

# **A Public Health Perspective on Industrial Animal Operations**

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# Agriculture and the Environment

- **Emissions associated with agricultural operations**
  - **PM<sub>10</sub> and PM<sub>2.5</sub>**
  - **O<sub>3</sub> precursors, NO<sub>x</sub> and VOCs**
  - **Greenhouse gases (CO<sub>2</sub>, N<sub>2</sub>, and CH<sub>4</sub>)**
  - **NH<sub>3</sub>**
  - **H<sub>2</sub>S**
  - **Biologically active agents,**
    - **bacteria, mold spores, allergens, endotoxin**
  - **Odors - related to the over 200 volatile organic compounds**
  - **Chemical drift – pesticides, herbicides, pharmaceuticals**



# Agriculture and Occupational Exposures

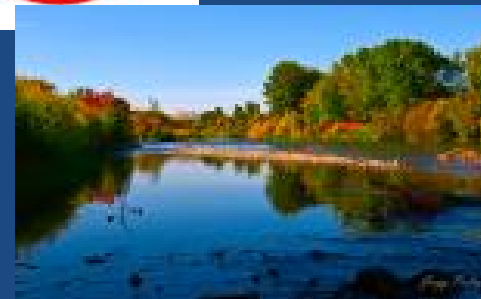
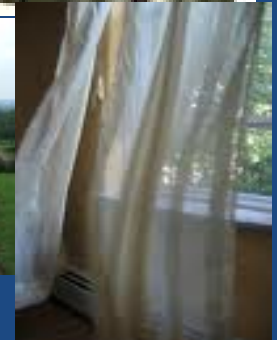
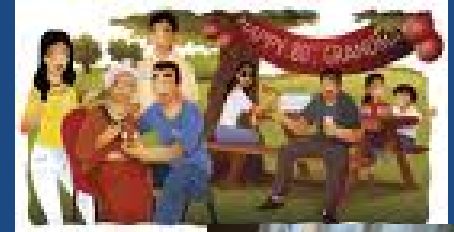
- What we know from industrial animal workers
  - pulmonary changes – reduced lung function
  - mucous membrane irritation,
  - asthma
  - chronic bronchitis
  - asthma-like syndrome
  - bronchial hyper-responsiveness
  - chronic obstructive pulmonary disease
  - sensitization
  - acute toxicity from high-dose gas exposures (nitrogen oxides, hydrogen sulfide, ammonia)
  - hypersensitivity pneumonitis,
  - eczema and skin disorders

Source: Mitloehner and Schekner, 2007, Omland , 2002



# Public Health Implications

- Respiratory health
- GI health
- Odors
- Psychological
- Quality of life
  
- Nuisance
- Environmental Impact
- Economics

A water quality index chart showing a color scale from blue (excellent) to red (poor). The chart includes a legend and a list of water quality parameters.

AP	Color
91-100 Excellent	Blue
81-90 Good	Green
71-80 Fair	Yellow
61-70 Marginal	Orange
51-60 Poor	Red
Below 50 Very Poor	Dark Red

Water Quality Index (WQI) Categories

Legend:

- Excellent
- Good
- Fair
- Marginal
- Poor
- Very Poor

Water Quality Parameters:

- Dissolved Oxygen
- Temperature
- pH
- Ammonia
- Nitrate
- Chloride
- Fluoride
- Calcium
- Magnesium
- Sulfate
- Total Dissolved Solids
- Total Suspended Solids
- Total Phosphorus
- Total Nitrogen
- Lead
- Copper
- Zinc
- Iron
- Manganese
- Barium
- Cadmium
- Chromium
- Cobalt
- Mercury
- Nickel
- Selenium
- Silver
- Vanadium
- Antimony
- Arsenic
- Boron
- Strontium
- Tellurium
- Thallium
- Uranium
- Vanadium
- Yttrium
- Zinc





## “Sound Science”

- These exposure situations are not clear-cut
- Clear-cut findings would include
  - an objective finding (e.g., a measurable effect, such as an altered blood chemistry or abnormal radiograph)
  - an adverse health effect, measured toxic substances at known toxic concentration, and an obvious dose-response relationship.
- These community exposures are much more complex because they are a mix of physical, mental, emotional, and social stressors.

