DPR's Ground Water Protection Program for Pesticides

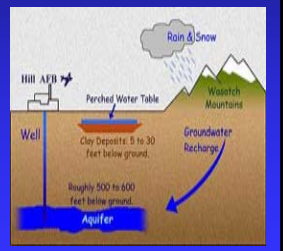
Murray Clayton
Staff Environmental Scientist

Ground Water Protection Program
Environmental Monitoring Branch
Department of Pesticide Regulation

PREC
January 18, 2013

Presentation Outline

- Law
- Identifying vulnerable areas
- Regulations to protect GW
- Evaluating new pesticides
- Well network



Pesticide Contamination Prevention Act (PCPA)

- Enacted in 1985 to prevent further pollution of ground water due to agricultural use of pesticides

PCPA Requirements:

✓ Collect environmental fate data for agricultural use pesticides

PCPA Requirements:

- ✓ Use those data to identify pesticides with the potential to pollute ground water (GWPL)
  - SNVs
  - Label language conducive to pesticide movement to ground water

Specific Numerical Values

Mobility related properties:

Water solubility =	>3 ppm
Soil adsorption (Koc) =	<1900 cm^3/g

Persistence related properties:

Hydrolysis half-life =	>14 days
Soil anaerobic half-life =	>9 days
Soil aerobic half-life =	>610 days

Ground Water Protection List, California Code of Regulations section 6800

PCPA Requirements:

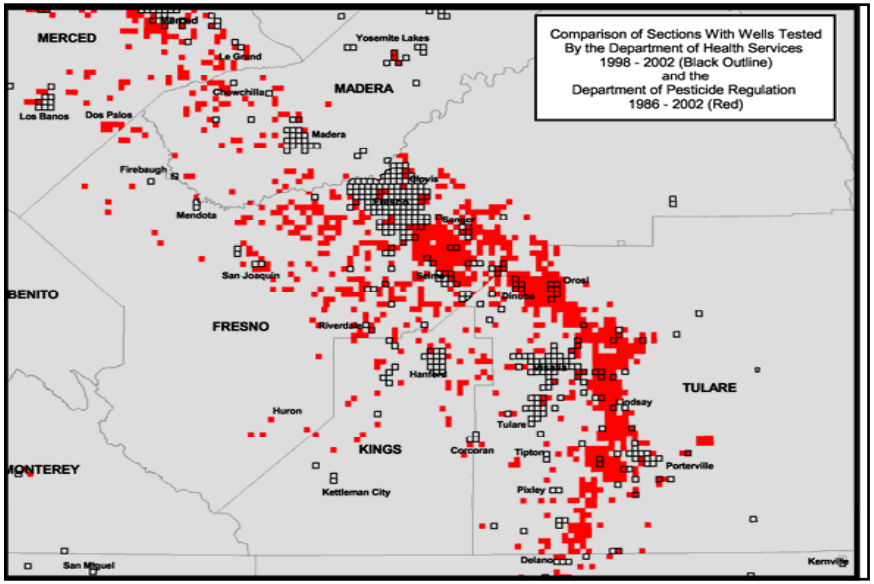
- ✓ Collect samples and analyze for those pesticides on the GWPL to determine if they are migrating to ground water

PCPA Requirements:

- ✓ All state and local agencies to submit to DPR results of all wells sampled for pesticides
  - Allows DPR to leverage ground water monitoring resources from other agencies

California Department of Public Health CDPH

THE COUNTY OF FRESNO 1856



PCPA Requirements:

- ✓ Maintain a database of pesticide monitoring and provide an annual summary of well monitoring results

http://www.cdpr.ca.gov/docs/emon/ehap.htm

Summary of Well Inventory Data Base

	Total	DPR
Records	2,092,495[a]	70,310
Wells Sampled	23,204	5,610
Wells with Pesticide Residues	4,875[b]	1,464

[a] Data submitted by DPH for municipal wells is major portion of records.

[b] The larger number of total positive wells is due to DBCP detections made in late 1970's and early 1980's.

PCPA Requirements:

- ✓ Determine if a detected pesticide is due to legal agricultural use

PCPA Requirements:

- ✓ Formally review, with recommendations from SWRCB and OEHHA, pesticides found in GW due to legal agricultural use to determine if continued use can be allowed

PCPA Requirements:

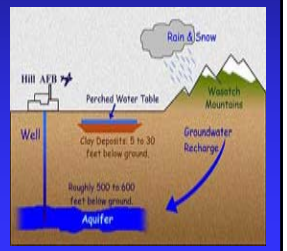
- ✓ Adopt regulations to modify use if necessary to protect ground water

dpr

13

Presentation Outline

- Law
- Identifying vulnerable areas
- Regulations to protect GW
- Evaluating new pesticides
- Well network



dpr

14

Identify Ground Water Protection Areas (GWPAs)

- Based on pesticide detections

  <u>or</u>
- CALVUL model developed by DPR
  - ➢ Specified soil types[1,2] and depth to ground water as vulnerable features

[1]Troiano, J., et al. 1994. **Use of cluster and principal component analyses to profile areas in California where ground water has been contaminated by pesticides.** Environ. Monitor. Assess. 32: 269-288.

