Indoor Uses of Ectoparasitic Pesticides Linked to Aquatic Toxicity

Stephanie Hughes, PE

June 2025

This information is approved for 1.0 hour of continuing education credit.

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Introduction to Your Speaker

Stephanie Hughes is a registered professional Chemical Engineer with more than 25 years of experience in chemical fate and transport, water quality, and regulatory compliance.

Stephanie provides consulting services and technical support to California local government agencies and is a Teaching Professor in Environmental Science at Santa Clara University.

She and her husband currently share their lives with two dogs. Stephanie is also a founding member and active volunteer at the Wildlife Center of Silicon Valley.

The newspaper of Silicon Valley

The Mercury

BayArea NewsGroup 111 Volume 172, Issue 83 SATURDAY, SEPTEMBER 10, 2022

'SQUIRREL-PALOOZA'

NHAT V. MEYER — STAFF PHOTOGRAPHER

Stephanie Hughes, a volunteer at Wildlife Center of Silicon Valley, feeds a baby eastern gray squirrel at the center in San Jose on Thursday.

Today's Topics

- Impacts of pesticide discharges to the sewer
- Scientific evidence linking specific persistent, toxic pesticides to flea/tick control
- Alternatives to on-pet and in-home treatments
- What veterinarians are saying
- What's next

Rosie

Frosty

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A collaborative entity of 55 wastewater treatment plants and sewer collection system agencies serving 7.1 million San Francisco Bay Area residents

The BACWA Pesticides Workgroup seeks to be proactive on pesticides

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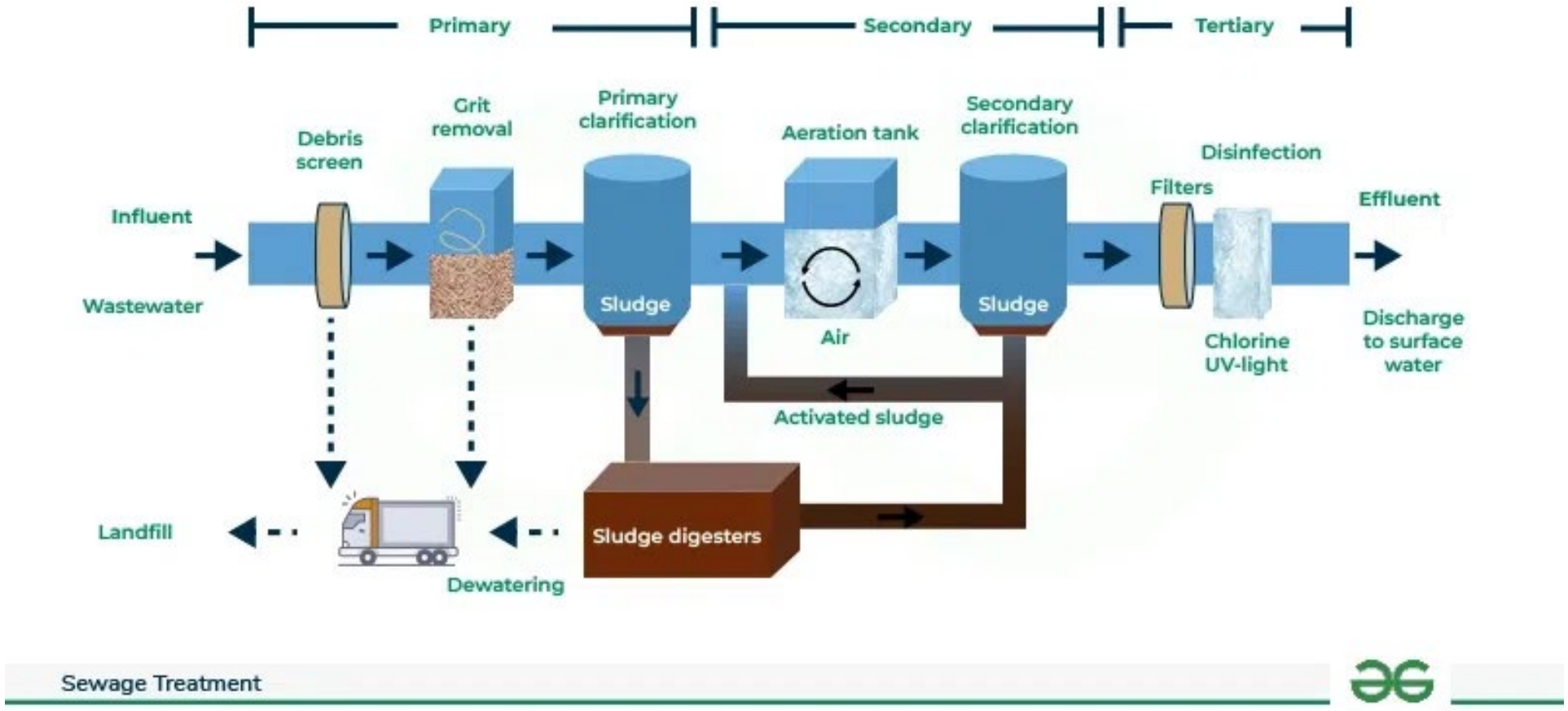
- Science & monitoring partnerships – collaborating with the San Francisco Estuary Institute and CA Department of Pesticide Regulation (DPR)
- Regulatory engagement – communicating with US EPA and DPR as pesticides are registered or in review for re-registration
- Safer alternatives – identifying alternatives and communicating this to consumers, pest control operators, and other stakeholders

Wastewater Treatment Process



https://www.geeksforgeeks.org/sewage-treatment-process/

Conventional Wastewater Treatment

*"Conventional **wastewater treatment technologies are generally ineffective at removing pesticides from wastewater…"***

*"seven compounds… were detected in treated wastewater effluent at **levels exceeding** U.S. Environmental Protection Agency (US EPA) **aquatic life benchmarks for chronic exposure to invertebrates**."*

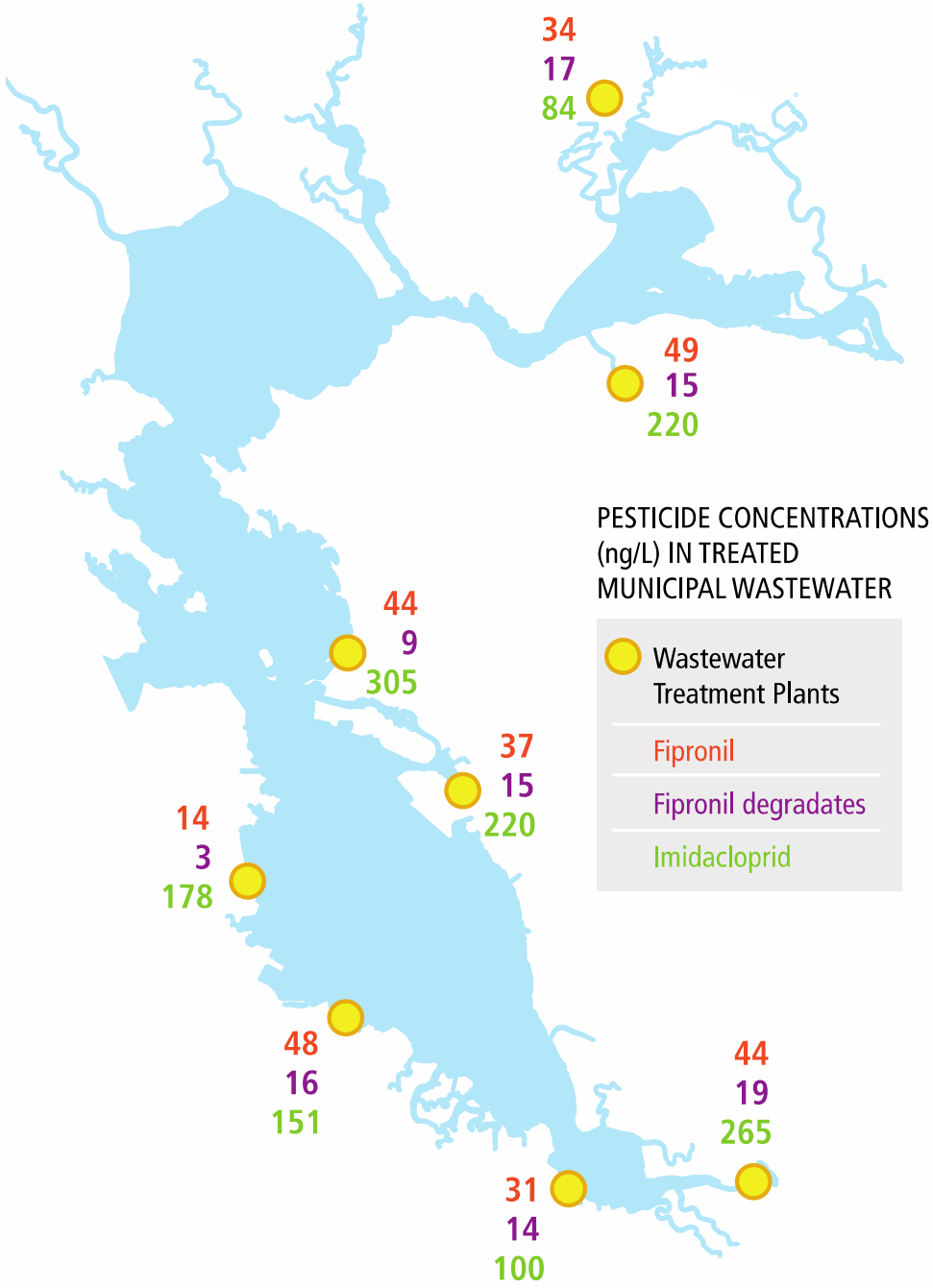
Sutton et al. (2019). "*Occurrence and Sources of Pesticides to Urban Wastewater and the Environment*" in Goh et al.; Pesticides in Surface Water: Monitoring, Modeling, Risk Assessment, and Management ACS Symposium Series; American Chemical Society: Washington, DC, 2019.

