a fluorescent dye into the spot treatment to provide photographic evidence of spot-on pesticide transfer. The photographic results shown in the paper illustrate the transfer from the application location to other areas of the pet’s fur and onto the pet owners’ hands.
- *In-house fogger and spray pathway:* A UC Riverside study from 2010 sought to better understand the human health consequences of indoor insecticidal treatments, comparing a

<sup>6</sup> Bigelow Dyk, M., et al. (2012) Fate and distribution of fipronil on companion animals and in their indoor residences following spot-on flea treatments, *Journal of Environmental Science and Health, Part B: Pesticides, Food Contaminants, and Agricultural Wastes*, **47**(10): 913-924

fogger, a perimeter spray, and both crack-and-crevice sprays, and spot sprays.<sup>7</sup> Researchers selected registered commercial products and applied per label instructions in rooms of unoccupied homes. They then evaluated the deposition of active ingredients, which included permethrin, chlorpyrifos, cyfluthrin, cypermethrin, and deltamethrin. They found that:

*“Each application type produced a surface residue, but the residues differed sharply in deposition and distribution. Relative to the general distribution of residue following fogger applications, perimeter, crack-and-crevice, and spot applications resulted in less total chemical residue and limited distribution to within 0–40 cm of the wall.”*

*“...fogger applications differ from all other methods of application that rely on directed sprays examined in this paper. This supports our proposal that deposition and spatial distribution are principally determined by the type of pesticide application (i.e. fogger vs. crack-and-crevice) and the actions of the applicator (i.e. heavy vs. light applications).”*

In 1990, the California Department of Food and Agriculture published a dermal contact study presenting findings regarding the transfer of residue to people and their clothing following a chlorpyrifos/allethrin fogger treatment in carpeted rooms.<sup>8</sup> The rooms were all located in a new hotel so as to eliminate background pesticide residue and to provide repeatability from room to room. The foggers were set up per label instructions and were activated for two hours followed by ventilation of the room. Male and female participants later conducted a standardized exercise routine in specific locations in the room. Shirts, tights, gloves and socks were subsequently collected for analysis. Both allethrin and chlorpyrifos were detected in all exposed samples exceeding the minimum detection limits. Had these garments been placed in the laundry, this would have resulted in discharge to the sewer. Similarly, when the volunteer participants showered, the residue on their heads and other bare skin transferred to the sewer.

Based on the data from these studies characterizing topical flea control active ingredient transfer to owners' hands and the transfer of fogger active ingredients to room occupants, it appears that washing of hands, clothing, carpets and floors could be significant sources of pesticides to POTWs.

#### Evidence from Collection Systems

CDPR is in the process of completing a collection system (“sewershed”) study within the City of Palo Alto’s Regional Water Quality Control Plant.<sup>9</sup> The study involved twenty-four hour time weighted composite samples (influent, effluent, and ten sites in the collection system). Samples were collected from several discharge-specific sites with potential for relatively large mass flux of pesticides (i.e., discharges from pet grooming operation, pest control operator, and a

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<sup>7</sup> Keenan, James J., John H. Ross, Vincent Sell, Helen M. Vega, Robert I. Krieger, “Deposition and spatial distribution of insecticides following fogger, perimeter sprays, spot sprays, and crack-and-crevice applications for treatment and control of indoor pests,” *Regulatory Toxicology and Pharmacology* 58 (2010) 189–195.

<sup>8</sup> Ross, J., T. Thongsinthusak, H.R. Fong, S. Margetich, R. Krieger, California Department of Food and Agriculture, “Measuring Potential Dermal Transfer of Surface Pesticide Residue Generated from Indoor Fogger Use: An Interim Report,” *Chemosphere*, Vol.20, Nos.3/4, pp 349-360, 1990.

<sup>9</sup> See [http://www.cdpr.ca.gov/docs/emon/surfwtr/presentations/presentation\\_130\\_targeted.pdf](http://www.cdpr.ca.gov/docs/emon/surfwtr/presentations/presentation_130_targeted.pdf)

laundromat). The samples were analyzed for a suite of pesticides. Preliminary results from the pet-grooming site provide evidence that pet washing is a pathway for pesticide discharges to sewer systems.

We encourage OPP to obtain the final results of this study, which should be available within the timeframe of OPP's exploration of mitigation strategies for pyriproxyfen.

#### POTW Influent and Effluent

Lastly, further insights regarding transport of indoor flea control products to POTWs comes from a study of fipronil and imidacloprid at eight POTWs that was recently conducted by the San Francisco Bay Regional Monitoring Program in collaboration with BACWA, CDPH and Arizona State University.<sup>10</sup> The study monitored imidacloprid and fipronil, as well as its degradates, in the influent and effluent of eight urban California POTWs. The results indicated that fipronil, its degradates, and imidacloprid were ubiquitous in the influent sewage and final treated effluent of all eight participating POTWs, and – based on a detailed analysis of the sewer discharge sources of these two chemicals, which have relatively little indoor use other than pet flea control – provide compelling evidence that pet flea control products may be the primary source of both chemicals in wastewater.

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<sup>10</sup> Sadaria, A.M., Sutton, R., Moran, K.D., Teerlink, J., Brown, J.V., Halden, R.U., 2017. Passage of fiproles and imidacloprid from urban pest control uses through wastewater treatment plants in northern California, USA. *Environ. Toxicol. Chem.* 36:6 1473-1482.