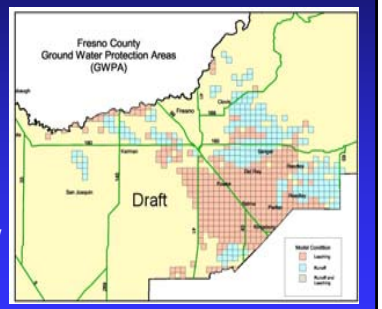
[2] Troiano, J., C. Nordmark, T. Barry, and B. Johnson. 1997. **Profiling areas of Ground Water Contamination by Pesticides in California: Phase II - Evaluation and Modification of a Statistical Model**. Environ. Monitor. Assess. 45:301-318.

dpr

15

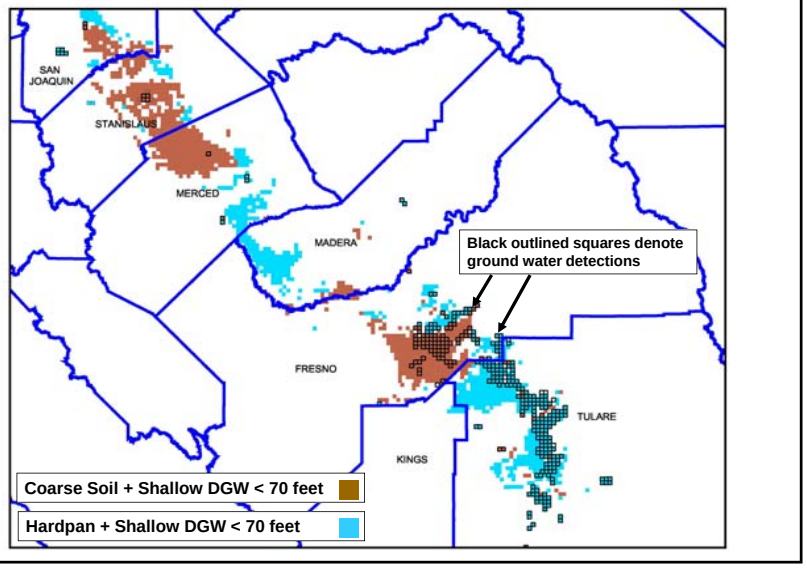
Types of GWPAs

- Leaching – coarse soils with high water infiltration rates & shallow GW of 70 feet or less
- Runoff – hardpan and some clay soils with low water infiltration rates & shallow GW of 70 feet or less



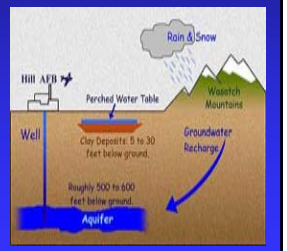
dpr

16



Presentation Outline

- Law
- Identifying vulnerable areas
- Regulations to protect GW
- Evaluating new pesticides
- Well network



dpr

Permits from the County Agricultural Commissioner

- Require operator to get a permit to use atrazine, bentazon, bromacil, diuron, norflurazon, prometon or simazine in GWPAs
- Permit must be conditioned with one of the enforceable management practice options

dpr

Leaching GWPAs – Management Practice Options

- Control irrigation water
  - No irrigation for 6 months, or
  - Irrigate away from the treated site
  - Manage irrigation efficiently[1]
- Scientific-based alternative approved by Director of DPR
- If none are feasible, 3-year use with approved protocol for testing alternative new method

dpr

[1]Troiano, J., et al. 1993. **Influence of Amount and Method of Irrigation Water Application on Leaching of Atrazine**. J. Environ. Qual. 22: 290-298.

Runoff GWPAs - Management Practice Options

In general:

- Incorporate pesticide into the soil[1]
- Pesticide application options
- Manage contaminated runoff water
  - Recirculating back onto field
  - Store in low-infiltration rate basin
- Scientific-based alternative approved by Director of DPR
- If none are feasible, 3-year use with approved protocol for testing alternative new method

[1]Troiano, J. and C. Garretson. 1998. **Movement of Simazine in Runoff Water from Citrus Orchard Row Middles as Affected by Mechanical Incorporation**. J. Environ. Qual. 27: 488-494.