Pesticide Discharges to the Sewer Can Harm the Environment and Be Costly

- Potential for pesticides to cause or contribute to wastewater treatment process interference
- Adverse impacts to receiving waters (rivers, bays, ocean)
- Permit compliance issues
- Exposes cities to the potential for third party lawsuits under the Federal Clean Water Act (CWA)
- Impacts costs of recycled water
- Impacts ability to reuse biosolids

In the San Francisco Bay Area, we have evidence that pesticides pass through wastewater treatment at **concentrations above aquatic toxicity thresholds** for sensitive organisms

Aquatic toxicity thresholds:
11 ng/L for fipronil
10 ng/L for imidacloprid



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.

Insecticides and Acaricides in the Environment

- The loss of these aquatic invertebrates at the base of the food web can impact an entire ecosystem
- These species in laboratory environments are considered *indicator organisms* that are hardy enough to survive and be monitored in lab conditions

Photo Credit – Mark Eliot

Pesticides of Concern are Those That Exhibit Aquatic Toxicity and Persist in the Environment

- Fipronil
- Imidacloprid
- Indoxacarb
- Pyrethroids
  - Bifenthrin
  - Cypermethrin
  - Deltamethrin
  - Permethrin

Dall-E created image by Alessandra Moyer, SF Bay Regional Water Board

Evidence of Ectoparasitic Pesticide Transport in the Home

Beau

Using Foggers Exposes People to Pesticide Residue

Science of the Total Environment 847 (2022) 157340

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

Wash-off potential of pyrethroids after use of total release fogger products

Mark Dery [a,*], Brian Dinh [a], Robert Budd [b], Dong-Hwan Choe [a]

[a] Department of Entomology, University of California, Riverside, CA 92521, USA
[b] Surface Water Protection Program, Environmental Monitoring Branch, California Department of Pesticide Regulation, 1001 I Street, Sacramento, CA 95812, USA

Chemosphere

Volume 20, Issues 3–4, 1990, Pages 349-360

Measuring potential dermal transfer of surface pesticide residue generated from indoor fogger use: An interim report

J. Ross*, T. Thongsinthusak, H.R. Fong, S. Margetich, R. Krieger

Journal of Exposure Analysis and Environmental Epidemiology (2003) 13, 112–119

www.nature.com/jea

Human exposure to indoor residential cyfluthrin residues during a structured activity program

RYAN L. WILLIAMS, CRAIG E. BERNARD, AND ROBERT I. KRIEGER

Personal Chemical Exposure Program, Department of Entomology, and Environmental Toxicology Graduate Program, University of California, Riverside, California, USA

Evidence for Fogger Residue Transfer to People

METHODS:

- Rooms in a new hotel (repeatability; eliminate background residue)
- Chlorpyrifos/allethrin foggers set up per label
- Participants later conducted a standardized exercise routine
- Shirts, tights, gloves and socks analyzed

RESULTS:

- Both pesticides were detected on all exposed clothing
- When the volunteers showered, the residue on their heads and other bare skin transferred to the sewer

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

In-House Foggers vs. Crack-and-Crevice Sprays

- UC Riverside study compared human exposure to indoor insecticidal treatment methods
  - fogger
  - perimeter spray
  - crack-and-crevice sprays
  - spot sprays
- Fogger applications resulted in highest chemical residue
- Crack-and-crevice and spot applications deposited high levels of pesticide directly at the target site

Regulatory Toxicology and Pharmacology 58 (2010) 189–195

Contents lists available at ScienceDirect

Regulatory Toxicology and Pharmacology

journal homepage: www.elsevier.com/locate/yrtph

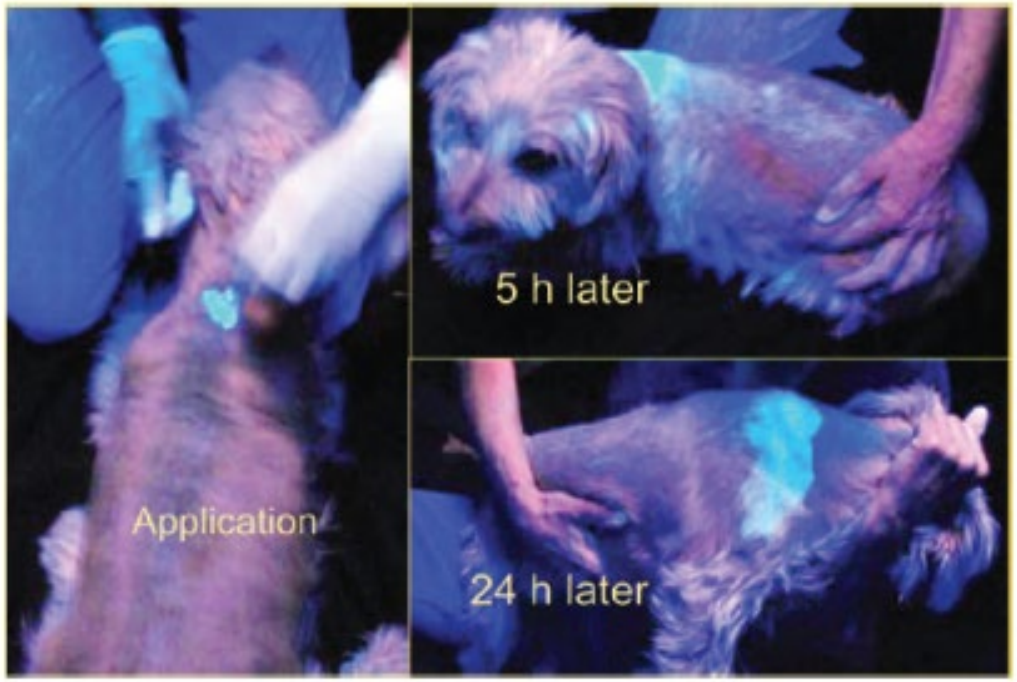
Deposition and spatial distribution of insecticides following fogger, perimeter sprays, spot sprays, and crack-and-crevice applications for treatment and control of indoor pests

James J. Keenan [a], John H. Ross [b], Vincent Sell [c], Helen M. Vega [a], Robert I. Krieger [a,*]

[a] Personal Chemical Exposure Program, Department of Entomology, University of California, Riverside, CA 92521, United States
[b] Gem Quality Risk, Inc. 5233 Marimore, Carmichael, CA 95608, United States
[c] Washburn & Sons, 807 Center Street, Riverside, CA 92507, United States

"Crack-and-crevice application…appears to be the most effective application type when one is trying to decrease potential exposure and maintain efficacy of treatment."

Topical Treatments Do Not Remain on the Pet



Researchers incorporated a fluorescent dye into the spot treatment to photograph the spread.

Fig. 3. Handling of a dog treated with Frontline® containing 1% Tinopal® CBS-X fluorescent tracer revealed contamination of hands during routine application and handling of a treated dog (color figure available online).

"Fate and Distribution of Fipronil on Companion Animals and in Their Indoor Residences Following Spot-On Flea Treatments," Bigelow Dyk, M., et al., J. of Env Science and Health, Part B, 2012, Vol 47, pp 913-924.

Evidence of Human Health Risks of Fipronil Exposure

*"Scenarios that pose a **potential risk** to home users include:*

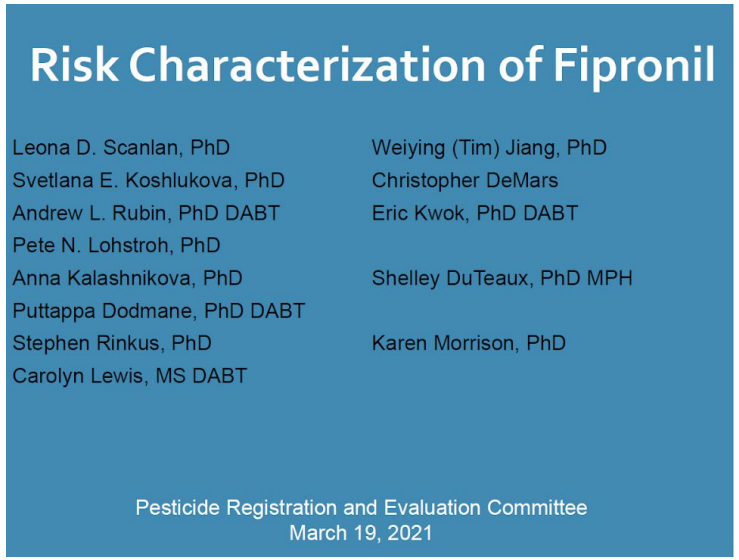
- *Acute **dermal exposure for users who apply pet spray** at home*

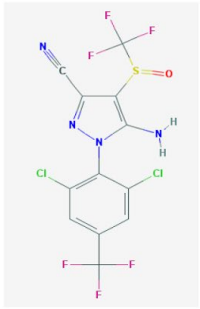
*Post-application **residential exposures for adults** considered to pose a **potential health risk** include:*

- *Seasonal **exposure to pet spray products***

*Post-application residential exposure for **children** considered to pose a potential health risk include:*

- *Short-term oral exposure to turf granules*
- *Seasonal **oral exposure to pet products***
- *Seasonal **dermal exposure to pet products**"*





Fipronil Risk Characterization Document, Human Health Assessment Branch, Department of Pesticide Regulation, California Environmental Protection Agency. March 2023.

