A Public Health Perspective on Industrial Animal Operations

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Agriculture and the Environment

- **Emissions associated with agricultural operations**
  - **PM_{10} and $PM_{2.5}$**
  - **O_3 precursors, NO_x and VOCs**
  - **Greenhouse gases (CO_2, N_2, and CH_4)**
  - **NH_3**
  - **H_2S**
  - **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

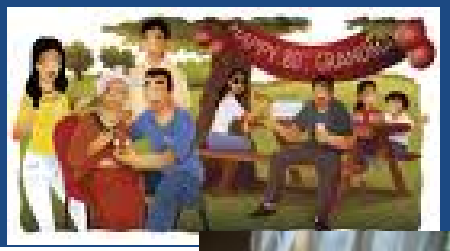
- What we know from industrial animal workers
  - pulmonary changes – reduced lung function
  - mucous membrane irritation,
  - asthma
  - chronic bronchitis
  - asthma-like syndrome
  - bronchial hyper-responsiveness
  - chronic obstructive pulmonary disease
  - sensitization
  - acute toxicity from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

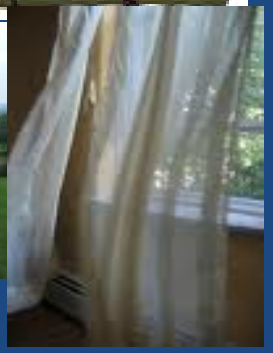
Source: Mitloehner and Schekner, 2007, Omland , 2002

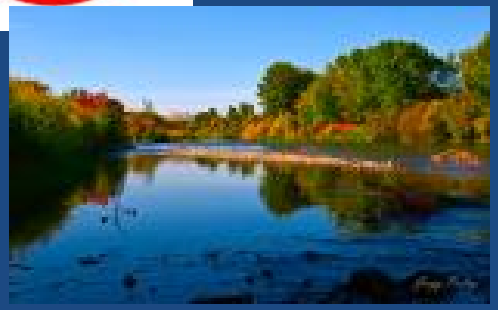
Public Health Implications

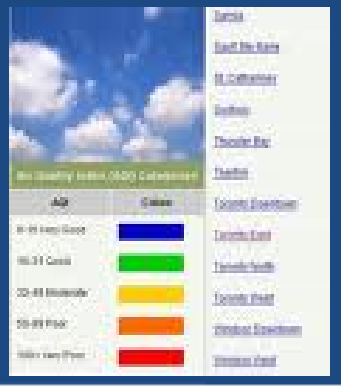
- Respiratory health
- GI health
- Odors
- Psychological
- Quality of life

- Nuisance
- Environmental Impact
- Economics









“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.

