POTW Pesticides Annual Update

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POTW Pesticides Conundrum

- 100s of Pesticides used & discharged
- Many pass through POTWs
- Some toxic as low as ng/L
- Treatment changes unrealistic (so many pesticides, such low concentrations!)
- State law prohibits local pesticide regulation

Water Board gets this

DPR gets this

EPA hasn't quite figured it out

BACWA's Work is Paying Off - DPR

- Hired wastewater experts
  - Dr. Jennifer Teerlink
  - Dr. Yina Xie
- Developing POTW discharge model
  - 1-2 years: Use for registration decisions!
- First discharge studies
- Sewershed Study

Characterizing Indoor Pesticide Use Patterns and Mass Loading in a Wastewater Catchment

CA Department of Pesticide Regulation
Environmental Monitoring Branch
Surface Water Protection Program
1001 I Street, Sacramento, CA 95814

*Jennifer Teerlink, Robert Budd, April DaSilva, Yuzhou Luo, Dan Wang, and Yina Xie

Abstract

The California Department of Pesticide Regulation, Surface Water Protection Program (SWPP) is investigating the use patterns and mass loading from indoor pesticide products to a typical wastewater sewershed. Pesticide concentrations of fipronil and pyrethroids have been reported in treated wastewater effluent at concentrations that exceed EPA Aquatic Life Benchmarks, posing potential risks to the surface waters to which they discharge. A source identification sampling study is being designed to better understand the relative mass contribution from residential, commercial, and institutional indoor pesticide use. Sampling will consist of twelve sampling sites within a sewershed catchment and paired weekday/weekend sampling events in spring, summer, and fall (6 events total). All samples will be taken as 24-hour flow weighted composites to allow for mass loading calculations. Resultant data will be used in conjunction with modeling efforts to better understand indoor pesticide products and uses that may require mitigation.

2016 Sewershed Sampling Sites

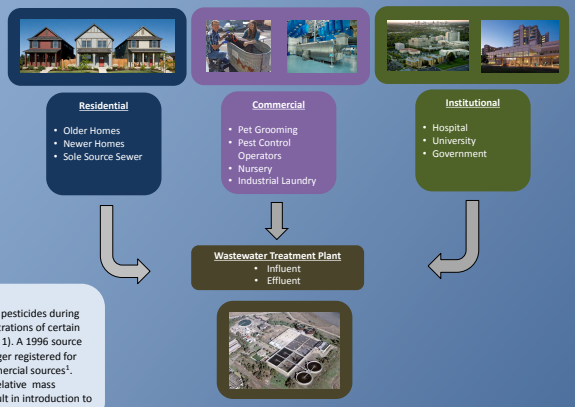

Figure 1. Proposed sampling locations within wastewater sewershed.

Introduction

There are limited data available detailing the fate and occurrence of pesticides during the wastewater treatment process. Available studies report concentrations of certain pesticides in effluent that exceed US EPA aquatic benchmarks (Table 1). A 1996 source identification study measuring organophosphates, which are no longer registered for indoor use, found mass loading of residential inputs exceeded commercial sources[1]. There is a need to gather updated information on the sources and relative mass contribution of pesticides currently registered for uses that may result in introduction to wastewater catchments.

Table 1. Summary of pesticide concentration in treated wastewater effluent reported in literature

Pesticide	PWG Survey[2] Average (ng/L)	DF	Max (ng/L)	Weston 20103[3] Max (ng/L)	DF	Lowest EPA Benchmark[4] (ng/L)
Bifenthrin	0.89	82	3.9	6.3	39	1.3
Cyfluthrin	0.60	60	4	1.7	6	7.4
λ-Cyhalothrin	0.30	48	1.6	5.5	17	2
Cypermethrin	2.11	81	13	17	6	69
Deltamethrin	0.31	16	1.2	2.7	11	4.1
Esfenvalerate	0.25	32	0.6	3.7	6	17
Fenpropathrin	0.22	3.2	0.8	0	0	64
Permethrin	20	65	170	17.2	33	1.4
Heidler 2009[5]						
Fipronil	30	-	70	-	-	11

Sampling Events

- Three sampling events: spring, summer, fall
- Paired weekday/weekend sampling events
- 24-hour flow-weighted composite samples to allow for mass loading calculations.

$$Concentration\left(\frac{mass}{volume}\right) * \text{flow}\left(\frac{volume}{time}\right) = mass\ loading\left(\frac{mass}{time}\right)$$

Objectives

1) Identify and characterize the total mass loading of pesticides to wastewater treatment facility at intake.
2) Quantify mass loading at a sub-catchment scale representing specific pesticide use patterns (residential, commercial, institutional).