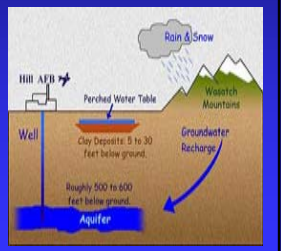
Statewide requirements – all pesticides

- Protect wellheads[1]
- Use backflow prevention devices[2]

[1] 3CCR section 6609
[2] 3CCR section 6610

Presentation Outline

- Law
- Identifying vulnerable areas
- Regulations to protect GW
- Evaluating new pesticides
- Well network



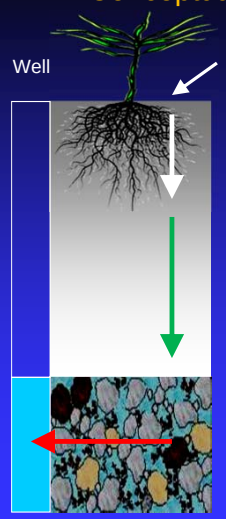
Evaluation of New Products

- SNV classification of active ingredient
- Review of field study data e.g. field dissipation studies, ground water monitoring studies, lysimeter studies
  - Residue persistence and mobility
- Computer modeling to estimate potential movement of pesticides to GW in vulnerable California soils[1,2]

[1]Spurlock, F. 2000. Effect of irrigation scheduling on movement of pesticides to ground water in coarse soils: Monte Carlo analysis of simulation modeling. Environmental Monitoring Branch, DPR.

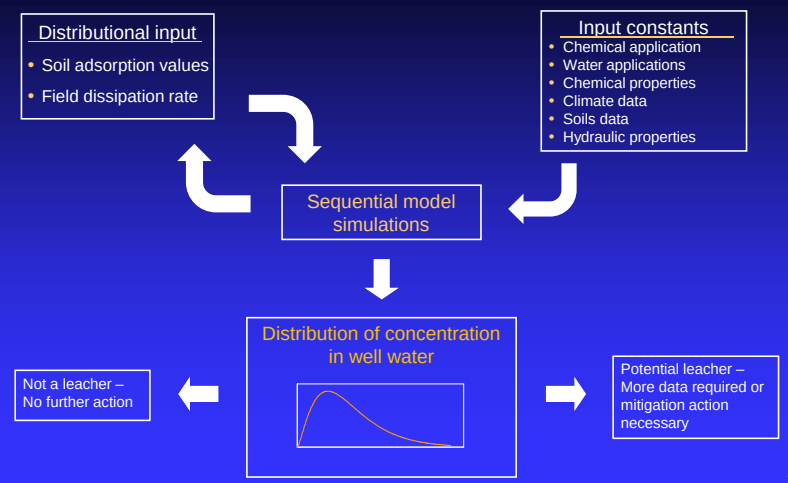
[2]Troiano, J. and M. Clayton. 2009. Modification of the Probabilistic Modeling Approach to Predict Well Water Concentrations Used for Assessing the Risk of Ground Water Contamination by Pesticides. Environmental Monitoring Branch, DPR. <http://www.cdpr.ca.gov/docs/emon/pubs/ehapreps/analysis_memos/probabilistic_model.pdf>

Conceptual Modeling Process for New Pesticides



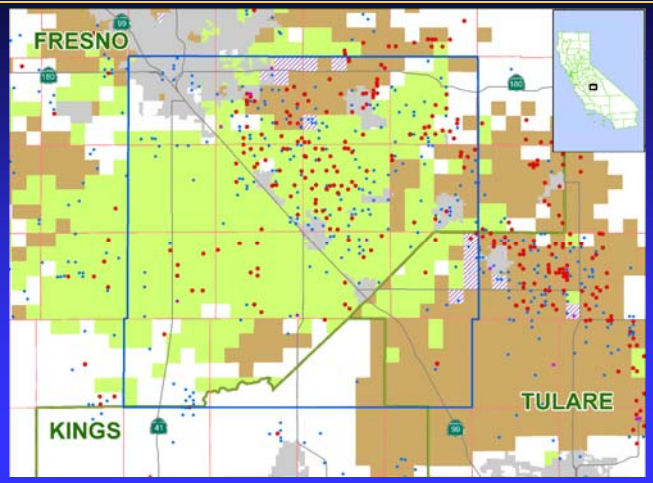
- **Root Zone**
  - Sophisticated, mechanistic-type model simulates pesticide soil adsorption and degradation processes and plant growth functions
- **Subsoil**
  - Empirical-based model simulates pesticide movement
- **Ground water**
  - Empirical model simulates dilution of pesticide into GW and movement to a well

