

Virginia Pollution Abatement Regulation and General Permit for Poultry Waste
 Management

Technical Advisory Committee Meeting

January 6, 2020 - 9:30 A.M.

DEQ - Piedmont Regional Office – Training Room

Meeting Notes from Technical Advisory Committee Meeting

Meeting Attendees

TAC Members	Representing
Tony Banks	Virginia Farm Bureau
Hobey Bauhan	Virginia Poultry Federation
Betsy Bowles	Department of Environmental Quality
Jacki Easter	Poultry Grower/ Poultry Waste Broker
Darrell Marshall (technical support)	Virginia Department of Agriculture and Consumer Services
Seth Mullins (technical support)	Department of Conservation and Recreation
Phillip Musegaas (alternate for Mark Frondorf)	Shenandoah Riverkeeper/ Potomac Riverkeeper Network
Mark Patterson (alternate for Steve Levitsky)	Perdue Foods
Holly Porter	Delmarva Poultry Industry, Inc.
James E. Riddell	Poultry Waste End-User/ Agronomist
Kyle Shreve	Virginia Agribusiness Council
Michael Thompson	Poultry Grower
Pete Watson	Poultry Grower
Joe Wood	Chesapeake Bay Foundation

Others Present	Representing
Bud Malone	Malone Poultry Consulting

DEQ Staff Present	
Kevin Cline	Bob Peer
Melanie Davenport	Neil Zahradka
Craig Nicol	

Absent TAC Members

TAC Members	Representing
Doug Baxter	Tyson Foods, Inc.
Adrienne Kotula	Chesapeake Bay Commission

Welcome and Introductions

The meeting was opened at 9:30 AM by Betsy Bowles, the Animal Feeding Operations Program Coordinator for the State and Technical Advisory Committee Lead. Betsy began the meeting by welcoming the group and thanking the committee members for devoting the time to participating in this process. Betsy reviewed the TAC meeting protocols.

Betsy provided the meeting space logistics. Betsy introduced the DEQ staff and asked the TAC members to introduce themselves including Mr. Bud Malone.

Final Call for Comments from TAC Members on (10/31) Meeting Notes

Betsy asked the group if anyone had any comments or revisions on the meeting notes that she had distributed by email prior to today's meeting. No one from the group offered comments or edits.

Summary of Stockpiling Literature Review (presentation from Joe Wood)

Presentation provided by Joe Wood and is attached to these notes.

Presented the a summary of his thoughts upon his review of 15-20 studies. Also noted the growth of the poultry industry in relation to the adoption of the VPA poultry regulation and the modeled effects of these on Nitrogen loads. Provided summary of studies of poultry litter stockpiling. Emphasized that ammonia losses to the atmosphere should be considered. Recommends that the stockpiles should be covered immediately when trying to be protective of water. If litter additives are documented then covering the stockpile is not as critical, covering the pile is not as critical. The documentation would allow a longer period of time for the stockpile not being covered.

- Point # 1: The scientific literature on stockpile nutrient leaching *and* runoff is variable, with some clear instances of leaching/runoff and other instances of minimal loss.
- Point #2: The impact of covering is also variable, although in many cases, covering provides a nitrogen and phosphorus benefit through various mechanisms. There were no clear/significant instances where covering increases overall nutrient loss.
- Point #3: Ammonia Emissions from litter piles are substantial and potentially a more important nutrient considerations than leaching. Literature suggests covering piles immediately can substantially reduce ammonia emissions, although the long term fate (i.e. after spreading) of ammonia depend on various management factors. Litter additives are recommended to manage ammonia and have potential benefits for bird health.

Recommendations to be protective of surface waters

1. In the absence of alum data, stockpiles should be covered immediately. We urge DEQ to require reporting on litter additives (i.e. acidifiers) to control ammonia emissions under this permit. Understanding Alum is not only important to understanding air quality impacts and deposition, but also has implications upon the nutrient content of litter which could be incorporated into NMPs. Including this information will help the agency manage impacts of poultry production across Virginia.
2. In the presence of documentation of litter additive to stabilize ammonia, stockpiles should still be covered promptly although a longer length of time may be justifiable.

3. We urge DEQ to revise the regulations to require the growers, end users and brokers to submit the data, of which they are already recording, to DEQ on an annual basis. Users are already recording this data, thus we do not believe it would be a substantive burden to submit it to DEQ once a year.

