Legislative Services Agency

MINUTES

Livestock Odor Study Committee

October 24, 2007 — First Meeting

MEMBERS PRESENT:

Senator Frank Wood, Co-chairperson
Senator William Heckroth
Senator David Johnson
Senator John Kibbie
Senator Paul McKinley
Representative Wes Whitead, Co-chairperson
Representative Jack Drake
Representative Mark Kuhn
Representative Michael May
Representative Delores Mertz

MEETING IN BRIEF

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I. Procedural Business

Call to Order. The Livestock Odor Study Committee was called to order by temporary Co-chairperson Wood at 9:33 a.m. on October 24, 2007, in Room 103 (the Supreme Court Chamber) of the State Capitol.

Election of Chairpersons. Upon motion by Representative Mertz, temporary Co-chairpersons Wood and Whitead were elected permanent co-chairpersons by unanimous voice vote.

Adoption of Rules. Upon motion by Representative Drake, the proposed rules for the Committee were adopted by unanimous voice vote.

Opening Remarks. Co-chairperson Wood emphasized that the Committee is charged to consider issues relating to odor associated with livestock, and to study and make recommendations for additional state funding for research into cost-effective management practices, facilities, equipment, and practices to mitigate a plan for livestock production facilities, for an Iowa State University Veterinary Laboratory review of airborne disease research, and for utilizing manure and other livestock waste products as sources of nutrient recovery and renewable energy.

Recess and Adjournment. The Committee took a luncheon recess from 12:32 p.m. until 1:15 p.m. The meeting was adjourned at 3:34 p.m.

Next Meeting. The next meeting of the Committee was scheduled for November 28, 2007, beginning at 10:00 a.m. in the Supreme Court Chamber of the State Capitol.

II. Iowa State University Panel

Dr. Steve Hoff, Dr. Jacek Koziel, and Dr. Jay Harmon from the Department of Agricultural and Biosystems Engineering at Iowa State University (ISU) presented to the Committee information regarding odor reduction research and methods.

Introduction. Dr. Hoff began by identifying the three primary sources for livestock odor: building ventilation, outside manure storage, and land application of manure. A relatively small number of chemicals and compounds are responsible for the characteristic livestock odor. Dr. Hoff stated that practical odor control methods currently exist, but that economics must be a consideration of any strategy. The ultimate goal of research efforts is to find economically feasible solutions with enough odor reduction to be effective during downwind events. Researchers are currently studying and testing a variety of odor control techniques, including development of a siting model, topical application to manure, biofiltration of ventilation air, chemical and sensory assessment of odor, ultraviolet treatment of ventilation air, and vegetative environmental buffers. Odor levels are typically measured in excess of 300 yards from the source. With the right conditions, however, odors can be smelled up to 11 miles away from the source. For an odor control method to be considered effective, it must result in at least a 70 percent reduction of source odor when needed. This standard does not require a 70 percent reduction 100 percent of the time, because the reduction may not be needed at all facilities.

Facility Siting. Dr. Harmon stated that siting of an animal feeding operation remains the most important factor to mitigate the effects of livestock odor. With proper preconstruction site selection,

many of the other odor mitigation techniques may be sparingly used or unneeded. The siting process examines receptors in all directions from the proposed site and couples that with an assessment of wind patterns during high odor season, which is typically March through October. Wind rose patterns are charted during those months. Atmospheric stability is also a consideration for siting because odors are less diffused in stable atmospheres, which typically occur during early morning and late at night. Earth heating during daytime hours creates a more unstable atmosphere which disperses odor. Researchers have used two standards for measuring odor: a dilution ratio (odor free to ambient air) of 2:1 denotes barely detectible odor and a dilution ratio of 7:1 denotes identifiable odors.

The result of siting research is the Community Assessment Model (CAM) for odor dispersion. The computer model calculates historical weather patterns, current odor sources, receptor characteristics, and distances and orientation from the odor source to predict the total hours of potential odor exposure that a point of interest will receive from March through October hours. A point of interest includes a neighboring residence, church, cemetery, business, or public use area. The potential odor exposure (source load) for a point of interest is first judged against a standard of not more than 1 percent of 2:1 odors (58 hours) and not more than 0.5 percent of 7:1 odors (29 hours). The data for the proposed site is added to data for existing sources to judge the site's impact upon points of interest using a standard of not more than 2 percent of 2:1 odors (115 hours) and not more than 1 percent of 7:1 odors (58 hours). The CAM has been used to site over 100 facilities. While CAM has shown to be effective, Dr. Harmon cautioned that it is difficult to account for the impact of terrain in the model. Dr. Harmon also stated that for siting to be effective, the model needs to be coupled with producer education, communication with neighbors, and common sense.