Evidence of Transport to the Sewer

Sage, Wednesday, and Gemini

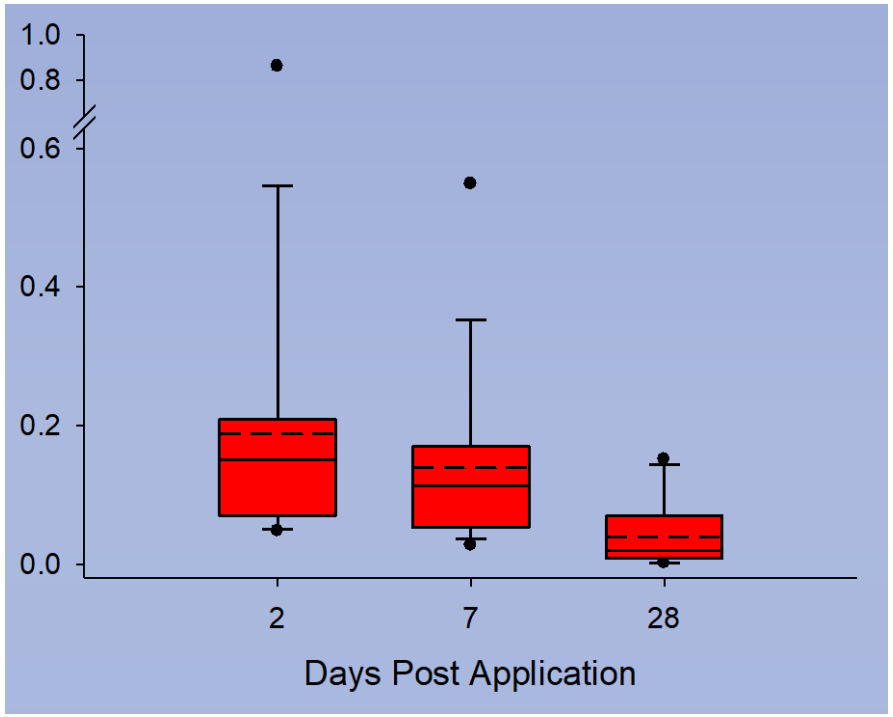
Spot-on Products Typically State That They are Waterproof Once Dry

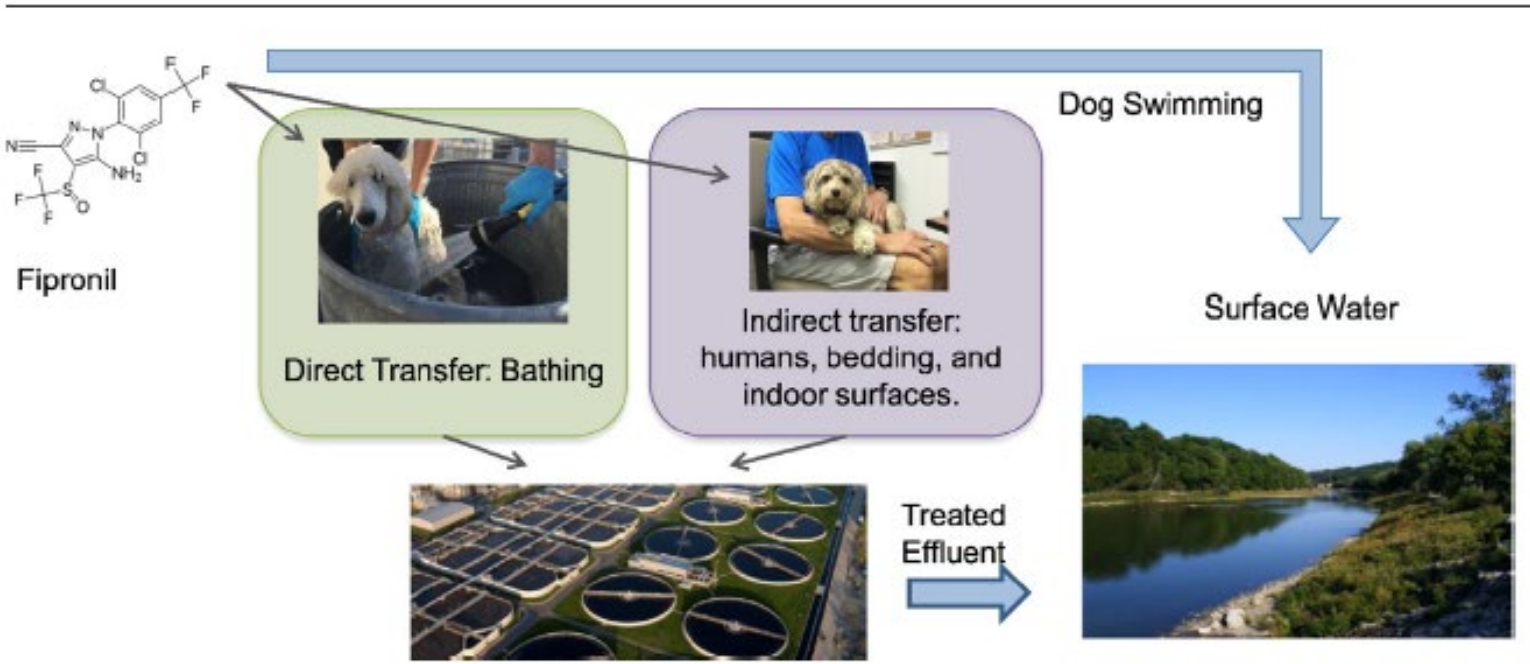
Chloe

Fipronil washoff to municipal wastewater from dogs treated with spot-on products

Jennifer Teerlink [a,*], Jorge Hernandez [b], Robert Budd [a]

[a] Department of Pesticide Regulation, California Environmental Protection Agency, Sacramento, CA 95812, USA
[b] California Department of Food and Agriculture, Sacramento, CA 95812, USA





Source: 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.

Assessing Pesticide Concentrations in the Sewage Collection System

Environmental Science & Technology

pubs.acs.org/est

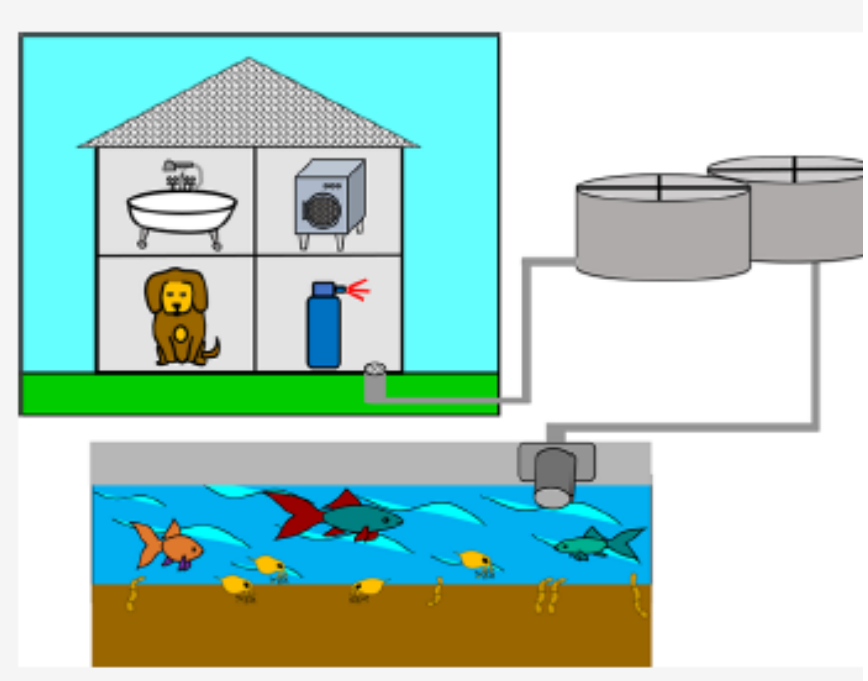
Article

Sub-sewershed Monitoring to Elucidate Down-the-Drain Pesticide Sources

Robert Budd,* Jennifer Teerlink, Christopher Alaimo, Luann Wong, and Thomas M. Young

Cite This: *Environ. Sci. Technol.* 2023, 57, 5404–5413

Read Online



Budd, R., et al., Sub-sewershed Monitoring to Elucidate Down-the-drain Pesticide Sources, Env. Sci, & Tech, 2023, 57, 5404-5413. https://doi.org/10.1021/acs.est.2c07443.

Compared Possible Hotspots to Typical Collection System Conditions

- Groomer
- Commercial Laundry
- Licensed Pest Control Operator
- Max detected in sewer laterals
- Median detected in sewer laterals