TAC Discussion

Hobey Bauhan provided additional information related to poultry production in VA. There is not an exponential growth in the industry. He stated that although production has increased since 2000 to the current number, but no new processing plants have been built. He noted that changes in production practices, including improvements in feed conversion has a direct affect the production and quality of litter produced. The construction of new houses is mostly replacement older houses. We are at the end of our building boom.

Joe stated that the numbers came from the US Agriculture Census and is in pounds and units of birds.

Hobey agrees that pounds of birds tend to rise.

Joe agreed that this is not an exponential growth but when he looks at the pattern he expects that industry will continue to rise (grow).

Hobey stated that he does not agree that this is a growing industry. He hopes it will be. Hobey emphasized that the Bay Model makes an assumption of increased poultry production based on 5-year history, but the industry is not moving in that direction. It is not accurate that the industry is growing. If you made the assumption back in the mid 2000's you would think there would not be an industry any longer.

Holly Porter asked if Joe was assuming that litter amendments are not being used. Holly pointed out that there were assumptions in the Maryland study that makes the study inaccurate 1) being that birds are in the houses year around-not true, 2) that no litter additives being used-not true, and 3) that all of the land in the Delmarva is agriculture land and not taking other land uses into account such as forestry, etc.-not true. Holly also noted that there are numerous assumptions in the Bay model that are not correct. The problem with the model is that if the litter amendments are not cost shared then it is not used in the model. Holly asked Joe if it is either/ or.

Joe said that if we can document that the additives are being used to stabilize Nitrogen in piles than the covering issue is more out of it. Ammonia emission is the much bigger issue for him.

Jackie Easter asked Joe if he is suggesting pile by pile and or houses or farms. Jackie followed up with if farmer A could document the additives and farmer B could not, is he suggesting that farmer B would need to cover the pile and farmer A would not need to cover the pile.

Joe responded to Jackie that it is more of a logistical question for DEQ.

Jackie thinks it would be a nightmare.

Joe asked if DEQ has the information.

Neil Zahradka stated that DEQ does not collect the information.

Kevin Dunn suggested that growers submit information to DEQ regarding use of litter amendments to be able use it in the Bay model.

Holly asked Joe Wood, if DEQ was to collect the litter amendments, then what would be more important, the storage.

Joe said collecting the amendment data is more important than covering the piles immediately.

Phillip Musegaas indicated that he would be comfortable with the cover rules as proposed if litter amendment use was documented.

Mike Thompson stated that in the Valley, the integrators require the additives at least 6 months out of the year. He noted that permeability of site foundation should be considered if any restrictions were placed on moving storage site to avoid leaching loss. Mike does not agree with rotating the storage site since most are on impermeable sites. He also noted issues related to ammonia release in a storage building. He noted when the piles are created that the pile caps itself off in a building or outside of a building. The capped piles that water hitting pile is absorbed on uncovered pile vs. that running off impermeable cover. Most of the outside storage is by end-users.

Melanie Davenport asked how long litter amendments had been in use.

Mike Thompson stated that he had been using it for 15 years.

Tony Banks noted that DCR had been considering affects of litter amendments for 25 years.

Mr. Malone noted that he has been working with the industry since 1980, on the Delmarva the industry has been using additives since the 1990's. Generally done one time per flock.

Jackie said the only time they do not use the amendments is when there is fresh bedding (litter) has been places in the buildings after a total clean out.

Hobey noted that amendments are used as an animal welfare practice to keep ammonia levels low in the houses.

[Summary of Poultry Litter Stockpiling Research \(presentation from Bud Malone\)](#)

Presentation provided by Bud Malone and is attached to these notes.

Mr. Malone stated the numbers that Joe pulled out of the different research papers, I do not disagree with, but what you have to look at is how the numbers are generated and that is the key to understanding why there is so much variability in the literature on nutrient losses. Mr. Malone also mentioned that he has not done a complete literature search on all of the work that has been done on stockpiling but that what he will share was information out of a (1) 2004 workshop, (2) important information related to the Binford study and (3) an Poultry Litter Expert panel to put together to look at recommendations on stockpiling. He also presented information regarding the studies that Joe has mentioned and why there are issues in making policy changes based on that research.