Biofiltration. Biofiltration is a process of discharging ventilated air under a bed of biomaterial acting as a biotreament substrate. The research presented by the panel used Hardwood and Western Cedar woodchips as biomaterial. Biofiltration has shown a 60 percent reduction in odor. Results have been better in deep pit locations. Installation estimates have been $9-$15 per pig space and the energy cost is about $0.45 per pig finished. Some of the potential issues or limitations of biofiltration include intermittent or partial ventilation, proper design to limit the impacted ventilation, moisture maintenance, and increased size. According to the panel, future research on biofilters would need to include testing on tunnel barns and the effects on ventilation in order to protect the health of livestock. There are currently only a few demonstration sites with operational biofilters.

Vegetative Environmental Buffers (VEB). Vegetative environmental buffers is typically a tree line. The VEBs promote the mixing and uplifting of air and also provide a visual screen to the odor source. A "wedge" shape of the VEBs seems to create the greatest potential air lift and mixing. While there is evidence of VEBs effectiveness (up to a 15 percent odor reduction), researchers find it difficult to quantify their precise impact. The primary problem with VEBs is the time needed to establish them. Other barriers, such as plastic sheeting and biocurtains, have been developed but their efficacy has not been studied in great detail.

Dietary Manipulation. Dietary manipulation has shown to have up to a 30 percent reduction in odor during testing and may improve hedonic tone, a property of odor relating to its pleasantness

or unpleasantness. Examples of dietary manipulation include reducing the protein content of the animal feed and adding certain amino acids.

Manure Covers and Injection. Permeable covers allow air to mix with manure but prevent wind from blowing directly over its surface. The cover material also forms a biological substrate. Testing of permeable covers has included four-inch and six-inch layers of straw, leca rock, and geotextile. Straw provided a 40-60 percent odor reduction at a low cost per square foot. However, the lifespan of straw is less than one year. The leca rock provided a 90 percent odor reduction with more than a 10-year lifespan. However, it is significantly more expensive. Limitations to permeable covers include the sinking of biological materials, the potential for pumping problems, and the practicality of use on areas greater than five acres.

Impermeable covers produce an odor reduction of over 90 percent in manure storage locations. However, covers have no application in the livestock buildings, manure removal is difficult, and the cost is approximately $2.50 per square foot.

Manure injection has been shown to reduce odor by 90 percent. This practice has costs associated with purchasing injection equipment and fuel. Additionally, injection may be a challenge with no-till practices.

Developing Mitigation Techniques. There is research to develop other odor mitigation techniques that have had little or no field testing. Some of those techniques include manure scrapers, bioscrubbers, manure belts, ultraviolet (UV) degradation, and topical applications. The panelists urged that before these techniques are fully developed, potential investors and users need to have a better understanding of their benefits and limitations.

UV Degradation. Dr. Koziel stated that degradation has shown great potential. Livestock manure has approximately 300 chemicals or compounds involved, but only a small percentage cause odor. Researchers used simultaneous chemical analysis and personal "sniff" tests to identify which chemicals are causing the characteristic livestock odor. There are 57 different smells or aromas linked to manure. The chemical composition of livestock odor is less complicated the further the receptor is from the source. Accordingly, it was important for researchers to identify which chemicals carry odor for longer distances. The compound p-Cresol was determined to be the most important compound to identify and counteract. The strength of p-Cresol does not dissipate greatly when traveling away from the source.

The UV technique developed by Dr. Koziel focus on those compounds and gases which cause the characteristic livestock odor. The UV light destroys odors by irradiation. According to Dr. Koziel, laboratory scale testing has produced excellent results. A five-watt UV lamp was used in the laboratory and it irradiated the sample in one second. In particular, p-Cresol was virtually eliminated. The technique allows immediate start-up by turning the UV source on and off, thereby fitting within Dr. Hoff's "as needed" approach. The UV treatment takes a short time and can be applied to moving air. An added benefit to UV treatments is the inactivation of airborne pathogens and other regulated gases. According to Dr. Koziel, the operating cost for a UV system would be low and there is the high likelihood that it could be utilized in both new and existing ventilation systems. Researchers are currently performing laboratory scale testing of UV degradation. Dr.

Hoff estimated completion of pilot scale and commercial scale testing within three years, and stated that ISU is seeking further funding for the development of UV mitigation technology.

Panel's Conclusions. Dr. Hoff concluded that: (1) there is no substitute for proper site selection, (2) effective odor control involves a suite of options, "one size does not fit all," (3) any mitigation strategy must have a proven economic assessment associated with it, (4) incorporating a mitigation strategy should be associated with a distance credit proportional to the level of odor control, as proven with research.