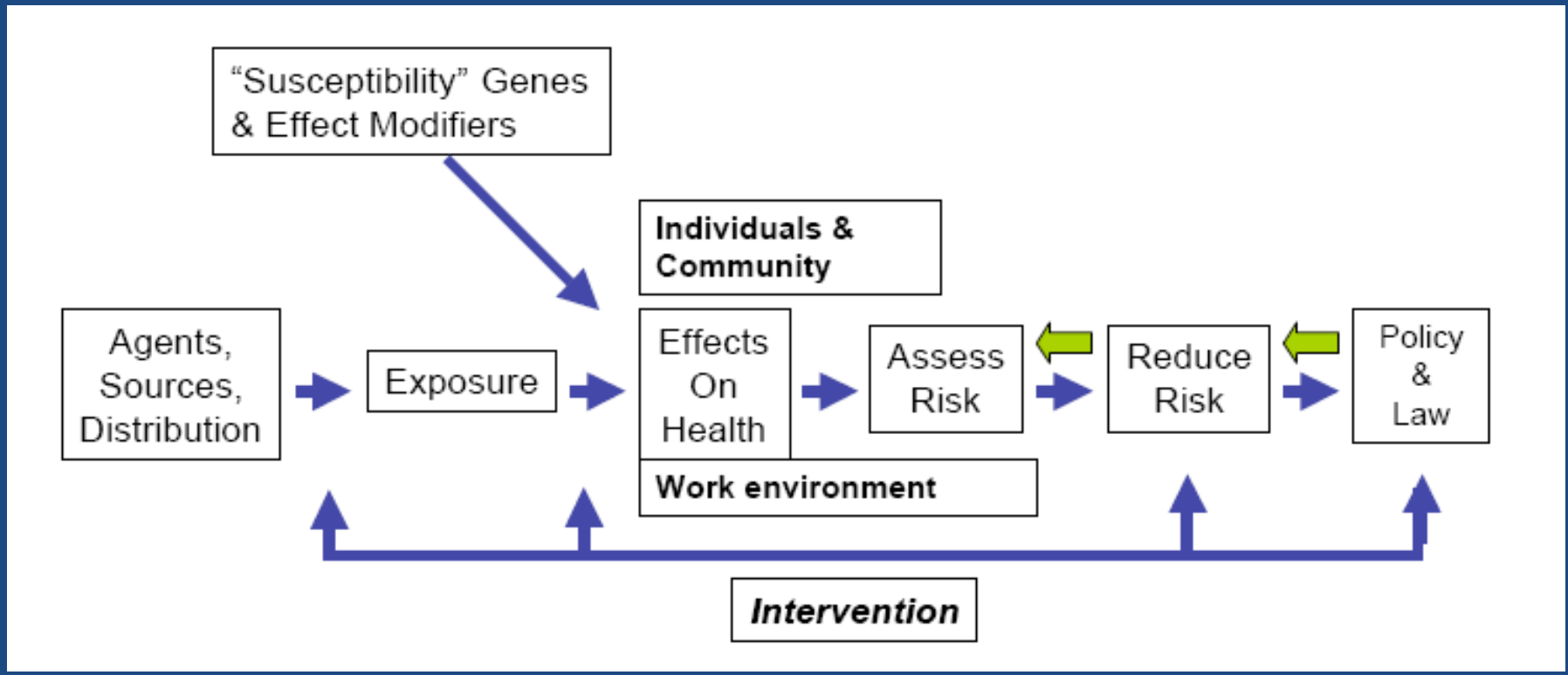
- These community exposures are much more complex because they are a mix of physical, mental, emotional, and social stressors.