When you look at the research, you need to look at a number of factors. The biggest factor is by far the shape and size of the pile and where the research was generated. Most of the research had been done on eight (8), 10, 12 ton piles. The research shows that minimizing surface area by maximizing the tonnage per square foot of litter is better because it reduces the area for potential for loss. Things that should be considered when comparing the research: litter age, litter type, what types of cover have been used, sizes and shape of pile, soil type, temperature,

rainfall, soil and water sampling methods, location and timing. Example of a study location – Europe, differences in the temperature and rainfall during the period of time the study took place, etc. Mr. Malone went through the studies and brought up the limitations of those studies for comparing each one. (see presentation for more details)

- The research suggests for field stockpiles - that the pile should not be placed on the same site year after year. He sees no research that shows that a pile should be kept out longer than 180 days.
- Minimum surface area per unit of volume
- Noted that cake litter is higher moisture content and nature of material causes it to become more saturated, and recommended covering stockpiles of cake litter.
- Better to keep litter in stockpiles regardless of storage duration rather than spread at the wrong time of year. Based on research data (from Binford study), covering piles keeps the temperature and moisture within the pile which allows the ammonia releases.

Poultry Litter Expert Panel Recommendations:

1. Minimize storage needs by scheduling cleanouts close to planting season.
2. Need proportional increase in on-farm storage with increased production capacity (designed for cake and not cleanouts).
3. Construct piles to minimize footprint (A shape, high as practical). Site pile to minimize nutrient losses. Little difference between 14 and 190 days storage, most risk occur first few days but impact is >0.
4. Stockpiling recommended (up to 190 days) when other options not available (field application, hydrological cycles, alternative uses).
5. Remediate pile footprint (surface soil removal, till, plant salt tolerant crop or one that removes nitrates).
6. Rotate storage site location. Literature supports covers reduce some ammonia losses but **no** data on losses from properly formed field stockpiles. No consistent effect of covers to reduce surface runoff or loading to soils under/adjacent to piles. N loading under piles from ammonia gas. Literature indicates covering increases plant available P.
7. Due to lack of consistent effect of covering, panel does not support mandatory covering of temporary field piles as means to reduce nutrient loading to soil and water.
8. Additional research needed on storage pad/BMPs to reduce nutrient loading below piles.
9. Avoid litter application during high-loss hydrologic conditions. Shallow incorporation recommended.

May Need Additional Research to Make Policy on Production Size Field Stockpiles

- Pad site options and remediation.
- Duration of field storage based on pile size and shape.
- Role of increase pile depth on ammonia emissions (cake stored in sheds and field cleanout litter)

- Determine the challenges, merits and/or consequences of covering production size stockpiles.
- Alternatives to poly or tarp covers to reduce ammonia emissions.
- N store management assessment, match storage method with land application procedures.

Mr. Malone's comments on the draft DEQ requirements:

- Permanent Storage Facility: Agree with all points but have concerns about condensation under impermeable cover.
- Temporary Storage Option One: Agree with all points assuming these are small, unshaped piles.
- Temporary Storage Option Two: Agree with most points with the following suggestion: 30 day storage limit may be too restrictive.

Mr. Malone's comments on CBF Recommendation to Cover All Stockpiles

- *Science panel and field scale temporary stockpile research do not support mandatory covering to reduce leachate and runoff. Results from most lab and small pile research studies not realistic or have many limitations.*
- *NO research data available on covering to reduce ammonia losses from field scale temporary stockpiles. Covering may cause some unintended negative consequences. Additional research needed.*

TAC Discussion

Phillip asked if the Binford study looked at smaller scale piles.

Mr. Malone responded that the field scale is at least six foot high and that is what the draft DEQ proposal is requiring. The Binford study looked at field scale - realistic stockpiles, not research scale. The field scale piles were at least 6 foot high and conical in shape and the tonnage is anywhere from 75 tons to greater.

Jackie small piles are probably the small end-user that may not typically get litter. The small piles are not going to be used by anyone one with a sizable operation.

Kevin asked what litter amendments were used in the studies.

Mr. Malone responded that the 1990 study used a dry, alum-based product in the field under the pile, not in the house. There was discussion regarding whether in-house use of ammonia reducing amendment vs. applied directly to exterior of pile once formed outside. Mr. Malone further stated that a good study would be to see if a litter amendment applied to the top of the litter what would it do to the ammonia emissions. He further stated that heat and moisture on a covered pile will cause the concentration of ammonia to come out significantly. The increase in pH, temperature and moisture will allow for the ammonia to increase.

Mike Thompson asked about a study relating to compacting the piles.

