Injury Prevention Using the Industrial Hygiene Paradigm

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What the heck is industrial hygiene?


Hierarchy of Controls
Most effective
Elimination
Physically remove the hazard
Substitution
Replace the hazard
Engineering Controls
Isolate people from the hazard
Administrative Controls
Change the way people work
PPE
Protect the worker with Personal Protective Equipment

How do you recognize hazards on the farm?

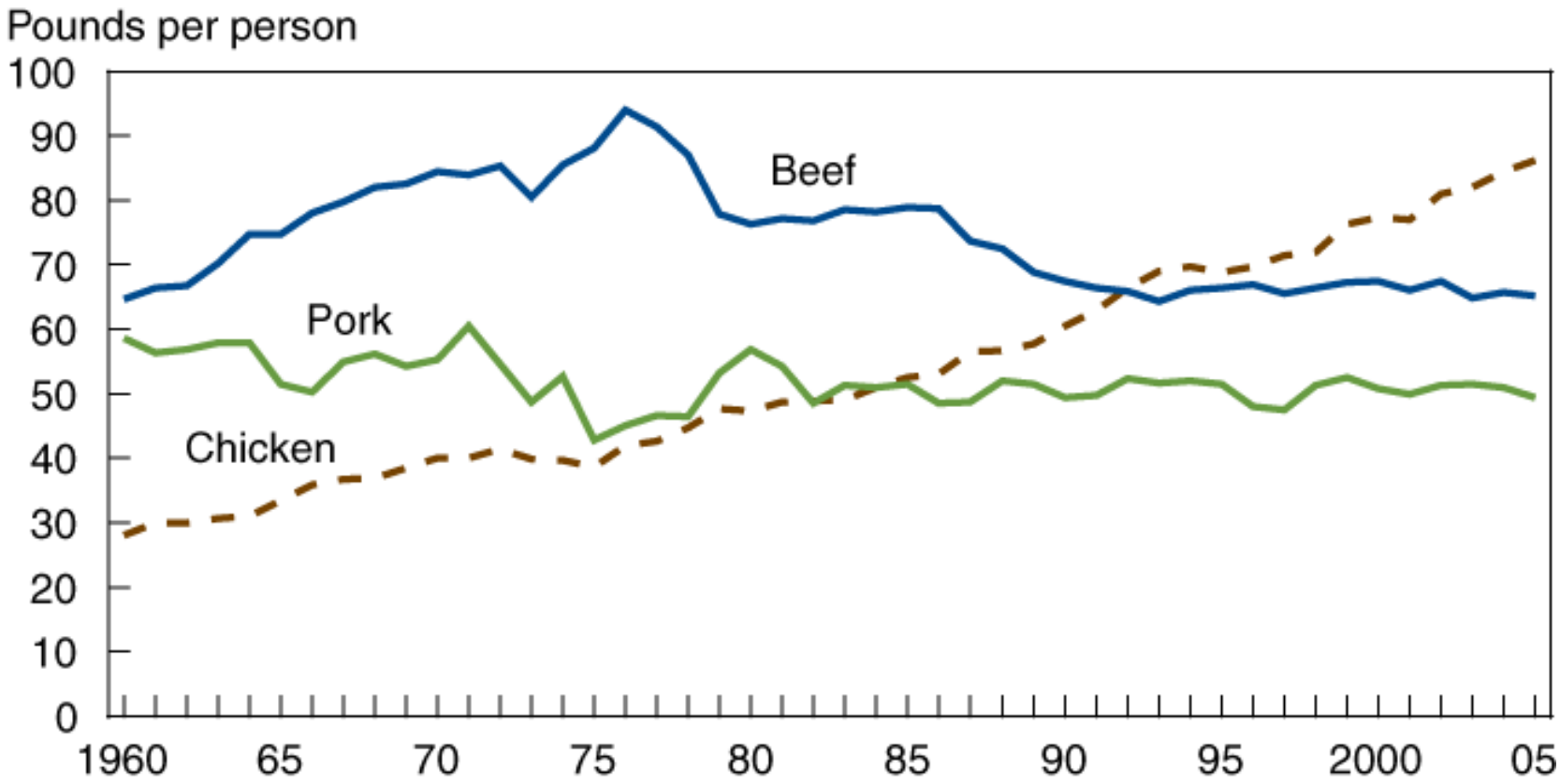
- Experience
- Stories from experienced producers
- Anticipation
- Recognition of hazards
- Measurement of exposure if needed
- Control
- Do the controls work?

US Chicken Meat Production

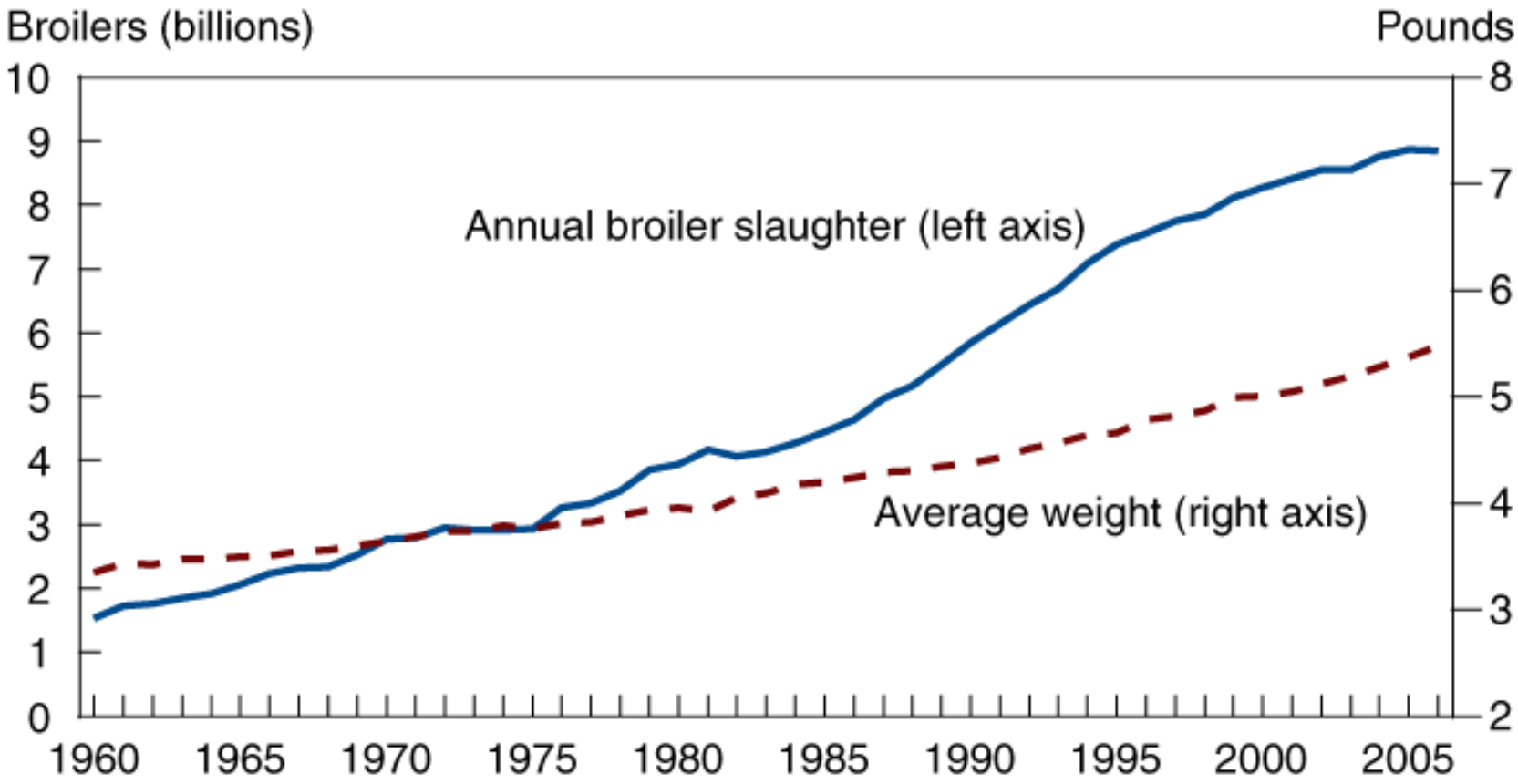
Broilers account for nearly all chicken meat and most poultry meat produced in the US

