

## **DRAFT**

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### ***Critical Issues Confronting Emissions from Large Animal Farms*** ***White Paper #1*** **July 14, 2004**

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#### **Introduction:**

Large animal feeding operations (AFO's) have been the target of numerous environmental lawsuits lately. By their sheer population and the large production outputs, they are perceived to be large emitters of pollutants and are immediately branded as threats to the health and welfare of surrounding communities. They are being charged with violating the national ambient air quality standards (NAAQS), violating the Title V-State Implementation Plan (SIP) provision or not reporting their emissions which is part of the CERCLA (Superfund) protocol. The National Ambient Air Quality Standard (NAAQS) for PM<sub>10</sub> is a concentration of 50 µg/m<sup>3</sup> (annual basis) and 150 µg/m<sup>3</sup> (24-hr average). A facility (in an attainment area<sup>1</sup>) is required to obtain a Title V permit if it emits more than 100 tons of a regulated pollutant per year (tpy) from a non-fugitive source. These facilities are referred to as major sources. A facility is subject to "prevention of significant deterioration" (PSD) permit program if the emissions inventories exceed 250 tpy of a regulated pollutant. CERCLA stipulates the reporting process be initiated when a facility exceeds a certain reportable quantity (RQ) for a particular contaminant (For ammonia and hydrogen sulfide the RQ is 100 pounds per day).

A recent case is the settlement between Buckeye Egg Farm, the largest commercial egg producer in Ohio and the EPA (USEPA, 2004). This farm has the capacity to house more than 12 million laying hens in over 100 barns in its three facilities (Croton, Marseilles and Mt. Victory). The EPA reported that the air emissions of particulate matter (PM) were significant – over 550 tons/year (tpy) from the Croton facility, over 700 tpy from the Marseilles facility, and over 600 tpy from the Mt. Victory facility. Buckeye was required to spend more than \$1.4 million to install abatement equipment and was fined an \$880,598 civil penalty.

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<sup>1</sup> For PM<sub>10</sub> in a non-attainment area, the threshold for Title V is 70 tpy.

**Positions: It is unlikely that any AFO emits sufficient PM<sub>10</sub> to meet the 100tpy (Title V) or 250 tpy (PSD) thresholds. Consequently, it is likely that the action by EPA that occurred in Ohio was not warranted. It is likely that emissions of PM<sub>10</sub> did not meet either Title V or PSD thresholds for this Buckeye Egg Farm!**

An evaluation of the emissions inventory of PM<sub>10</sub> supposedly emitted by the three Buckeye facilities based on USEPA document (USEPA, 2001) for broiler operations and on a published report by the Center for Agricultural Air Quality Engineering and Sciences (CAAQES) on a tunnel ventilated poultry (broiler) operation (Lacey, 2003), is presented in Table 1. For this table, the emission factors of 36 mg PM<sub>10</sub>/bird/day based on the lower limit of the EPA document and 26.5 mg PM<sub>10</sub>/bird/day based on published report for broiler operations (Lacey et al., 2003) were assumed. By direct calculation using the reported population from the three facilities, it was observed that none of the facilities would exceed the Title V provisions of PM<sub>10</sub> since none would have PM<sub>10</sub> emission greater than 100 tpy.

Table 1. Calculation of PM<sub>10</sub> from Three Facilities of Buckeye Egg Farm.

Facility	No. of Barns	Population (Birds)	PM <sub>10</sub> from AP42 (tons/year)	PM <sub>10</sub> from Lacey (tons/year)
Croton	30	3.6 M	47.3	34.8
Marseilles	38	4.56 M	59.9	44.1
Mt. Victory	32	3.84 M	50.5	37.1
Totals	100	12 M	157.5	116

If the 12 million laying hens emitted more than 1,850 tpy of PM<sub>10</sub> as indicated by EPA, each bird would have emitted more than 422 mg PM<sub>10</sub>/day. The emission factor is about 12 to 16 times the emission factors reported in USEPA (2001) and Lacey et al (2003).

**Position: It is likely that PM<sub>10</sub> emissions from ventilated houses of laying hens will be significantly less than PM<sub>10</sub> emissions from tunnel ventilated houses containing broilers. Hence, the PM<sub>10</sub> emissions estimated in Table 1 should be conservative.**

EPA reported that the emissions estimates were the result of “measurements” at the facilities. However, measurement protocols were not reported and data were not presented to support the emission inventory numbers. It is challenging to accurately measure emission rates of PM<sub>10</sub> from ventilated poultry houses. Emission rates are calculated from measurements of ventilation rates and from PM concentrations measurements. Ventilation rates in mechanically ventilated buildings can vary significantly from reported fan characteristics because of mechanical wear, dust and dirt buildup, and external wind effects. Actual airflows have been reported that were 5% to 25% less than published fan curve data (Casey *et al.* 2002). Use of published fan curves instead of actual flow data in calculating emission rates will likewise be in error by 5% to 25%.

The other issue that could have affected the emission rate measurements was that PM<sub>10</sub> sampling is also beset with over-sampling errors<sup>2</sup> on measurements. Studies at CAAQES have shown that the measurement of concentrations of agricultural PM having characteristic mass median diameters (MMD) greater than 10 µm (AED) have significant over-sampling errors. For example, Lacey et al (2003) reported a typical MMD for broiler dust of 24 µm (AED) with a corresponding geometric standard deviation (GSD) of 1.6. The potential over-sampling error for PM having this particle size distribution could exceed 225%. (Capareda et al., 2004).

### ***What can be done?***

Continued research must be conducted to establish a meaningful emission factor value for layer operations to guide poultry operators of the operational limits for their PM<sub>10</sub> emissions. Currently, these poultry operators have no knowledge of how the PM<sub>10</sub> concentrations from their facility are estimated and how to conduct an inventory of their emissions on an annual basis. So far, there have been no published reports on emission factors for layer facilities. CAAQES may assist those AFO's in developing their emission factors.

### ***References***

1. USEPA. 2004. Ohio's Largest Egg Producer Agrees to Dramatic Air Pollution Reductions from Three Giant Facilities. 02/23/2004 Press Release from: <http://www.epa.gov/newsroom>.
2. USEPA. 2001. Emission from Animal Feeding Operations. Emission Standards Division, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, 2711. On: Emission Factors and Estimates from Model Farms, Table 8-19, p 8-36. August 15, 2001 Draft.
3. Casey, K. D., E. F. Wheeler, R. S. Gates, H. Xin, P. A. Topper, J. S. Zajackowski, Y. Liang, A. J. Heber and L. D. Jacobson. 2002. Quality assured measurements of livestock building emissions: Part 4. Building ventilation rate. Air and Waste Management Association Conference, San Francisco, CA, AWMA.
4. Lacey R.E., J.S. Redwine and C.B. Parnell. 2003. Particulate Matter and Ammonia Emission Factors for Tunnel-Ventilated Broiler Production Houses in the Southern U.S. Transactions of the ASAE 46(4) 1203-1214.
5. Capareda S.C., L. Wang, C.B. Parnell and B.W. Shaw. 2004. Particle size distribution of particulate matter emitted by agricultural operations: Impacts on PM<sub>10</sub> and PM<sub>2.5</sub> concentration measurements. Proceedings of the 2004 Beltwide Cotton Conferences, National Cotton Council of America, Memphis, TN.

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<sup>2</sup> "Over-sampling" is a term that CAAQES has used to denote the over-estimate of PM<sub>10</sub> concentrations by Federal Reference Method (FRM) samplers. It is a consequence of penetration of larger particles to the filter that are weighed as particles less than 10 micrometers (AED) when in fact they are not. These errors can exceed 300%.