


Pesticide Applicators Professional Association  
Chico, CA March 10, 2015

**PAPA Seminar**  
Chico  
March 10, 2015

**Golf Course Maintenance and Stream Water Quality: Double Bogey or Eagle?**

 **Blankinship Associates**  
Agricultural & Environmental  
Scientists & Engineers

Contra Costa Clean Water Program Golf Course Study

**Today's Talk**

- Why We Did It
- How We Did It
- What We Found
- What YOU Should Do
- "The Risk Myth"



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**Rationale**

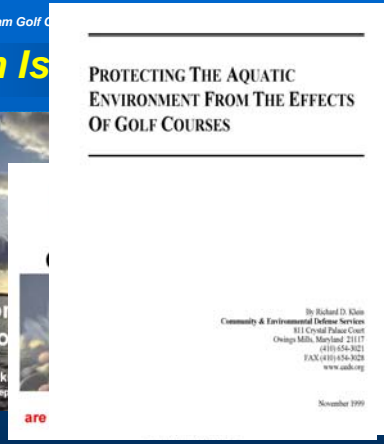
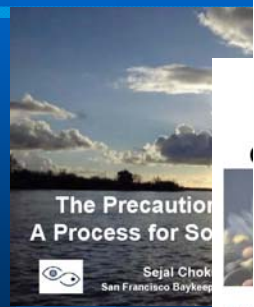
- The Sponsors
  - City of Pittsburg
  - Contra Costa Co Cleanwater Program
- NPDES Permit
- Water Quality Protection
- Address Golf Course Perceptions



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**Perception Is**



By Richard D. Klein  
Community & Environmental Defense Services  
111 Condit Palace Court  
Owings Mills, Maryland 21117  
(410) 456-9121  
FAX (410) 456-9123  
www.amb.org  
November 1999

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## Perception Is Reality

Beyond Pesticides Daily News Blog

**Aquatic Organisms Harmed by Golf Course Pesticides**

Beyond Pesticides, May 5, 2008. A new study indicates that some pesticides applied to golf courses in the Protonburg Canal of central Ontario may have an impact on aquatic organisms in adjacent watersheds. The study is published in the April issue of *Environmental Toxicology and Chemistry*.

Golf courses affect the environment by altering the habitat through the release of nutrients and pesticides. The Protonburg Canal region of central Ontario, Canada, is a major recreational area, is generally susceptible to the impacts of golf courses as a result of the geology and hydrology of this region. The Canal area is characterized by rivers, lakes, wetlands, and streams. Golf courses in this area typically grow turf for all a hard base which allows chemicals used on the courses to leach into surrounding bodies of water.

Beyond Pesticides, October 20, 2008. Ontario is moving to reduce exposure to herbicides by banning the use and cosmetic use of pesticides. According to the *Canadian Food Inspection Agency*, Ontario's pesticide sales among the highest in North America. It could also reduce a variety of environmental issues by reducing the amount of pesticides used for public health reasons and allowing evidence of the potential health risk of pesticides, particularly for children. The law would likely also affect other spraying of weeds which pesticides used for farming in forestry. Golf courses would still be able to use pesticides, but they would not be allowed for maintenance and other nearby environments by herbicides in a golf course.

The government is becoming more and more aware of the potential risks in our environment, not only to our health, but to our children's health. That's why we're taking action on behalf of the next generation of Ontarians, and reducing their exposure to chemicals. *Leafy Greens Ontario* (MGOCA).

Many municipalities have already shown leadership in banning or restricting cosmetic use pesticides. With its new ban on pesticides in all Ontario watersheds, the "Leafy Greens Ontario" (MGOCA) is taking the next step.

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## Perception Is Reality

**GOLF DIGEST**  
May 2008

PLAY GREAT IN '08  
ANNIKA HIT MORE FAIRWAYS  
LITTLE UP & DOWN LIKE A PRO  
PLUS THE MOST IMPORTANT ARTICLE WE'VE EVER PUBLISHED

**"The most important article we've ever published"**

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## Perception Is Reality

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## Perception Is Reality

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## Perception Is Reality



- **Golf Digest:** Would you say that golf-course pesticide use in the United States today is not safe?
- **Jay Feldman\*:** I would say that, yes.