Figure 1

Trends in per capita consumption, 1960-2005



Growth in broiler production, 1960-2006



Source: USDA, National Agricultural Statistics Service.

How are broiler chickens produced?

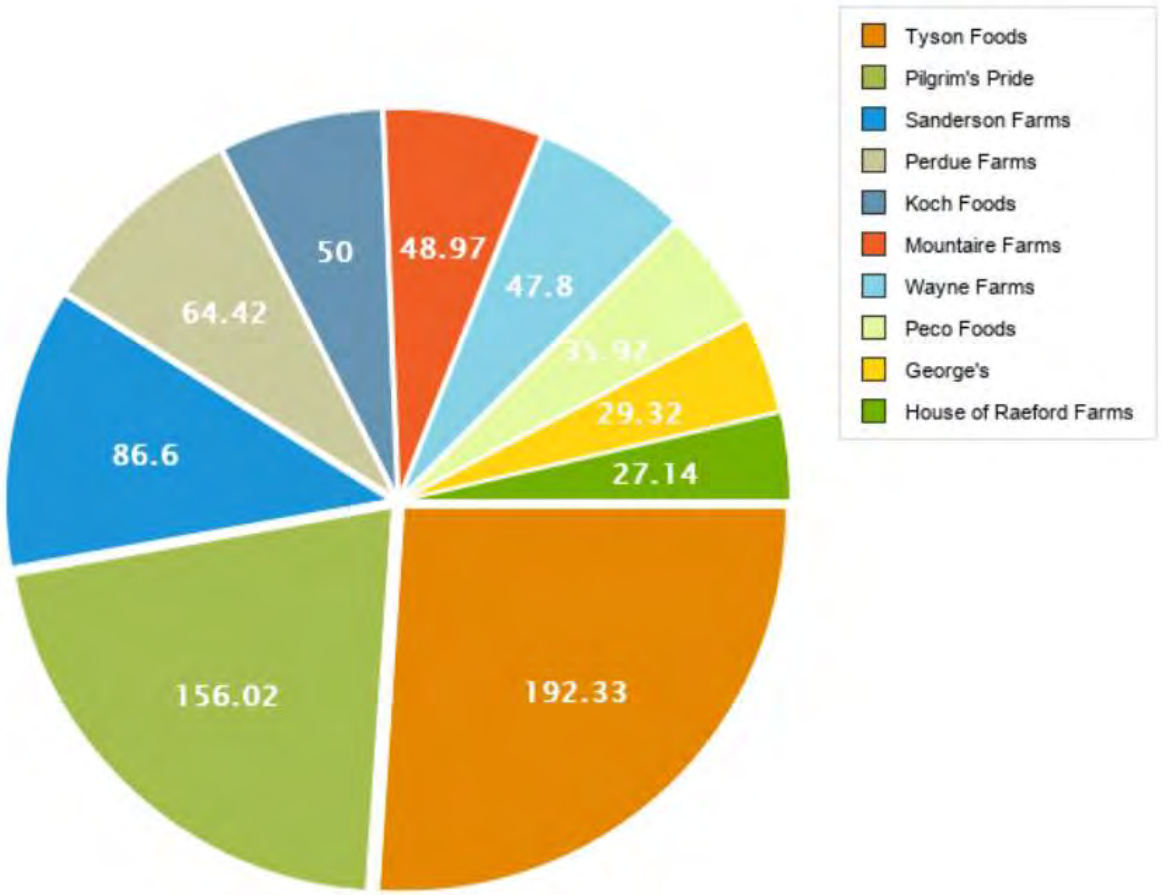
- The broiler industry's processes are tightly controlled by firms called *integrators* who:
  - operate processing plants
  - feed mills
  - hatcheries
- Integrators contract with farmers to grow broiler chicks to market weight

Integrator Companies

- 40 integrators are currently in operation in the US
- 10 integrators account for more than 60 percent of all the broiler production in the US
- Broiler production is found mostly in the southeastern and south central states
  - these two regions produce ~ 85 % of US chicken meat
  - Georgia, Arkansas, Alabama, Mississippi, and North Carolina produce ~ 60 % of all the broiler meat in the US

Top Integrator Companies (2019)

