



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?



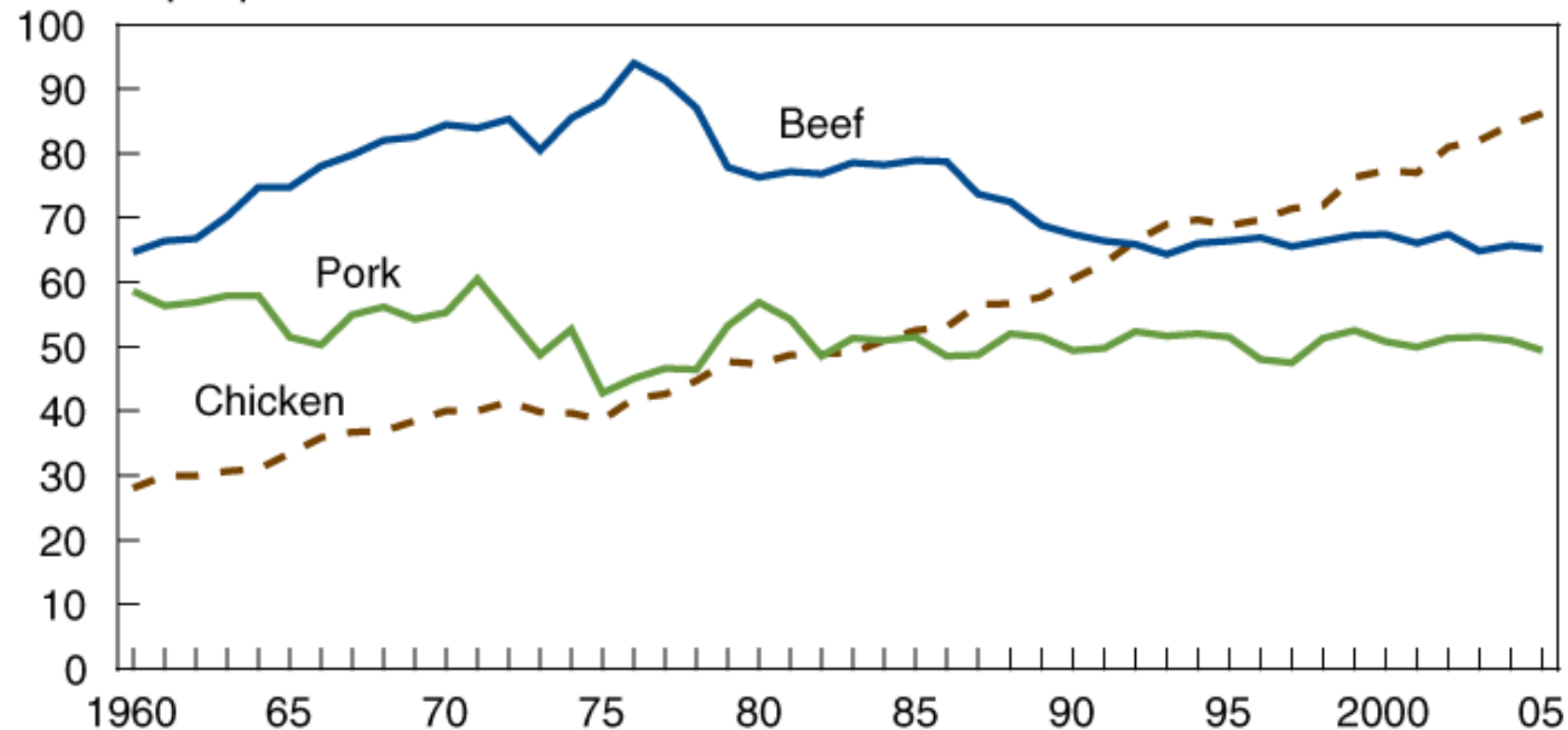
US Chicken Meat Production

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

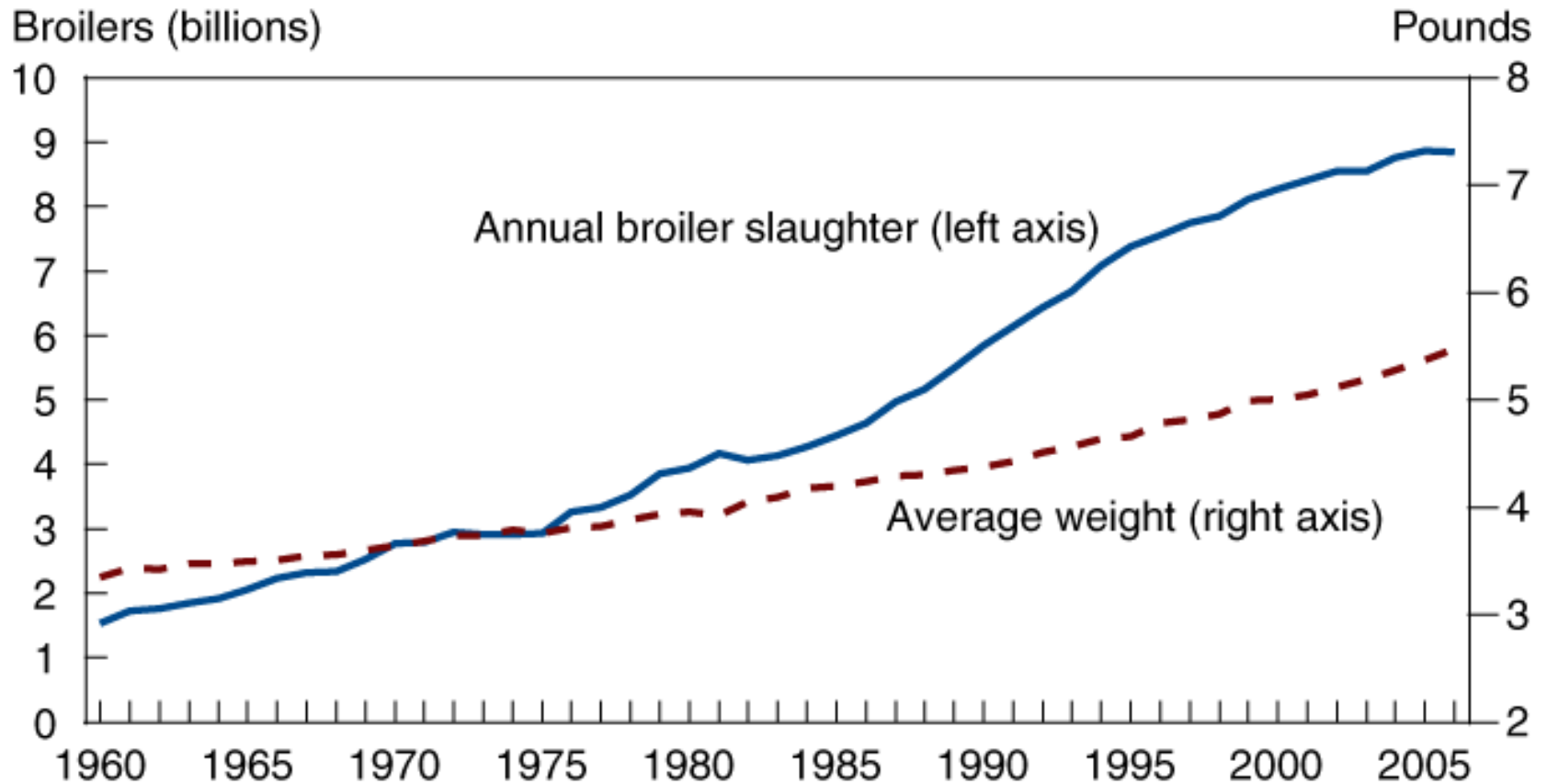
