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Poultry Housing Tips

Running timer fans prior to chick placement

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Do you wait until your chicks arrive before turning on your timer fans? On the surface this seems like a good idea. After all, what purpose do timer fans serve when there are no chicks in the house? But, a recent air quality survey of houses prior to chick placement has indicated that ventilating during preheating is a necessity from a safety standpoint.

Heating systems that burn propane or natural gas in residences, unlike poultry houses, heat the air in the house indirectly. That is, the hot air produced by the burner flows over a coil (heat exchanger), through which air from inside the house is being circulated. The heat exchanger allows the air inside the house to be heated without introducing any of the potentially toxic gasses produced by the burning of propane or natural gas.

Furnaces and brooders in poultry houses are of course quite different. The hot air produced by the burning of propane/natural gas, as well as the combustion gasses go directly into the house. If a poultry house is properly ventilated, the fact that combustion gasses are being exhausted into the house does not present a serious problem. But, when houses are not ventilated, it can be a different story.

Burning a gallon of propane requires 50 cubic feet of oxygen (250 cubic feet of air), and produces 108 cubic feet of carbon dioxide and nearly a gallon of water, in addition to approximately 92,000 Btu's of heat. If the brooder or furnace is properly maintained, very little to no carbon monoxide is generated. During cold weather, over 50 gallons of propane may be burned over a 24-hour period to maintain a house temperature of 90^{O}F. Theoretically, if there were no fresh air coming in the house, over 10% of the oxygen in the house would be consumed and more than 5,000 cubic feet of pure carbon dioxide would be added to the air in the house each day. Making matters worse is that though very little carbon monoxide is produced by a properly maintained brooder or furnace, many are not properly maintained and, as a result, produce a significant amount of carbon monoxide. One indicator that your heating system may be producing carbon monoxide is a yellowish flame or the presence of soot on a brooder or furnace. But, be aware that carbon monoxide can be generated even by a brooder/furnace that appears to be producing a quality flame.

In the past, the build-up of combustion gasses was not a likely problem because most broiler houses were very loose. Just the slightest wind could easily bring in thousands of cubic feet of fresh air each minute. But what about today? A significant effort has been made over the years to increase the tightness of our houses to reduce heating costs as well as make them cooler during hot weather. The fact of the matter is that in many houses today, unless there are fans running, there is essentially no fresh air entering the house.

Recently a brief study was conducted of carbon dioxide, carbon monoxide, and oxygen concentrations in broiler houses which were preheating without ventilation. Farms studied were preheated at least 24 hours prior to taking gas measurements. Measurements were taken in the center of the brooding area one foot above the floor. Though the findings are preliminary, they do provide reason for concern and caution. A brief explanation of possible health effects and findings are provided below.

Carbon Dioxide:

Carbon dioxide (CO_2) is a colorless, odorless, nonflammable gas which is a product of normal respiration and fuel combustion. This gas has been reported to cause myriad effects on health that include but are not limited to increased respiratory rate, elevated blood pressure, sleepiness, headache, convulsions, difficulty in breathing (dyspnea), suffocation (asphyxia), sweating or unconsciousness. For CO_2, the maximum eight-hour exposure limit is 5,000 ppm and the maximum 15 minute exposure is 30,000 ppm (OSHA). Studies have shown exposure to 50,000 ppm of carbon dioxide for 15 minutes can result in signs of intoxication. The concentration of carbon dioxide in outside air is approximately 350 ppm.

Carbon dioxide concentrations in the broiler houses studied ranged from a low of 3,000 ppm to nearly 10,000 ppm, thus indicating when exhaust fans are not run during preheating, spending prolonged periods of time in a house may have adverse health effects.

Carbon Monoxide:

Carbon monoxide (CO), the more serious of the three gases measured, is a colorless, odorless gas that is a product in engine exhaust and can be produced by gas furnaces and appliances that do not get adequate air. Where CO_2 is normally found in respiration, CO is a poisonous gas and can be fatal. CO has greater than a 200 fold binding affinity for blood hemoglobin, the protein that transports oxygen through blood. Thus CO can prevent transport of oxygen from the lungs to body tissues. Effects of CO inhalation include nausea, dizziness, mental confusion, drowsiness and headache followed by unconsciousness, respiratory failure and death. For CO, the eight-hour exposure limit is 50 ppm and the maximum recommended 15 minute exposure limit is 200 ppm (OSHA). Research has shown a prolonged exposure to 200 ppm can result in a mild head ache, 400 ppm will lead to a headache in about two hours, and 800 ppm carbon monoxide can result in a headache in 45 minutes, nausea, collapse, and unconsciousness in two hours.