Source - Donham. 2010



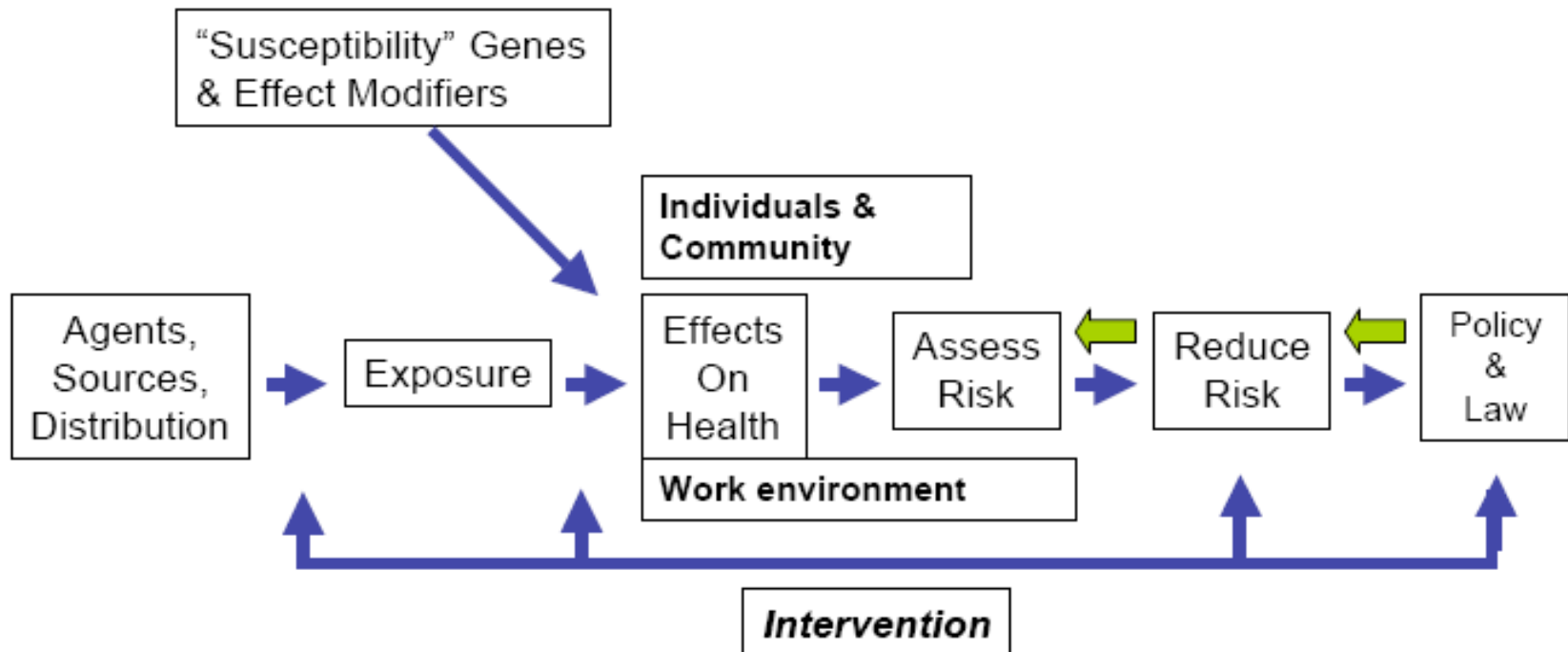


# The public health perspective

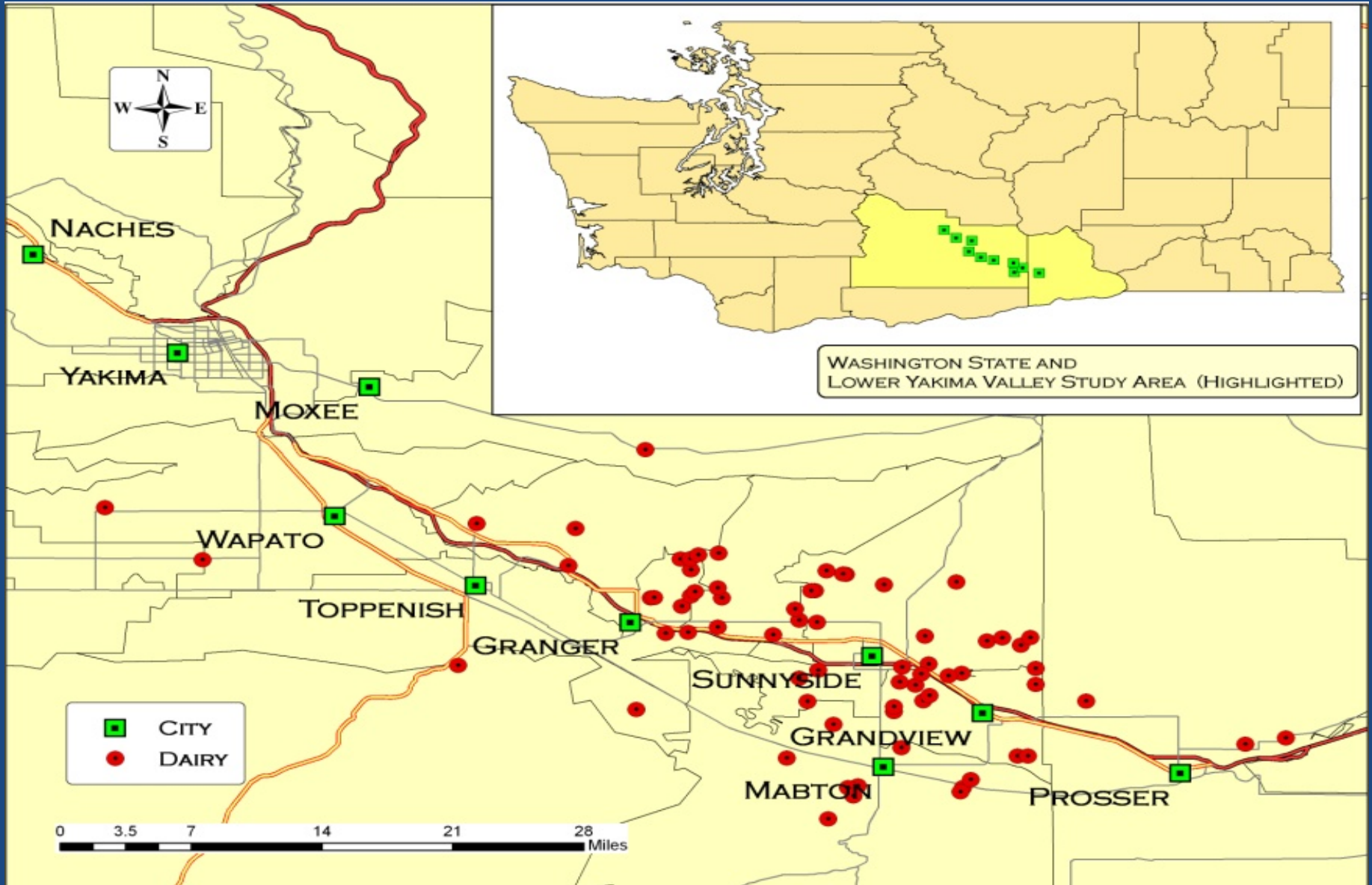
- Rural vs Urban
- Traditional farming and the industrial farming process
- Susceptible populations
  - Children
  - Asthma
  - Elderly
- There is no “safe level of PM
- Threshold limits for allergens are being questioned
- Gases are irritants and contributors of chronic respiratory disease