Implications

- Provide information on mass loading of target pesticides to wastewater catchment.
- Identify non-target pesticides or adjuvants from unexpected uses that may require additional study.
- Construct a mass balance of specific use patterns at the sub-catchment and compare pesticide use patterns.
- Identify use patterns or active ingredients that may require mitigation.

Analytical Methods

Samples will be analyzed using high resolution mass spectrometry with gas and liquid chromatography to allow simultaneous quantification of the target compounds and identification non-target analytes.

Target Analyses

- 20 Pyrethroids
- Fipronil + Degradates
- Imidacloprid
- Propoxur
- Pyriproxyfen

Non-Target Analyses

- Identification of pesticides or adjuvants not identified as priority
- Enables identification of major unexpected uses

References

[1] Singhasemanon et al. (1998) Diazinon and Chlorpyrifos in the Central Contra Costa Sanitary District Sewer System, Summer 1996, California Department of Pesticide Regulation.
[2] Markle et al. (2014). Pyrethroid pesticides in municipal wastewater: A baseline survey of publicly owned treatment works facilities in California in 2013, Pyrethroid Working Group.
[3] Weston and Lydy (2010). Urban and Agricultural Sources of Pyrethroid Insecticides to the Sacramento-San Joaquin Delta of California. ES&T 44(5): 1833-1840.
[4] http://www.epa.gov/oppefed1/ecorisk_ders/aquatic_life_benchmark.htm
[5] Heidler and Halden (2009). Fate of organohalogens in US wastewater treatment plants and estimated chemical releases to soils nationwide from biosolids recycling. J of Env. Mon. 11(12): 2207-2215.

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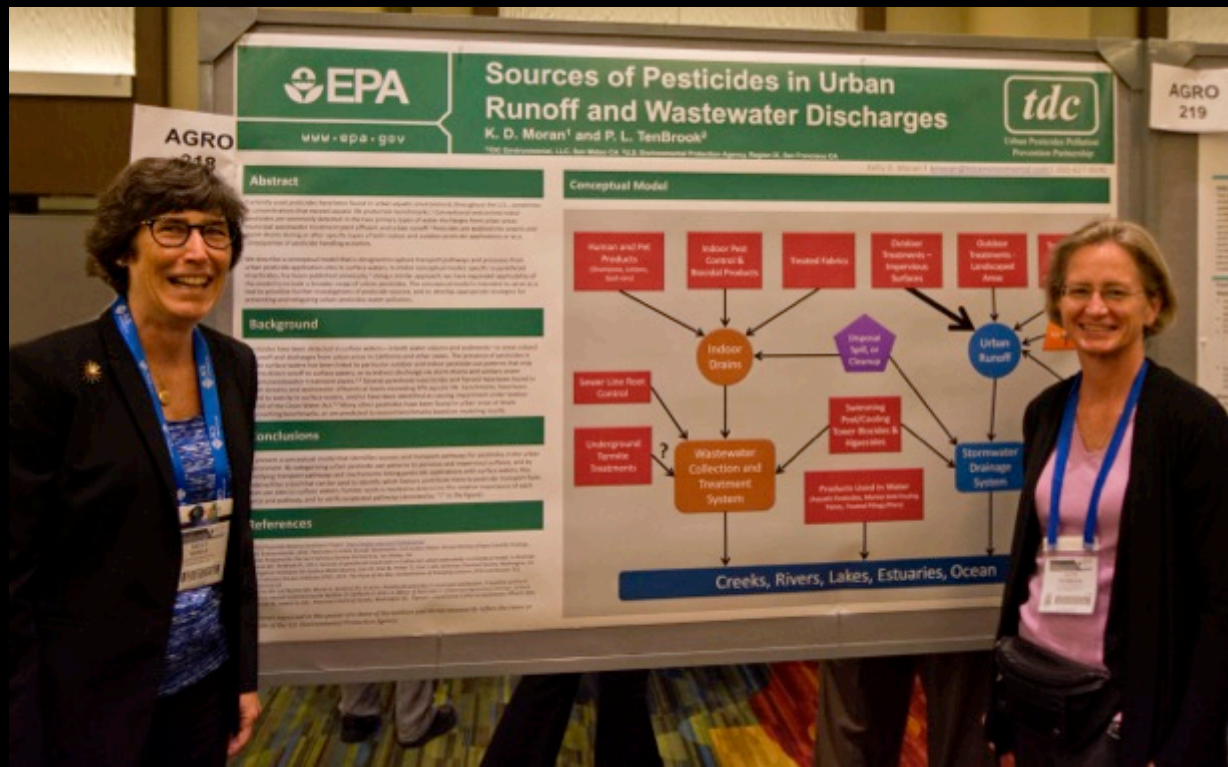
BACWA's Work Has Promise - EPA

- Using POTW discharge model (has scientific errors)
- POTW process interference testing requirements
- R9 Pesticides liaison is wastewater expert (Dr. Patti TenBrook)