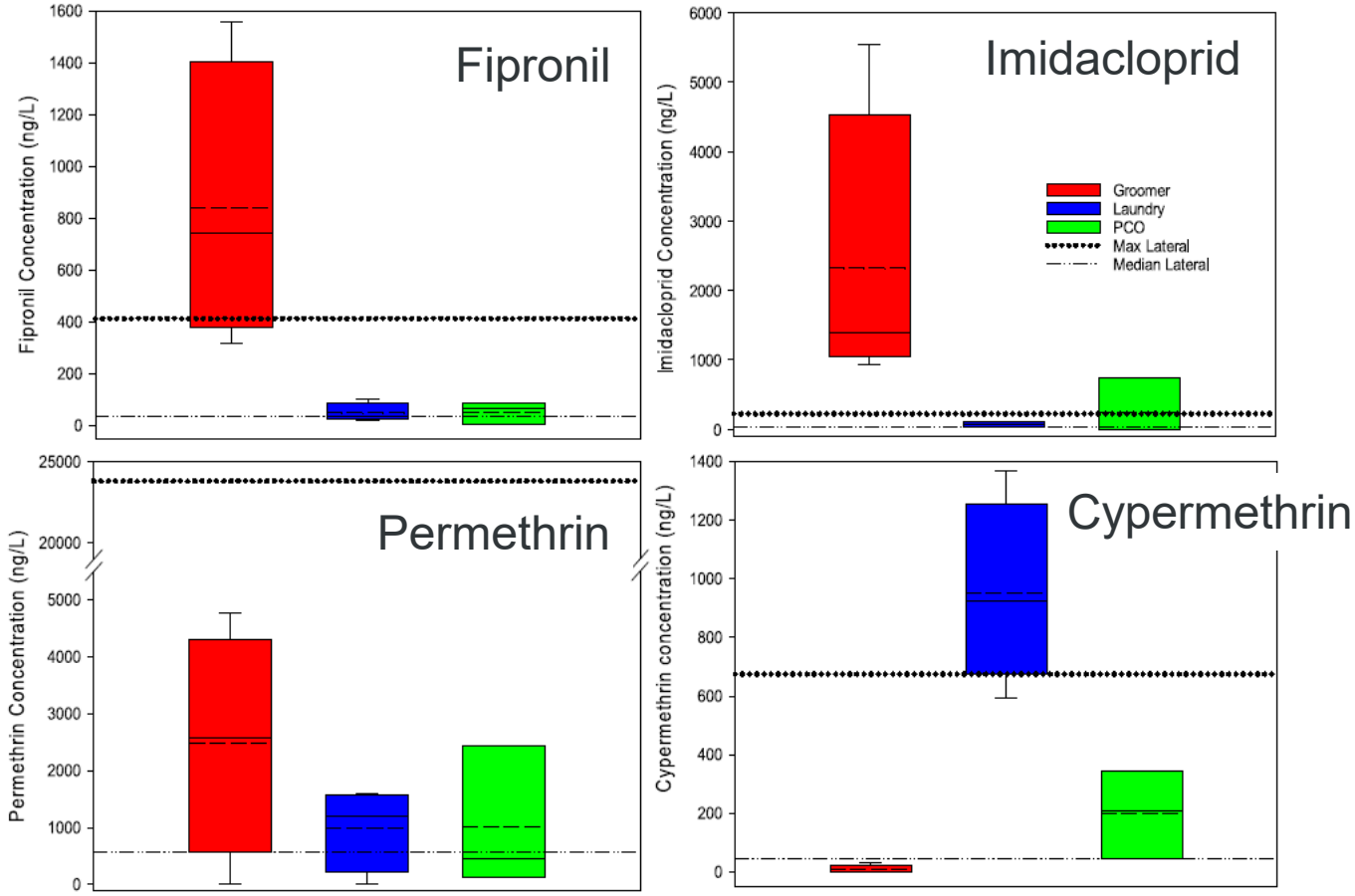


Figure 5. Concentration box plots of (A) fipronil, (B) imidacloprid, (C) permethrin, and (D) cypermethrin at groomer (red), laundry (blue), and PCO (green) sub-sewershed monitoring locations. Dashed line in the box represents the mean concentration.

Budd, R., et al., Sub-sewershed Monitoring to Elucidate Down-the-drain Pesticide Sources, Env. Sci, & Tech, 2023, 57, 5404-5413. https://doi.org/10.1021/acs.est.2c07443.

Similar Studies Ongoing in the U.K.

Science of the Total Environment 755 (2021) 143560

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

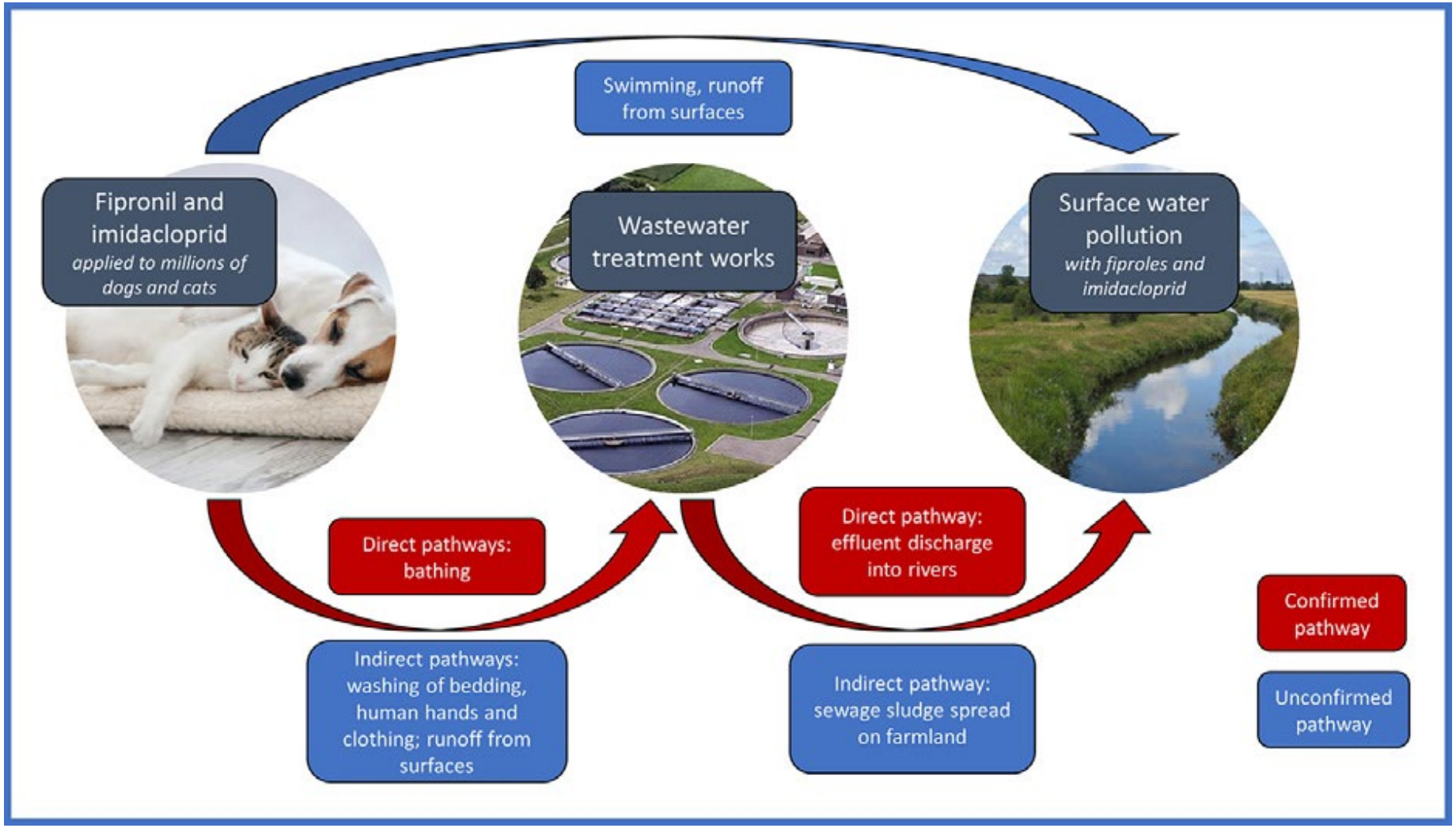
Potential role of veterinary flea products in widespread pesticide contamination of English rivers

Rosemary Perkins [a,*], Martin Whitehead [b], Wayne Civil [c], Dave Goulson [a]

[a] University of Sussex, School of Life Sciences, Falmer, Brighton BN1 9QG, United Kingdom
[b] Chipping Norton Veterinary Hospital, Banbury Road, Chipping Norton, Oxfordshire OX7 5SY, United Kingdom
[c] Environment Agency, National Laboratory Service, National Monitoring Services Starcross Laboratory, Exeter EX6 8FD, United Kingdom

U.K. findings:

Graphical Abstract from Perkins, et al., 2021



How Indoor and On-Pet Treatments Travel through Sewer Systems to Water Bodies

Indoor pet flea control product

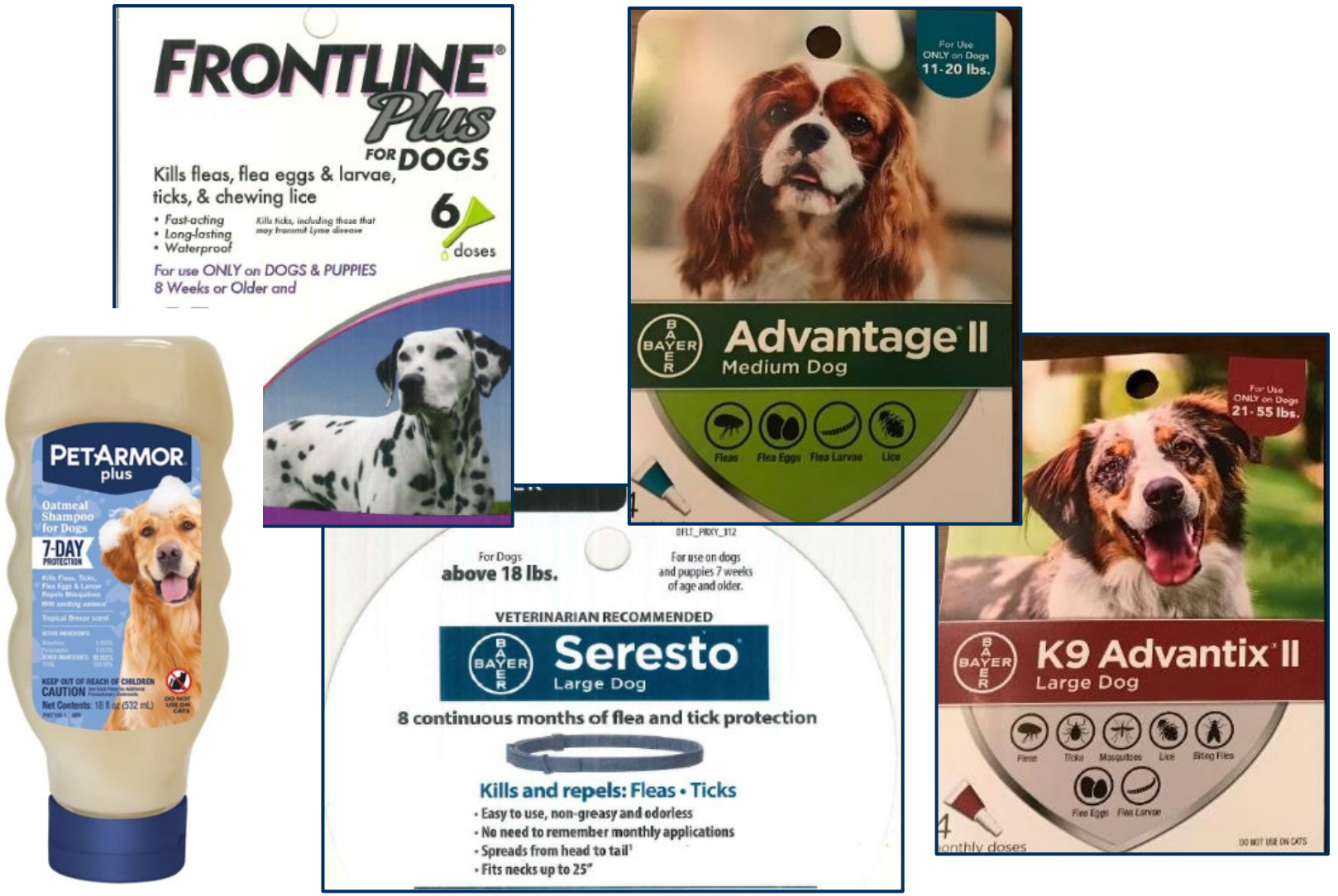
Washing of pets, hands, pet bedding, floors, carpets, and clothing

Transport to sanitary sewer system

Discharge to water body, recycled water, and/or biosolids

Pesticides of Concern are Those That Exhibit Aquatic Toxicity and Persist in the Environment

- Fipronil
- Imidacloprid
- Indoxacarb
- Pyrethroids
  - Bifenthrin
  - Cypermethrin
  - Deltamethrin
  - Permethrin



What About Other Indoor Uses?