Source - Donham. 2010

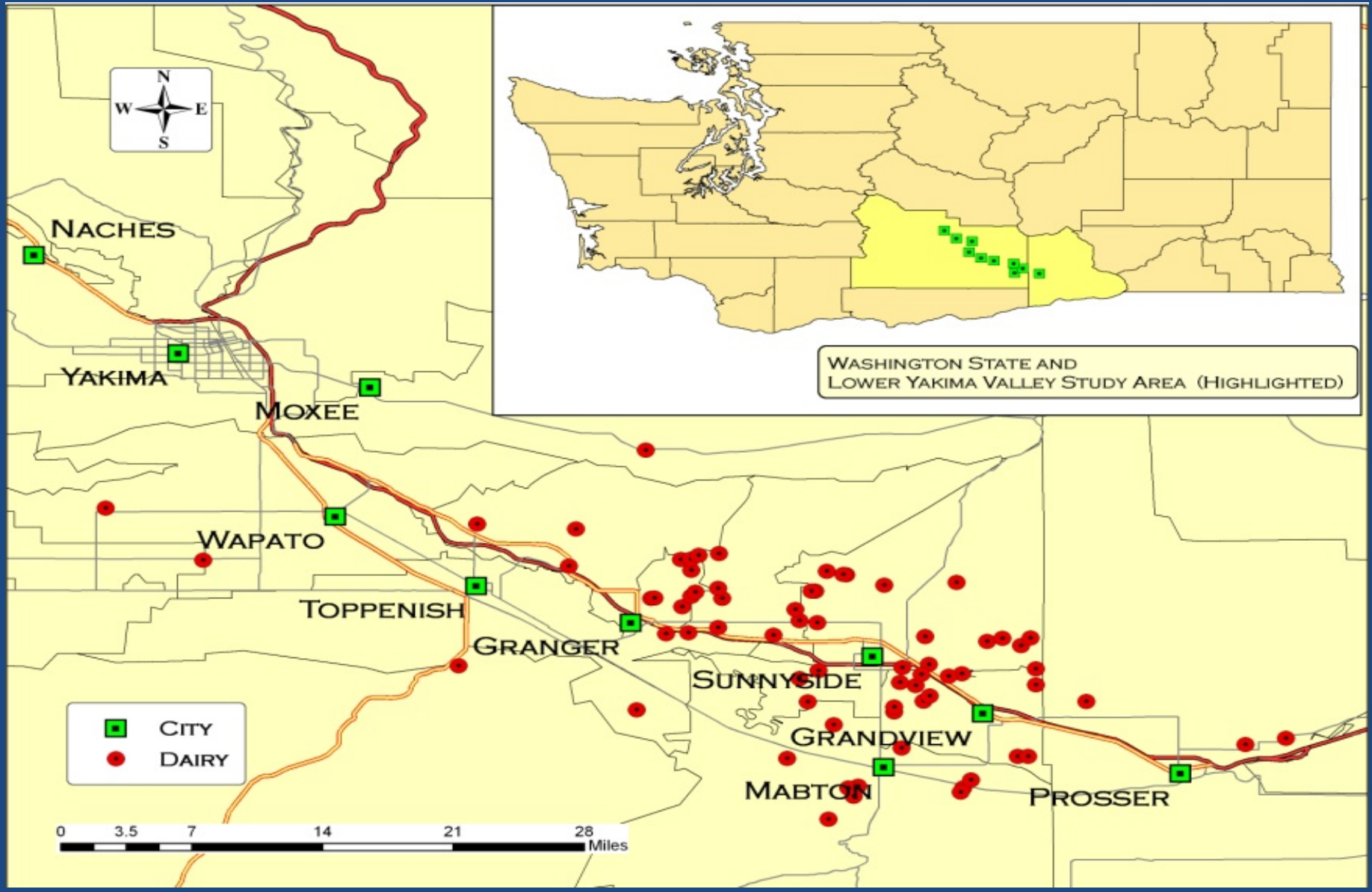
The public health perspective

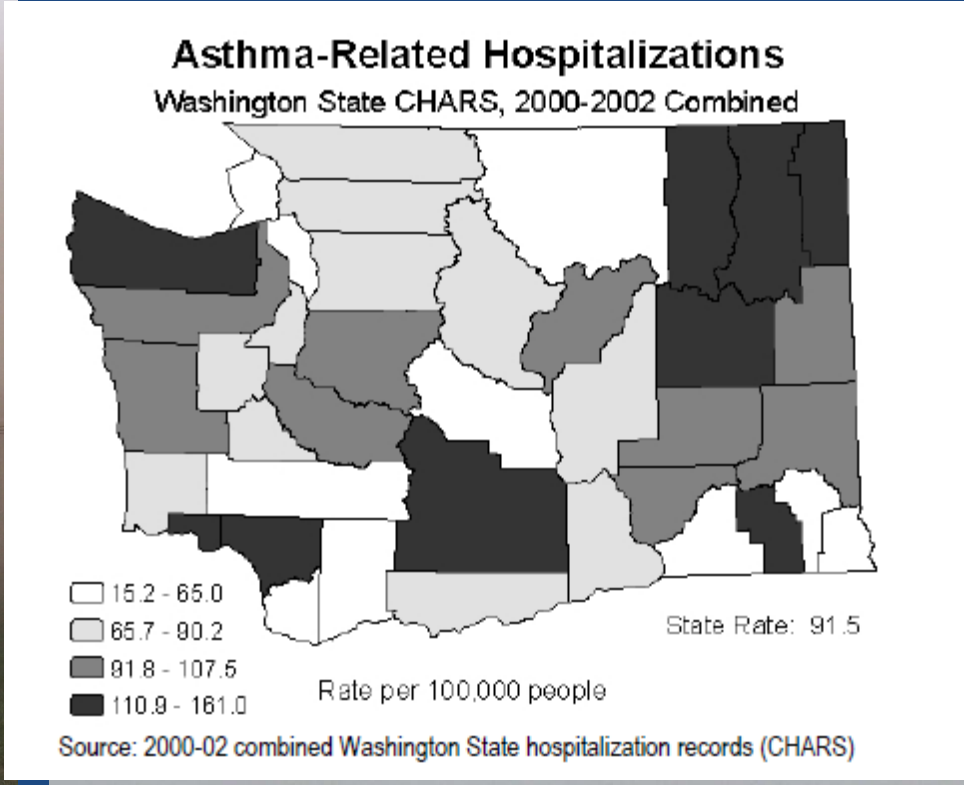
- Rural vs Urban
- Traditional farming and the industrial farming process
- Susceptible populations
  - Children
  - Asthma
  - Elderly
- There is no “safe level of PM
- Threshold limits for allergens are being questioned
- Gases are irritants and contributors of chronic respiratory disease