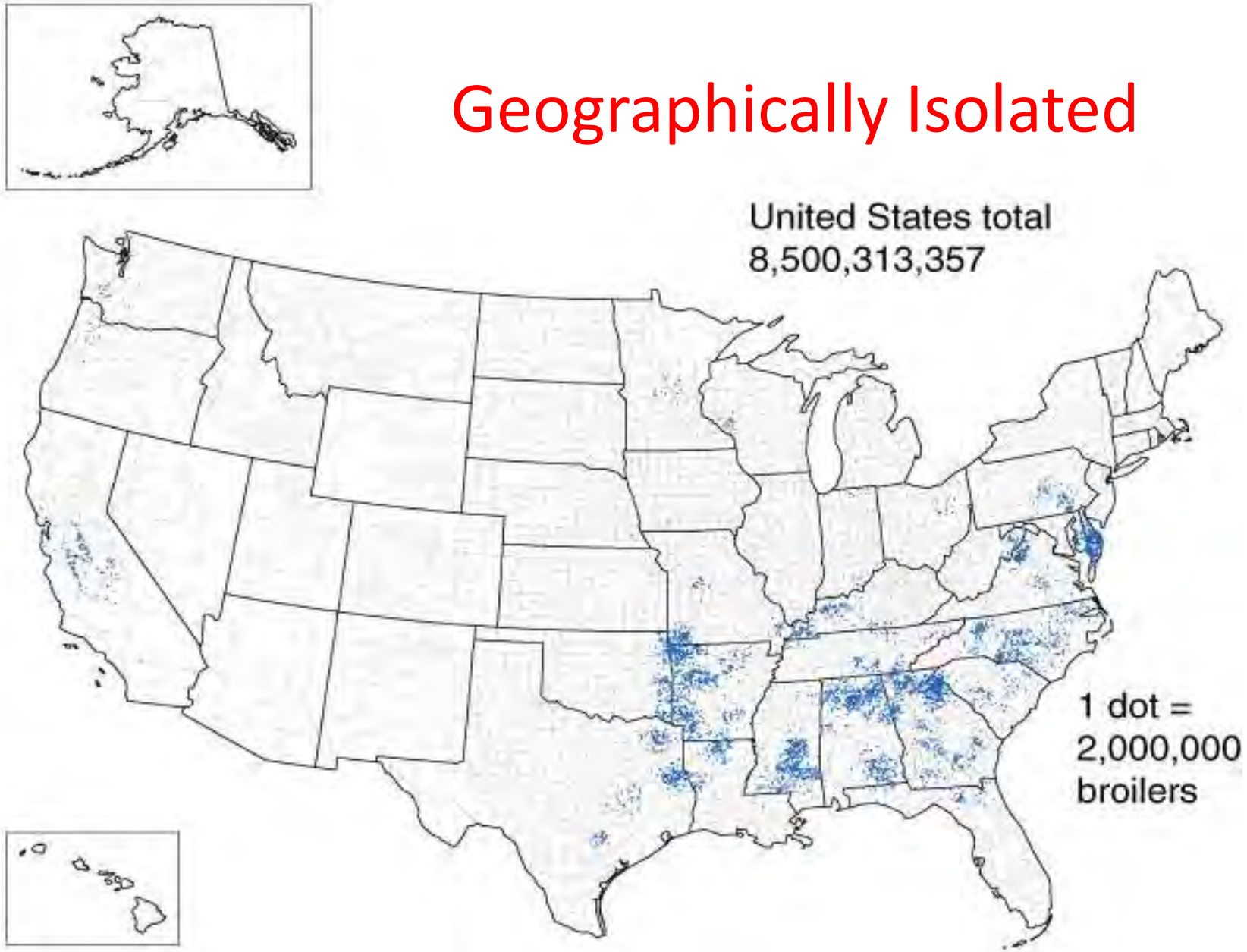
http://www.uspoultry.org/economic_data/



Broiler Industry Economics

- Broiler growers paid by the integrators by contract
- Integrators own the feed and the chicks
- Compensation is based on:
  - all growers receive a base fee
  - relative performance to other growers
    - e.g., growers who deliver more poultry meat for the number of chicks placed, receive higher payments
  - competition between growers results
- Grower income
  - 4-6 building broiler farm will generate ~ $20,000, annually

Geographically Isolated



Source: USDA, National Agricultural Statistics Service.