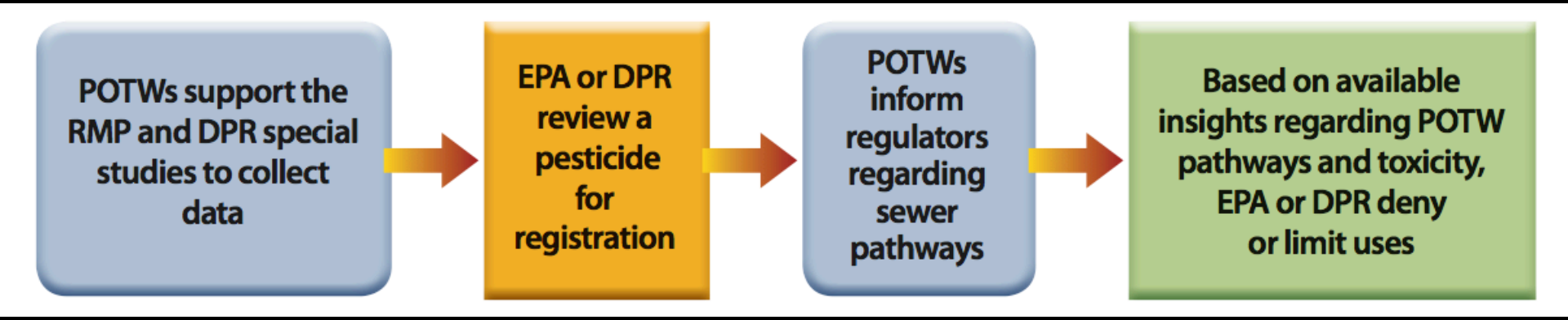


EPA a Challenge – But Drives POTW Solutions

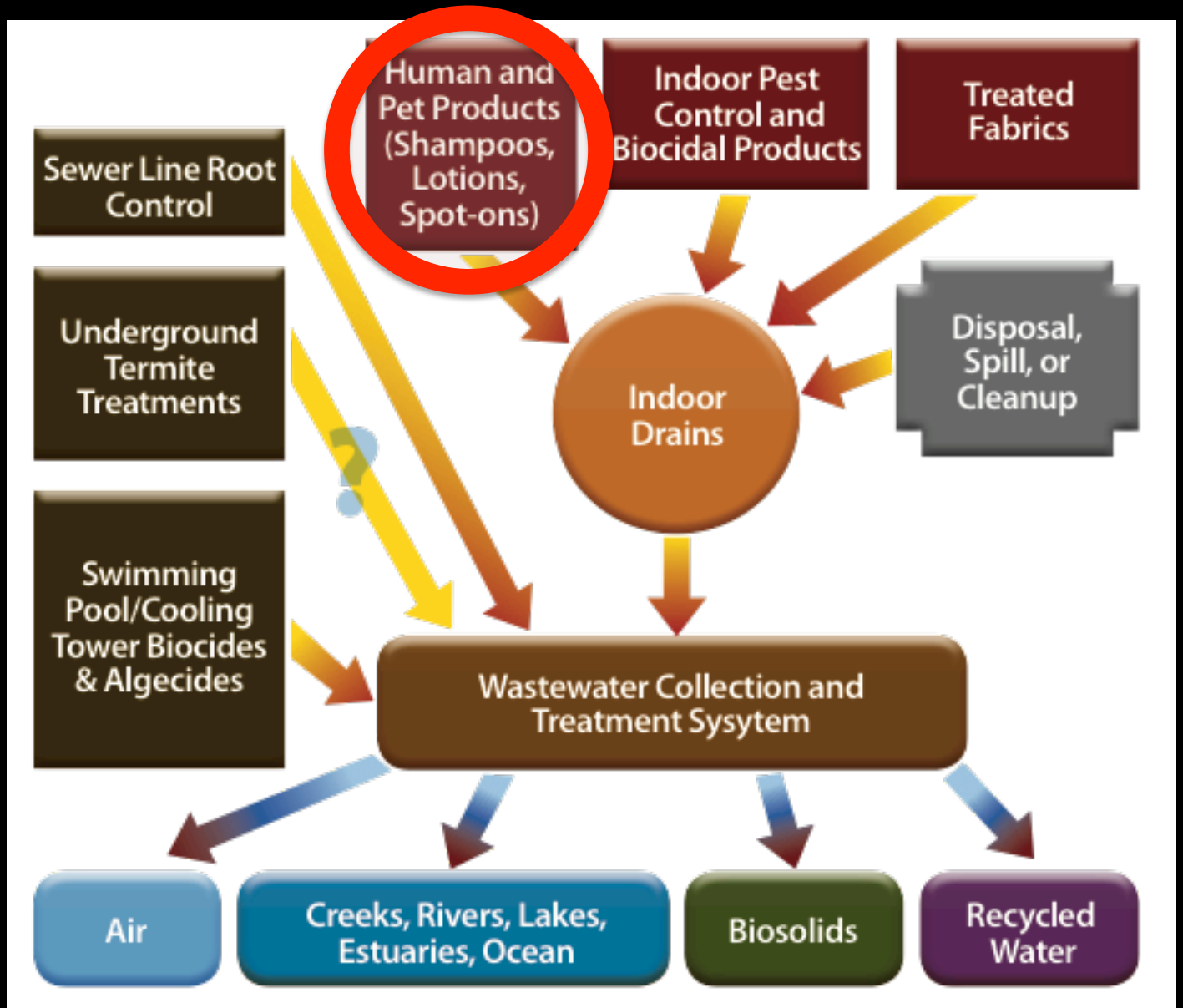
- Authority for consumer products better than DPR
- EPA reviews pesticides only once every 15 years
  - Top 4 priorities up in FY 2016/17
  - Technically complex reviews have multiple steps
  - EPA distracted by ESA litigation & Bee problems
- No data = no action!
  - Evidence is required for pesticide regulation
  - No POTW monitoring system