Figure 1

Trends in per capita consumption, 1960-2005

Pounds per person



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

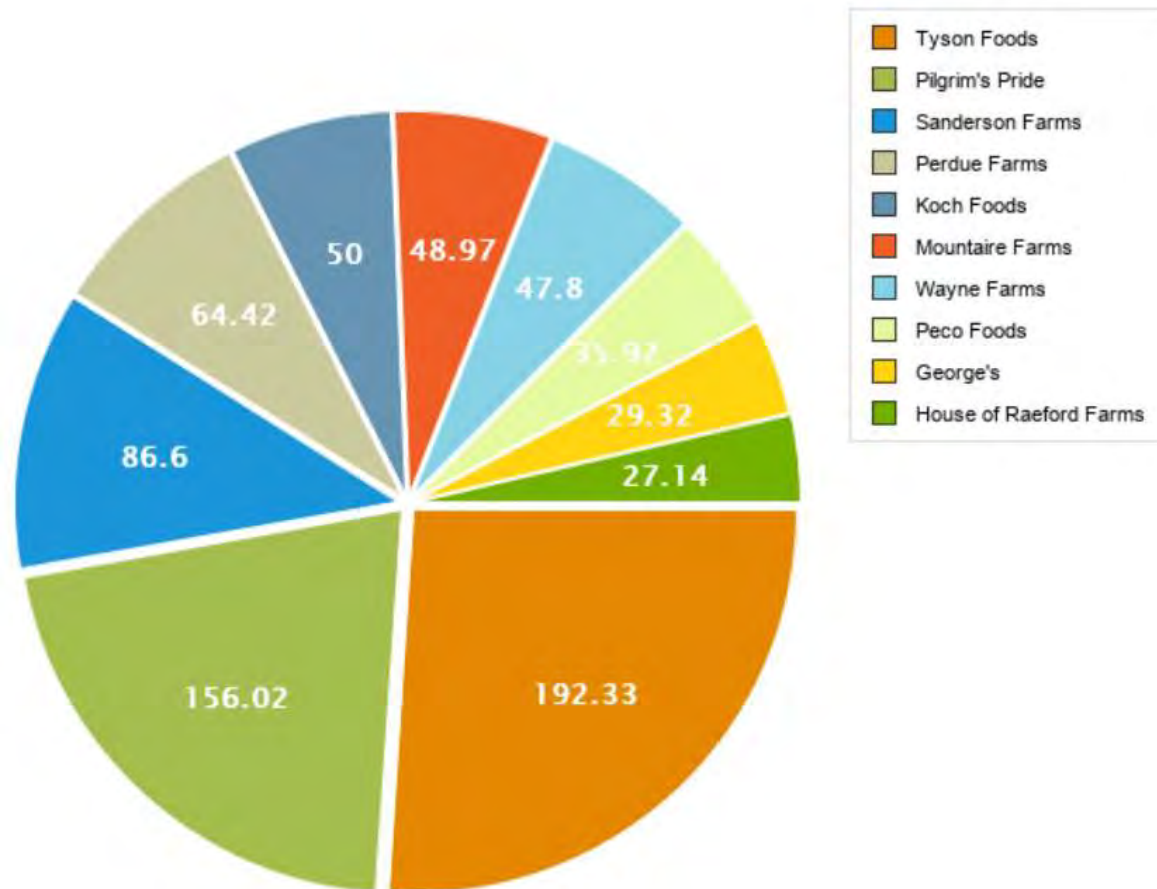
Integrator Companies



- 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