Mr. Malone further discussed the ongoing studies that suggest that compacting field storage piles may reduce ammonia losses due to reduction of pore space/air in piles.

Mr. Malone stated that he was not sure if they would be able to use enough additive in the house that would carry out to the stockpile.

Joe acknowledged the issue relating to the studies based on the scale of the pile. He further stated that covering a pile in most cases probably does not do much good. Joe saw in that studies the cover led to decreases in releases. He did not see where a cover increases the releases. Joe believes that extending the time for storage with no cover is less protective.

Jim Riddell stated that we still need to be able to move the litter to utilize it. We all want to protect the water. If we make it impractical then we are defeating the purpose.

Kevin said he could provide invoices for the litter amendments.

Mike Thompson said the integrator would be able to provide the information (some integrator's pay a percentage of the cost of the amendment).

Phillip asked what the pile sizes look like.

Jim responded that the piles are A shaped and large. Litter has more value than just N-P-K.

Discussion Related to Temporary Storage of Poultry Waste

Joe clarified his proposal regarding adding the requirement to report use of litter amendments. He stated that the benefit of having the data outweighs the loss of having the cover immediately.

Hobey likes the 30 day conditions but cannot understand why the option one should be immediate cover. Hobey suggested that there should be some provision for allowing to not cover it immediately if the weather forecast does not call for rain.

There was further discussion between Kevin and others with Hobey regarding the burden of properly shaping a pile immediately. Hobey said maybe that was the solution would be to just shape the pile immediately (as required in the draft requirements). Some producers represented indicated that this would not be a large burden.

There was discussion regarding practicality of covering for short time periods.

Mike Thompson suggested that some consideration be given to allowing properly shaped piles to be uncovered for at least 90 days. Litter goes out January, February and March from the Valley area.

Hobey asked about Delaware and Maryland requirements for storage. Further conversation ensued regarding the requirements in other states for uncovered piles, and it was noted that other states' requirements extend much further than 30 days. Hobey stated that based on the other states that perhaps they have bought into the research that has been done.

Kevin would like to see bigger buffers around the storage. He discussed adding slope requirements like the frozen ground requirements.

Betsy pointed out that the frozen ground requirements are specific to the land application of litter. Betsy noted how the existing requirements for the site (which remain in the draft) actually addresses slope "stormwater cannot run onto or under the waste".

Betsy reviewed all of the proposed requirements for storage (much is existing site characteristic requirements).

Betsy pointed out that there might be problems with requiring a temporary storage pile to be moved every year due to limitations in the land area managed or owned by the grower especially if the grower does not have permanent storage. If it is in-field storage, then I can see moving the pile every year. However, the grower at the farm with the additional set-backs could be very limited to storage siting if we add an additional requirement to move the storage site every year. Betsy stated that we could create an additional category by separating temporary farm storage and temporary field storage.

Kevin asked if the temporary storage pertained to the end-user or the poultry grower.

Betsy responded that the proposed language is for all entities and pertains to all storage.

Kevin stated that having the impermeable barrier is insanely impractical for an end-user.

Betsy responded that these requirements have not changed and they exist in the current regulations. Betsy explained the requirements for impermeable barriers.

BREAK 11:35-11:55

Betsy continued review of the proposed regulatory requirements for storage. The requirements would be identical throughout the regulation for all entities.

Betsy asked if there would be a need to separate out field storage vs. storage at the production facility.

Hobey responded that he did not think so.

Kevin asked if the storage in the field would allow 90 days.

Betsy clarified that there are a few reasons why a 30-day limit on uncovered piles was that there. One of the reasons to not go beyond the 30 day limit as required in the draft language is because some EPA staff believe that storage uncovered for beyond 14 days can be considered rudimentary liquid storage. The animal number threshold significantly changes liquid storage when being defined as a CAFO. The other significant reason is the NMP requirement to land apply litter no greater than 30 days from planting the crop. Without an NMP, you are not allowed to land apply greater than 30 days from planting. Again, these requirements are identical with all storage for all entities. It would be more difficult for DEQ compliance staff and for the effected entities to allow different times for different scenarios or entities.

Hobey stated that he thought that the way Betsy structured the storage requirements seems simple enough and well thought out – when you get to your 30 days you can just convert to cover it (option one). He would argue that more than 30 days would be justified, especially based on what we have seen in Maryland and Delaware. He could make the argument for 60, 90 or 120 days of uncovered storage.