Pesticides Management Vision

Move management upstream from CWA → FIFRA



POTW Pesticides Sources



RMP Special Study – Fipronil & Imidacloprid

24-hour composites sludge/biosolids

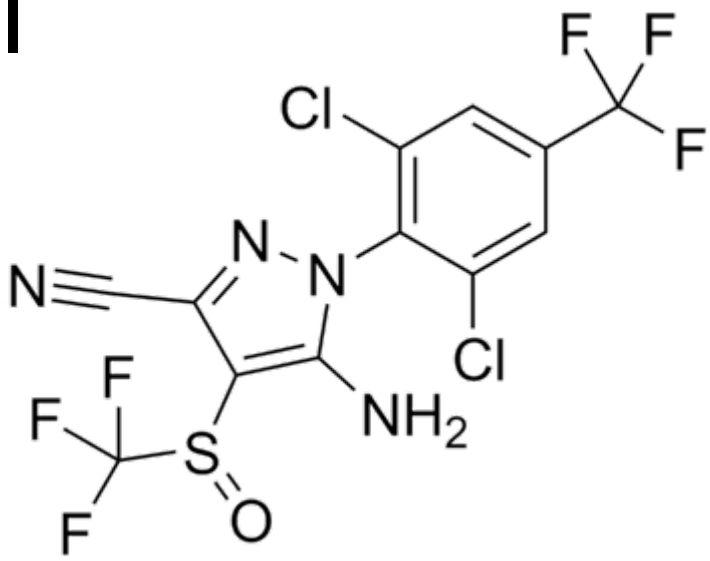
Joint POTW participation key factor for success

Contributors

- Regional Monitoring Program for Water Quality in San Francisco Bay
- Bay Area wastewater community
- Arizona State University
- TDC Environmental, LLC
- California Department of Pesticide Regulation

TIER 3
MODERATE CONCERN

Fipronil



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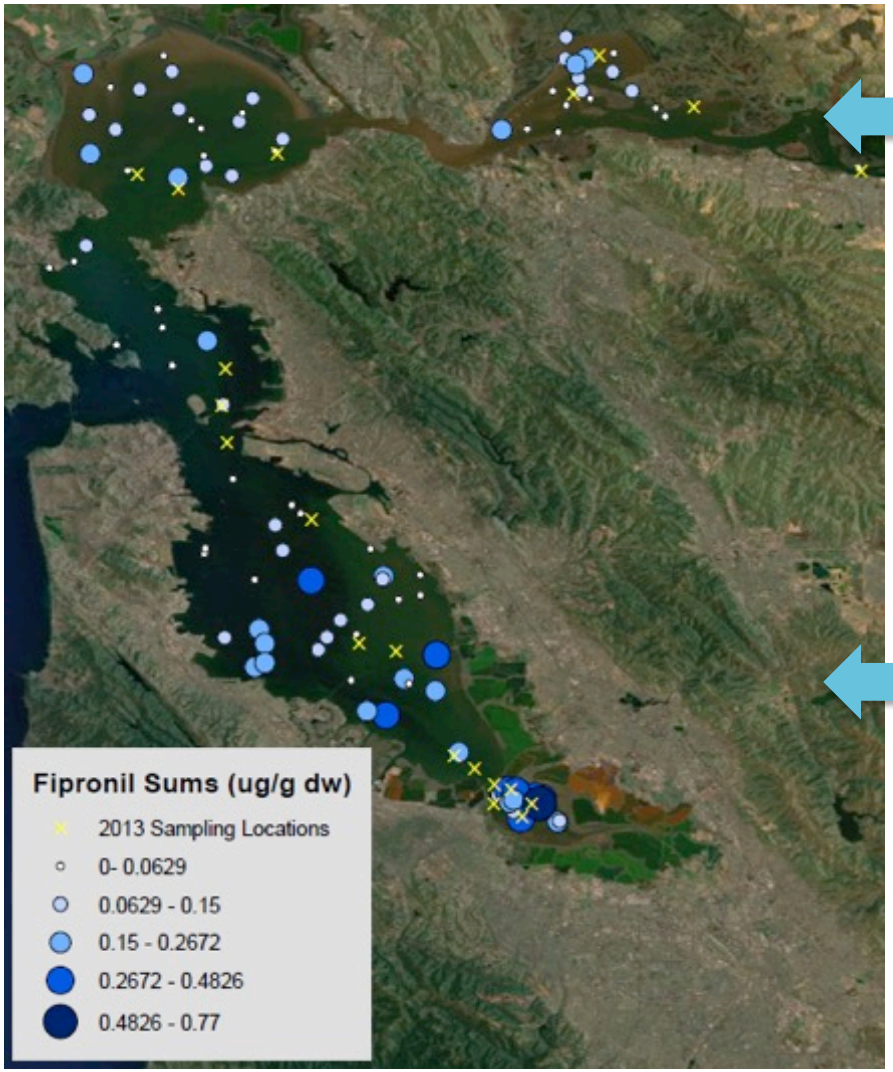
Fipronil