# Environmental Health paradigm



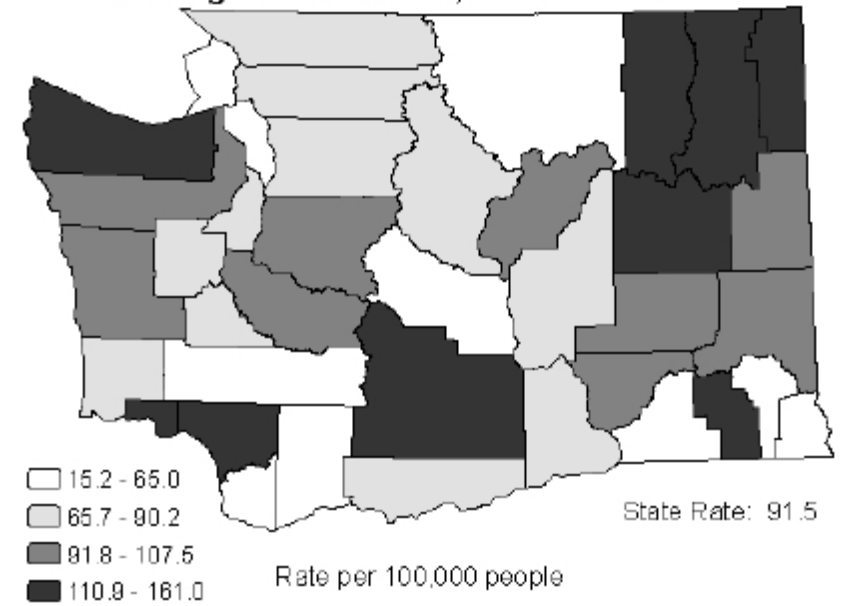
# Study Area







## Asthma-Related Hospitalizations Washington State CHARS, 2000-2002 Combined



Source: 2000-02 combined Washington State hospitalization records (CHARS)

### Yakima County

- One in 11 adults have asthma.
- One in 14 adults have had a heart attack, coronary heart disease, angina, or stroke.

Economic costs of asthma as reported in  
"The Burden of Washington Asthma"