FIPRONIL

- Registered by US EPA for:
  - Indoor sprays and topicals for fleas and ticks
  - A subsurface termiticide
  - Crack and crevice insecticide

Astro

What About Other Indoor Uses?

IMIDACLOPRID

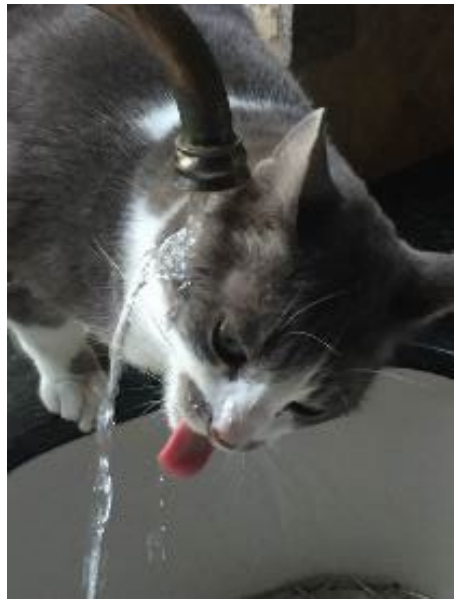
- Registered by US EPA for:
  - On-pet uses (spot-on treatment and collars)
  - Indoor areas for bed bugs
  - Crack-and-crevice treatments
  - Pre- and post-construction termiticide
  - Wood preservative

Chip

What About Other Indoor Uses?

INDOXACARB

- Registered by US EPA for:
  - Spot-on treatments of cats and dogs
  - Bait products for ants, cockroaches, and crickets
  - Crack and-crevice uses



Lucy

Indoor Flea/Tick Control is the Overwhelming Source of Pesticides That Exhibit Aquatic Toxicity and Persist in the Environment

- Fipronil
- Imidacloprid
- Indoxacarb
- Pyrethroids
  - Bifenthrin
  - Cypermethrin
  - Deltamethrin
  - Permethrin

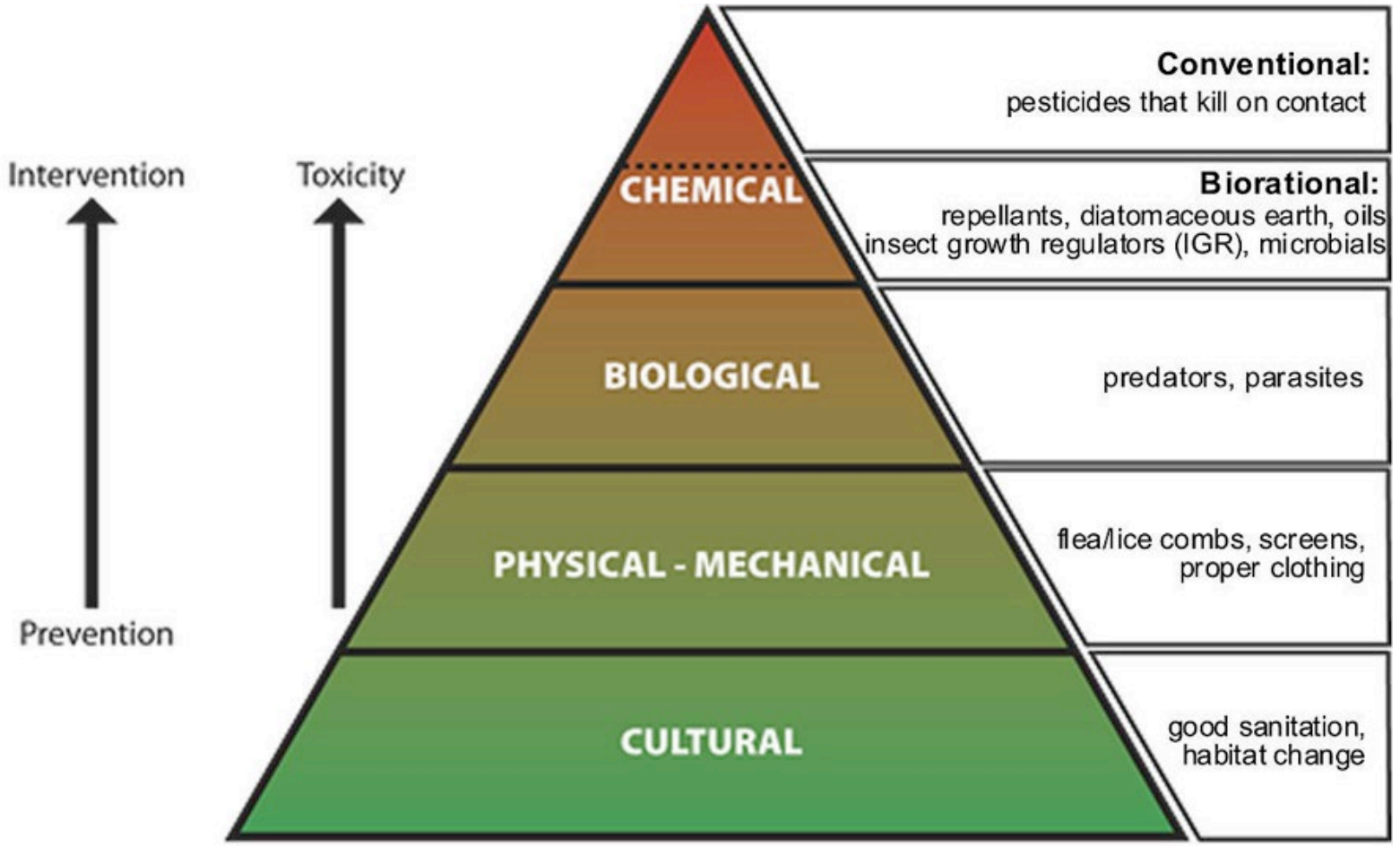
- Seeking to reduce the use so the values in wastewater effluent return to below aquatic toxicity thresholds

- This list could change:
  - As consumer preferences change
  - As new products come to the marketplace
  - As new science emerges

Alternatives

Integrated Pest Management (IPM)

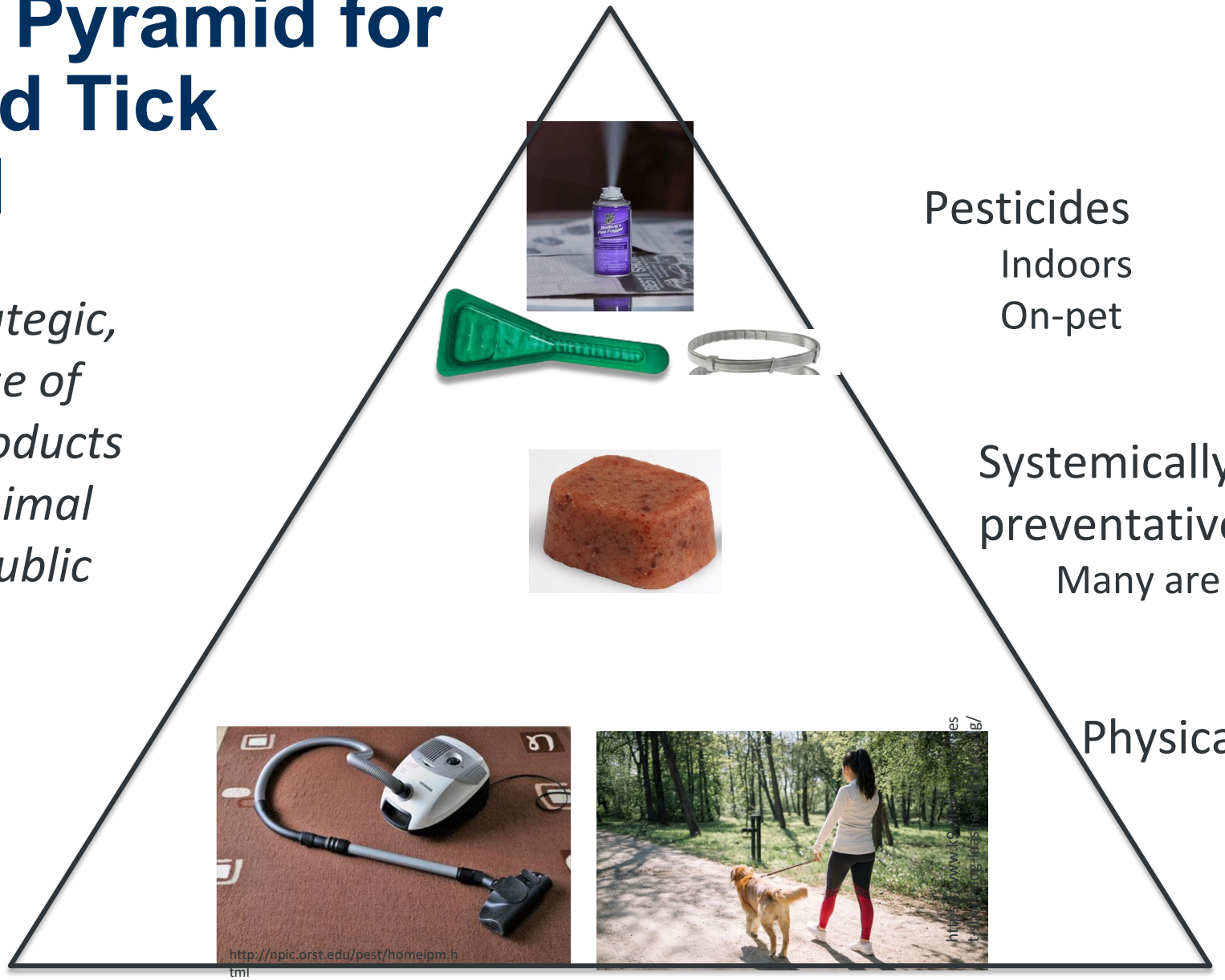
A powerful concept for pest management



https://www.epa.gov/ipm/definition-verifiable-school-ipm

An IPM Pyramid for Flea and Tick Control

Consider strategic, risk-based use of pesticidal products to protect animal health and public health



Alternatives Include Systemically-Acting Medications

- May be administered either orally (chewables) or topically
- Many also protect against internal parasites
- Many of the newest ones are isoxazolines
  - Associated with possible adverse neurologic reactions in some dogs
- Prescriptions required rather than over the counter
  - Creates a social justice aspect

Evidence Suggests that Systemics May be More Effective Than Topicals

"In this study systemically acting insecticides such as nitenpyram, and the topically applied but systemically active insecticide selamectin, were ***more effective*** *in interfering with flea blood feeding* ***than were imidacloprid and fipronil****."*

"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.