Joe asked if the group was opposed to getting the litter amendment information as part of the reporting requirements, he said that without that he would not support the storage requirements.

Betsy clarified that at this time (in the draft proposal) DEQ is not requiring reporting from the growers.

The members of the TAC had a discussion to gain clarification of what Joe was proposing.

Hobey asked recordkeeping so DEQ can get the data.

Joe stated as a requirement.

Holly asked recordkeeping or reporting.

Phillip said both.

Neil stated that for the purposes of Joe's question, keep the subject to recordkeeping. Records that DEQ can ask for if DEQ wants them.

Holly asked if this would be based on inspections.

Neil said reporting is a separate question.

The group discussed who would likely have the information, the growers. And how the information would be obtained by DEQ.

Hobey stated that everyone is inspected and the records are kept on-site and DEQ can ask to see the records.

Kevin agreed that the records could be looked at when requested during an inspection.

Betsy said that we could look at it as a BMP. This would not be a guarantee that this could get into the model.

Joe stated that the BMP question is five years down the road.

Holly asked what would be the benefit to DEQ of getting the information.

Kevin stated that it could be used in the model if it could be verified. He stated that if the growers are doing this, then the growers could get credit for the amendment use. The problem is getting it verified for the model purposes.

Holly asked what DEQ would use the data for since it is not likely that the data only would be enough to submit to the CBP to get credit in the model.

Kyle expressed concern about adding a requirement if it does not have a specific use by DEQ, and he is concerned and wants the permit not to become more burdensome if it does not add value.

Kevin suggested that it would not be much of a burden to report something he is already doing.

Hobey suggested that the information could be collected by DEQ outside the requirements of the general permit.

Conversation followed regarding what data would have to be reported. It was pointed out that what EPA would need in order to get credit in the model for use was a more complicated question.

Joe stated that this is not for the model but for agency knowledge.

Jim stated that it sounded like the recordkeeping may be similar to pesticide applicator license recordkeeping. The applicators have to show the evidence/record of what is used.

Jackie said she did not think the use of the amendment would change if the litter was transferred off site. The amendment would still have been done.

Betsy stated that DEQ could perhaps add this to the inspection form. If we add it to the inspection report we will know if the grower has used a litter amendment. We could look at receipts or recordkeeping forms. Betsy pointed out that there would be a learning curve for the grower to be ready to provide the information available and we could introduce the requirement over a period of time through the inspection. It would become expected if we added to the question the inspection form. She stated that we could have a question that asks about BMPs, which could include litter amendments.

Hobey said it sounds like we are looking to do a survey of what people are doing. He suggested that this could be an initiative that could collaborate with the Virginia Poultry Federation to get the litter amendment use information.

Betsy responded that yes, since the amendments would change over time.

The group discussed what would be documented "what Joe was asking for".

Joe stated that the purpose getting the data is to find out what the effects or if it has effects on nutrient losses over time. Joe stated that we do not want to wait to get the data just because we cannot get credit in the model today, otherwise we will never get it.

Holly stated that maybe there are other ways to obtain the information. She also stated that she would agree that getting credit would be good but this is more of a recordkeeping issue on the grower not the end-user. Maybe this could be done during this inspection, even that may not be enough for the model. Holly mentioned that perhaps this could be a part of study that she is in the process of working on with University of Delaware for the Delmarva. It could be another institution. Holly pointed out that this data would be better, better to be verified to get to the model than recordkeeping. Holly asked again what is the purpose of getting the data.

Joe said it may not get us to the model, but it is a step to improving documentation and a step to Virginia's Bay restoration goals. For an agency understanding possibly to provide guidance. DEQ does not know what is being used.

Phillip if the information could be useful for a study (research). How would the data be accessible to the researchers? Should we consider having the data be reported to get it to a researcher.

Holly stated that a researcher can get the data other ways than through reporting. Holly also pointed out that the use of litter amendments is for animal welfare not necessarily for nutrients. The concern is that litter amendments and how they are used should not be dictated for nutrients aspects.

Phillip stated that was not they were not suggesting that.

Kyle stated his concern that the more and more conditions you put in the permit the harder it would be to get to the mission of the permit. He wants to make sure the Concerned that this will be an overburden.

Phillip stated that he thinks they are not asking to require the data but if the grower is doing it to let DEQ know.

Kyle pointed out that if the permit says to tell DEQ then it is a requirement.