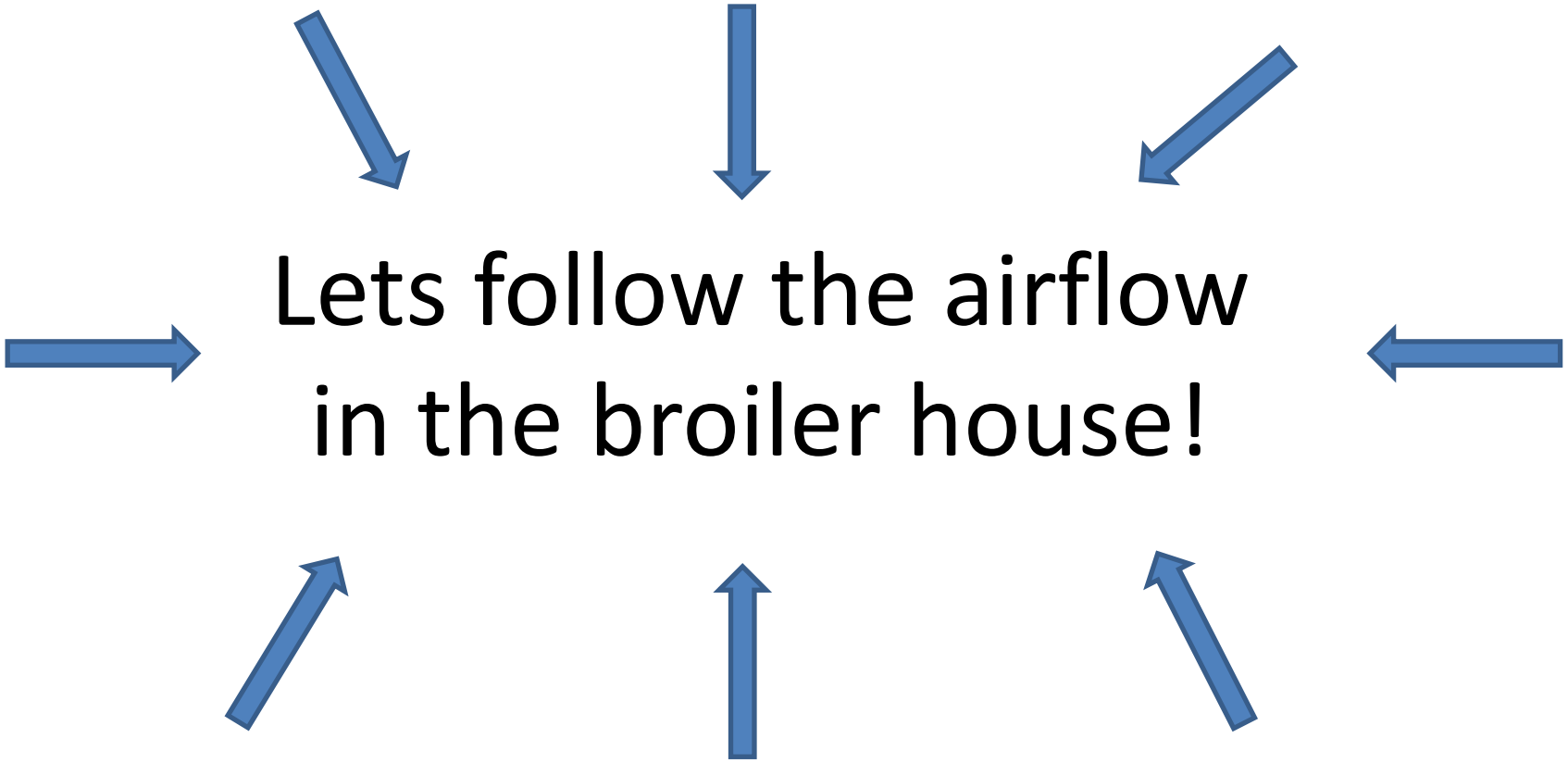
Summary Facts

• Slaughter/evisceration (# plants)	185
• Workers directly employed	300,000
• Workers indirectly employed	200,000
• Family farms growing broilers (or hatching eggs)	30,500
• Corn used for feed (bushels)	1.2 billion
• Soybean used for feed (bushels)	500 million
• Amount of mixed feed used (tons)	55 million
• Wholesale value of shipments of industry	$50 billion
• Consumer expenditures for chicken	$70 billion

National Chicken Council, 2020

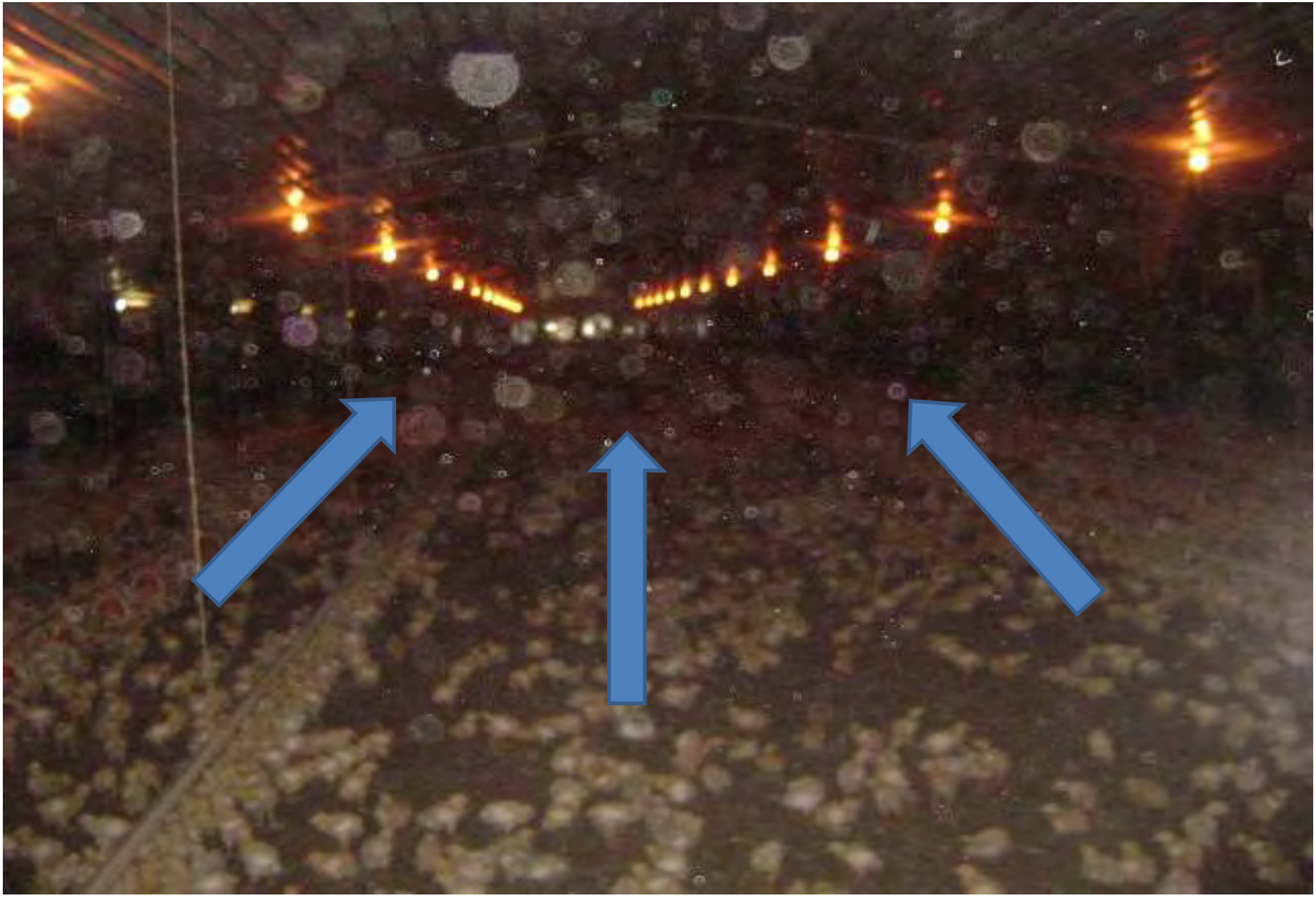
Broiler Housing

- Broiler houses are expensive to build
  - $300,000 per 30,000 ft^2 house (2006 $)
  - ~30,000 broiler chickens per house
- ~ 70,000 houses in production in 2006
- Current design standards
  - solid walls compared to curtain walls
  - climate control
    - tunnel ventilation
    - evaporative cooling cells
    - designed to keep birds body temp between 41^{o}C and 42.2^{o}C


Lets follow the airflow
in the broiler house!