# Yakima Valley Study Area

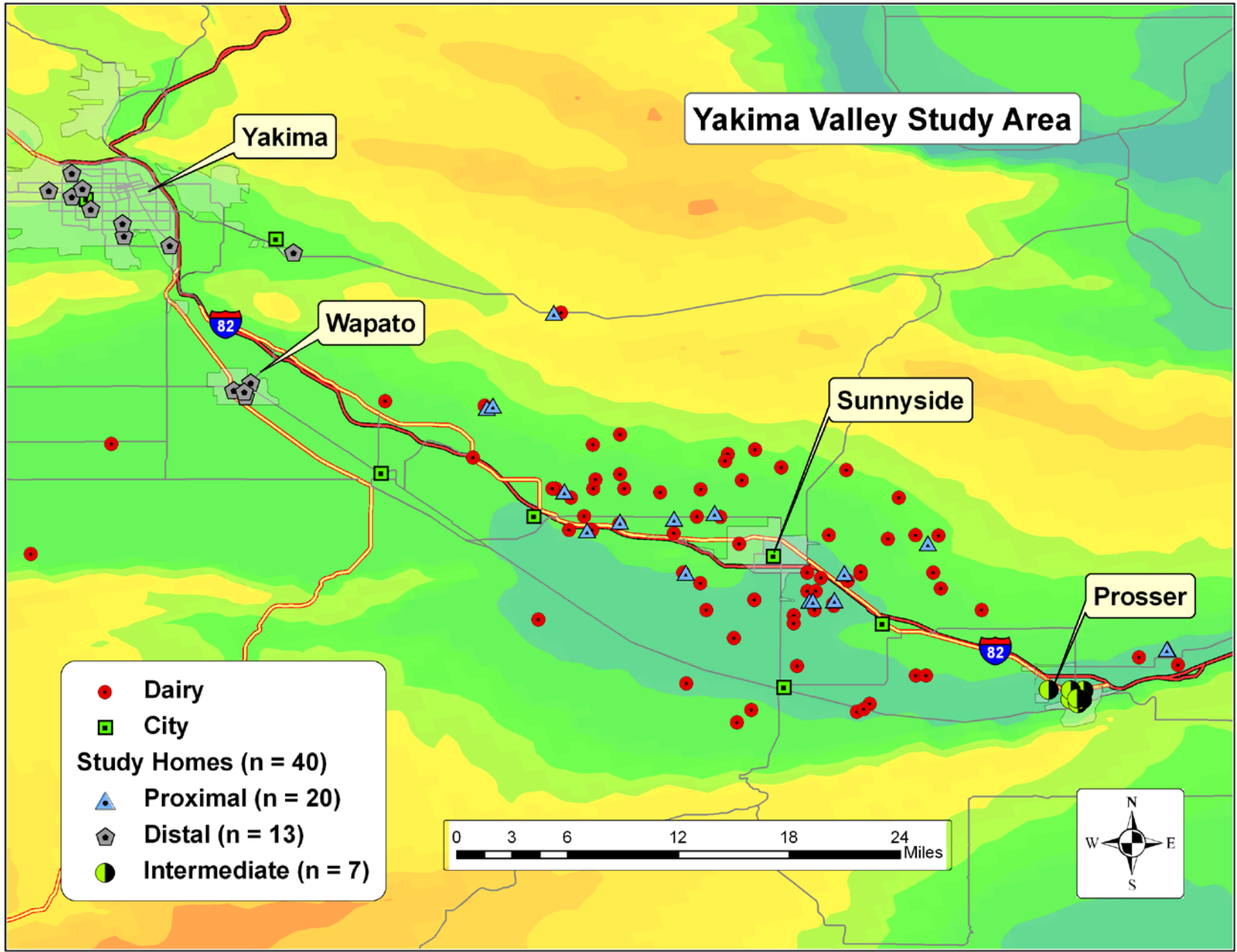
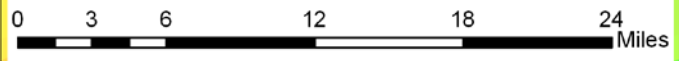
Yakima

Wapato

Sunnyside

Prosser

- Dairy
- City
- Study Homes (n = 40)
  - ▲ Proximal (n = 20)
  - ⬠ Distal (n = 13)
  - Intermediate (n = 7)



# Study

- **20 Proximal (P)** within ¼ mile from facility or facility sprayfield
- **7 Intermediate (I)** 3 miles from facility, but not > 3 mile from sprayfield
- **13 Distal (D)** > 3 miles from facility and sprayfield
  - Simultaneous indoor/outdoor sampling for 5 days
  - Study Sampling Timeframe June 10 – August 19, 2008

## Collected Samples and Analysis

- **Airborne PM Total Dust**
  - BGI 400S pump, 37mm cassette, PTFE filter
    - PM Mass – gravimetric analysis, JHSPH
- **Bos d 2 Cow Allergen – ELISA**, Indoor Biotechnologies, Inc.
- **Ammonia – Grandko Passive Sampler**, ICP analysis, JHSPH

## Settled Dust

- **Bos d 2 Cow Allergen – ELISA**, Indoor Biotechnologies, Inc.
- **Endotoxin analysis – LAL**, Thorne Lab U. Iowa