Why? Hypotheses include:

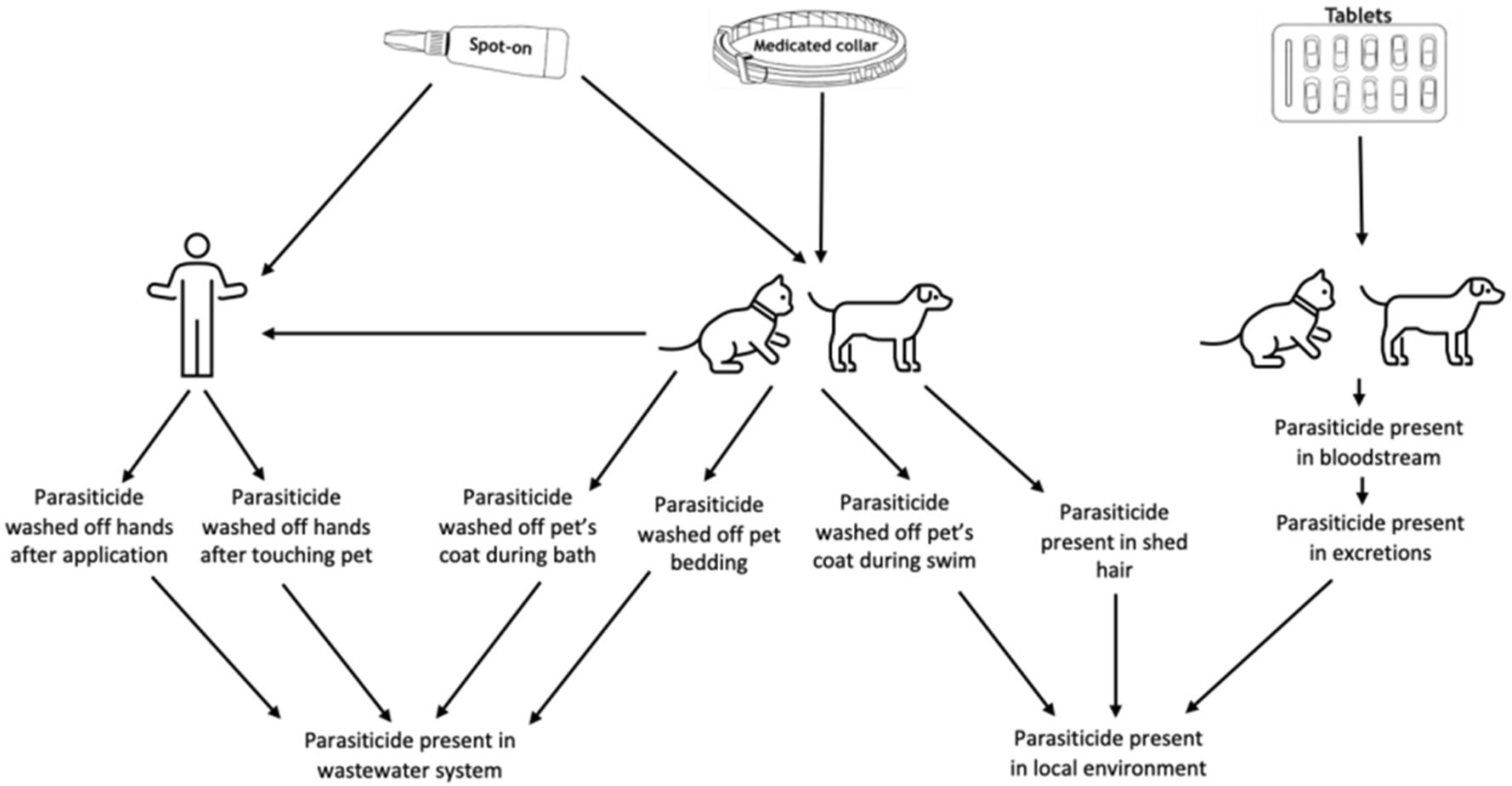
- More accurate application method
- More direct approach (pest bites animal rather than happens upon the topical on skin or fur)
- The active ingredient is not being licked off or diluted around the home

How Oral In-Pet Treatments Might Travel*

- Chewable administered to pet
- Excreted active ingredient (or metabolite)
  - Cat litter pan –> landfill (or flushed?)
  - Outdoors –> bagged –> landfill
  - Outdoors to pervious surface (grass, dirt) –> absorbed
  - Outdoors to impervious surfaces (pavement) –> stormwater runoff
- Exuded through skin
  - Transport from fur to bedding, humans, local environment?
  - Transport to sewer during washing?

* There is far less research and scientific understanding of these pathways.

Route to Wastewater & the Environment



Wells & Collins *Environ Sci Pollut Res* 2022

Orals May Pose Lower Risk of Environmental Harm

*"**It is possible that orally administered isoxazolines such as afoxalaner, lotilaner or oral formulations of fluralaner may pose a lower risk of environmental harm.** Orally administered fluralaner is primarily excreted unchanged in the faeces, as opposed to being widely disseminated in hair and skin (European Medicines Agency, 2013). **However, concerns still exist**, as **fluralaner is extremely persistent in the environment,** with a DT50 in soil of up to 989 days and has **a high toxic potency for non-target invertebrates** (European Medicines Agency, 2017)."*

From Perkins et al., Potential role of veterinary flea products in widespread pesticide contamination of English rivers, Science of the Total Environment 755 (2021) 143560.

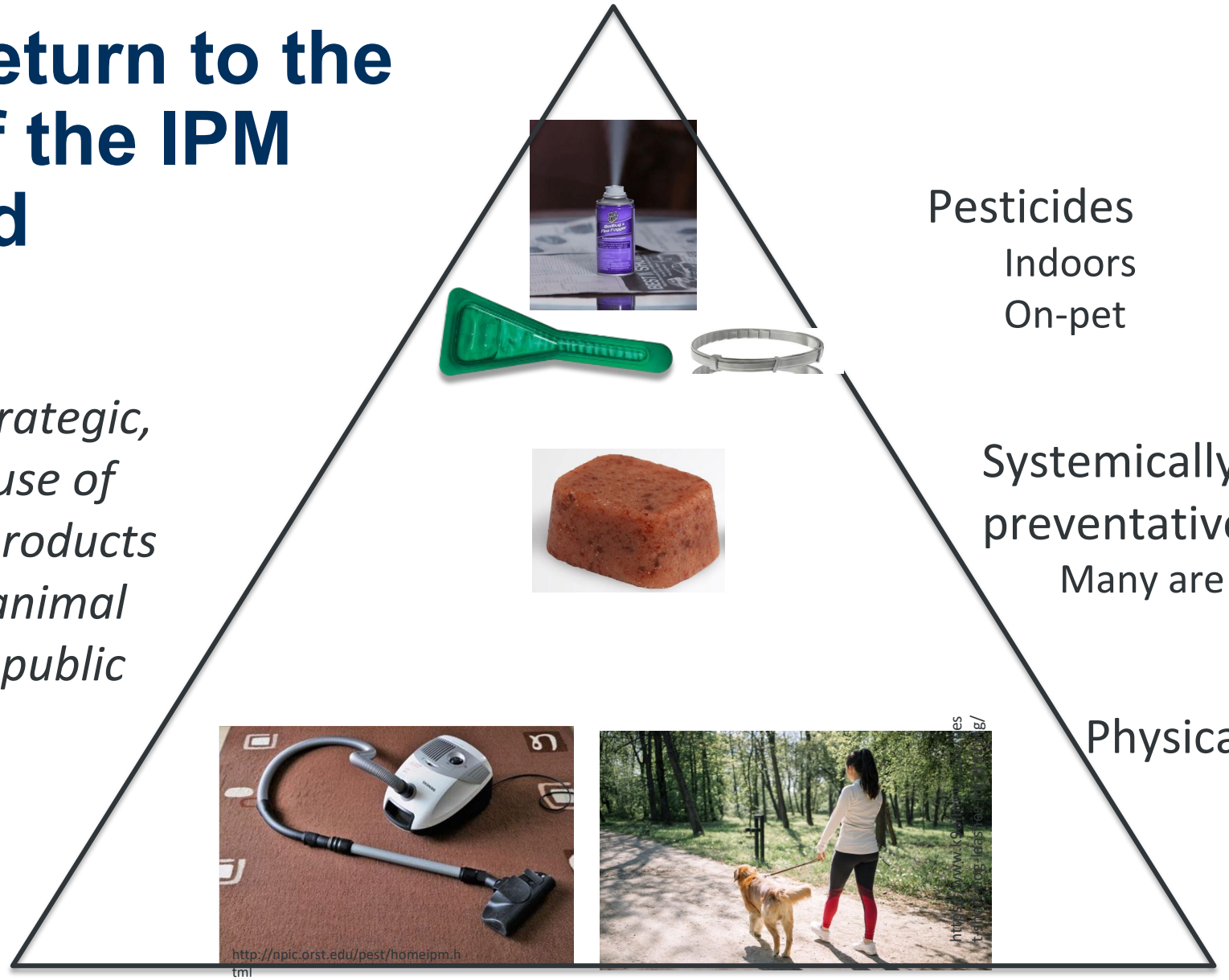
For Water Quality and Public Health, One Is Always on the Lookout for Regrettable Substitutions