Broiler House

Broiler House



Broiler House

Broiler House

Grower Major Work Tasks

Daily Tasks

- Mortality collection
- Checking feed and water lines
- Monitoring computer system

Non-daily Tasks

- Place chicks
- Inspection
- Caking out top layer of litter for next flock
- Catch crews
- Power washing

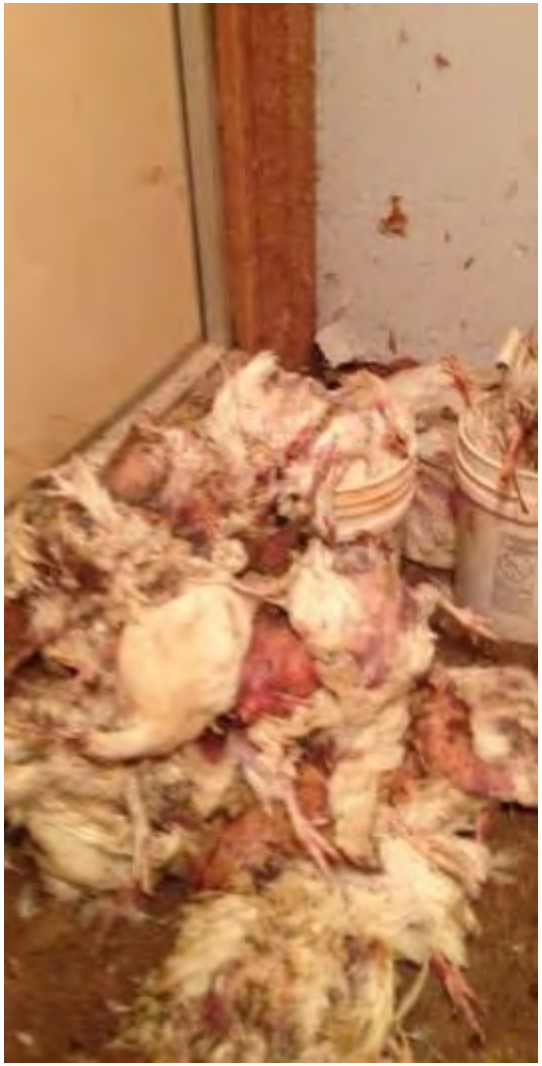
*5-6 houses = about 40 hours per week of work

Mortality Collection (daily task)

- Walk through the buildings and pick up dead chickens
- Results in the greatest amount of time in the building
  - *e.g.,* 2hr task for a four-building farm

www.delawareonline.com

Mortality Collection



Incineration of Mortalities

Inspection

Monitoring Computer System

Place New Chicks

Catch Crew

- Chickens are manually caught and placed in cages on a truck
- Privately contracted crews are hired by integrators

www.motherjones.com

Bedding Cake Out

- Breaking the crust of chicken manure on the surface of the bedding
    - Bedding is most often wood chips or sawdust

Maintenance

Grower Major Work Tasks

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- Checking feed and water lines
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Non-daily Tasks

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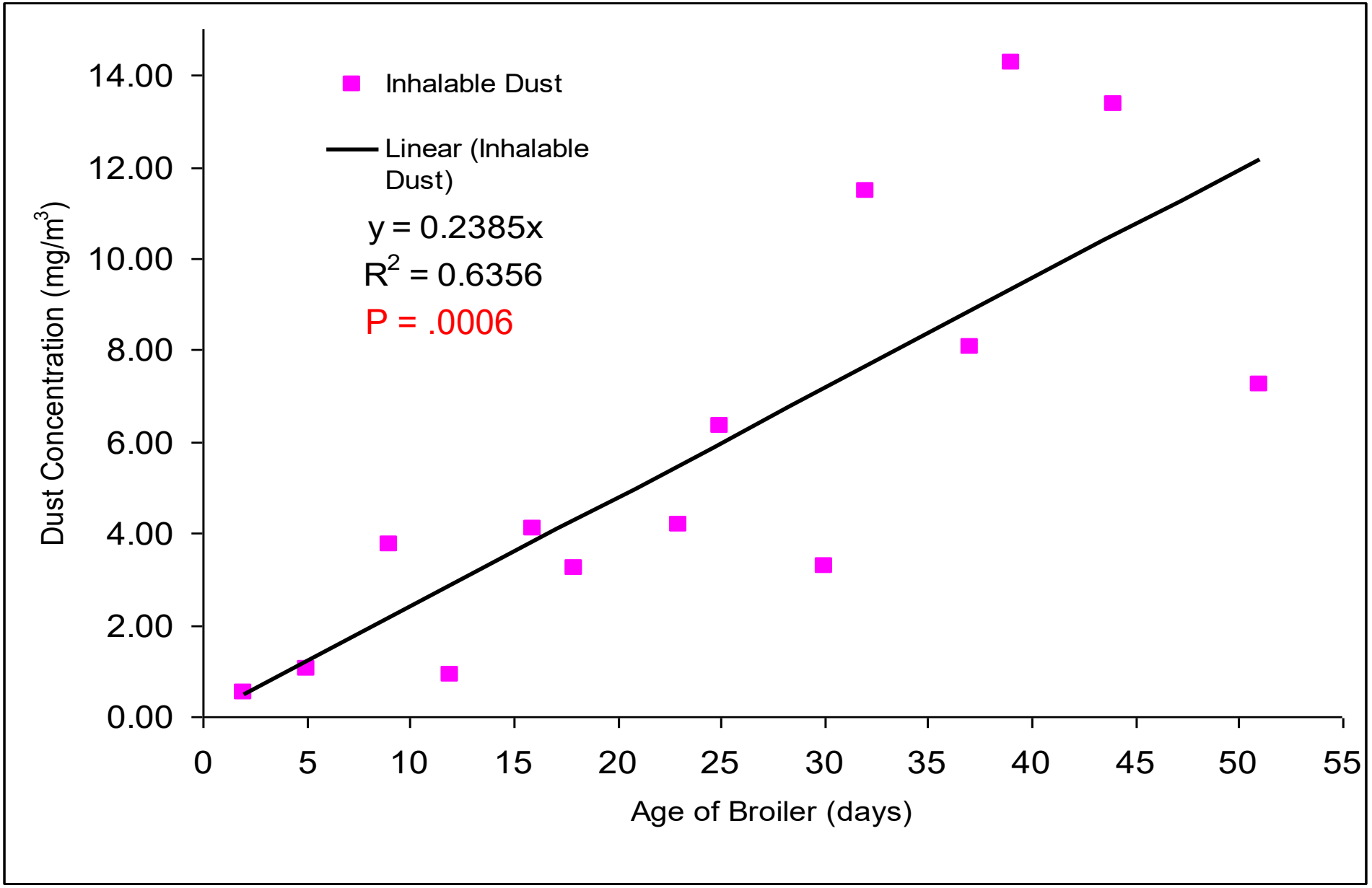
Sampling – What are the dust concentrations?