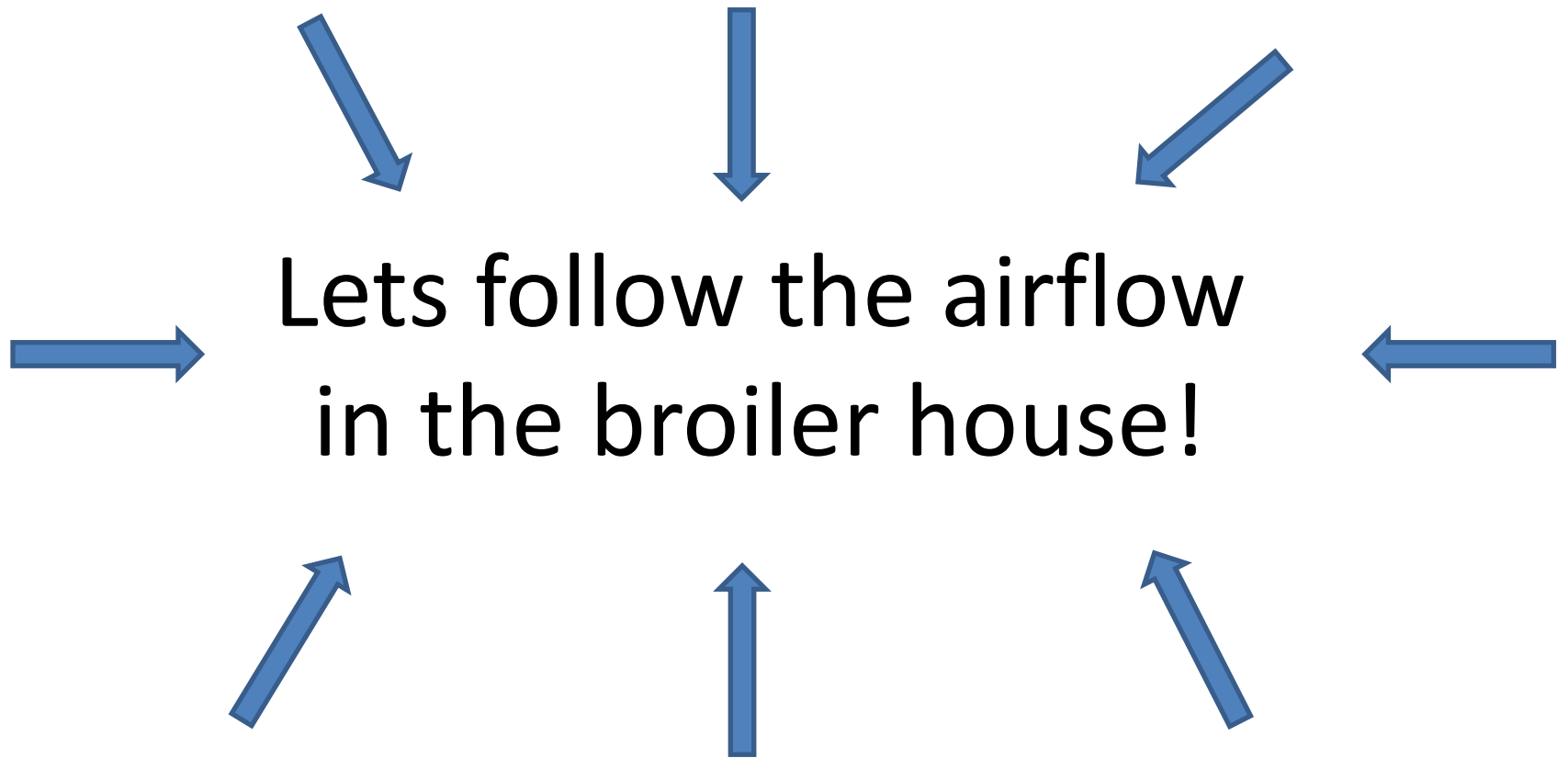


Summary Facts

• 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

Broiler Housing

- Broiler houses are expensive to build
 - \$300,000 per 30,000 ft² 