

CAFOs

Concentrated Animal Feeding Operations

PUBLIC HEALTH

CAFOs and Public Health: *Odor and its Possible Health Effects*



Paul Ebner
Animal Sciences

Odors associated with livestock manure are foremost among complaints made by individuals who live in the vicinity of concentrated animal feeding operations (CAFOs). While some view these odors as nothing more than a nuisance, others are concerned that livestock odors could potentially affect their health. The purpose of this paper is to discuss how odor is created and recent research examining the possible effects of livestock odors on human health.

What is odor?

Livestock odors by and large generate from manure. While there are numerous odorous compounds associated with manure, namely, ammonia, hydrogen sulfide, alcohols, among others, no single compound is responsible for the overall odor. Rather, odors associated with livestock manure result from a combination of dozens, if not hundreds, of airborne compounds.

These compounds can act synergistically to produce an odor that is actually more intense than what would be expected from the sum of the individual compounds present. This is an important point as several recent studies have shown that the actual concentrations of toxic compounds associated with CAFO emissions found at residences surrounding CAFOs (e.g., hydrogen sulfide and ammonia) are much lower than concentrations thought to impact human health^{1,2,3}. It appears that in most cases, individuals are able to detect odor and recognize it as offensive even though there is not likely to be an appreciable amount of specific toxins in the air.



How are humans affected by odor?

Humans instinctively react to odor whether the odor is pleasant or offensive. The most common reaction is a disturbance in mood. For example, agreeable odors can induce feelings of relaxation and pleasure while offensive odors can induce feelings of anger, or even fatigue. Since odors can cause quantifiable increases in measurable stress responses such as blood pressure and blood sugar levels, the effects of odor on mood disturbances are not entirely psychological⁴.

It is not surprising that the popular press often contains anecdotal reports of what would be considered mood disturbances, such as anger and anxiety in individuals who are consistently exposed to livestock odors. At this time, only a very small number of studies have studied livestock odors and mood disturbances in CAFO neighbors in a more scientific manner. One of the most often-cited studies was conducted by a group from Duke University. They examined odors generated by a large confined pork operation and concluded that some individuals living in the vicinity of the farm

This publication is one title in the *Concentrated Animal Feeding Operations* series.

To view the entire series, visit <<http://www.ansc.purdue.edu/CAFO/>>.

Purdue Extension
Knowledge to Go
1-888-EXT-INFO

did, in fact, experience some higher levels of tension, depression, anger, fatigue, confusion, and less vigor⁵. It is important to note, however, that this is only one study and other confirmatory studies are not available. Therefore, it would be premature and inappropriate to broadly extrapolate its findings to livestock production in general.

Can odor make us sick?

In rare cases, reactions to offensive odors can actually result in physical symptoms. Such ailments are said to be annoyance-mediated. That is, the physical symptoms of illness are a result of a psychological reaction to odor and not any toxin-mediated irritation. For instance, individuals exposed to irritating odors may report headaches, nausea, and irritation of the eyes, nose, and throat and other self-reported physical symptoms⁶.

Therefore, humans can respond both mentally and physically to unpleasant odors. The two types of reactions, however, may not be mutually exclusive. In fact, one study examining odors associated with a hazardous waste site described the relationship between worry (a mood disturbance) and physical symptoms such as headaches, and eye and throat irritations as one where physical and psychological effects of the irritating odor acted synergistically to produce overall reactions⁷.

What about livestock odors?

A few studies (references 8-10) have documented respiratory ailments in CAFO neighbors. In each study, the symptoms reported by the affected individuals were self-reported symptoms such as headaches, nausea, itchy eyes and throats, among other symptoms. These symptoms are usually considered separate from more objective measurements such as decreased lung capacity, blood parameters, and inflammation, although they are not considered less real. Nevertheless, in each study objective measurements were not affected in CAFO neighbors.

The fact that neighbors regularly report mood disturbances in response to odor coupled with respiratory ailments being largely self-reported or perceived indicates that the two reactions are possibly interconnected in that respiratory ailments may be largely annoyance-mediated, i.e. resulting from the reaction of exposed individuals to irritating odors and not specific toxins.

If so, concentrating on odor abatement and proper setbacks of the livestock farms could eliminate many of the problems cited by CAFO neighbors.

Methods to Reduce the Impact of Odor on Neighbors

Knowing some basic facts regarding why odor causes negative reactions and designing facilities and setbacks with these facts in mind could go a long way to reducing complaints of CAFO neighbors. For instance, the frequency of odor incidents over time is the most important factor in determining an individual's reaction to an odor with complaints increasing with frequency of exposure⁶.