## Appendix 2

### Pet Flea Control Products: Alternatives Analysis

#### Alternatives and Mitigation

BACWA requests that EPA, in coordination with CDPH (which has extensive relevant information and expertise), veterinarians, and registrants, develop mitigation strategies for pet flea control products, including spot-ons and collars. Two specific topics are discussed below, as an effort to provide insight regarding mitigation options for flea control:

- Alternatives: oral medications and integrated pest management appear effective
- Optimization of application rates of pet flea control products

#### Alternatives: Integrated Pest Management and Oral Medications

Mechanical controls (e.g., vacuuming) appear to be key to avoiding a flea infestation in a home. Further, since the previous registration, there is now an opportunity provided by oral treatments that have come on the market in recent years (available for both dogs and cats) that could avoid the on-pet use of not only pyriproxyfen, but also alternatives that are problematic from the water quality perspective (e.g., fipronil, pyrethroids, indoxacarb, and imidacloprid).

The fleas found on a pet are estimated to represent only 1-5% of the flea cycle in a home; the other 95% are found as eggs, larvae, pupae, and adult fleas throughout the home and surrounding environment.<sup>11</sup> It takes about 18 days for a flea egg to grow into an adult flea, but in cool weather immature fleas can lay dormant in a pupal cocoon for up to 1 year. Adult fleas can live on a pet for 30 to 40 days. Fleas lay 20 to 50 eggs each day; consequently flea problems in residential settings can get out of control quickly.

Therefore, to avoid repeat infestations, one must address all stages of this flea cycle including flea eggs, larvae and pupae.<sup>12</sup> One way to do so is via non-pesticide mechanical controls, including frequent indoor vacuuming, washing of pet bedding, and use of a pet flea comb.<sup>13</sup> In particular, vacuuming needs to be both thorough and frequent. It should include the pet sleeping area, floors, furniture and all upholstered or carpeted surfaces, including under cushions, furniture and in other hard to reach places. Regarding frequency, it turns out that during the pupal stage, the flea is encased in a shell that is not penetrated by pesticides. The act of vacuuming can speed up the process. Specific guidance from one study notes the following:

*"The vibration also stimulates adult fleas to emerge from their cocoons so that they can be collected in the vacuum machine. Therefore frequent vacuuming, during a flea infestation, can reduce the overall flea burden in the home. It should be ensured that vacuum bags are disposed of properly, to prevent recolonization of the home with flea stages previously removed by vacuuming."*<sup>14</sup>

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<sup>11</sup> Halos, L., et al. (2014). Flea Control Failure? Myths and Realities. Trends in Parasitology, 30:5 228-233.

<sup>12</sup> Ibid, 228-233.(enclosed)

<sup>13</sup> American Veterinary Medical Association (2009). External Parasites.

<sup>14</sup> "Biology, Treatment, and Control of Flea and Tick Infestations," Blagburn, B., and Dryden, M., Vet Clin Small Anim, 2009, Vol 39, pp 1173-1200. (enclosed)

Although spot-on pet flea control products currently dominate the pet flea control market, new oral medications have recently become available. The table on the following page summarizes the current state of available oral medications for pets. The new pills, which are registered by U.S. FDA rather than EPA, appear to eliminate aquatic (and human) exposure pathways and should be equally or more convenient for pet owners, once they have obtained a prescription from a veterinarian. The involvement of the veterinarian has the added benefit of providing pet-specific guidance on flea control approach and safe dosage. Some studies indicate that oral medications may be more effective than topical spot treatments possibly because there is less reliance on proper application by the owner.<sup>15</sup>

#### Optimization of Application Rates of Pet Flea Control Products

Another consideration for pet flea control products is that of application rate. Given that these household and pet flea control products have a transport pathway to the sewer, it would be of great interest to understand whether manufacturers have optimized the amounts applied. While spot-ons come in different doses based on pet weight, it is unclear whether that optimization was based solely on pet health or whether that is also the minimum dosage for effective insecticidal activity.

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<sup>15</sup> "Flea blood feeding patterns in cats treated with oral nitenpyram and the topical insecticides imidacloprid, fipronil and selamectin," McCoy, c., et al., *Veterinary Parasitology*, Vol. 156, pp 293-301, 2008.

**List of Currently Available Oral Pet Treatments for Fleas (Alphabetical)**

<b>Active Ingredient</b>	<b>Example Product Names and Manufacturers</b>	<b>Dogs, Cats or Both?</b>	<b>Flea, Tick, Both</b>	<b>Dose Schedule</b>	<b>Adulticide?</b>	<b>Insect Growth Regulator?</b>	<b>Chemical Family</b>	<b>Year Registered</b>
<b>Afoxolaner</b>	Nexgard (Merial)	Dogs only	Both	1 month	X	No	Isoxazoline <sup>16</sup>	2013
<b>Fluralaner</b>	Bravecto (Merck)	Dogs only	Both	2-3 months	X	No	Isoxazoline	2014
<b>Lufenuron</b>	Program (Novartis) and Sentinel (that also includes a heartworm pharma)	Both	Flea eggs, as well as hookworms, roundworms	1 month	No	X	Benzoylurea	1995 (for dogs)
<b>Nitenpyram</b>	Capstar (Novartis), Capguard (Sentry)	Both	Flea	A few hours only (meant for immediate infestation control)	X	No	Neonicotinoid	2000
<b>Sarolaner</b>	Simparica (Zoetis, a subsidiary of Pfizer)	Dogs only	Both	1 month	X	No	Isoxazoline	2016
<b>Spinosad</b>	Comfortis and Trifexis (Elanco)	Both	Flea	1 month	X	No	Spinosyn, macrocyclic lactone	2007 (approx)

<sup>16</sup> Flea products from the isoxazoline chemical family are new to the marketplace; therefore pet health insights are largely limited to the studies conducted by the manufacturers and the packaging text required by the FDA. There appears to be no published information about health and safety beyond the manufacturer guidance in the MSDS. Due to the application method (pill), human exposure is likely small, though no data are available to verify this assumption.