Environmental Health paradigm



Study Area

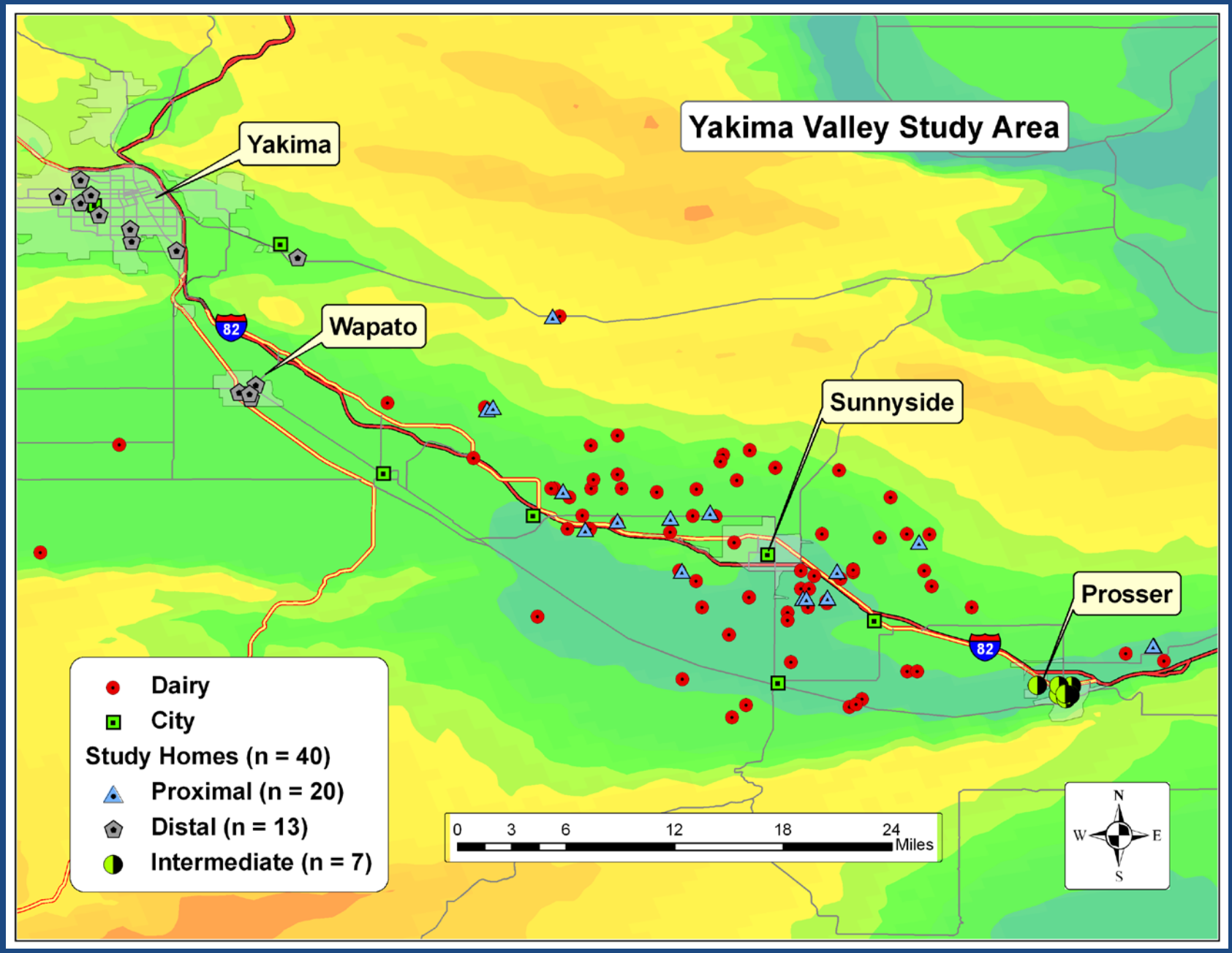

N
W
E
S
NACHES
YAKIMA
MOXEE
WAPATO
TOPPENISH
GRANGER
SUNNYSIDE
GRANDVIEW
MABTON
PROSSER
CITY
DAIRY
0
3.5
7
14
21
28
Miles
WASHINGTON STATE AND
LOWER YAKIMA VALLEY STUDY AREA (HIGHLIGHTED)