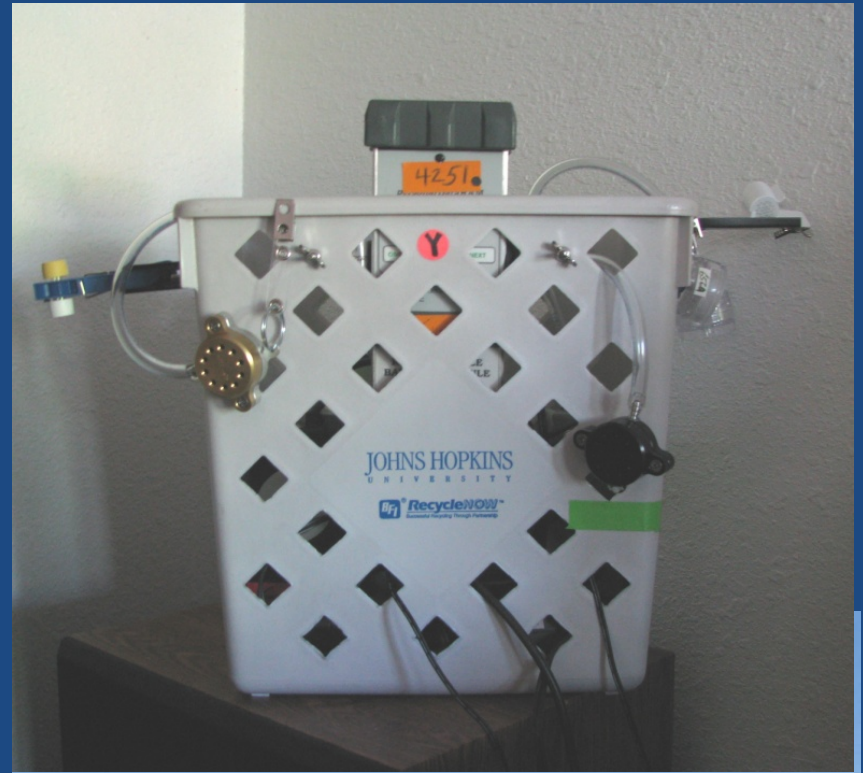


# Housing Characteristics

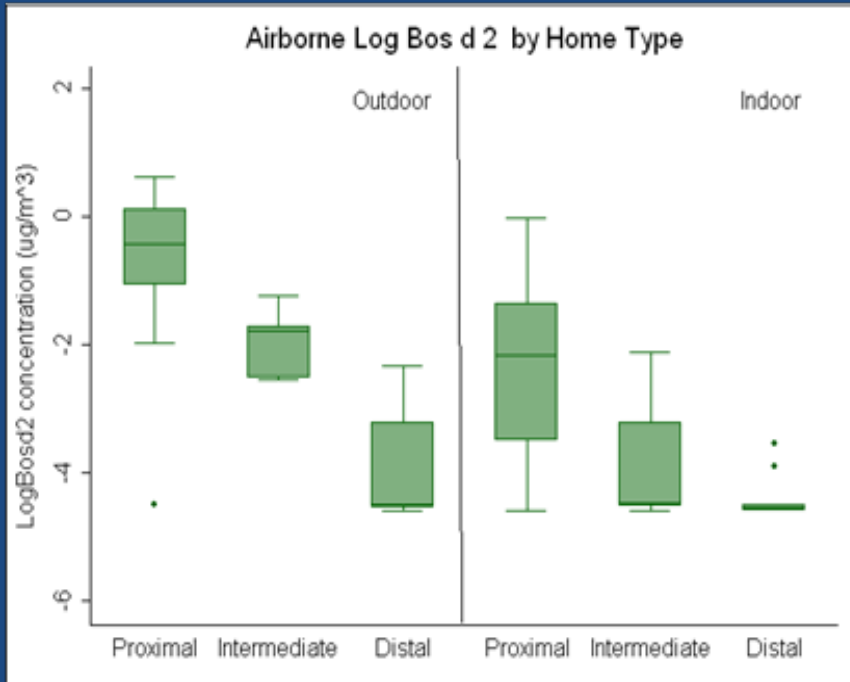
## Home types were similar:

- home age
- # of people in home
- presence of pets
- air conditioning use



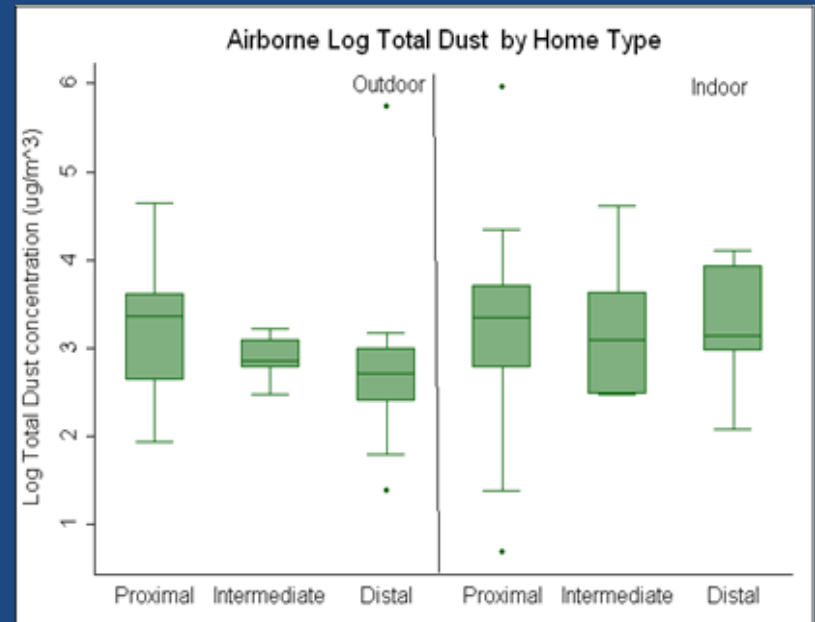
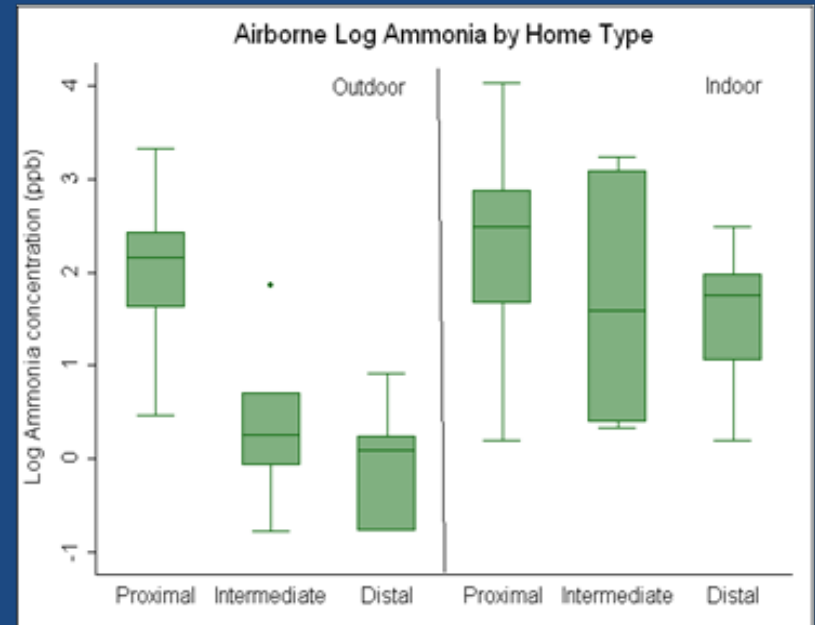