Pathways to Bay:

Stormwater

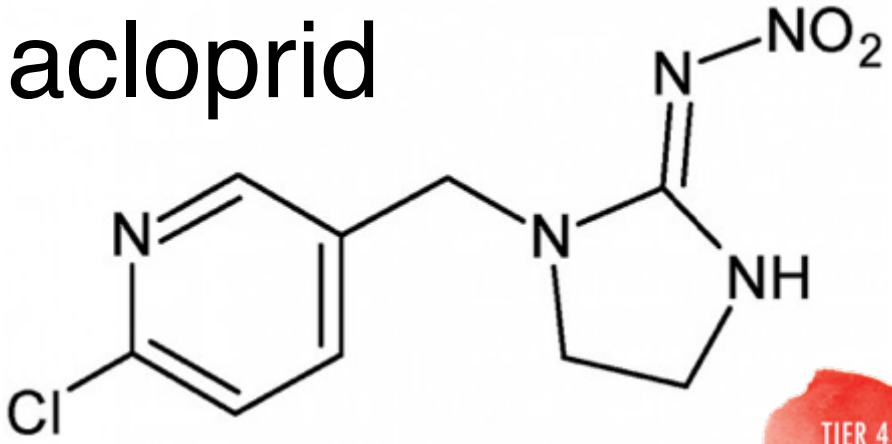
- Detected in **96%** of samples from 6 creeks
- **One-third** exceeded toxicity thresholds

Treated Wastewater

- Limited data suggest treatment has little effect
- DATA NEEDED

Imidacloprid

polystyrene insulation,
vinyl siding, adhesives, sealants,
textiles for outdoor use,
pressure-treated wood decking