Inhalable Dust
Linear (Inhalable Dust)
y = 0.2385x
R2 = 0.6356
P = .0006
Dust Concentration (mg/m3)
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0
5
10
15
20
25
30
35
40
45
50
55
Age of Broiler (days)

Task-Based Exposure Assessment – Dead Bird Pick-Up (n=5)

	Inhalable Dust† (Mean, SD)	Inhalable Endotoxin‡ (Mean, SD)	Respirable Dust† (Mean, SD)	Respirable Endotoxin‡ (Mean, SD)
Week 4 (n=2)	15.0 (1.8)	31,423 (12,939)	0.7 (0.1)	593 (208)
Week 5 (n=3)	22.3 (2.4)	43,730 (10,635)	0.7 (0.4)	728 (671)
Combined	19.4 (4.5)	38,811 (11,991)	0.7 (0.2)	674 (491)

†mg/m^3
‡EU/m^3

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Exposure concentrations exceed recommended guidelines and likely OSHA Permissible Exposure Limits (8-hr TWA: 15 mg/m^3 – Total Dust). However, workers may not spend 8-hrs in barns.

WHAT SHOULD WE DO?

Intervention: what should we do?

Engineering

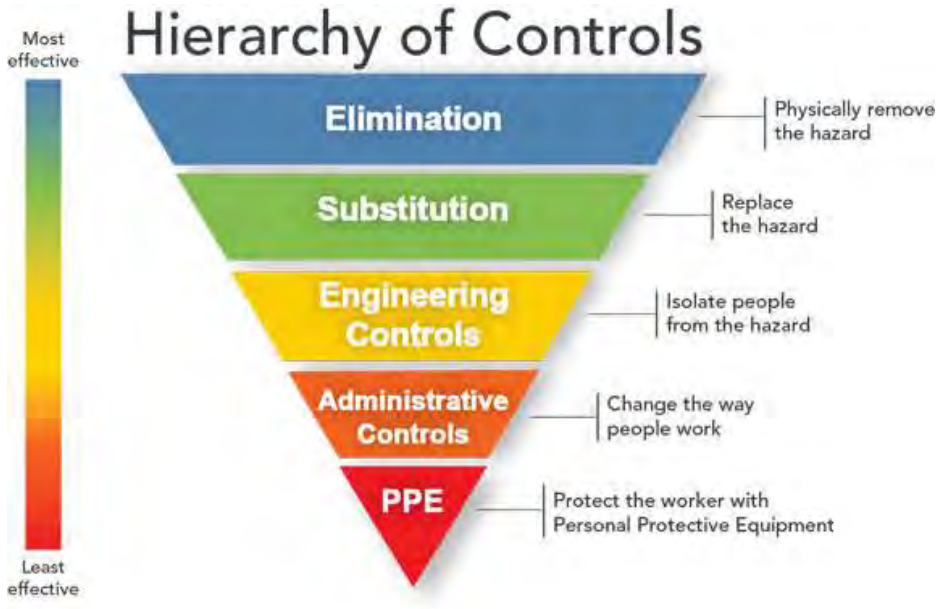
- Litter amendments to reduce dust generation
- More ventilation