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°C and 42.2°C



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



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

Bedding Cake Out

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



Maintenance



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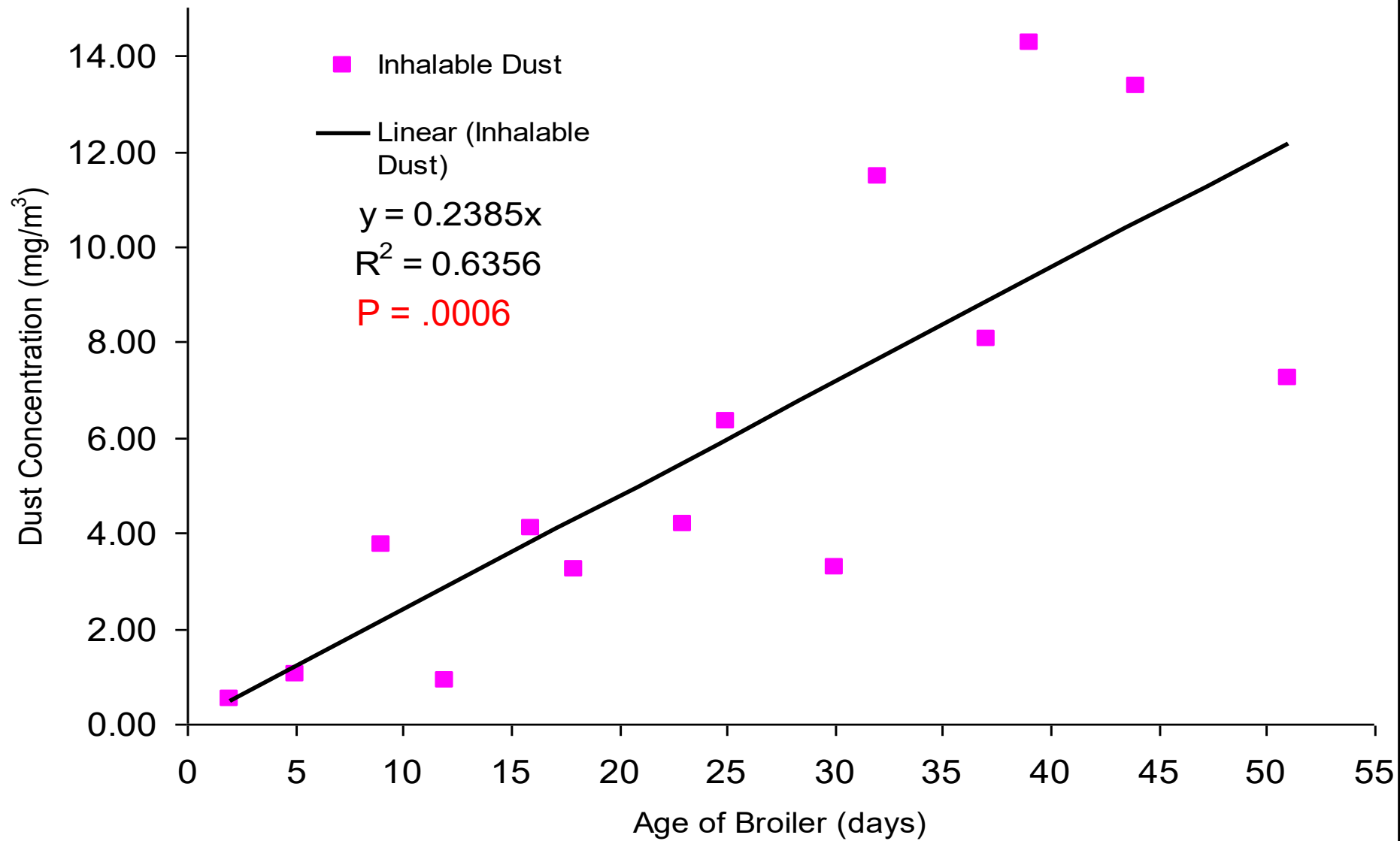
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Sampling – What are the dust concentrations?