# Air Results



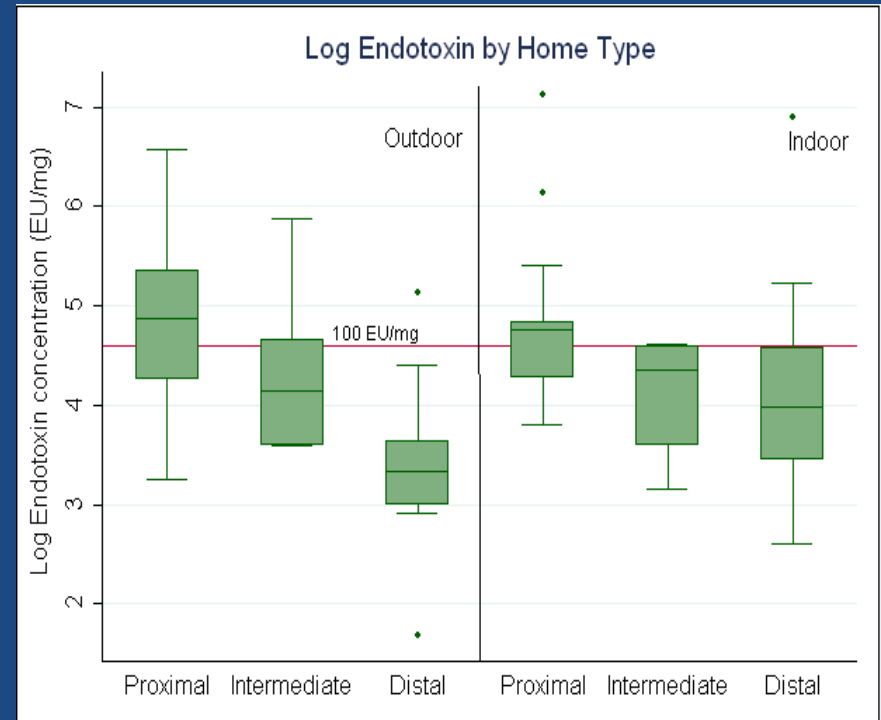
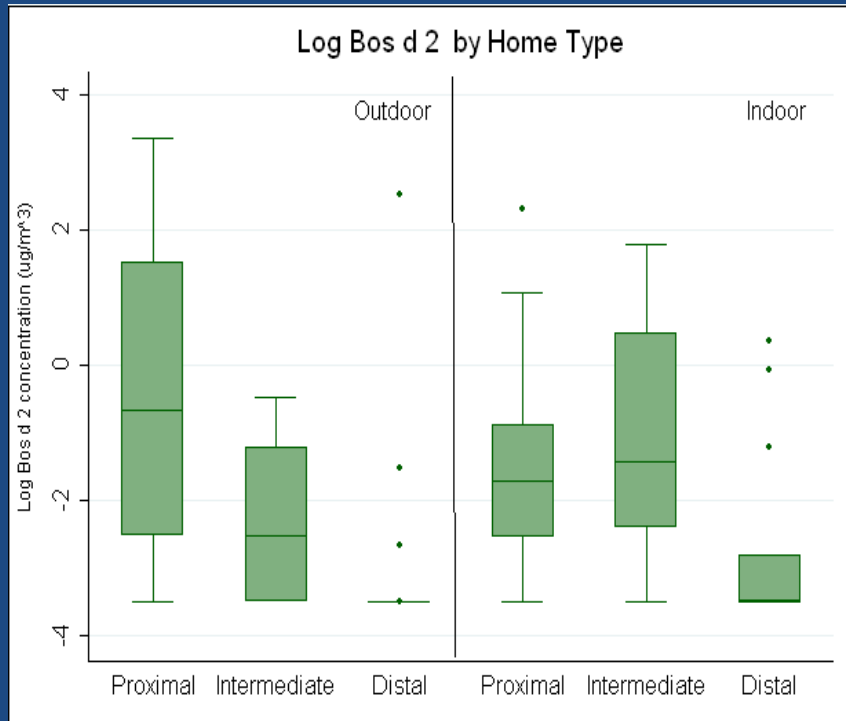
Outdoor concentrations - 80, 8 and 2 times higher in proximal vs distal homes

Indoor concentrations 10, 2, NSD higher in proximal vs distal homes





# Settled Dust Results





# Communities

- These findings illustrate that large scale dairies influence the concentrations of environmental contaminants inside and outside of Yakima County community homes.
- There is little research in the US on communities impacted by animal operations.
- There are currently no studies which are looking specifically at community exposures to airborne agricultural contaminants and health outcomes.
- There are no national reporting programs for rural health or agricultural community illnesses





# Further Research is Needed

- Studies are needed which evaluate the benefits of research demonstration projects
- Need to evaluate the benefits of best management practices and proposed technologies
- Rural ambient air quality monitoring is needed to evaluate these exposures.
- The establishment of a rural health reporting system is recommended which evaluates:
  - Respiratory
  - GI
  - Mental Health (odors, extra stressors)
  - Quality of Life (enjoyment of environment, economic)