Committee Questions. In response to an inquiry by the Committee, Dr. Hoff estimated that 50 percent of the research discussed during the presentation has come directly from the efforts of ISU. Committee members asked the panel about their current research efforts and what level of funding would be needed to further that research. Dr. Hoff stressed the need for additional demonstration and implementation sites for the various mitigation techniques and funding to allow the CAM to be calibrated to animals other than swine. Panelists, however, were unable to provide an estimate of the funding needed to continue their research efforts.

Senator Kibbie questioned how many of the 400-600 new construction permit locations are utilizing the mitigation methods described during the presentation. Dr. Harmon indicated that there is some voluntary use of ISU's siting model, but noted that overall very few sites are using these other mitigation techniques. Currently, Dr. Hoff is providing free siting analysis in order to develop and refine the model. Representative Mertz questioned whether there is sufficient education of producers to make them aware of these odor mitigation methods. Dr. Hoff noted that education and awareness of some of these mitigation practices has increased in recent years and many industry members are becoming more aware of the ongoing work at ISU.

Senator McKinley was joined by other members of the Committee in expressing concern over the lack of established standards or guidelines for acceptable livestock odor levels. Discussion centered around both what the standard should be and who should be given the responsibility of establishing the standard. According to Dr. Hoff, the research community does not have full agreement on acceptable levels of livestock odor.

III. Bioconversion Companies Panel

General. The Committee considered testimony from Mr. Don Nelson, Manager and Project Finance Director, Bison Renewable Energy LLC, located at Minneapolis, Minnesota, and Mr. Ted Mathews, Anaerobic Digester/Nutrient Recovery Manager of E^3 Biofuels, LLC, located at Mead, Nebraska. E^3 Biofuels, LLC, also has a facility located in New York. Anaerobic digestion was originally developed in the 1980s and had enjoyed success since that time in Europe.

Description. Mr. Nelson and Mr. Mathews both discussed the process of obtaining biogas and other chemicals from an anaerobic digester system which is associated with an ethanol production facility and a beef cattle feedlot. For example, the E^3 Biofuels, Mead, Nebraska, facility provides 78 percent of gas to a neighboring ethanol plant. However, each facility must be a certain capacity to adequately support one another. The biosolids used in the anaerobic digesters come from sources like animal waste, meat processing, cheese production, bakeries, and fisheries. With current technology, however, certain biosolids like swine waste are less efficient than sources like

cattle manure. Anaerobic digestion produces biogas which is principally composed of 65 percent methane and 35 percent carbon dioxide. The facilities utilize nutrient recovery systems and lower the release of ammonia and methane into the environment. Mr. Nelson discussed the Bison's Biogas Regional Anaerobic Digester (BRAD) being developed in Sioux County, Iowa. Each BRAD tank is 24 feet tall and sunk into the ground 12 feet, with walls 12 inches thick. As health and safety precautions, each BRAD facility utilizes biofilters and mandates that biosolid transport trucks are washed regularly on-site.

Committee Questions. In response to questions by Committee members, Mr. Nelson and Mr. Mathews discussed prices paid for biogas as compared with natural gas, collection of manure, and distribution systems for biogas. Mr. Nelson and Mr. Mathews stated that the market is very competitive and the industry has a promising future. Mr. Nelson also indicated that wider implementation could occur with incentives from state or federal governments.

According to both panelists, industry members are developing relationships with groups for the use and distribution of anaerobic digestion byproducts like pathogen-free compost that could be used as fertilizer. Mr. Nelson cited various community benefits, including reduced odor due to farm-site collection, reduced odor due to an enclosed process, manure management solutions for large producers, job creation, production of renewable energy, tax revenue to the community, and local investment opportunities.

IV. United States Department of Agriculture Panel

Introduction. The Committee considered presentations by Dr. Brian Kerr, Research Leader, and Dr. Steven Trabue, Research Chemist, Swine Odor Manure Management Research, National Soil Tilth Research Laboratory, Agricultural Research Services, United States Department of Agriculture (USDA). They explained that their research goal is to develop practical technologies resulting in improved gastrointestinal and whole-animal nutrient utilization and a modified microbial ecology (including pathogens) leading to a reduction of the impact of livestock production on the soil, water, and air environment.

Complexity. Dr. Kerr and Dr. Trabue emphasized that odor is a complex issue and described a number of analytical methods used to quantify odorants, including the use of human panelists and equipment which isolates chemical components. The variation in human panelists was demonstrated by the results of a swine pit simulation study.