Probabilistic Approach for Modeling Pesticides to GW



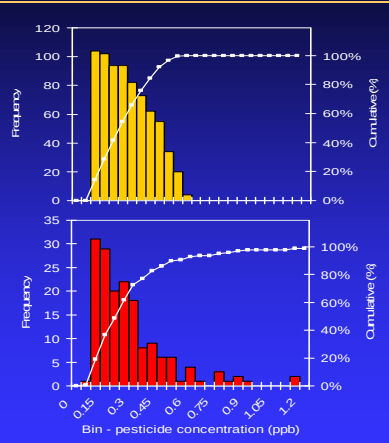
Verification of Probabilistic Model

(Atrazine, Simazine, Diuron, Norflurazon, Bromacil, Hexazinone)



Verification of Probabilistic Model

(Atrazine, Simazine, Diuron, Norflurazon, Bromacil, Hexazinone)



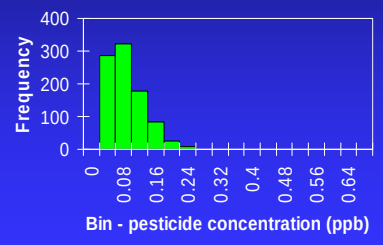
Model predictions

- 25th percentile = 0.14 ppb
- 50th percentile = 0.23 ppb
- 75th percentile = 0.35 ppb
- 95th percentile = 0.48 ppb

Observed data

- 25th percentile = 0.12 ppb
- 50th percentile = 0.21 ppb
- 75th percentile = 0.32 ppb
- 95th percentile = 0.74 ppb

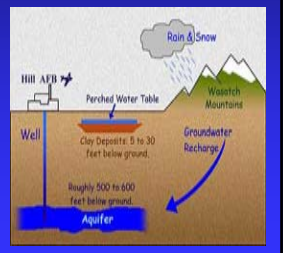
Test of New Pesticide



	Percentiles	ppb
Maximum	100%	0.23
	95	0.15
	75	0.09
Median	50	0.06
	25	0.03
	5	0.01
Minimum	0	0.01

Presentation Outline

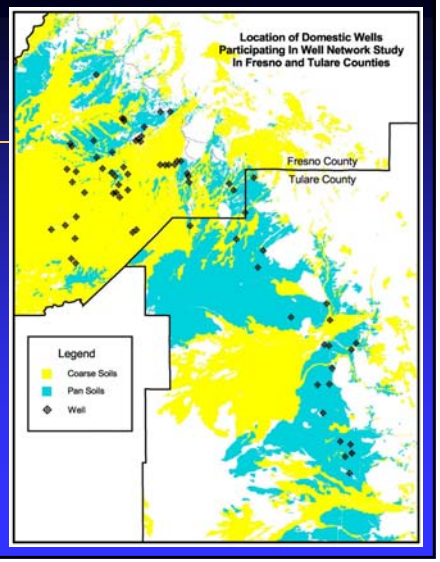
- Law
- Identifying vulnerable areas
- Regulations to protect GW
- Evaluating new pesticides
- Well network



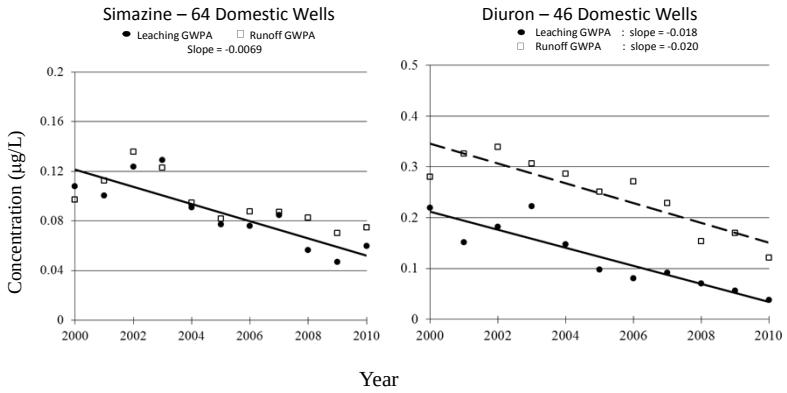
Well Network

- Monitoring ~70 domestic wells
- Measuring effectiveness of regulations

Troiano ,et al. Association Between Regulation and Pesticide Concentration in Domestic Water Wells in Fresno and Tulare Counties, California. Submitted to Journal of Environmental Quality



Domestic Monitoring Well Network Overall Analysis



Questions