

Fipronil



RMP Emerging Contaminants Workgroup
April 17th, 2009



Why Fipronil?

- Relatively new insecticide
 - Increasing market share
 - Pyrethroids & other insecticides decreasing
 - Urban use
- Found in runoff & streams
- UP3 recommended including fipronil & degradates in water quality monitoring



Overview

- Phenylpyrazole insecticide
- Disrupts nerve function via GABA (γ -aminobutyric acid type A) receptors
- $\log K_{ow}$ 3.5
- 1987 - developed
- 1993 - introduced for use
- 1996 - registered for US use



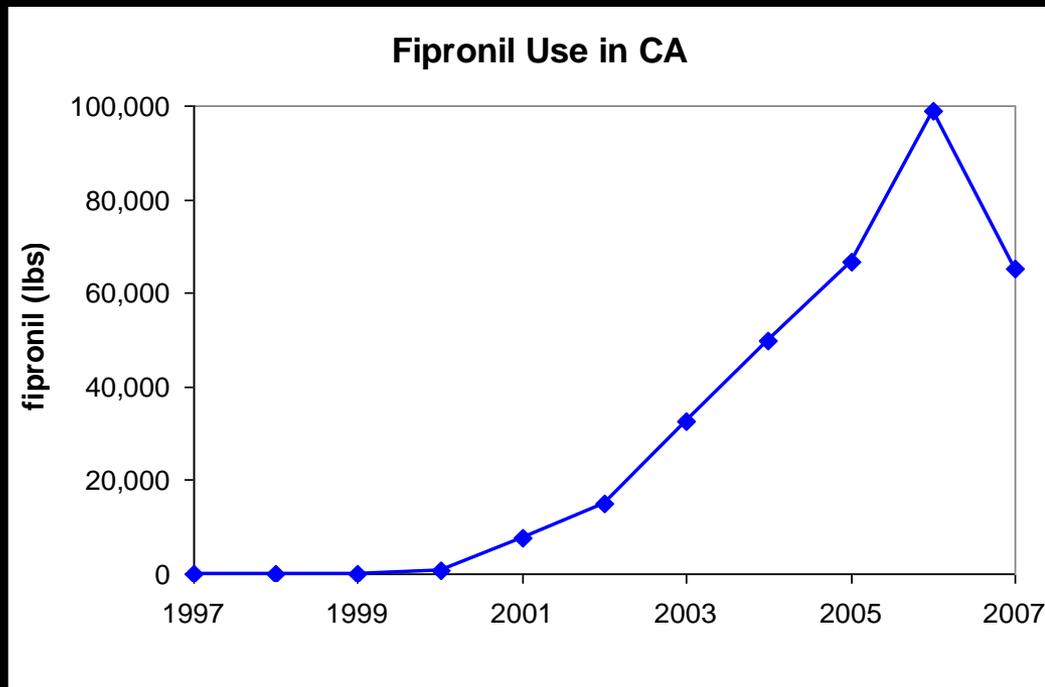
Uses

- Turf products
- Seed treatments
- Topical pet care products
- Gel baits (e.g., ants)
- Liquid termiticides
- Agriculture (e.g., rice & cotton)



Use - CA

- ~65,000 lbs in CA in 2007 - structural (DPR 2007)
- Not registered for ag. use in CA
 - Emergency exceptions
- 37 products registered in CA (DPR 2009)



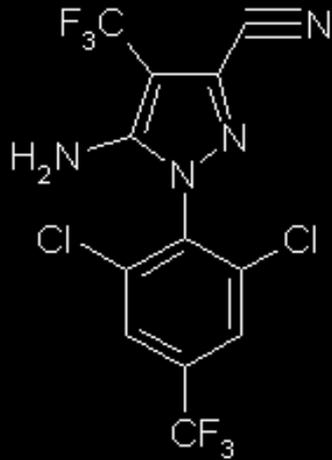
(DPR 2005, 2006, 2007)