Administrative

- Change task to reduce exposure

PPE

- Define barriers to N95 use
- Other respirators
- Other PPE

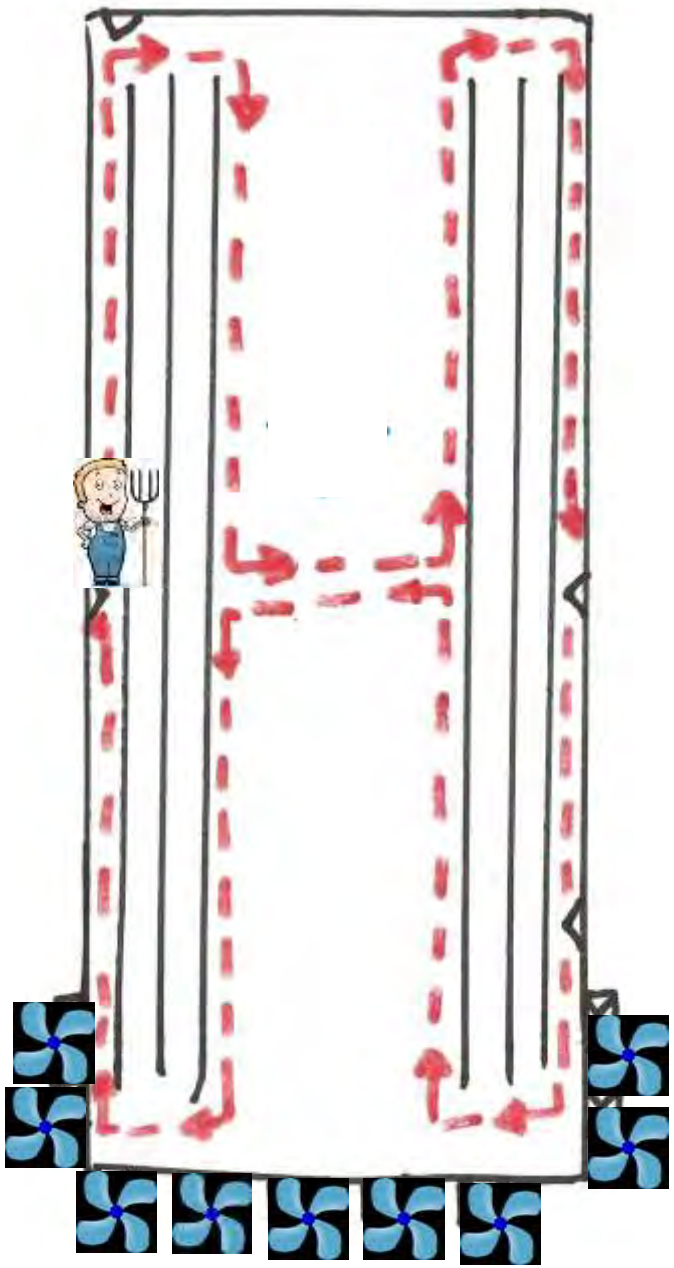


Task-Based Exposure Assessment

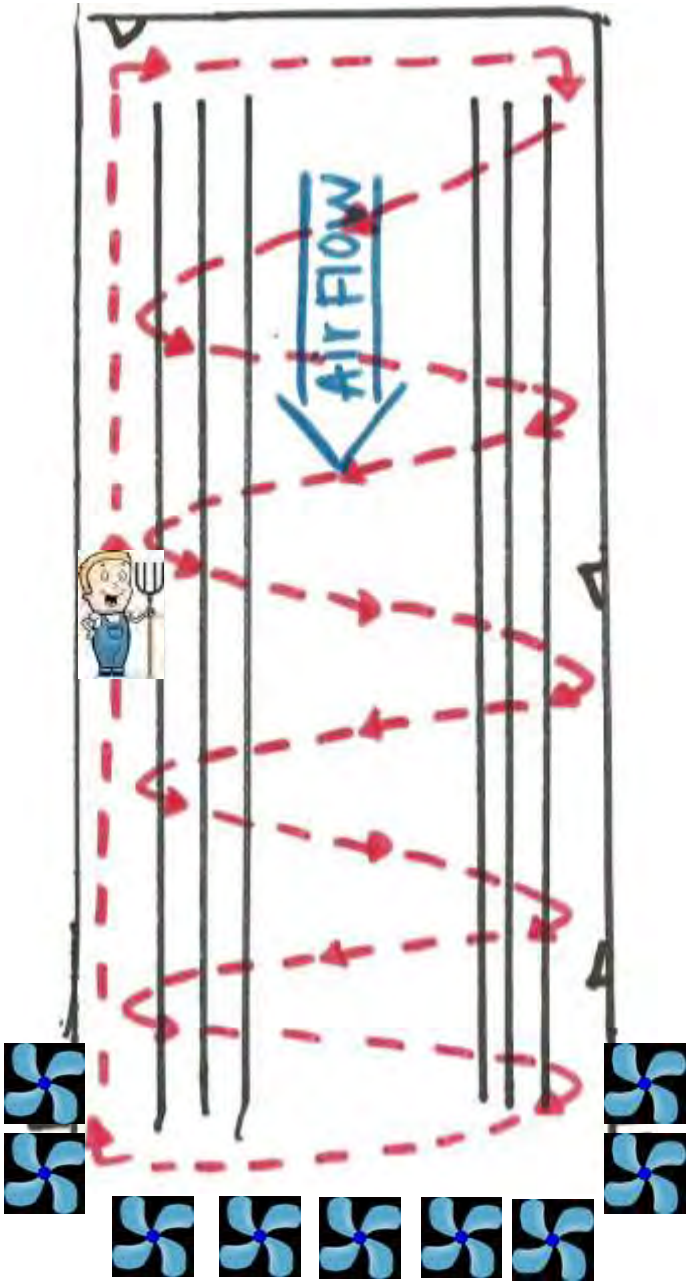
Task - Mortality Pickup - Administrative Control

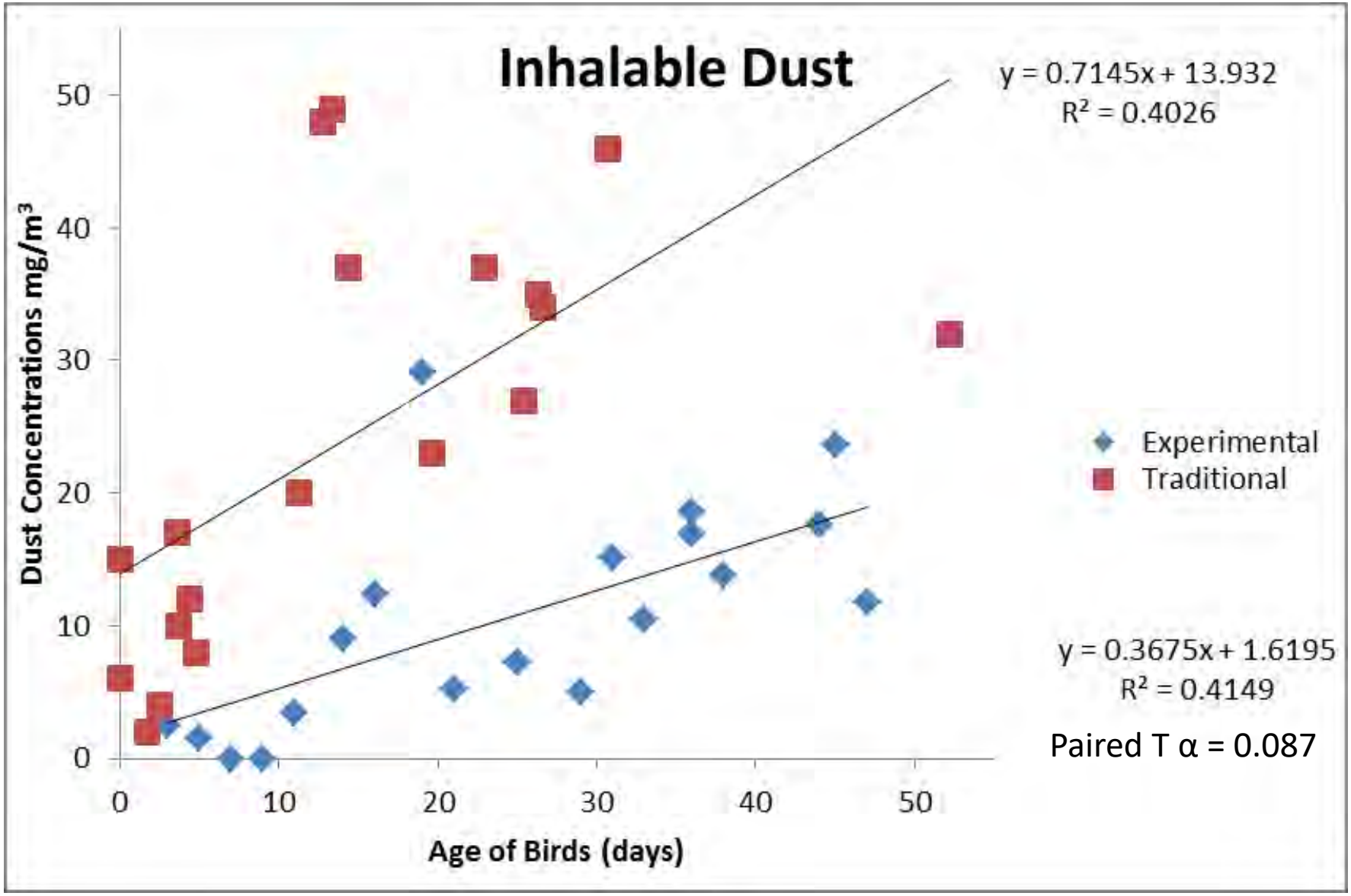
The goal was to alter the approach to the task of “mortality pick up” to experimentally decrease dust exposure during work