\* Co-founder: Beyond Pesticides

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## Objectives

- **Organic v. traditional fertilizer:**  
Which is better for protecting surface water quality adjacent to golf courses ?
- **Are pesticides leaving golf courses ?**



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## Overview

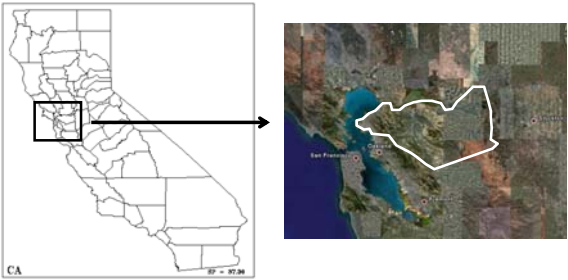


### Golf in Contra Costa Co.

- 30 Courses
- 31 Watersheds
- Wide Geographic, Weather and Area-Specific Variability

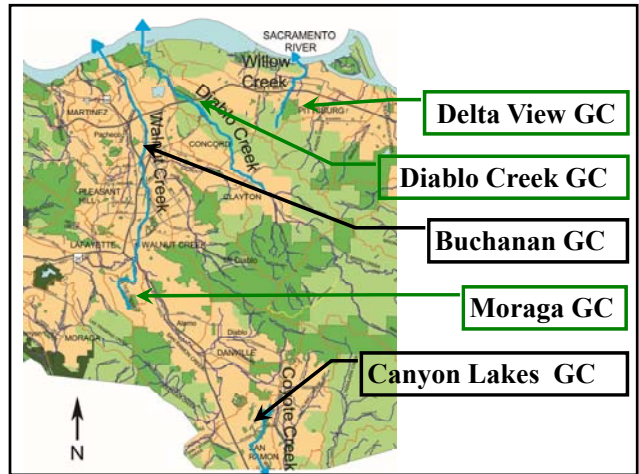
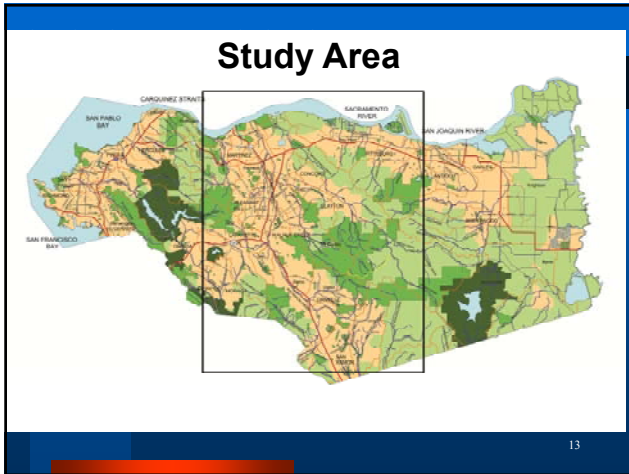
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## Study Area



CA 02 = 07.00

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## Overview (con't)

**“Organic”**

VS.

**“Traditional”**

**Fertilizer**

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**Milorganite® 6-2-0 Classic**

PROFESSIONAL TURFGRASS - ORGANIC NITROGEN FERTILIZER

- SOLUBLE ORGANIC NITROGEN
- HIGH IN WATER INSOLUBLE NITROGEN
- FULL ORGANICALLY COMPLETED WITH ADD DEEP GREEN COLORING
- ENVIRONMENTAL SAFETY

## Overview (con't)

- **Organic Fertilizer**
  - Not synthesized
  - Examples:
    - Manure (steer, poultry, etc.)
    - Meal (bone, feather, meat, blood, fish, etc.)
    - Biosolids (i.e., wastewater treatment byproducts)

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## Overview (con't)

- **Traditional Fertilizer**
  - “Synthetic” or “Man-made”
  - Mineral origin or product of a chemical manufacturing process
  - Examples:
    - Salts: Ammonium phosphate, potassium nitrate
    - Derivatives of nitrogen: Sulfur or polymer-coated, methylene urea