- “fluralaner presented a broad insecticidal spectrum having toxic activity on 19 kinds of insects belonging to 11 taxonomic orders” *
- What we don’t know is whether it will ultimately become a concern due to toxicity, environmental pathways, and persistence

** Gonçalves, et al., Discovery, development, chemical diversity and design of isoxazoline-based insecticides, Bioorg. Med. Chem. 30 (2021) 115934*

Let's Return to the Base of the IPM Pyramid

Consider strategic, risk-based use of pesticidal products to protect animal health and public health



Pesticides
- Indoors
- On-pet

Systemically-acting pet preventatives
- Many are orals/chewables

Physical measures
- Vacuum; clean bedding
- Monitor
- Keep out of tall grass

Using IPM for Flea Control

1. **Prevent**: vacuum (everywhere, often), wash bedding, steam clean
2. **Monitor:** flea combs, flea traps
3. **Crack-and-crevice sprays:** more effective and reduce human exposure, relative to foggers and carpet sprays

https://www.preventivevet.com/pets/how-to-get-rid-of-fleas-in-your-home

https://www.ecats.vet/siteSearch/view/225302_Fleas.pml

https://www.instructables.com/Simple-Flea-Trap/

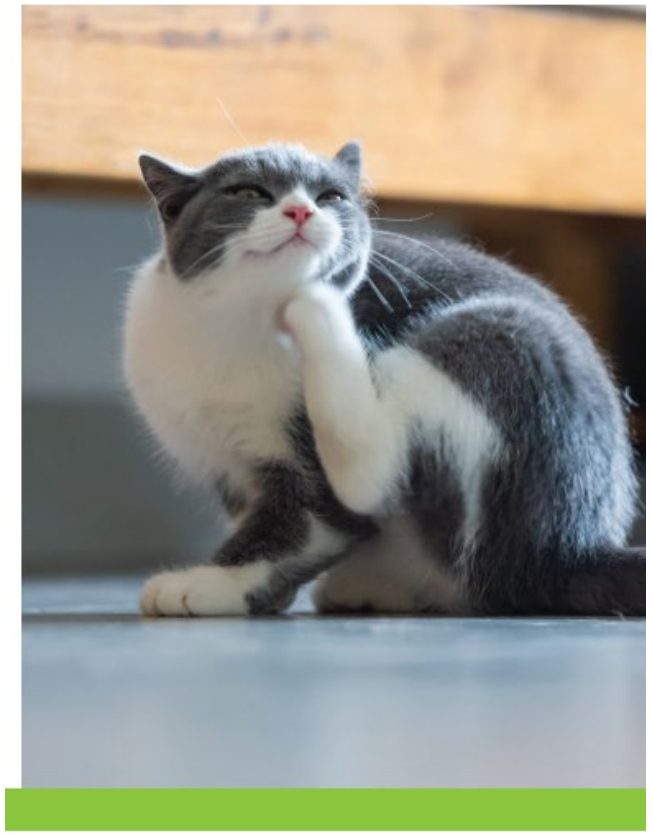
Similarly for Ticks…Prevention is the Key

1. If possible, **keep your dog's coat short**.
2. **Try to keep out of the brush.**
3. **Thoroughly inspect your pet** after walks. Pay particular attention to the nose, mouth, eyes, ears (inside too), around tails and under the collar.
4. **Seek to create a tick-free zone in your yard**, controlling brush or tall grass.

Ellis

What are veterinarians saying?

AVMA Flea Recommendations



"Because much of a flea's life cycle is spent somewhere other than on a pet, **treating just your pet will provide only temporary relief.** …Therefore, you will need to **regularly clean your pet's living area** to remove and kill early-stage fleas. This means **thoroughly cleaning your pet's sleeping quarters and vacuuming/ cleaning floors and furniture where your pet hangs out.**"

AVMA, "External Parasites" brochure, 2022.

2024 Veterinary Survey

In 2024, BACWA teamed with the Veterinary Information Network (VIN), to survey veterinarians about fipronil, imidacloprid and alternative flea/tick controls.

- 637 USA veterinarians (including 73 California vets)
- 47 veterinarians from outside the USA

Veterinary Survey Results

- 12% of US vets (and 18% of California vets) currently do not recommend either fipronil or imidacloprid to their clients
- When presented with brief information (mid-survey) about aquatic toxicity concerns, an additional 60% of vets indicated they would be somewhat or very willing to consider changing their product recommendations.

- 2024 VIN Survey

Alternative strategies surveyed veterinarians would recommend (in order of preference):

Flea Control

1. Orals/chewables
2. Home mechanical treatments (vacuuming, washing bedding)
3. Another on-pet topical or collar
4. Professional pest control service
5. Home pesticidal treatments (carpet sprays or foggers)
6. Flea shampoo

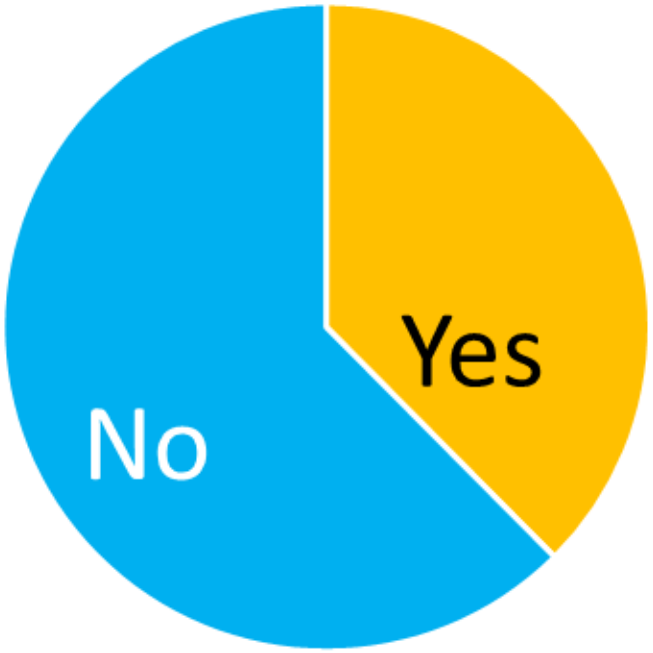
Tick Control

1. Orals/chewables
2. Rigorous coat inspections
3. Another on-pet topical or collar
4. Keeping the dogs on trails / avoiding woods and tall grass
5. Professional pest control service
6. Creating a tick free zone in the yard
7. Home pesticidal treatments (outdoor sprays)

- 2024 VIN Survey

What about barriers?

Are there barriers in place that prevent you from removing fipronil and/or imidacloprid from your recommendations for flea or tick control altogether?



Top Four Barriers Identified by Vets

1. Cost
2. Client compliance / Ease of administration
3. Prescription vs OTC
4. Adverse reactions/Suitability (seizures, food allergies to chewable flavorings, pregnant/lactating patients, puppies and kittens)

- 2024 VIN Survey

Additional Feedback to VIN Survey:

Do you have any other thoughts about flea or tick products that contain fipronil or imidacloprid?

- “I am concerned… we were **taught these products were safe once dried**.” – DVM, IL
- “When prescribing a product one must **consider owner compliance**. ...If the product is not easy to use and requiring minimum effort, clients will not use it, or will use it one time, not consistently.” –DVM, CA
- “Occasionally we reach for these products if pet has **adverse reactions to the chewables**, **neuro disease**, or the owner has severe **financial constraints**.” –DVM, VT
- “I think it will be really **hard to convince owners** about the importance of aquatic contamination. Tragedy of the commons e.g. (my pet alone won't kill fish) and **lack of trust in science**.” –DVM, AK

Additional Feedback to VIN Survey:

Do you have any other thoughts about flea or tick products that contain fipronil or imidacloprid?

- “These two products are some of the most **widely available** options and **did seem to be revolutionary to options used prior to the early 1990s**.” –DVM, OR
- “We **haven't used in over 15 years**, nor recommend.” –DVM, OH
- “One must **balance the risks of systemic illness** such as anemia, Hematropic Mycoplasmosis (HM), borreliosis (Lyme), anaplasmosis, ehrlichiosis and tick paralysis **versus pesticide risk**.” –DVM, CA
- “Since these products are OTC, **the manufacturers and EPA need to lead the charge** in reducing environmental contamination and concerns.” –DVM, TX

Veterinary Webinar from the U.K.

https://www.youtube.com/watch?v=wnJZD5ZchJM

The Vet Sustain webinar:

Acknowledged that this is a challenging and tricky situation:

- OTC availability
- Years of vet advice promoting regular prevention
- Lack of single-ingredient products
- Incomplete science
- Balancing individual patient welfare with wider, global, generational animal and human welfare

The Vet Sustain webinar:

Had the following recommendations for parasiticides:

- Risk-based approach
  - Outside, travel, raw foods, other pets, immunocompromised individuals, monitoring
- Using narrow-spectrum rather than broad-spectrum products (even though that may be convenient)
- Ensure appropriate use (no bathing, swimming)
- Initiate conversations with your team and, if corporate, central management

UK Veterinary Publication

*"We believe that the **products used to treat endo- and ectoparasites** in dogs and cats **require urgent attention**. The first step we must take is to **stop the blanket prophylactic use of antiparasitic drugs.** Until recently, the veterinary profession used drugs to **treat parasites in a strategic fashion**, which would minimise environmental exposure."*

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ARTICLE

Environmental pollution from pet parasiticides

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Recap and Resources for Next Steps

Recap

- Fipronil
- Imidacloprid
- Indoxacarb
- Pyrethroids
  - Bifenthrin
  - Cypermethrin
  - Deltamethrin
  - Permethrin

- Flea and tick control pesticides are reaching sewer systems
- Pesticides subsequently discharged into water bodies can exceed aquatic toxicity thresholds
- CA's Dept of Pesticide Regulation has identified potential human health risks associated with fipronil
- When vets, animal shelters and pet adoption agencies use these topicals, consumers view that as an endorsement
- Orally administered products may pose lower environmental risk

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baywise.org/learning-center/protect-your-pets-your-family-and-the-bay/

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Learning Center

Protect Your Pets, Your Family, and the Bay

If you are a pet owner or someone who works with pets, you know how important it is to keep our furry friends free of fleas and ticks. However, you may not know that products used to treat fleas and ticks – such as spot-on treatments, collars, sprays, and foggers – expose your family and home to toxic pesticides.

baywise.org/business-resources/pollution-prevention-guidance-for-veterin...