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
82
82
Dairy
City
Study Homes (n = 40)
Proximal (n = 20)
Distal (n = 13)
Intermediate (n = 7)
0 3 6 12 18 24
Miles
N
W
E
S

Study

- 20 Proximal (P) within ¼ mile from facility or facility sprayfield
- 7 Intermediate (I) 3 miles from facility, but not > 3mile 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

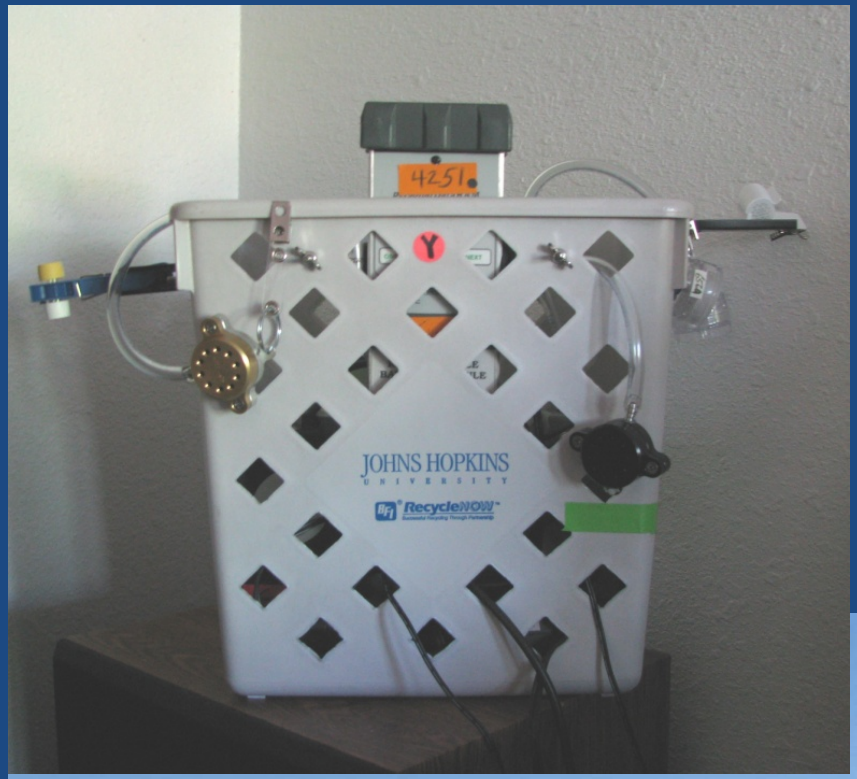
Settled Dust

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

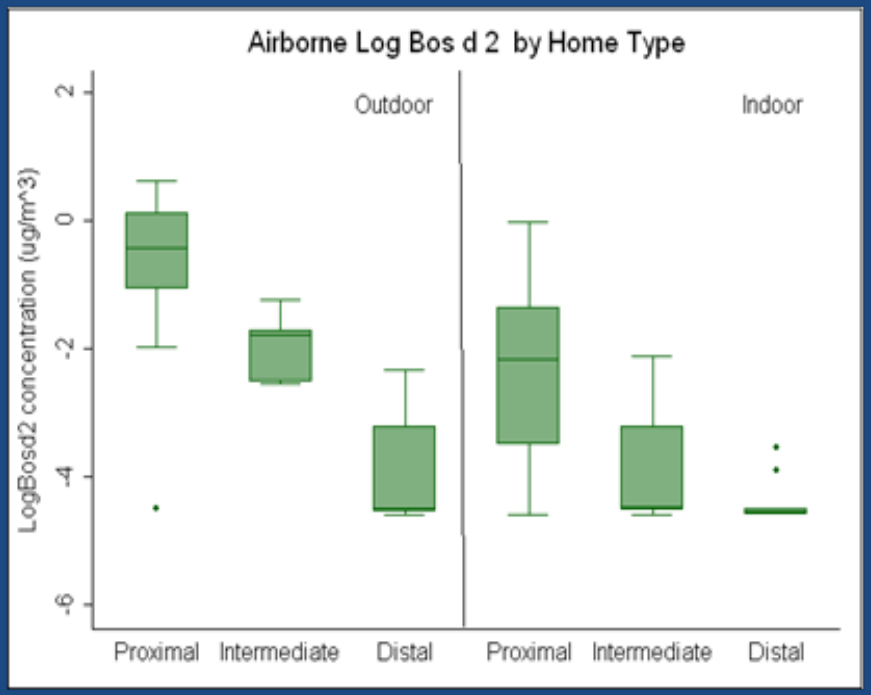
Housing Characteristics

Home types were similar:

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

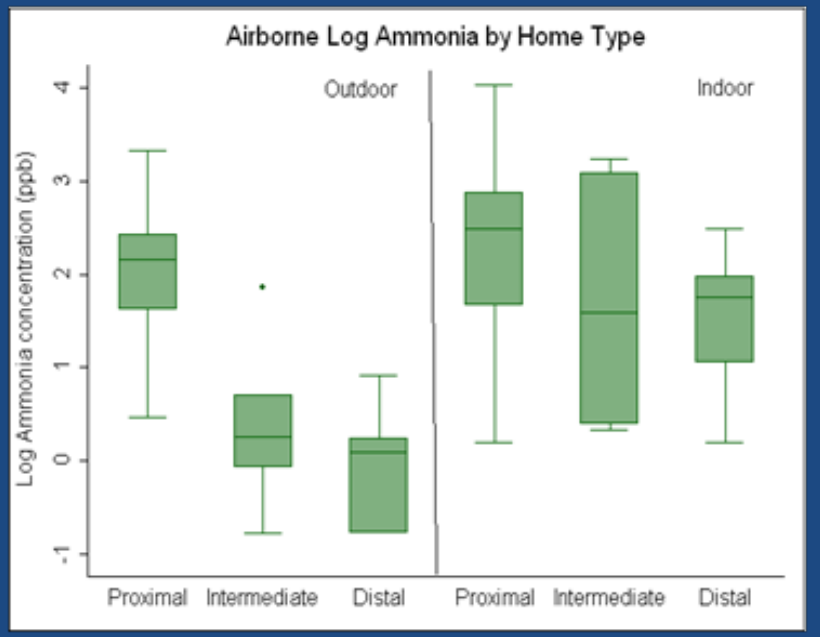

4251
JOHNS HOPKINS
UNIVERSITY
RecycleNOW

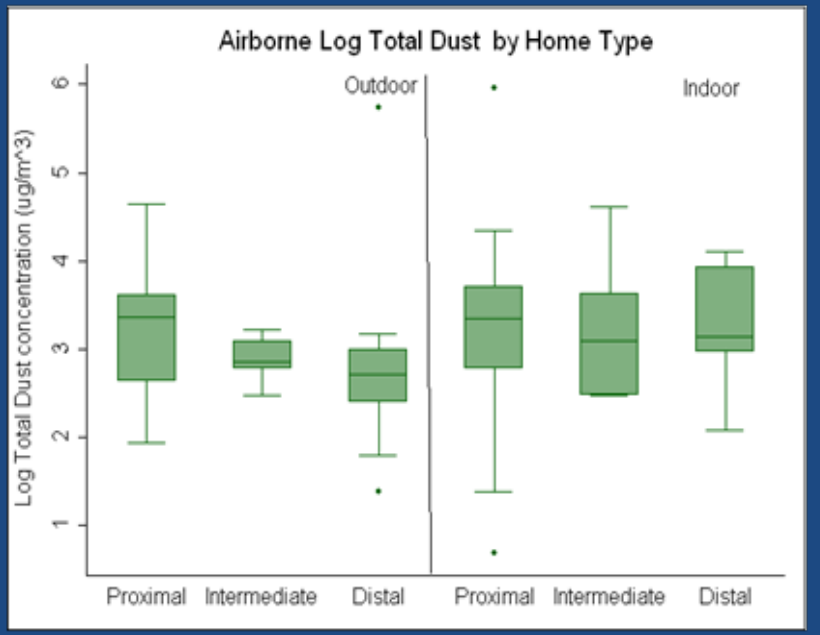
Air Results