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## Methods

- **Traditional Courses**
  - Buchanan Fields
  - Canyon Lakes (2 sites)
- **Organic Courses**
  - Delta View
  - Diablo Creek
  - Moraga




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## Methods (con't)

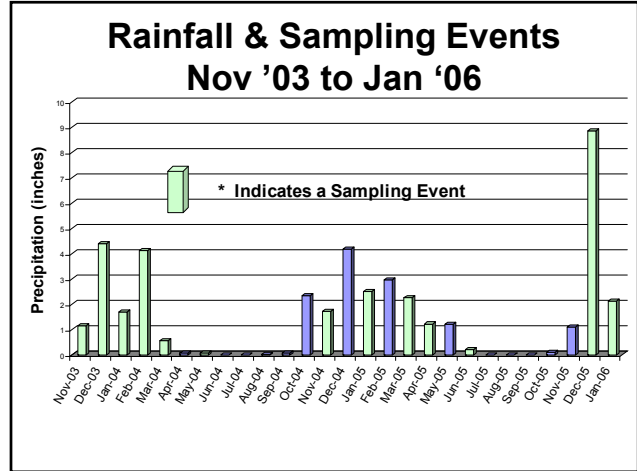
- **Grab Samples**
  - Up and Down Stream of the Course
  - Sampled Primarily During Wet Weather Flow
- **Analysis**
  - Nutrients (NPK) & General Chemistry
  - Aquatic Toxicity (Algae & Water Flea)



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*Contra Costa Clean Water Program Golf Course Study*

## Results



- 3 storm seasons
- 13 rain storms
- 46 sample events
- > 1,000 water quality measurements made

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*Contra Costa Clean Water Program Golf Course Study*

## Results: Water Flea Toxicity

- No Ceriodaphnia (Water Flea) toxicity
- Significance: No insecticides leaving courses studied

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## Results: Water Quality

- Little or No Change in Water Quality
  - Upstream v. Downstream
  - Organic v. Inorganic
- **Significance: No obvious nutrient contributions**

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## Results: Water Quality

Figure C-2. Average Ammonia vs. Time

Season	TraditionalUS	TraditionalDS	OrganicUS	OrganicDS
Spring	1.4	1.0	0.3	0.3
Summer	1.0	1.0	0.1	0.1
Fall	0.4	0.4	0.2	0.2
Winter	0.3	0.3	0.3	0.3

Bottom-line #1: More NH<sub>3</sub> detected with traditional courses  
Bottom-line #2: NH<sub>3</sub> leaves organic courses in summer

## Results: Agronomy

Figure D-1: Comparison Of Nitrogen Use By Course Type and Season

Season	Organic	Traditional
Spring	40	20
Summer	65	70
Fall	50	70
Winter	45	25

Bottomline: Both techniques result in similar total N applied

## Results: Algae

Percent Change in Algae (Upstream v. Downstream)

Course	Change (%)	Category
Buchanan Fields	32%	Growing
Canyon Lakes-North	-4%	Dying
Canyon Lakes-South	4%	Growing
Traditional Course Ave.	8%	Growing
Delta View	-3%	Dying
Diablo Creek	-14%	Dying
Mirage	9%	Growing
Organic Course Ave.	-2%	Dying
All Course Ave.	3%	Growing

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## Results: Algae




- Trends
  - Organic Courses: 2% downstream reduction
  - Traditional Courses: 8% downstream enhancement
- Significance
  - Algae-limiting agents leaving organic courses
  - Nutrients leaving traditional courses
- Magnitude
  - Small
  - Highly Variable

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## Conclusions



- Does the choice of fertilizer (organic v. traditional) influence surface water quality adjacent to golf courses ? **Yes**
- Are pesticides leaving golf courses?  
**No (insecticides)**  
**Unknown (herbicides/fungicides)**

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## Conclusions (con't)

- What does influence surface water quality adjacent to golf courses ?
  - Buffers
  - Be “ Fertilizer Smart”
  - Turf BMPs



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## Use of Buffers



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### Be "Fertilizer Smart"

- Apply based on soil & plant tissue testing & according to label direction
- Make multiple applications in small amounts
- Select & use slow release fertilizer carefully
- Do not apply before rainfall