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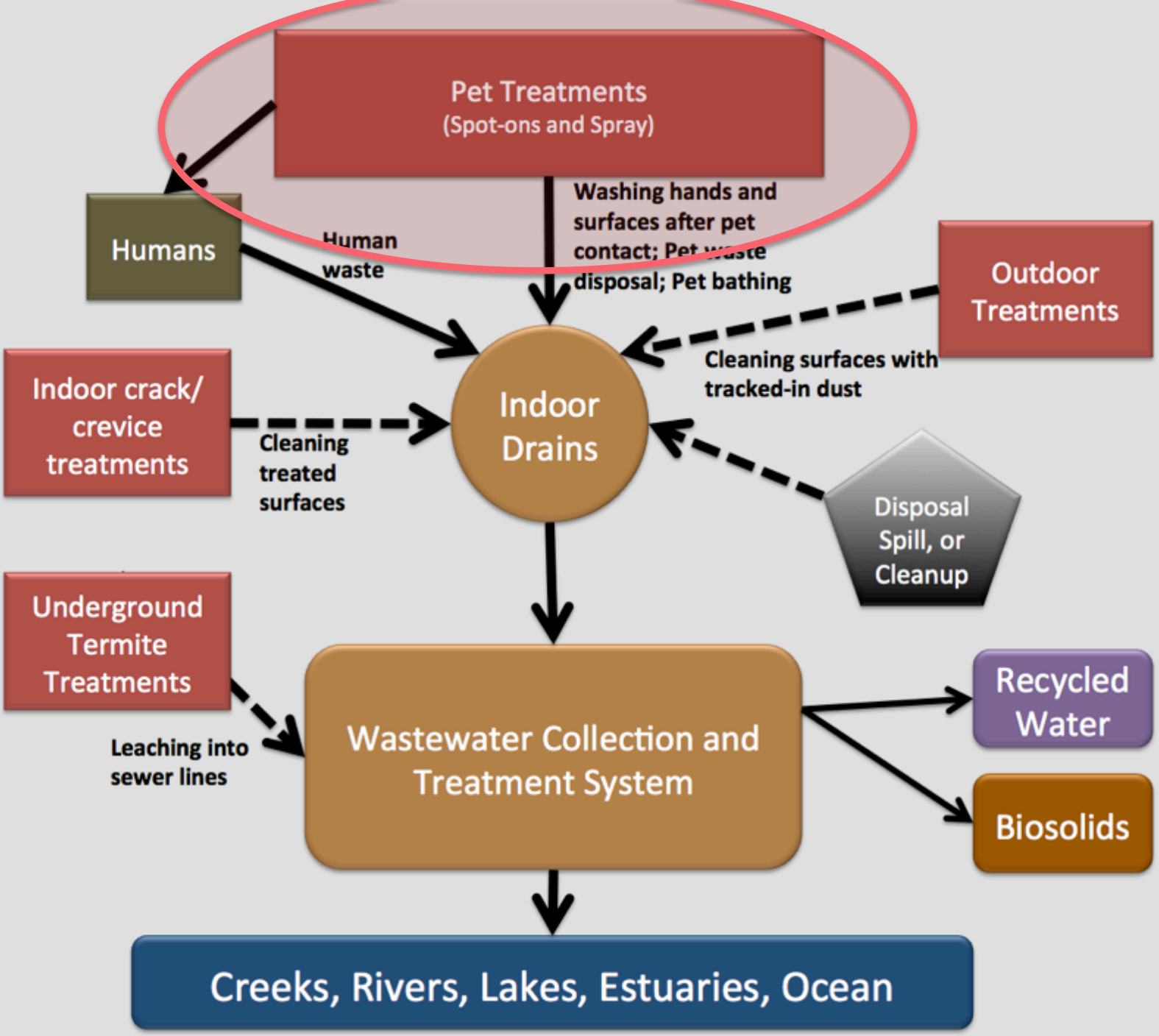
TIER 4
HIGH CONCERN