Diet. Of the 300 compounds in livestock odor, they identified key odorants in swine manure traceable to dietary inputs, including carbohydrates, fiber, starch and nonstarch polysaccharides, proteins, amino acids, and minerals. They discussed the relationship between sulfur and odor, noting that distillers dried grains with solubles (DDGS) produced during ethanol production, contains large concentrations of sulfur which may impact odor. Research suggests that for each 1 percentage unit reduction in dietary crude protein, total nitrogen losses can be reduced by approximately 8 percent. Positive results were also seen with the addition of certain amino acids. The data also shows, however, that there is a point at which further modifications do not yield significant reductions in output. Additional fiber was shown to yield good results, but that it also increased the production of fatty acids. Dr. Kerr and Dr. Trabue cautioned that while changing

dietary rations may reduce odor, it may also affect the quality of commodities produced, including the composition of livestock carcasses. Precision feeding was advocated by the panel in order to maximize the effectiveness of feeding and minimize nutrient wastage.

Committee Questions. In response to questions by Committee members, Dr. Kerr and Dr. Trabue discussed the role of sulfur and phosphorus in swine dietary rations, the impact of higher oil content of DDGS upon swine carcass quality, and odor measurement techniques.

V. Dr. Sean Fitzsimmons, Department of Natural Resources

Study Results. The Committee considered a presentation by Dr. Fitzsimmons, Senior Environmental Specialist, Air Quality Bureau, Environmental Protection Division, Department of Natural Resources (DNR). According to Dr. Fitzsimmons, a DNR Ambient Air Monitoring Group was established to monitor odor pursuant to Code section 459.207, in part so the DNR may develop comprehensive plans and programs for the abatement, control, and prevention of airborne pollutants. He noted that 1,708 odor measurements were taken by environmental specialists in the DNR field offices between 2003 and 2005 using a scentometer, a device that dilutes odorous air with odor-free air to a specified ratio. Dr. Fitzsimmons stated that for purposes of the study, the odor threshold at a monitoring location was 7:1 dilution ratio (odor-free to ambient air) taken from two readings. He explained that measurements were taken at a fence line for facilities (buildings and manure storage structures) and fields where manure was applied. Other measurements were taken at locations referred to as public use areas, educational institutions, religious institutions, residences, and commercial enterprises (PERRCs). By statute a facility cannot be constructed or expanded closer than a specified distance from a PERRC.

According to Dr. Fitzsimmons, for measurements at the fence line, the exceedance rate was 7 percent for facilities and 11 percent for manure application. For measurements at a PERRC, the exceedance rate was 4 percent. According to the study, a deep pit storage had a lower exceedance rate than a lagoon or tank used to store liquid manure and the application of liquid manure by injection resulted in a lower exceedance rate than liquid manure applied with subsequent incorporation. However, the purpose of the study was not to compare the odors from different types of facilities, so Dr. Fitzsimmons was unable do draw any statistical conclusions that deep pits provided better odor reduction.

Odor readings collected during the study were not done at standardized times, but instead were conducted during field officers' normal course of inspections. As a result, Committee members believed that the study was hampered by the time of day odor samples were taken. Dr. Fitzsimmons stated, however, that the practicality of a nighttime or early morning field study would be difficult based on the permission needed to enter and take samples on private property.

Committee Discussion. In response to questions by Committee members, Dr. Fitzsimmons discussed the number of exceedances which were measured from a single confinement feeding operation, the lack of consensus regarding an odor standard, the migration of odor plumes which could affect locations based on a number of factors including atmospheric conditions, and the use of mitigation technologies. Representative Kuhn sought clarification of the study's overall conclusion by asking specifically whether the results showed higher than common accepted levels

of odor and whether there was an effect on human health. Dr. Fitzsimmons indicated that the conclusion was undefined because there is a lack of consensus as to what the common acceptable levels are and what levels might pose a risk to human health. Committee members then expressed concern that the study was hampered by the lack of an established standard. Dr. Fitzsimmons provided brief explanations of the odor standards in other states and indicated that rulemaking has previously been attempted by the DNR and legislative action was vetoed by the Governor. Committee members also questioned whether a proposal for an odor standard should come from the General Assembly or the DNR.