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### Turf BMPs

- Irrigate based on Eto
- Establish and maintain healthy turf
- Maintain high heights of cut
- Recycle grass clippings
- Use IPM
- Periodically monitor surface and groundwater quality

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### Understanding "The Risk Myth"

$$\text{Risk} = \text{Toxicity} \times \text{Exposure}$$

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### The Risk Myth: Toxicity Terms

- **LC<sub>50</sub>**
  - Lethal Concentration that kills 50% of a test population
  - Typically expressed in mg/L
- **LD<sub>50</sub>**
  - Lethal Dose that kills 50% of a test population
  - Typically expressed in mg/Kg of animal body weight

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## The Risk Myth: Toxicity Data

Product Name	Active Ingredient	LC50	
		mg/L	Species
Various	Glyphosate IPA Salt	79 -120	Fathead Minnow
Nautique	Copper Carbonate	2 to 21	Fathead Minnow
Sonar	Fluridone	12	Rainbow Trout
Reward	Diquat Dibromide	12	Rainbow Trout
Copper Sulfate	Copper Sulfate Pentahydrate	1	Fathead Minnow

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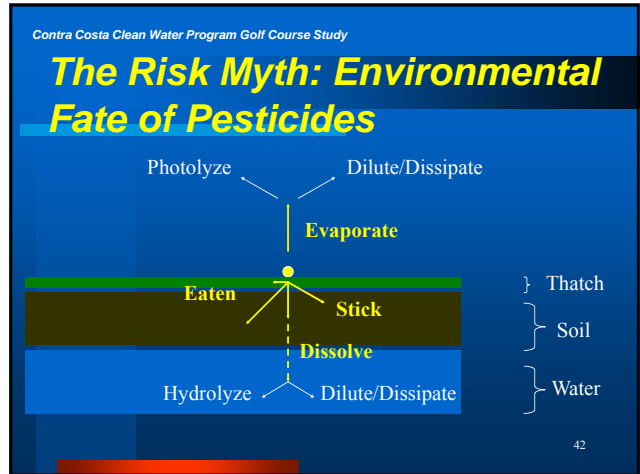
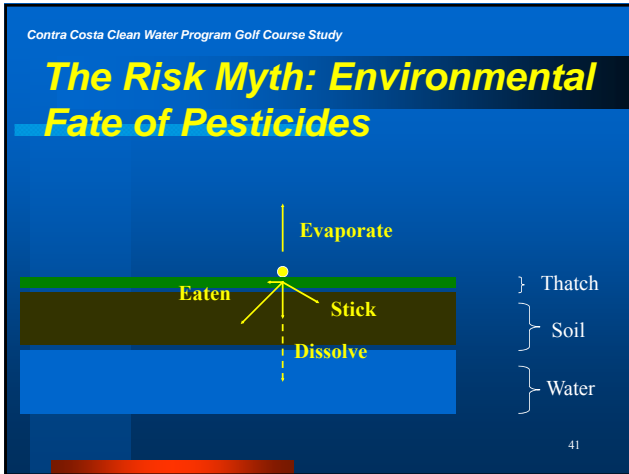
USEPA Classification	Acute Aquatic LC <sub>50</sub> (mg/L)
Practically Non-Toxic	>100
Slightly Toxic	10-100
Moderately Toxic	1-10
Highly Toxic	0.1-1
Very Highly Toxic	< 0.1

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- ## The Risk Myth: Exposure
- Dermal (Absorption)
  - Oral (Ingestion)
  - Inhalation (Inhalation)
  - But, what happens to the chemical on the way to the receptor.....?
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- Contra Costa Clean Water Program Golf Course Study
- ## The Risk Myth: Managing Exposure
- You Can't Change Toxicity...
  - ...So Manage Exposure
    - Understand Environmental Fate
    - Use BMPs
    - Read the Label
    - Make An Informed Pesticide Selection
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***BMPs: Integrated Pest Management***

- Know Your Pest
- Establish Thresholds
- Scout
- Use Mechanical, Cultural and Chemical Tools
- Repeat

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***Questions?***



Mike Blankinship  
(530) 757-0941  
mike@h2osci.com