Pollution Prevention Guidance for Veterinarians

Topical Flea & Tick Control Products Expose Pet Owners to Toxic Chemicals and Pollute San Francisco Bay

Vets are their clients' trusted source for flea and tick control information. The veterinary community can help educate Bay Area pet owners about the efficacy and benefits of systemically-acting pet flea and tick medications which also reduce pesticide exposures to people and the San Francisco Bay.

EFFECTIVE ECO-FRIENDLY PEST CONTROL • LESS-TOXIC PRODUCTS

KEEP FLEAS OFF YOUR PETS AND OUT OF YOUR HOME

FLEA CONTROL IS EASY AS 1–2–3!

1. Keep them out

- Frequently vacuum floors, carpets, and furniture
- Wash pet and human bedding
- Regularly clean or caulk cracks and crevices in floors and baseboards

2. Monitor

- Use flea traps to monitor your household
- Check your pet for fleas using a flea comb and a dish of soapy water, which will also get rid of any adult fleas

3. Treat your pets

- Wash your pet with pesticide-free shampoo and warm water
- Instead of topical treatment, ask your veterinarian if oral treatment is an option

FINDING FLEAS IN THE HOME

- Adult fleas spend much of their time on an animal's body. If you haven't seen fleas but your dog or cat is scratching, your pet may have fleas.
- You may be able to see tiny white flea eggs and white, worm-like flea larvae on the floor, in cracks and crevices, in carpets, and where pets rest or sleep. You may also see "flea dirt" (flea droppings) where your pet sleeps. These black specks contain blood, and turn red when wet.
- Use a light trap to monitor your home for fleas. Light traps attract fleas and trap them on sticky paper. Traps work better if people and pets are not around — fleas prefer warm bodies to traps.

PREVENTING FLEAS

In your home

The vast majority of fleas (in several life stages) live throughout your home rather than on your pet. Therefore indoor flea prevention is a key part of flea control.

- **Frequently vacuum carpets, floors, couches, and chairs** to pick up adult fleas, larvae, and eggs. Empty vacuum or dispose of bags in the trash, outdoors.
- **Frequently wash pet bedding in hot soapy water.**
- **Thoroughly clean cracks and crevices in floors or baseboards, or permanently seal with caulk.**
- **Blow or hand dust diatomaceous earth (DE) into cracks and crevices.** Use DE labeled for use on pests, or use "food-grade" DE; avoid swimming pool DE. Wear a dust mask and goggles to keep DE out of your lungs and eyes.
- **Avoid using indoor foggers** as the pesticides transfer onto you, your clothing, and indoor surfaces. Upon washing, these pesticides go down the sewer drain and impact water quality.

FLEA FACTS

Fleas make pets and people uncomfortable, and can transmit tapeworms to pets and sometimes to children.

Fleas in your home spend the vast majority of their lifetime — up to 18 months — as eggs, larvae or pupae, not as biting fleas on your pet. Adult fleas can live on your pet for up to 40 days and females lay 20-50 eggs every day, which means flea problems can get out of control quickly, especially in warmer weather when fleas are more active. This is why getting rid of all life stages of fleas by vacuuming and washing pet bedding — not just getting rid of adult fleas — is needed to prevent or stop a flea infestation.

Choose eco-friendly products for your home and garden. Look for this symbol before you buy.

On your pet

- **Wash your pet with a pesticide-free pet shampoo and warm water.** Avoid shampoos containing the pesticide bifenthrin. When bifenthrin ends up in our waters, it harms crustaceans, aquatic insects, and fish.
- **Use a flea comb (available at pet stores) to remove adult fleas on your cat or dog.** Drown fleas caught in the comb in a cup of warm soapy water and flush or pour down the drain. Make sure to comb well around your pet's neck and base of the tail.
- **Ask your veterinarian if chewable (oral) flea medications are an option for your pet.** These products are safer for the environment than indoor foggers and topical ("spot-on") pet treatments, sprays and collars.
- **If you use spot-on flea treatments, avoid products that contain fipronil, bifenthrin, imidacloprid, indoxacarb, deltamethrin, or permethrin** — chemicals that cause water quality programs in creeks, rivers, or bays, and the ocean.

Outdoors

- **Don't treat for fleas outdoors unless you see large numbers of fleas there.** Spray insecticidal soap only in those areas where you find fleas.
- **Apply beneficial nematodes** (*H. bacteriophora* or *S. carpocapse*) to soil where you have found fleas. Soil temperature must be between 60°F and 90°F, and the soil should be moist. Water before and after application, but don't soak the area.

USING PESTICIDES INDOORS ISN'T HEALTHY FOR YOU, YOUR PETS, OR THE ENVIRONMENT

Pesticides used on your pet or throughout your home transfer onto you and indoor surfaces around your home. For example, exposure to fipronil — a common ingredient in many spot-on topical treatments — may lead to adverse human health impacts to those applying the treatment and to children (California Department of Pesticide Regulation, 2023).

When washing pets, bedding, clothing, and your hands, these pesticides go down the sewer drain and impact water quality. Wastewater treatment plants cannot fully remove complex chemicals like pesticides. Wastewater agencies are concerned that pesticides in spot-on flea treatments can wash off a pet — even weeks after being applied — and end up in California waterways.

Scan the QR Code to learn more about controlling fleas.

WWW.OURWATEROURWORLD.ORG

Our Water Our World (OWOW) is an award-winning partnership between municipal agencies and garden centers and hardware stores that sell pest control products. Initiated in 1998, the program focuses on less-toxic, eco-friendly products and techniques as many common pesticides are harmful to sensitive species and ecosystems when they reach California surface waters.

Our Water Our World fact sheets and store displays educate residents about less-toxic pest management. Look for the ***Eco-friendly*** tag next to less-toxic products in participating stores and nurseries.

Our Water Our World is a program of the California Stormwater Quality Association (CASQA), a 501(c)(3) non-profit organization that advances sustainable stormwater management protective of California water resources. CASQA is the registered service mark of the California Stormwater Quality Association®.

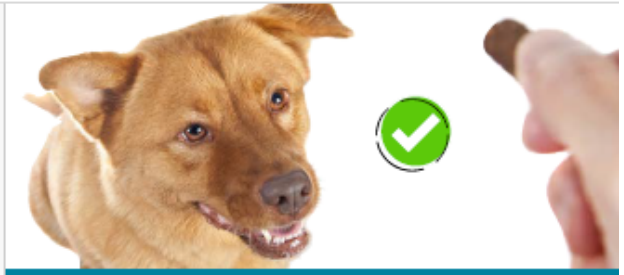
Pest control strategies and methods described in this publication are consistent with integrated pest management (IPM) concepts, and are based on scientific studies and tests in actual home and garden settings. Use suggested products according to label directions and dispose of unwanted or leftover pesticides at a household hazardous waste collection facility or event. For more information on pesticide disposal, visit **www.earth911.com**.

For more information, contact:

www.ourwaterourworld.org

University of California IPM
www.ipm.ucanr.edu

To find out how you can protect water quality with eco-friendly pest control, go to **ourwaterourworld.org/pesticides-and-water-quality**



Prevent Fleas and Ticks

Ask your vet if chewable flea and tick medications are an option for your pet.

Chewable flea and tick medications may be a preferable alternative to topical treatments. Pesticides in spot-on treatments, collars, sprays, and foggers transfer onto you and indoor surfaces around your home. When washing pets, bedding, clothing, and your hands, these pesticides go down the drain and impact San Francisco Bay water quality.

The best defense is a good offense. Follow these tips to help reduce flea and tick problems before they start:

- **Fleas** - regularly vacuum floors, furniture, pet bedding and other fabrics. Use a flea comb dipped in soapy water to capture fleas.
- **Ticks** - regularly groom and inspect your pet for ticks and keep them out of tall grasses and shrubs during tick season.

For more information, visit baywise.org.

BACWA BAY AREA CLEAN WATER AGENCIES

Prevención de pulgas y garrapatas

Consulte a su veterinario si los medicamentos masticables contra pulgas y garrapatas son una opción adecuada para su mascota.

Los medicamentos masticables contra pulgas y garrapatas pueden ser una alternativa preferible a los tratamientos tópicos. Los pesticidas que se encuentran en tratamientos tópicos, collares, aerosoles y nebulizadores se transfieren a usted y las superficies del interior de su hogar. Cuando baña sus mascotas, lava la cama para mascotas, la ropa y las manos, estos pesticidas salen por el desagüe y tienen un impacto en la calidad del agua de la bahía de San Francisco.

La mejor defensa es un buen ataque. Siga estos consejos para ayudar a reducir los problemas de pulgas y garrapatas antes de que comiencen:

- **Pulgas:** pase la aspiradora de forma regular por pisos, muebles, cama lecho para mascotas y otras telas. Utilice un peine para pulgas mojado en agua jabonosa para atrapar las pulgas.
- **Garrapatas:** acicale regularmente a su mascota y haga una inspección regular de su mascota para detectar garrapatas. Manténgala alejada de la hierba alta y de los arbustos durante la temporada de garrapatas.

Para mayor información visite baywise.org.

BACWA BAY AREA CLEAN WATER AGENCIES

BACWA developed countertop educational materials which can be modified for other regions.

Next Steps

Consider how to reduce public exposure and water quality impacts

1. Help clarify the messages
2. Raise awareness
   - Talk with your teams
   - Educate your clients
3. Consider how to handle the social justice aspect / cost disparity of some alternatives
4. Continue this dialogue
   - Reach out to me
   - Our official AVMA liaisons are Dr. Warren Hess (Associate Director, AVMA) and Dr. Danielle Godard (Vice Chair, AVMA CEI)

Gemini and Sage, as inseparable kittens

Thank You!

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https://baywise.org

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