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/m³

[‡]EU/m³

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Exposure concentrations exceed recommended guidelines and likely OSHA Permissible Exposure Limits (8-hr TWA: 15 mg/m³ – 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

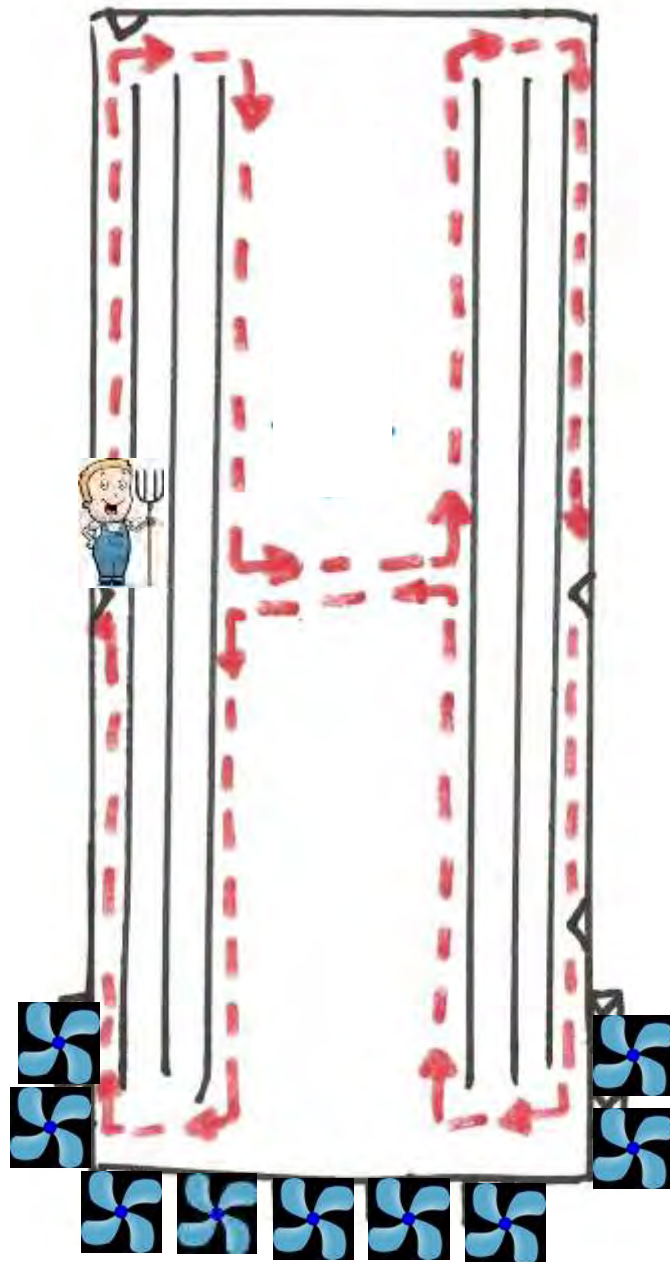


Task-Based Exposure Assessment

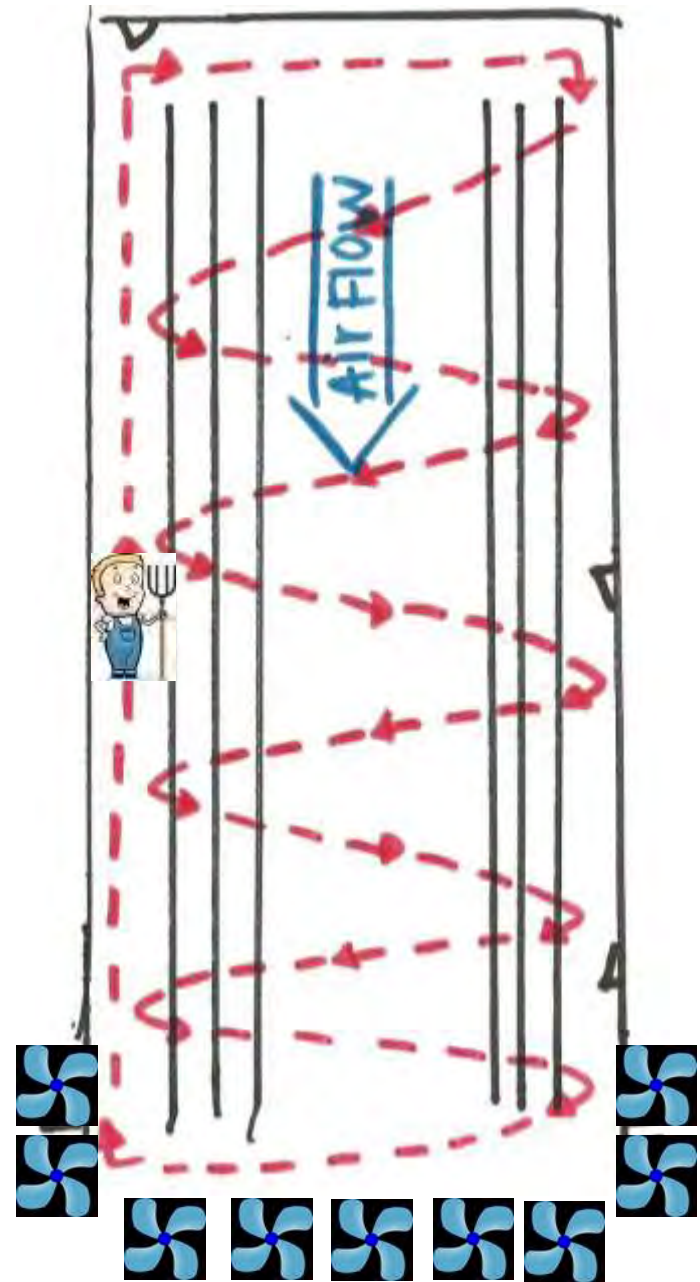
Task - Mortality Pickup -
Administrative Control

