Assessing Poultry House Environments

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Poultry House Environment
- Temperature
- Relative Humidity
- Light intensity
- Carbon Dioxide
- Carbon Monoxide
- Ammonia
- Litter moisture
- Water quality
- House tightness

Data Loggers
- Temperature
- RH
- Light
- Gases
  - Ammonia
  - CO2
  - CO

More data provides more information

Temperature & RH

Temperature
Relative Humidity

Temperature, RH & Airspeed

- Kestrel Wind Meter

Environmental Monitoring: Kestrel Anemometer

<table>
<thead>
<tr>
<th>Price</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
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<td>$70</td>
<td>$100</td>
<td>$150</td>
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Infrared Temperature Gun

- $55

Water consumption and lighting programs

Infrared Camera

- Czarick and Lacy, 2001
Measuring Light intensity

- Angle of light meter
- Straight up
- Light source

Litter Moisture

Collecting Samples

- Trench method

Random Surface Samples

- Weigh ~100g of litter from composite sample
- Dry in oven for 24 h at 120 F
- Weigh dried sample

\[ \frac{(\text{Wet Wt.} - \text{Dry Wt.})}{\text{Wet Wt.}} \times 100 \]

Litter Moisture

- The best way to quickly determine litter condition is to grab a handful near a drinker and squeeze.
  - If the litter clumps together in a ball, it is too wet.
  - If the litter falls apart immediately, it is too dry, creating dusty conditions.
  - If the litter clumps briefly and then crumbles apart, it has the correct moisture content — about 20 to 25 percent

Evaluate Water Quality

- Minerals
  - Fe, Mn, Mg, Ca, SO4, etc...

- Microbe content
  - Total plate count
  - E. coli

- Conduct annually

Static Pressure Test

- Magnehelic Pressure Differential Gauge (Dwyer Model # 2000-00)
  - $75 for gauge
  - $35 for portable kit

- Turn on fan 48” or two 36”
- Conduct 2 or 3 times per year
Use Smoke Emitters

Air Quality

- To manage air quality, gases must be able to be detected and quantified
- Identify problems
- Know when to address problems
- Know if solution is effective

Carbon Monoxide (CO)

Carbon monoxide meters are a useful tool

- Reasonable cost $200 - $300
- Most major instrument manufacturers (Fluke, Extech, Telaire, etc.)
- Google to find these products

Using a carbon monoxide meter

- Check for CO prior to chick placement
- In the morning
- Cold weather
- Check individual brooders

Another useful tool is a carbon monoxide data logger

- Low CO levels may be incorrect conclusions
- Levels are highest when you are not there
Carbon monoxide data logger

- Monitors CO levels on a continuous basis for ...
- Day, week, month(s)
- Downloadable to a PC → easy to produce graphs.

Extremely High CO Concentrations

Acceptable CO Concentrations

To truly determine if Carbon Dioxide is a problem you have to measure it.

- Telaire 7001 ($430)
- Good for spot checking and can be connected to data logger for long term monitoring.

Draw Tubes

- Tubes for multiple gases
  - CO2, CO, NH3, etc..
- Pump = $150
- Tubes = $30/box of 10
Detecting and measuring NH₃

- Produce in the litter
  - More concentrated at bird level
  - Measuring at bird level is important
- Ventilation
- Time of day

NH₃ levels vary throughout the day

Detecting and measuring NH₃

- Smell
  - Humans – 5-50 ppm and above
  - Loose sensitivity over repeated exposure
  - Not able to detect reliably
  - Can not depend solely for bird health

In most cases, if you can smell ammonia, then the levels are probably already too high.

Detecting and measuring NH₃

- Smell
  - In most cases, if you can smell ammonia, then the levels are probably already too high
  - Increase ventilation
  - Monitor relative humidity

Ammonia Measurement

- Hydrion Ammonia Test Paper
- Draw Tubes
- Passive Tubes
- Electric meters
  - Electrochemical
  - Electrochemical combinations

Hydrion Ammonia Test Paper

- Wet a small piece of the paper with distilled H₂O
- Expose it to the air (~15 sec)
- Chemical react in the paper and a color change occurs - compare to chart

- Fairly accurate, but not precise
- Can determine if it is high
- Sampling error
Gas Detection Tubes

- Most common
- Requires pump
- One point in time
- Accuracy can be variable
  - Sampling errors
  - Errors in reading
- Tubes intended for single measurement
  - Multiple measurements can be done

Passive Dosi-Tube

- Time weighted measurement of ammonia
- No pump is required
- Accuracy can vary
- Price will limit use

Electric Ammonia Meters

- Electrochemical
  - Most common
  - Can be very accurate
- Disadvantages
  - Environment
  - Calibration
  - Cost
- Electrochemical combinations

Electric meters – continuous monitoring

![Graph showing Ammonia Concentrations](chart.png)

- Ammonia (ppm) over time
- Data points marked by color

UGA Electrostatic Study

![Image of Electrostatic Study equipment](image.png)

Ritz et al., 2004
Measuring Ammonia Accurately
- More accuracy and sensitivity
- Requires more expensive equipment
- All ammonia sensors saturate
  - Depends on:
    - Concentration
    - Exposure time

Draeger CMS Analyzer
- Draws air sample through chip
- Provides a numerical reading

Photoacoustic Analyzer
- Uses combination of infrared light and sound to detect gases
- High sensitivity
- Expensive
  - $42,000

Gas Washing Bottles
- NH₃ trapped in Sulfuric Acid
- N content analyzed by spectrophotometer
- Time weighted average
- Accuracy & sensitivity good
- Labor intensive
  - Approximately $15 per sample

Ammonia Detectors

Poultry Ammonia Sensor
Ammonia Measurement

- Be aware of the limitations for each method
- Be aware of potential for errors
  - Improper equipment use
  - Ventilation status
  - Instrumentation in need of maintenance
- Litter condition
- Relative humidity

Any Questions?

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