Kevin thought that maybe the recordkeeping could be something like a receipt. Kevin is using the amendment for his birds. He did not think it would be much of a burden if he is already doing it. It is listed in the Bay model that we could get credit.

Tony stated out that is the point, DEQ has never expressed an interest in the data. And now it is being suggested to add it to the regulation.

Seth asked if EPA requires the verification on anything (i.e., lime or fertilizer).

Betsy responded that EPA does not require verification for inspections and such.

The discussion surrounded verification and what kind of recordkeeping was needed.

Kevin thought this could be voluntary. And possibly in the future, maybe this could be used for the model later. Kevin stated that sometimes it is okay to ask them to do a little more.

Betsy responded about a voluntary aspect. She further asked if Hobey and Holly could get the information of what is the use, the typical.

Hobey said that we could get the information through a survey to go to the growers and collaborate with VPF. He recommended a uniform survey instrument to compare the information. You could ask the producers to supply the information every couple of years or on an annual basis. Hobey said it would not need it in the regulation.

Kevin said that he did not think it could ever be used by the Bay model unless it comes from an institution.

Joe stated that DEQ would never do that. He said we are understaffed. He asked the group if they really thought this would happen unless it was a requirement.

Tony said making it a requirement will not help DEQ have the data accepted by the Bay model.

Betsy agreed with Tony's statement, no, especially if is a reporting requirement.

Mike said this could be asked during the inspection. If DEQ asked producers to complete a report/recordkeeping form then there would be resistance. Asking during the inspection would not be so bad.

Kevin agreed with Mike. Kevin also said he would not want anyone to tell them how much to use to get a certain point scale. He would share how much he is using.

Phillip responded to Kevin saying he was thinking the latter.

Discussion followed regarding acquisition of data through inspections, permit recordkeeping, and other means.

Betsy stated that the additives are not used for compliance. The additives have nothing to do with compliance or with the permit. This is completely a separate issue for the permit, it is much like we do not say how big the cage is for layers and for those who allow for daylight, we do not

say how much time the birds are allowed outside. DEQ does not get into the production side of the farm like regulating bird size (lbs.), what they do with the animals and how they raise them. The production decisions fluctuate all of the time.

Hobey said it seems that this would be more appropriate for an institution like VA Tech or another institution to get the information.

Holly agreed that a research institution is a better place to get more information. Then this data would be better suited for modeling purposes and the Bay program has accepted the information from other states (Delaware). She does not disagree that the information would be helpful for many reasons, but not sure that it should be put into regulation because the use is based on production standards and not on nutrients, that is where she has concern.

Joe said from his perspective, and knows there is not a consensus, going to a 30 days allowance weakens the permit, maybe only slightly. And that going to 30 days is convenient for the producer. To counteract that, collecting this information, making this requirement advances our states understanding of this and our ability to address this problem. He can live with the 30 days and if we do something to push back in another area. He stated that without that he will oppose the 30 days.

Betsy stated that in response to Joe's statement of pushing back: in the proposal there are weekly inspections and requiring a lot more documentation for all storage, more than we have ever required.

Joe said from his perspective the package today is a weaker package.

Betsy disagreed and said that it was definitely not intended to be weaker than what is currently in the requirements.

Joe stated he will take his position to the Board but if we require litter additives. Betsy responded: requiring litter additives is a different requirement than earlier stated. Joe said then reporting litter additives. Betsy responded that we have never looked at requiring reporting of any records other than transfer records. Joe then said recordkeeping of litter amendments.

Betsy responded that it could be more palatable to get the information to complete a survey or get the information during an inspection. Betsy asked if Joe is looking for adjustments to be made in the litter additives. Joe responded that he is just looking for recordkeeping. Betsy asked if that meant a yes or no to the use of a litter additive. Joe said yes. Betsy responded that the yes or no is more like a survey. Joe responded that if it is not a requirement, they would not have to respond to a survey. Joe again said he has no confidence that DEQ will get a survey completed.

Kevin asked if it could first come from the integrator. Betsy explained that would be difficult to keep up with integrators since they change.

Hobey stated can we just ask this information. Betsy responded that we could add this possibly to the inspection report. As she mentioned before adding a question related to BMPs. Betsy did state that a survey on the other hand could allow us to get the information quick but doing it through the inspection, it would take a couple of years to get around to all of the farms.