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

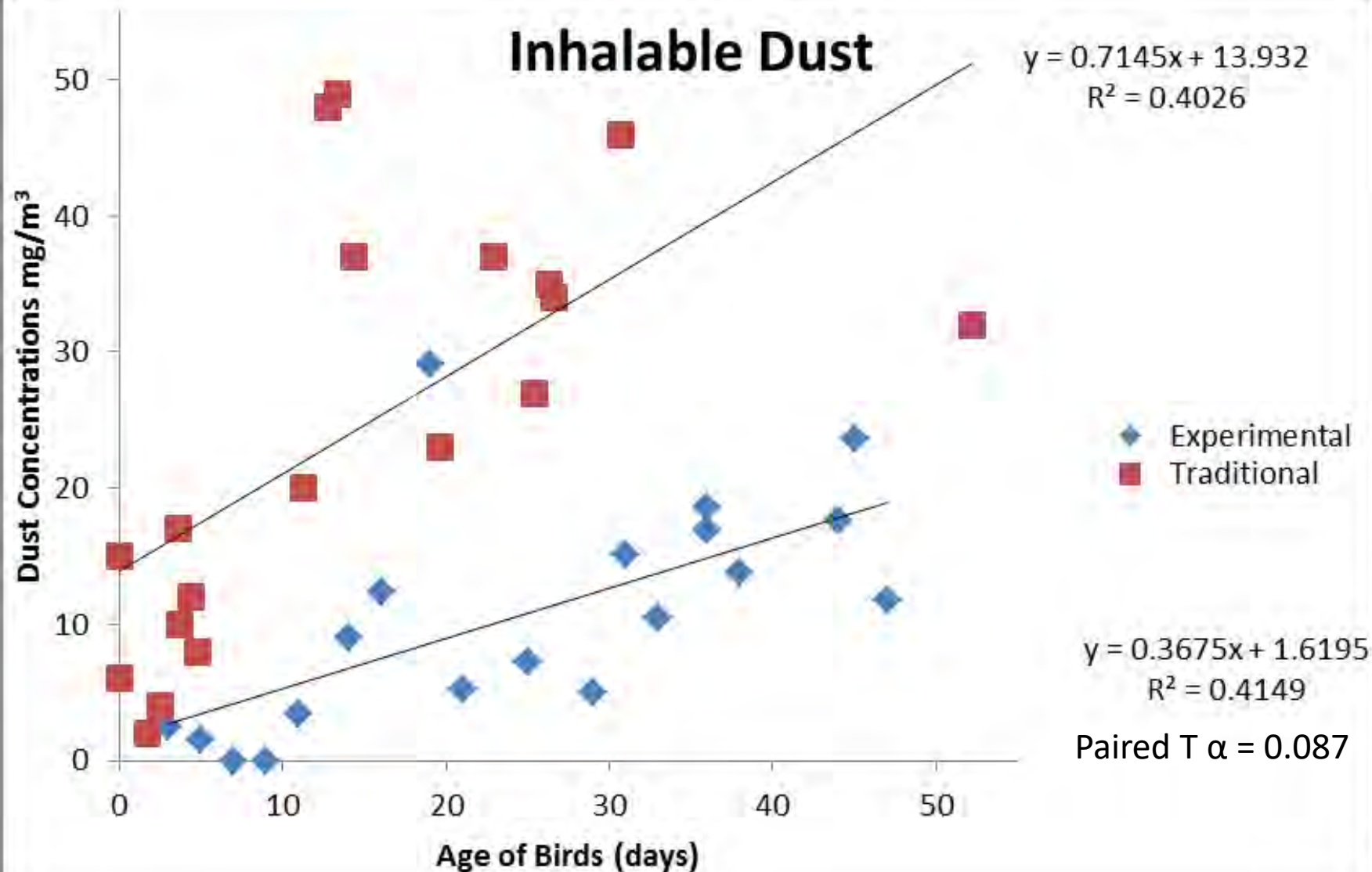
Traditional



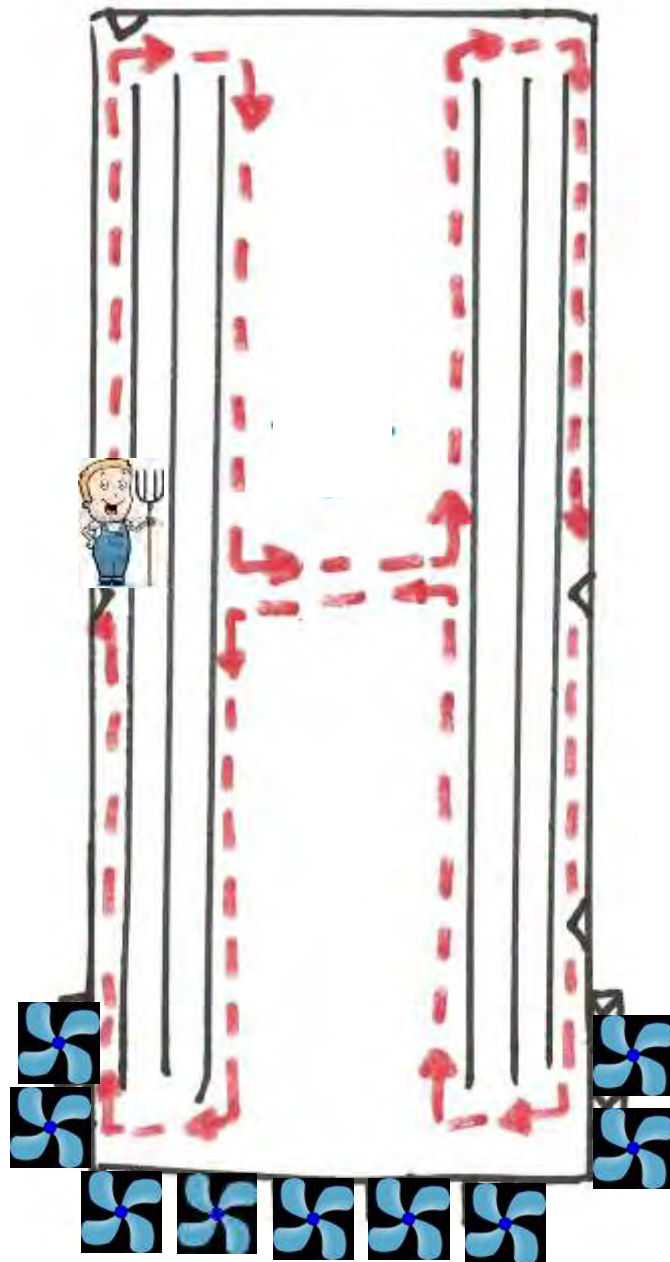
Experimental