Intensity and duration are also very influential as irritation increases with time regardless of acclimatization. The perceived offensiveness of the odor also plays a large role as mood disturbances and health problems correlate with the perception that the offending odor is unhealthy as is seen with second-hand smoke⁶.

Other factors influencing reactions to odor include sex, coping style, and age, among others. Females generally have lower odor thresholds while males respond more aggressively to irritating odors. Likewise, individuals with problem solving coping skills report increased annoyance to irritating odors while those with avoidance coping skills report the opposite⁶. This indicates that the factors behind reactions to odors are complex and can vary greatly from person to person.

Researchers, including those at Purdue, are currently examining different options for limiting the amount and types of odor emanating from livestock facilities. Some management practices that can reduce odor are included below (reviewed in depth in reference 11). Note that not every practice is appropriate for all types of livestock and all types of production systems and some methods are not yet affordable to the majority of producers.

1. Regularly remove manure from buildings.
2. Keep manure dry (not possible in many production systems).
3. Keep buildings and floors clean and dry.
4. Use bedding instead of liquid manure removal systems (not possible in many production systems).
5. Employ biofilters (very high initial and maintenance costs).

6. Cover manure storage systems.
7. Plant odor-absorbing trees around manure storage sites.
8. Avoid overly wet and/or anaerobic systems.
9. Avoid longstanding stockpiles of manure.
10. Immediately incorporate manure when added to cropland.
11. Compost manure (not possible in many production systems).
12. Employ anaerobic digesters (very cost prohibitive).
13. Establish sufficient distance between manure storage sites and neighbors.
14. Coordinate manure spreading with neighbors schedule to avoid disruption of outdoor activities.
15. Be aware of prevailing summer wind conditions when planning activities such as mixing or removing manure from a storage and when choosing a land application site for the manure.
16. Check diet formulations to reduce nitrogen excretion and odors.

Conclusions

Odor is a very complex issue with many factors dictating why certain odors are more or less offensive to different individuals. What is clear is that neighbors of CAFOs can complain about the odors that emanate from livestock facilities and some worry that the odors could actually cause physical illness. It is possible that these illnesses could be the result of a reaction to odor and not any specific toxin. Therefore, concentrating on odor abatement, proper setbacks, and proper manure management could go a long way to reducing many of the conflicts surrounding these larger livestock facilities.

References

1. Donham KJ, Lee JA, Thu K, Reynolds SJ. 2006. Assessment of air quality at neighbor residences in the vicinity of swine production facilities. *Journal of Agromedicine*.
2. Reynold SJ, Donham KJ, Stookes-berry J. 1997. Air quality assessments in the vicinity of swine production facilities. *Journal of Agromedicine*. 4:37-46.
3. Steve Hoff, Iowa State University. 2007. Personal Communication.
4. Martin GN. 1996. Olfactory remediation: Current evidence and possible applications. *Social Science Medicine*. 43:63-70.
5. Schiffman SS, Sattely Miller EA, Suggs MS, Graham BG. 1995. The effect of environmental odors emanating from commercial swine operations on the mood of nearby residents. *Brain Research Bulletin*. 37:369-375.
6. Nimmermark S. 2004. Odour influence on well-being and health with specific focus on animal production emissions. *Annals of Agricultural and Environmental Medicine*. 11:163-173.
7. Shusterman D, Lipscomb J, Neutra R, Satin K. 1991. Symptom prevalence and odor-worry interaction near hazardous waste sites. *Environmental Health Perspectives*. 94:25-30.
8. Radon K, Schulze A, Ehrenstein V, van Strien RT, Praml G, Nowak D. 2006. Environmental exposure to confined animal feeding operations and respiratory health of neighboring residents. 18:300-307.
9. Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. 2006. Asthma symptoms among adolescents who attend public schools that are located near confined swine feeding operations. *Pediatrics*. Jul; 118 (1): e66-75.
10. Sigurdarson ST, Kline JN. 2006. School proximity to concentrated animal feeding operations and prevalence of asthma in students. *Chest*. Jun; 129 (6): 1486-91.
11. Heber A, Person H. 2005. Odor control options for confined feeding. Purdue University Cooperative Extension Service. ID-310.
12. Le PD, Aarnink AJA, Ogink NWM, Becker PM, Verstegen MWA. 2005. Odour from animal production facilities: its relationship to diet. *Nutrition Research Reviews*. 18:3-30.