Betsy stated that we could add a clause about documenting BMPs used on the farm. DEQ also provides the clarification about new requirement changes during the training and inspections.

Further discussion occurred related to BMP recordkeeping and reporting. Betsy explained that we have to draw the line where the BMPs are voluntary in what we include in the requirements of the permit. She further stated that we cannot expect the permittee to record and or report information related to voluntary BMPs employed on the farm. When it comes to if this is good information for future and potential Bay model we can add a requirement to permit to document BMPs used on the farm.

Jackie stated that the amendments are not being used by us for the manure, they are being used by us for the health of the poultry. Initially she was okay with providing the documentation but know not if it is one more requirement. Jackie also stated that it is not true that going to 30 days is for the convenience of the producer but that it is more convenient for whomever is land applying the manure.

Betsy asked if for the input from the group about asking for adding a BMP clause (as discussed permit)

Mike asked about the timing of the days of storage, he asked if the group would vote. Betsy responded that

Holly mentions that Maryland and Delaware requires everyone gets a Nutrient Management Plan, and in Maryland and Delaware they have a CAFO (federal permit) so for storage in the production area day 15 the manure may be considered something else.

Mike thinks that the producer for field storage there should be 90 days.

Jackie said it goes back to what Betsy said about having another category for field versus production area storage.

Melanie suggested that perhaps the definition of temporary storage should clarify that it cannot exceed 180 days. The group did not have strong feelings as long as the requirement was clear.

Jim suggested having 60 days uncovered.

Kyle said that it could be restated into different categories but that so long as it is clear it would not have to be restated. He believed that 30 days is good and there could argument for 60 to 90 days.

Kyle expressed support for using another means other than the regulation to collect information related to ammonia reduction amendments (litter amendments).

Phillip asked if Kyle would be comfortable with it being added to the inspection. Kyle said he understands why Betsy said she would have the BMP question open, Kyle thinks that he would rather see the question more specific because he is concerned that it will open it up to expand the data requests. However, Kyle stated that it could be answered with a survey. Hobey mentioned what was done with the Turkey information.

Darrell stated that in order to add it to the regulation, DEQ needs to know what information they need to collect. Darrell stated further that without the knowledge of what data is needed for the model, we will not be able to get the data into the model.

Hobey suggested that DEQ should take back what we heard and determine what to propose.

Seth asked about the 14 day storage versus 30 day and how it relates to the rudimentary liquid waste storage discussion. Betsy responded that the weekly inspections would provide documentation to demonstrate that there is no evidence of storm water running under the pile. Betsy pointed out that field storage for a CAFO owner is considered production area. Betsy believes that we are not going too far with the 30 days because of the ramped up documentation for storage. Neil added that this does not alter the duty to apply, there is still a prohibition of a discharge. The inspections and documentation is integral to the change from 14 to 30 days.

Neil asked the group, specifying that the question was really directed to the poultry producers, what they thought of the level of burden on the producer was related to the added inspections and recordkeeping requirement for temporary storage.

Each of the growers on the committee indicated that they did not feel that the additional recordkeeping requirement for temporary storage was burdensome.

Mike stated that he thought it would not be a problem for the producer but possibly for the end-user. Jackie clarified that not a problem for the person who has someone helping them document.

Betsy clarified that from what she is hearing from the group, the storage language is good as proposed (the draft sent prior to Christmas). She said she will check with the group near the end of the meeting.

Summary of Revisions Made Since Last Meeting Related to Commercial Poultry Processors

Betsy indicated that in conversations with the DEQ Office of the Attorney General representative supported DEQ's authority to add requirements for commercial poultry processors to the GP.

Betsy made changes to the proposed language based on suggestions from the AG representative and the suggestions made at the last meeting.

- Revised proposed definition
- Revised language (replaced spilled with deposited or released)
- Added language to ensure clean up and disinfection (C&D) are not affected by this section

Betsy reviewed the proposed requirements and asked if there were any questions or concerns regarding the changes.

Some members of the group indicated that the changes since the last meeting were improvements.

Holly Porter suggested that the timeframe for the initial submittal of the processor's plan should be increased from 30 for 60 days. Holly also asked if DEQ would develop a template for the processor plan to be submitted.

Betsy said she would look at developing a template for the processor.

Discussion Related to Poultry Waste Transfer Records Reporting Requirements

Betsy indicated that CBF and the Riverkeeper had expressed a desire for the regulation to require reporting of records by both producers and end-users.