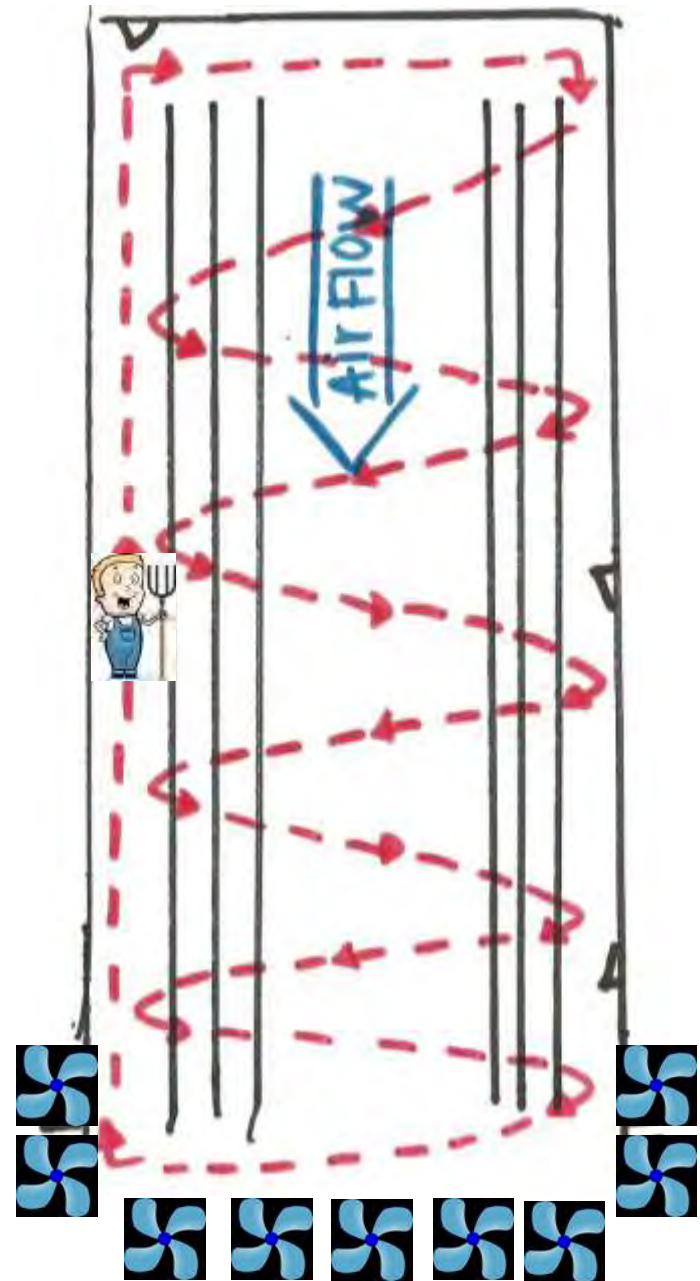
Inhalable Dust



Traditional



Experimental



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

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Questions?