TIER 3
MODERATE CONCERN

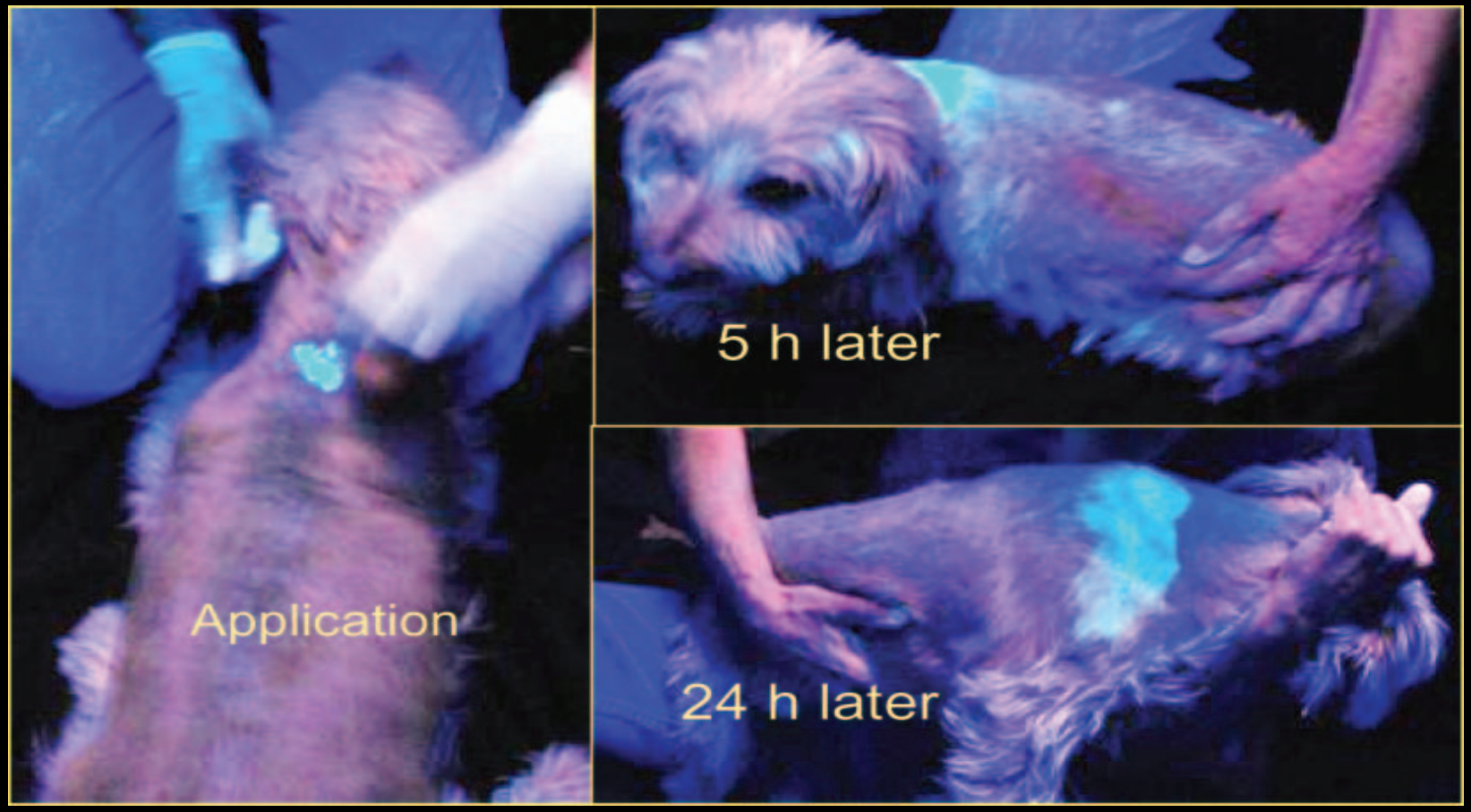
TIER 2
LOW CONCERN

TIER 1
POSSIBLE CONCERN

Fipronil & Imidacloprid RMP monitoring data – in review for publication


Pet Treatments
(Spot-ons and Spray)
Humans
Human waste
Washing hands and surfaces after pet contact; Pet waste disposal; Pet bathing
Outdoor Treatments
Cleaning surfaces with tracked-in dust
Indoor crack/ crevice treatments
Cleaning treated surfaces
Indoor Drains
Disposal Spill, or Cleanup
Underground Termite Treatments
Leaching into sewer lines
Wastewater Collection and Treatment System
Recycled Water
Biosolids
Creeks, Rivers, Lakes, Estuaries, Ocean

Chemical spreads out after treatment



Photos: Bigelow-Dyk 2012

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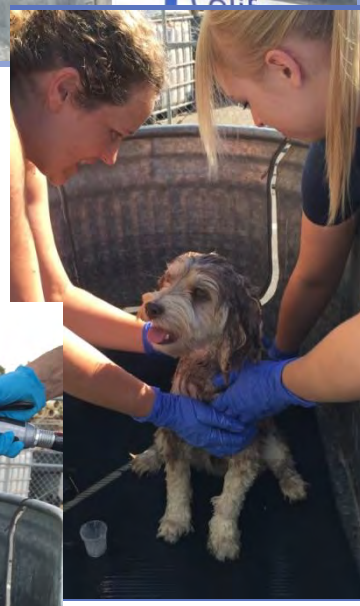
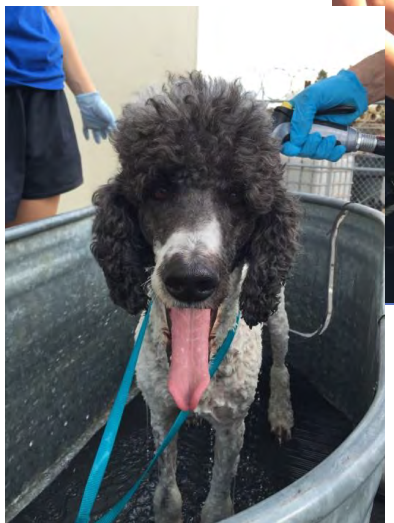
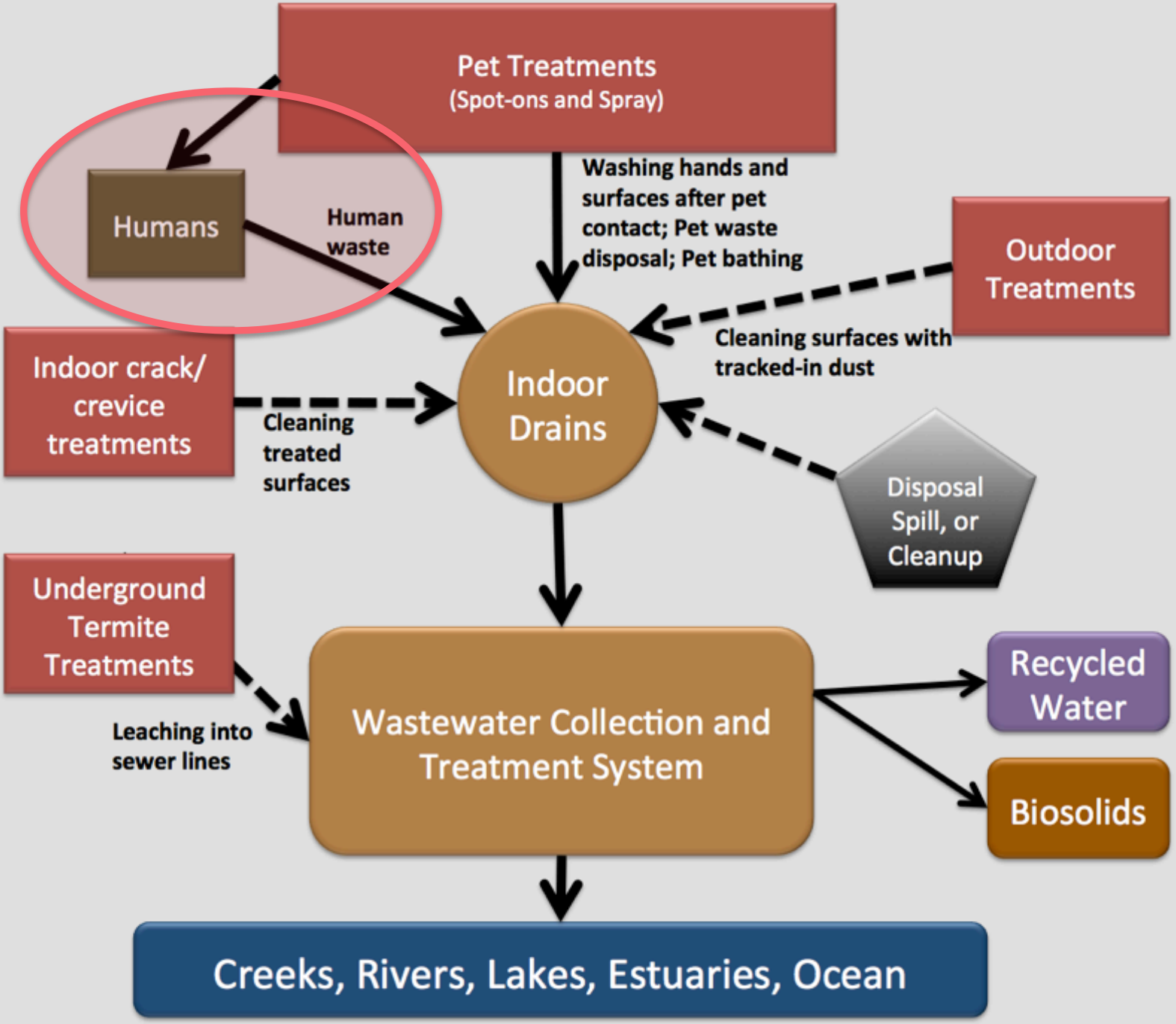
Fipronil Washes Off Pets