CO Level (ppm)	Exposure Time	Signs and Symptoms
200	2 - 3 hours	Mild headache
400	1 hour	Headache, muscle weakness, and nausea
800	45 minutes	Headache, dizziness, and nausea
1300	45 minutes	Cherry-red colored skin violent headache
1600	30 minutes 2 hours	Headache, dizziness, nausea Irreversible damage - death
2000	1 hour	Irreversible damage - death
3200	5 - 10 minutes 30 minutes	Immediate headache - dizziness Irreversible damage - death
6400	10 minutes	Irreversible damage - death

Table 1. Carbon Monoxide levels and effects upon human health

While the carbon monoxide levels in most houses visited were well below the eight-hour exposure limit of 50 ppm, on one farm the carbon monoxide level was approximately 100 ppm in one house and 200 ppm in a second. Clearly the cause of the high carbon monoxide was poorly maintained brooders. The brooders produced a very yellow flame and there was a significant amount of soot accumulation on the brooder hover. The brooders were in obvious need of cleaning and maintenance.

This does not mean that a brooder/furnace that appears to be producing a quality flame is not producing carbon monoxide. Recently, a pullet vaccination crew working in a house in the Midwest complained of headaches and nausea. The fire department came out and measured carbon monoxide concentrations of between 400 and 600 ppm. A few years ago a poultry house worker in the southeast fell asleep in a house waiting for chicks to arrive. The next morning when the chick bus arrived he was found to be in a coma. Luckily he recovered. The fact is that in both cases the brooders/furnaces appeared to be burning properly, but minimum ventilation fans were not running at all or at an extremely low rate.

Oxygen:

The normal level of oxygen in outside air is approximately 20.5%. Environments with oxygen concentrations below 19.5% can have adverse physiological effects. At oxygen concentrations of 17% or less, faster deep breathing will occur. Prolonged exposure could result in dizziness, rapid pulse and loss of consciousness. Depending on the length of exposure time and the oxygen concentration, prolonged exposure could become a health hazzard.

Oxygen Level	Signs and Symptoms
20.5	
19.5	Minimum OSHA level
17	Faster, deeper breathing
15	Dizziness, buzzing in ears, rapid pulse
13	Loss of consciousness with prolonged exposure
9	Fainting, loss of consciousness
7	Life threatening
6	Convulsions, death

Table 2. Oxygen level and effects upon human health

Oxygen levels on farms visited ranged between 20.5 and 19.5 percent. Oxygen levels in this range would not have any adverse affects upon human health.

Though only a few farms had significant air quality problems, it is important to keep in mind that the measurements were taken on fewer than a dozen farms during relatively mild winter weather. A few farms out of only a dozen farms is a significant percentage. Furthermore, had it been colder when brooders/furnaces were operating at a higher level or had the houses been tighter, the concentration of gasses could have easily been higher.

It is also important to keep in mind that though individually, the concentration of carbon dioxide, carbon monoxide, and oxygen were a marginal problem on the majority of the farms, it is likely that the combination of the high gas levels with slightly low oxygen levels could have a much greater adverse effect. For instance, a carbon dioxide level of 5,000

ppm alone may not be of serious concern, but when combined with a slightly elevated carbon monoxide level and slightly decreased oxygen levels, potential adverse health effects are likely to be increased. Furthermore, ammonia levels were not measured on the test farms they were high, which brings up the question: What effect would high ammonia concentrations have on the situation?

The good news is that the problems associated with gas build-up during brooding can be easily avoided. First, make sure you are maintaining your brooders/furnaces according to the manufacturer's recommendations. Have your gas pressure checked to make sure that your brooders/furnaces are receiving the proper pressure so that they will burn efficiently. Most importantly **run your timer fans during preheating!** It typically doesn't take much. Probably the same or a little less than you would run on day-old birds (i.e. two 36" fans, 30 seconds out of five minutes). Yes, you will use a little more gas during preheating, but it is money well spent.

One last word of caution. Don't think that if you turn your exhaust fans on just prior to entering the house that you will eliminate any potential hazzard. Depending on how much your minimum ventilation fans are operating, it could take **hours** to bring carbon dioxide and monoxide concentrations down to acceptable levels.

Bottom line, any time that people or birds are going to be in a poultry house, the minimum ventilation system should be operating.

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