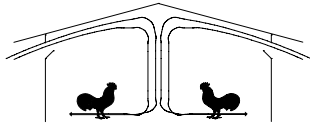




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Poultry Housing Tips

Carbon Monoxide Measuring and Monitoring

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Figure 1. Carbon monoxide meter

Carbon monoxide is a colorless, odorless gas that is produced by brooders and furnaces when they are not operating properly that can lead to sickness and death for both humans and poultry. The reason that carbon monoxide is so dangerous is because it has a 200 time greater binding affinity for blood hemoglobin, the protein that transports oxygen through blood, than does oxygen. Thus carbon monoxide can prevent transport of oxygen from the lungs to body tissues.

The effects of carbon monoxide inhalation in humans include nausea, dizziness, mental confusion, drowsiness and headache followed by unconsciousness, respiratory failure and death. The OSHA eight-hour exposure limit for carbon monoxide is 50 ppm and the maximum recommended 15 minute exposure limit is 200 ppm. Research has shown a prolonged exposure to 200 ppm can result in a mild headache, 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 (Table 1).

Though very high levels of carbon monoxide can also cause mortality problems in poultry houses (Table 2), what is more likely to be a problem are relatively low levels which can occur during brooding when heating systems are operating long hours and ventilation rates are typically very low. At no time does a bird grow faster than during the first few weeks of its life. During the first ten days of a chicken's life its weight will approximately triple. To support this rapid rate of growth, a young chick has to take in a lot of oxygen. When carbon monoxide is present even in relatively low levels, it can restrict a chick's uptake of oxygen thus leading to performance issues. To avoid problems, it is generally recommended that carbon monoxide levels should kept well below 50 ppm with some experts recommending below 10 ppm.

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Because of the serious potential for both human and bird health problems, carbon monoxide is an air quality variable that producers should be on the look out for. One method of checking for the presence of carbon monoxide is to install a residential carbon monoxide alarm during brooding. Most units are designed to sound an audible alarm if carbon monoxide levels are too high. They are typically set to alarm based on the UL Standard 2304: 70 ppm for between 60 - 240 minutes, 150 ppm (10 - 50 minutes) or 400 ppm (4 -15 minutes). Though the standard was developed for residential carbon monoxide alarms, it should be applicable to poultry housing. The advantage of this type of unit over other measuring devices is that they can be purchased at about any hardware store and are relatively inexpensive. The disadvantages are they do not provide an actual read out of the carbon monoxide concentration which is very valuable in diagnosing a carbon monoxide problem and may not be suited for longtime use in poultry houses.

Carbon monoxide (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

Carbon monoxide (ppm)	Exposure Time	Signs and Symptoms
70	-	Linked to high incidence of ascites
600	30 minutes distress	Headache, muscle weakness, and nausea
3,000	1 ½ - 2 hours	Lethal

Table 2. Carbon monoxide levels and effects upon poultry

Another option is to use a handheld carbon monoxide meter. A carbon monoxide meter can be purchased for between \$200 and \$300 and provides a nearly instantaneous measurement of carbon monoxide levels in a house. One of the biggest advantages of a meter over a residential alarm is that you can evaluate the level of carbon monoxide in different areas of the house. Furthermore, if you find you have a high level of carbon monoxide you can track down the brooders/furnaces which are the source of the carbon monoxide.

It is important to realize that carbon monoxide is not necessarily a ventilation problem...it is often a maintenance problem. Increasing ventilation rates may not solve a carbon monoxide problem because the more you ventilate during cold weather, the more the heating system will operate, the more carbon monoxide the heating system will produce. The solution of course is to keep carbon monoxide from being produced in the first place, which brings us to brooder/furnace maintenance. The fact is a properly maintained brooder, operating at the proper gas pressure, produces very little if any carbon monoxide.

The most common signs that you may have a problem with carbon monoxide are soot on the brooders and yellow flames, both of which are indicators of incomplete combustion of propane/natural gas (Figures 1 and 2). Improper combustion of propane/natural gas can be caused by things such as worn out gas orifices, improper gas pressure, or dirty air filters.



Figure 2. Soot covered brooder.

Another very useful tool in uncovering a potential carbon monoxide problem is a carbon monoxide data logger (\$240 + software). These devices can be placed in a house and be programmed to measure carbon monoxide concentrations every minute or two for an entire flock (Figure 3. www.onsetcomp.com). The data can then be downloaded and graphed to see if/when carbon monoxide was a problem. As can be seen in Figure 4, carbon monoxide is highest late at night when heating systems tend to operate the most and managers are not likely to be present to measure carbon monoxide levels with a hand held meter.



Figure 3. Carbon Monoxide data logger.

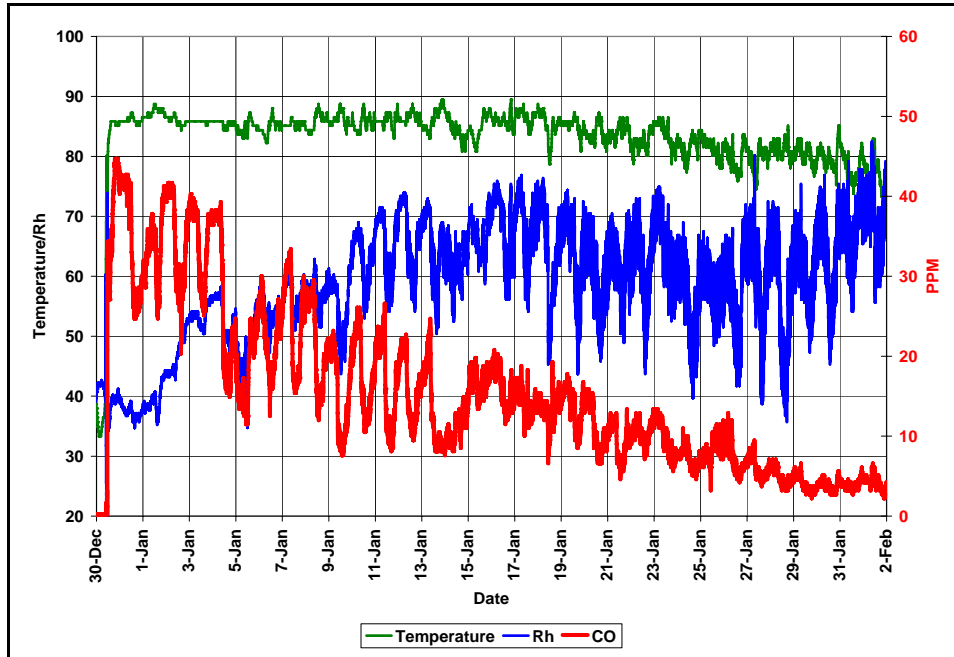


Figure 4. Temperature, relative humidity, carbon monoxide graph from turkey brooder house.

If you find you have a carbon monoxide problem contact your local poultry equipment dealer to get help in solving the problem. The manufacturer of your brooder/furnace can also provide useful information on the proper maintenance of your heating system as well as things that may be causing your carbon monoxide problem. If you track down your carbon monoxide problem to a specific brooder(s) or furnace it would be best not to use them until they have been repaired. High carbon monoxide levels should not be taken lightly.

Carbon monoxide is a very dangerous gas. One of the things that makes it so dangerous is that because it is colorless and odorless it is basically impossible to determine if you have a problem unless you have a tool that can measure it. With a carbon monoxide meter and/or data logger a producer can not only determine if carbon monoxide is a problem but track down the source of it as well.

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