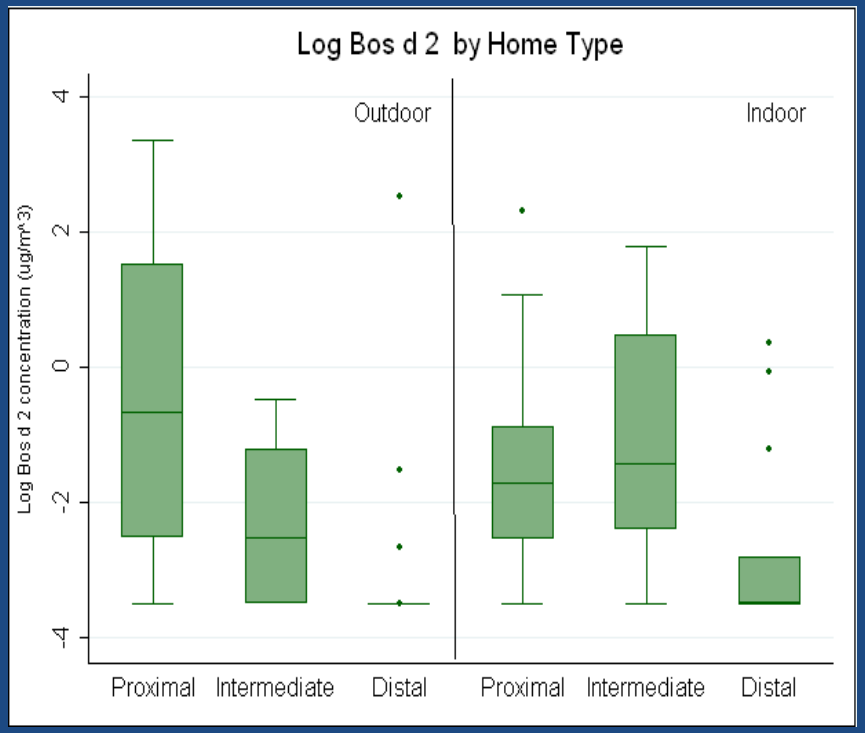
Outdoor concentrations - 80, 8 and 2 times higher in proximal vs distal homes

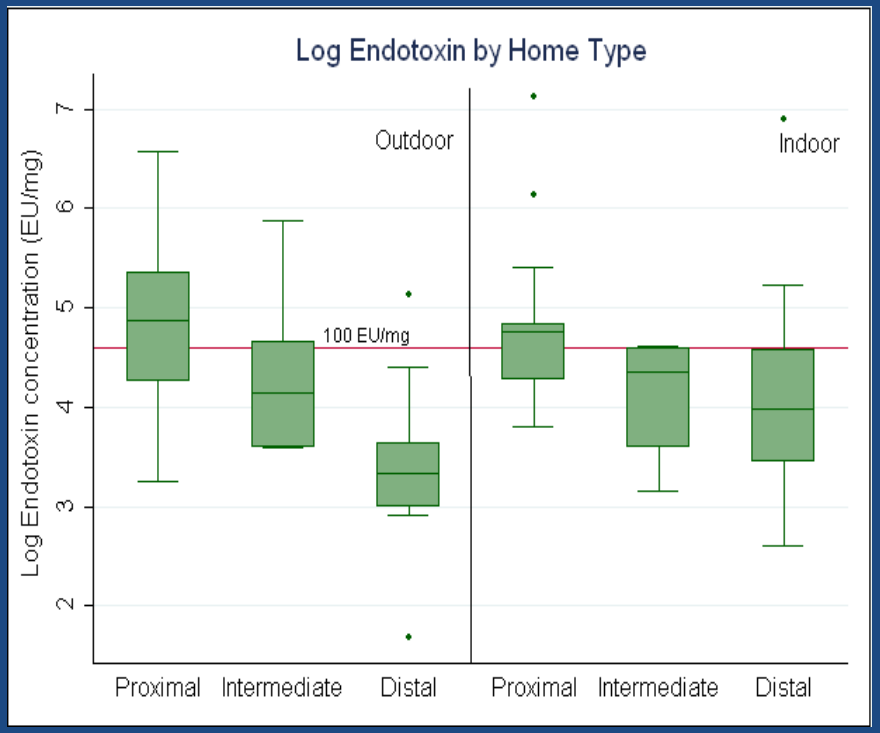
Indoor concentrations 10, 2, NSD higher in proximal vs distal homes