Wash-off continues for at least 28 days





Source: DPR preliminary data Photos: DPR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Leaching into sewer lines
Wastewater Collection and Treatment System
Recycled Water
Biosolids
Creeks, Rivers, Lakes, Estuaries, Ocean

These Data = Big News for EPA & DPR

- Neither agency has ever considered discharges from pet "spot-on" treatments!
- Timing is crucial!
- Best mitigation opportunity = EPA's fipronil & imidacloprid reviews *this year*
- Big changes in whole approach to POTW discharges are possible <u>if we get the word out</u> to EPA & manufacturers

BAPPG is Being Proactive on These Issues

- Multiple calls with both EPA and DPR
  - Active coordination with DPR to work on EPA
  - Study is example of EPA regulatory gaps crossing 3 divisions in pesticide regulatory program
  - EPA-invited presentation – ACS Philadelphia (Aug.)
- Reviewing flea/tick alternatives to pet "spot treatments"

Change ahead – fipronil health risks

Pesticides Market Constantly Evolving

Pet Flea Control Product mix 2005-2014 constantly changing

Pesticides Management Vision

Move management upstream from CWA → FIFRA

MS4 Progress Promising for POTWs

State Water Board Pesticides Plan
Stormwater Only

Primary Pesticides Solution = DPR + EPA

Anticipated permit requirements:

1. Outreach/education (OWOW etc.)
2. Limit municipal pesticide use (IPM)
3. Regulatory participation (UP3)
4. Conduct *useful* monitoring

Draft in 2016 → Adoption 2017

FY 2016-2017 Highlights

- EPA Risk Assessments: Pyrethroids, Fipronil, Imidacloprid, Copper
- EPA Science discussions – ACS Conference (Aug.)
  - K. Moran invited presenter
  - Can POTW predictive model be improved?
- DPR
  - Sewershed Study
  - Registration predictive model development & test cases based on BACWA request letters
  - Science discussions - POTW & salt water monitoring
- State Water Board Stormwater Pesticides Plan

Future is Promising

- It's a marathon – not a sprint
- Change will only occur with active POTW engagement


Thank you!