Existing Regulations

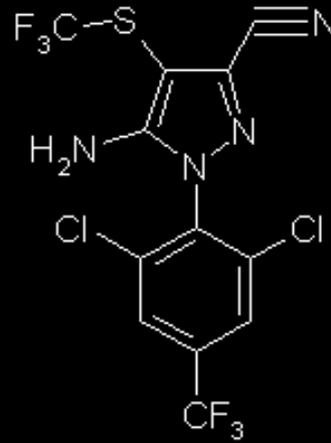
- No EPA WQC or SQC
- LA surface water TMDL
 - 4.6 $\mu\text{g L}^{-1}$ acute
 - 2.3 $\mu\text{g L}^{-1}$ chronic



Degradates



fipronil
desulfinyl



fipronil
sulfide



fipronil
sulfone



Toxicity

- Water

- 220 ng/L copepod (*Amphiascus tenuiremis*)
(Chandler et al. 2004)
 - 2d developmental delay
 - 71% reduction in egg extrusion
- 140 ng/L Mysid shrimp LC₅₀
(US EPA 1996)



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- Sediment

- Larval midge (*Chironomus tentans*) (Maul 2008)

	fipronil	fipronil sulfide	fipronil sulfone
LC50	130	160	120
EC50 _{immob}	100	60	40

ng/g organic carbon



Concentrations in CA

- Urban streams feeding Sac. & San J. (NAWQA 2009)
 - Fipronil at DL est. 5 - 100 ng/L
 - Fipronil sulfide 5 - 18 ng/L
 - Fipronil sulfone 6 - 13 ng/L

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- Golden Gate Nat'l Rec Area Urban Streams (Hladik & Orlando 2008)
 - Fipronil ~0.8 ng/L
 - Fipronil sulfone ~1.4 ng/L

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- Urban Runoff - Sac. & Orange Counties (Oki et al. 2008)
 - Fipronil & degradates detected in Sac.
 - >140 ng/L (Mysid shrimp LC₅₀) in OC

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- SQO Lower Delta Sediment (Lowe 2009)
 - Fipronil & degradates <20 ng/g dw

Water tox

- Mysid 140 ng/L
- Copepod 220 ng/L

Sediment tox

- Midge 100 ng/g org. C

Analysis Options

- Fipronil, fipronil desulfinyl, fipronil sulfide, fipronil sulfone

	Sediment			Water		
	MDL	RL	Cost	MDL	RL	Cost
AXYS	0.4 pg/g *			5 - 10 pg/L *		
EBMUD	~10 ppb dw		\$0 *	-	-	-
CDFG	25 ppb dw	50 ppb dw	\$433	~0.01 µg/L	~0.02 µg/L	\$306



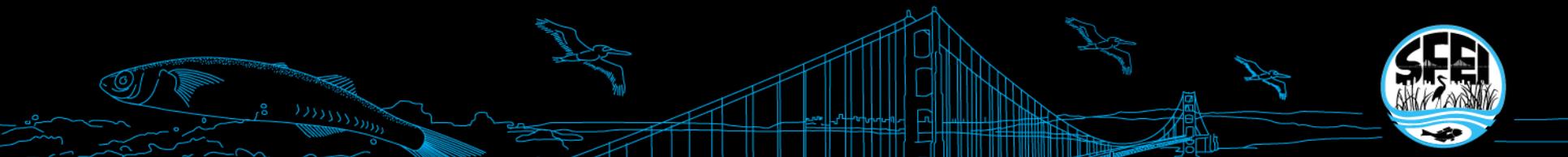
Proposed Approach

- Fipronil, fipronil sulfide, fipronil sulfone, fipronil desulfinyl
- GC/MS
- Half of S&T 2010 sites
 - 9 water - CDFG
 - 20 sediment - EBMUD



Budget

Task	Estimated Cost
Water analysis (\$306/sample × 9 samples)	\$2,754
Sediment analysis (\$0/sample × 20 samples)	\$0
Project Management	\$600
Data Management	\$5,400
Data analysis and reporting	\$9,000
Miscellaneous expenses	\$1,000
Total	\$18,754



GG Nat'l Rec Area Sampling Sites



(Hladik & Orlando 2008)

Lower Delta Sampling Sites

