Preliminary Summary Points from U.S. Environmental Protection Agency

Science Advisory Board Animal Feeding Operations Emissions Review Panel

For Purposes of Discussion at

March 15, 2012 Animal Feeding Operation Emission Review Panel Open Public Meeting

Summary of Sections 3 & 4 – Broiler Document

- Great lengths to describe parameters that are not used. If there wasn't enough data then consider providing this information upfront and then stop talking about the influence of those parameters
- Use this new found space to better describe procedures and build reader's confidence in the data
    - Really need to know how many samples were collected at each time
    - Fan calibration procedures and frequency
    - Missing details such as how the change in purge time for first 4 months of gas sampling in CA was dealt with
    - Figures are helpful, well organized. Integrate sampler info into the section. What analyzer, what TSP equipment, etc.
    - PM sampling schedule and disproportion of PM10, PM2.5 and TSP samples
    - Explain what data were not received and why
    - Explain the 75% completeness criteria – why that value? Whatt did the 25% of data include – uniformity in what it represents?
    - Would benefit from being cleaned up and more careful about how the sites are described. Ie. Inlet systems are poorly described. Some discrepancies between section and later on
    - Ventilation rate should be more carefully described to illustrate the lengths taken to conduct the work (i.e. FANS system and repeated calibrations).
- A low frequency of negative values does convey good maintenance; need to convey that QAPP was followed using some other means
- Are data representative of the industry and the literature?
    - Table 4-3 H2S data is highly suspect for CA1-B
    - PM2.5 emissions range for CA (table 5-11) is much higher than others and range does not match the same data presented in table 5-12
    - Growers will routinely record bird weight – not really the case
- Data received during call – disconcerting how many studies were completely disregarded. Those data should be able to be used to cross validate the developed EEMs. Tables should reflect what data would be applicable to validation

- Consider use of more of the identified data – suggest additional criteria that might be considered or use these data as a performance evaluation of the EEM
- Under what regimes would the EEMs, developed under limited number of houses give accurate results. So test the EEM against other data that address these different regimes.

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Summary of Response to Charge Question 7: Use of Volatile Organic Compounds (VOC) Data in Developing VOC Emissions Estimating Methodologies

Comments on the approach EPA used to develop the draft broiler VOC EEM

1. More detail is needed in the document on how VOCs were measured, particularly at the Kentucky site.
2. More scientific information in the document on what drives VOC emissions would be useful.
3. The procedure used to collect VOC data in California has not produced useful data for empirical model development and should not be used in the EEM.
4. The VOC emission data available for boiler operations is very limited and not adequate to support an EEM that can be applied throughout the U.S.
5. The EPA is required to provide an EEM for daily and annual VOC emissions; however, there is provision in the Consent Agreement that if the SAB decides that the available data are not adequate to support development of the EEM, the EPA can delay that development until adequate data are available.
6. VOC speciation data are important. The individual compounds found should be reported for both the Kentucky and California sites. The most important compounds should be identified.
7. Reactivity of the VOCs included in the measure of non methane hydrocarbons is important and should be available for use with any EEM that is developed and applied to agricultural operations.
8. Some indication of the relative magnitude of the VOC emissions from broiler facilities to background levels and other sources would be helpful information.

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Comments on EPA's approach for handling negative or zero emission measurements and alternative approaches

Negative Data

- There are two types of negative data: calculated and raw.
- For calculated data, negative values should be included. This is because the background values, used to create the calculated values (measured – background), were measured either intermittently (twice a day for gas), or continuously without correction for lag time in the barn (PM data). This could lead to a bias either up or down, potentially creating negative data values. Additionally, if an event occurred outside the barn (i.e., other barn cleanout, manure movement, etc.), or meteorological conditions created the exhaust air to come back into the barn, these events may create a spike or change in measured values that effect the calculated values. If negative values are excluded due to calculated error, then there is a bias toward those values that were overestimated on the positive side.
- If the calculated value is negative, the raw data can be consulted to discover if it is a calculated effect or other.
- If the instrument produces a negative value that is due to a "below detection" reading, the number should be converted to 0 and used.
- If raw data is deemed negative after adjustment due to calibration, the value should be included in the data set. If not, there is a bias to those data that are positive due to the same process.
- Data should be qualified on an individual basis.
- The model should include negative values. There is already a lot of uncertainty in the measurements, which speaks to inclusion of negative values that qualify. There is no statistical problem with inclusion of negative values into the model.

Zero Data

- If the calculated value is 0, it should be used.
- If the raw data is 0, it should be used.
- If data is 0 after instrument calibration adjustment, it should be used.

Outliers are a separate issue and should be treated first outside of this process.

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Section 5 of the Broiler Report:

Nichole:

- Section 5 raises more questions. It is not robust enough to address concerns on data quality. For example, section 5.1, calibration of the equipment is not clear and how the equipment malfunction and data outlier was dealt with?
- Two emission data acquisition programs were used, but lack of specific descriptions of the systems.
- Section 5.3. About data completeness, 75% completeness criteria is confusing. Table 5-2 shows less than 75% data completeness.
- Two sites comparison: they are different. Statistical analysis of the significant difference is needed.
- **A**t Kentucky site, there is not reason for missing data.
- Negative and zero values.
- Why collection of the data at different time is not clear.
- Tables 5-11 ~ 5-14. Units need to be cleaned and consistent. Mass/bird/day is more appropriate than mass/day.
- Background data need to be included

Eileen:

- Table 5-13: California emission range is very high, and need to be checked.
- Table 5-10: break it into two tables: grow-out and clean-out.