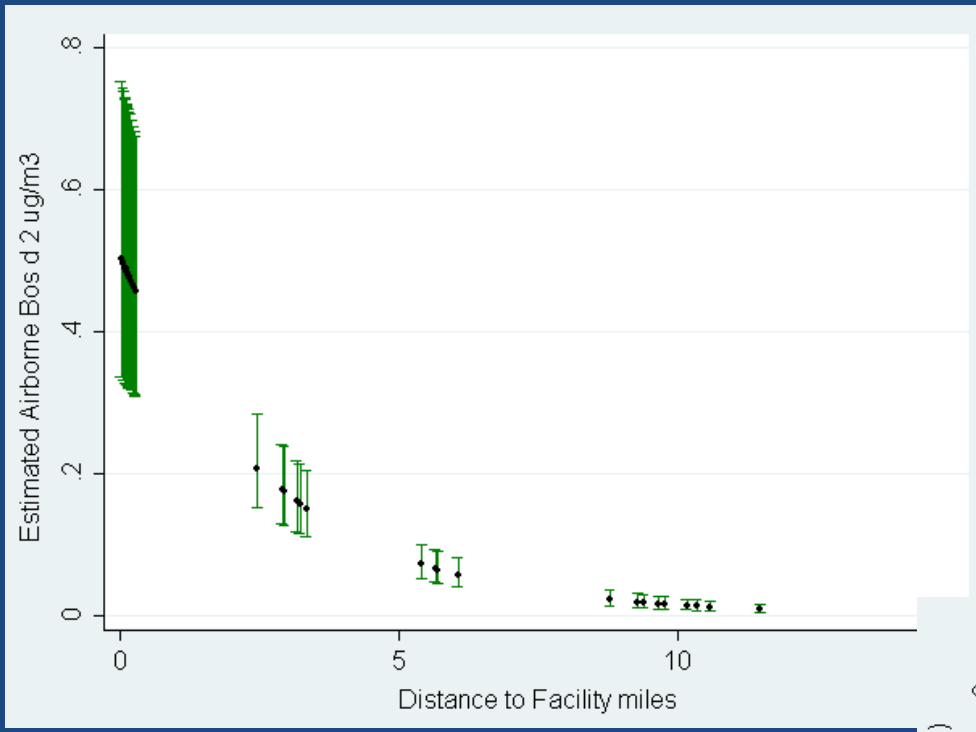


Settled Dust Results

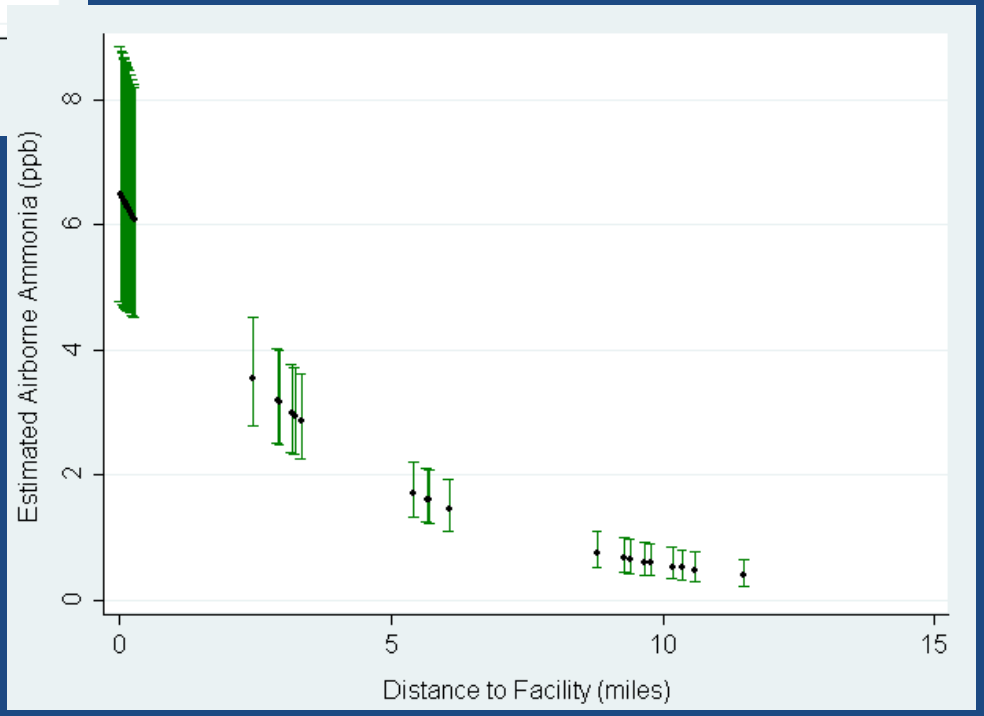




Results
Distance to Facility



Airborne concentrations
above “background”
seen at up to 5 miles



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)