VI. Secretary Bill Northey and Director Richard Leopold

Agency Perspectives. The Committee considered testimony from Mr. Northey, Secretary of Agriculture, and Mr. Leopold, Director of the DNR. Secretary Northey discussed the past history of regulations affecting animal feeding operations, the use of modeling by ISU, and research initiatives which he believes deserve attention, including the use of biofilters, vegetation plantings, and ultraviolet light. Secretary Northey expressed support for the development of as many mitigation methods as possible due to the possibility that each method will not be useful at every facility. Secretary Northey also discussed the need for further development of the siting model developed by ISU and a standardized system for odor measurements. According to Secretary Northey, enough research has been completed to allow a progressive proposal to be developed. Under such a proposal, volunteer and incentive based actions are acceptable; however, regulatory or legislative action might be the next step if those efforts are not successful. Director Leopold discussed both the actual and perceived odor issues which affect producers, and courses of possible action including ISU research projects with participation by producers and organizations representing agricultural producers.

Committee Questions. In response to questions by Committee members, Director Leopold discussed the use of the master matrix used to site confinement feeding operations, the willingness of producers to participate in research projects during periods of low market prices, the weather's affect on the storage and application of manure, the frustration of persons who neighbor animal feeding operations, the need to develop practical strategies, and the implementation of demonstration projects. Secretary Northey advocated increasing the number of demonstration sites to the level at which researchers would still be able to adequately manage them.

VII. Committee Discussion

Committee members had a wide-ranging discussion about a number of issues, including the number of technologies being developed to mitigate odor, the need to focus upon practical applications of research with proven results, the use of small-scale on-farm biodigestors, the importance for the state to continue to move forward in developing solutions, the amount of additional resources required by ISU to support its research initiatives, the importance of educating the producers and the public regarding odor, the importance of establishing a time frame in which to develop proven odor mitigation strategies, the need to establish a state odor standard, the importance of siting of animal feeding operations, the need to focus upon building design, the need to retrofit existing structures which house animals or store manure, the need to increase funding

for the DNR and the Department of Agriculture and Land Stewardship (DALS), and the need for the DNR, DALS, and ISU to continue cooperating.

In particular, the Committee discussed the possibility of implementing some mitigation methods as regulations because many producers may not voluntarily assume additional costs. Committee members also noted that some methods have been proven to the point where implementation could begin, with later modifications. As for siting efforts, the Committee discussed whether requiring producers to choose a particular site is better than providing enough incentives for the producer to choose a proper site on their own.

Senator Kibbie noted that the design of buildings has not advanced in 20 or more years.

Representative May expressed concern that efforts to reduce livestock odor has not rapidly progressed. Several Committee members believed that a proactive approach, rather than conducting additional mandated studies, may be more beneficial. Committee discussion also involved the possibility of designating a person to coordinate the various research efforts. Representative Mertz agreed that implementation of the various odor-reducing methods is advisable, but questioned its value if the DNR and DALS are not provided with the resources and funding to accomplish the goal.

Committee members requested that ISU representatives return for the next meeting to discuss which methods and technologies are ready for implementation immediately or in the near future, potential incentives for implementation of siting and mitigation methods, research funding needs, and possible private sector involvement in the research and implementation process. Co-chairperson Wood noted that the Committee charge requires consideration of issues involving airborne diseases affecting livestock.

VIII. Materials Filed With the Legislative Services Agency

The following materials listed were distributed at or in connection with the meeting and are filed with the Legislative Services Agency. The materials may be accessed from the <Additional Information> link on the Committee's Internet Webpage:

http://www.legis.state.ia.us/aspx/Committees/Committee.aspx?id=213

1. Background Memorandum prepared by Doug Adkisson, Legislative Services Agency.
2. Supporting Documents — Results of the Iowa DNR Animal Feeding Operations Odor Study.
3. Supporting Documents — Air Quality Evaluation Downwind from Swine Facilities.
4. Supporting Documents — Denmark Conference Modeling — Hoff & Bundy.
5. Supporting Documents — Partial Biofiltration from a Curtain-Sided Deep-Pit Swine Finisher.
6. Supporting Documents — Mitigating Swine Odor with Strategically Designed Shelterbelts Systems: A Review.

7. Supporting Documents — Classification of Effective Odor Mitigation Techniques — Odors Originating from Housing.
8. Supporting Documents — Gaps in Odor Mitigation Techniques.
9. Proposed Rules.
10. Adopted Rules.
11. Testimony, Dr. Jay Harmon, Dr. Jacek Koziel, Dr. Steve Hoff, ISU (PowerPoint).
12. Testimony, Dr. Don Nelson, Bison Renewable Energy (PowerPoint).
13. Testimony, Mr. Ted Mathews, E^3 Biofuels (PowerPoint).
14. Testimony, Dr. Brian Kerr and Dr. Steven Trabue, USDA (PowerPoint).
15. Testimony, Dr. Sean Fitzsimmons, DNR (PowerPoint).

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