Lingying:

- The objectives of the data collection need to be reviewed to guide data preparation. From a process analysis point of view, key tangible variables need to be included.
- In the Section 5.1: more data need to be included: such as mass balance data, hourly or daily average data?
- In section 5.2: Criteria for EPA selection and drop of the data need to be presented
- Need to analyze the two site conditions to see if they can cover the variation ranges of the U.S. broiler production. More analysis on the rational to have the two sites is needed than simply present the data.
- 75% data completeness criteria: sample size based on sub-data variation analysis is need to determine the criteria for data completeness for each of the specific air emission.
- Literature data need to be included for emission range analysis and possibly for the EEM validation.

E Eric:

- Median or average?

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Section 6 of the Broiler Report:

- Consider what other variables are needed; text suggests there are seasonal influences but season was not in the model.
- Negative values should be included in data presentation.
- Comparison is qualitative in nature – need to include the statistical comparisons, including outliers, range and variability
- Emission are expressed in g/d – express on a mass basis or unit area basis in order to normalize between sites so one can compare between sites
- Compare values with published data
- Use of cycle day rather than date or flock age – structure graph so that you have grow out and clean out sections

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Sections 1, 2 and 10 of the Broiler Report:

INTRODUCTION chapter 1

Review of **Consent Agreement process and history should be updated** to include description of what actually evolved that is some cases is different than the original intent (section 1.1).

Development of a Process-Based Model was the primary focus of NAS recommendations so this whole report should also focus on the 'processes' behind emission rate (ER). It was discovered during discussion of this draft report that development of the process-based model is a long term EPA goal. If a process-based model is not the current intent of EPA effort, **the development of statistically-based models as short-term tools should be explicitly stated early in the report**. Even so, the report's analysis would be strengthened by referral to the mechanistic processes behind the emission estimating methods employed. Primary mechanisms that lead to emissions of each regulated parameter should be described in relation to the surrogate statistical parameter for a better understanding of how the statistical model is valid. For example, bird number and mass is considered a surrogate for fresh manure production that impacts ammonia emission.

Minor note: The Air compliance Agreement had a record number of participants at 2600 yet this is a very small fraction of the one-half million AFOs in the country (section 1.0). EPA may want to build a case that although only 0.5% of AFOs chose to participate that they represent xx% (hopefully a large fraction) of total confinement animal production.

NAEMS **data collection expectations** need to be established in section 1.2. Some listed parameters are continuous and some periodic and this difference in data collection guidelines was noted in EPA presentation slides. This section would benefit from similar treatment to let readers know that some items are grab samples while others can be collected full time. For each animal species report, be sure that methodologies listed and described matches what was actually used! Our panel noted discrepancies in instrumentation type listed here and noted as deployed later in the report. Note when data were not collected or not provided for final analysis even if collected; or more simply, leave irrelevant data parameters out of the report. This long list leaves a first impression that all parameters were collected (which they were not) and collected with similar level of intensity (which they were not).

The accurate determination of ventilation rate (VR) is a very important aspect of the NAEMS data collection in order to achieve representative emission data. **The determination of accurate ventilation rate should be given more prominence in the report** with a concise description of how this was achieved (page 1.4). There was a lot of care and work involved in obtaining on-farm VR at each NAEMS site and this should be recognized. Also note throughout the report a correction for proper terminology: "static pressure *difference*" between inside and outside the building is the driving force for ventilation air movement and not simply "static pressure".

The broiler data were collected at an **extremely limited number of study sites**, even for the NAEMS. This should be acknowledged in the introduction. There were four broiler barns on three farms, which is half the number of study opportunities than any of the other species (barns/houses in NAEMS included 8 layers, 9 dairy and 11 swine). The study houses were felt to be representative of current industry practice but will shortly appear outdated as this industry is already adopting newer technology.

Table 1.1 needs attention so that 'rates' have a time unit and 'per animal' or 'per area' is needed in some other cases. There is a mix of American and Metric units that offers confusion.

There must be a quantification of emission uncertainty and/or variability. Emphasize that EEM currently being developed by EPA will offer a point value along with a confidence interval that represents the expected and naturally-occurring variation in emissions. This is an important aspect of the emission estimation and eventual reporting. The presentation of EEM as only one value for a given set of circumstances would be incorrect.

The range of conditions under which the NAEMS-based EEMs can be used needs to be explicitly stated. For example over what ambient temperature range during grow out or litter management period between flocks. There should be cautionary notes about using the EEM outside of the range studied.

OVERVIEW chapter 2

Section 2.5 mentions that ER will be measured from both confinement houses and manure storages (but not land application). **There is no mention in this report about stockpiled litter storage emission measurements** (litter being the combination of bedding and manure). But the NAEMS did measure ER between flocks in houses empty of birds. Strengthen this section by noting that broiler houses are commonly managed as both bird production facilities and as dry manure storage if litter is not completely cleaned out between flocks. So the between-flock emission measurements of houses managed with de-caked built-up litter may suffice as manure-storage data. Here is a good place in the report to strengthen the **tie to the process-based model** development since litter, through microbial degradation and natural chemical interactions, is an emission source for all the parameters measured.

Throughout the report, **the emissions from populated houses during grow-out and empty houses during litter management needs to be presented separately** since the house is managed very differently during these two time periods. It is correct to segregate the differential in emissions observed from fully cleaned out houses versus de-caked built-up litter houses.

Ventilation system and control operation needs more clarification, particularly inlet description and function.

14 March 2012

Eileen Fabian Wheeler and Robert Hagevoort