Traditional



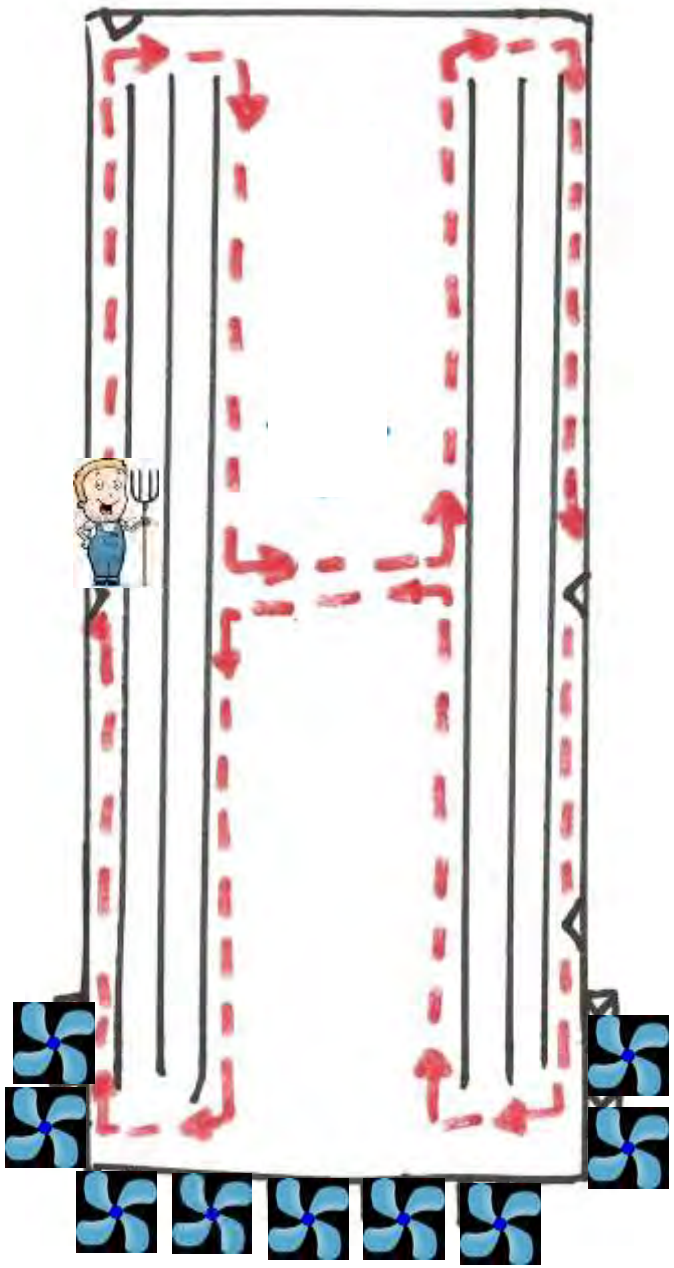
Experimental





Paired T α = 0.087

Traditional



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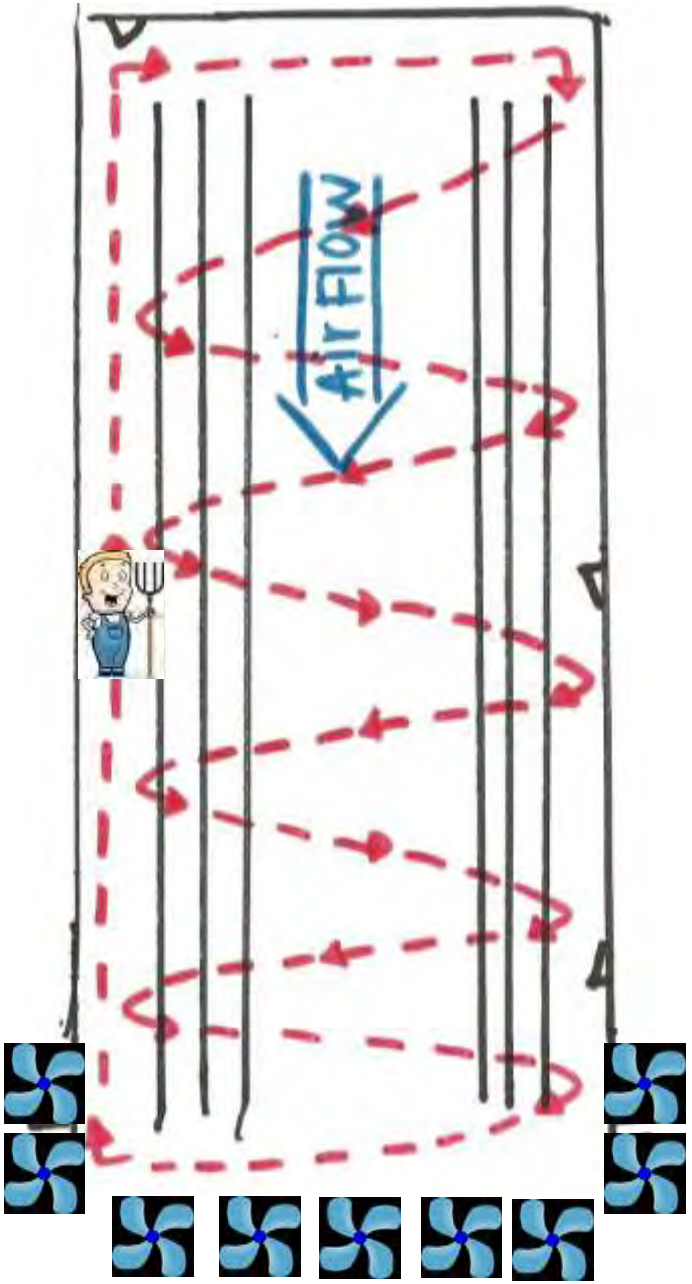

What's next?

- Disseminate information to growers to suggest changing how the task is performed
- Organizing focus groups to evaluate change
- Collect information about the success/failure of task-modification
  - Take longer?
  - Other hazards?
- Try again….other modifications?

Acknowledgements

- Stephen F. Austin State University
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Questions?