Phillip stated that it would be adding a reporting requirement not additional records.

Hobey asked who did they want to report, just the producers. Phillip asked for clarification on who already reports. Betsy said we get the brokers reports and we get the growers records while on the inspection.

Hobey said we had talked about this extensively at a previous meeting related to the reporting and recordkeeping and the Bay model needs. Hobey expressed concern that a reporting requirement for end-users may have the unintended effect of stranding litter. And he is concerned that the level of training to get the requirement out their but that it could also cause a requirement to be on the books that will cause a compliance issue.

Kyle recalled discussions from the first meeting regarding what information DEQ needed to accurately report poultry litter transport data for the CB model, and that conversations were that information reported by brokers and recorded by producers and collected by DEQ was enough to meet model requirements.

Kevin mentioned the trouble of getting the data to the model on a timely basis.

Kyle said the way the language is written now and they support is that if we get the data from the broker and grower (via inspection and DEQ request).

Jackie stated that her concern is that if the end-user is going to be required to submit an annual report then it will be a lot easier for the end-user to pick up the phone and calling southern states.

Further discussion surrounded the recordkeeping and reporting possibilities to ensure that the data is reportable to the Bay model. Betsy pointed out that the language was tweaked so that the records will be reported in a format required by the Department. This allows for the agency to have a digital option when it becomes available.

Betsy explained the reasoning for not putting a reporting date in the permit at this time, and noted that we could in the future make further changes in the regulation to add a date for reporting by the grower. Betsy outlined the plan to have the regions request the data from the growers on an annual basis (in the first year that these amendments are effective) in a manner that will allow the agency to utilize the staff resources efficiently. Betsy stated that the preference is to use our staff time for completing inspections rather than entering data from transfer records being submitted by growers annually in a big slug if we added an annual date for the submittal of records by the grower. By not adding a specific date in the regulation, DEQ can request the data over time to allow for a more efficient manner of receiving the data. Right now the data, is held in a spreadsheet. DEQ explained that we have started working on a digital manner to maintain the records and the Department intends to get that technology rolled out.

Joe expressed that memorializing the reporting requirement by including the requirement in the regulation provides reasonable assurance that Virginia will meet the goals of WIP III.

Phillip mentioned that we could phase in the requirement. Neil stated that would actually inhibit immediate meeting of the goal our ability to get the information if we add a phased in date for submittal. Neil further stated that if we add a phased in date, the blanket request for data removed for that piece. Betsy clarified the blanket request condition is negated. She gave the example that a good lawyer would argue that the permittee would not need to submit the data until the phased in deadline.

Joe asked how will we memorialize how we plan to request the data.

Neil stated that we would address it in the response to comments.

Betsy responded that she writes guidance for the staff that outlines what has to be done with permits, compliance, and how and when they put data into our data system. The request by our staff would be outlined in the guidance. Betsy stated that she did not want a data effort to restrict a compliance efforts because the same people have to do both. She further explained that we can accomplish this by getting the regions to request the data. She said that if we had unlimited staff or resources we would not delay adding a date to the regulation.

Kevin asked for clarification that if DEQ is going to add in guidance that in the first year staff will request growers for the transfer recordkeeping. Betsy responded that yes, the requirement for DEQ staff will be added to the staff guidance.

Final Comments or Concerns from Members of the TAC

Betsy asked each of the members to voice any final concerns or comments on the draft proposed regulatory language. The following are the responses from the members.

Mark Patterson – nothing to add, Mark expressed his appreciation for all the work that Betsy put into this. Betsy responded that she appreciated his comments and all of Mark's help.

Holly Porter – likes the 30 day uncovered storage limit, good reports with the presentations from both sides, she would have to agree that some of this is on a small scale and believes that there are some research gaps and would not want to rely on it for policy changes. Expressed support for additional data be collected for purposes of documenting BMPs but that the permit may not be the best tool. Has concern of how the litter amendments and regulatory requirements and compliance.

Kyle Shrieve – supports regulation in current form, some concerns about commercial processor section, but feels they can live with it. Concerns about requiring data about the litter amendments.

Darrell Marshall – supports voluntary collection of BMP data (litter amendments), but does not think that VPA permit requirements are best mechanism to collect that data

Tony Banks – echoes Darrell's thoughts

Joe Wood – adding reporting requirements for alum benefits everyone in the room, concerns about covering all stockpiles, and not reporting litter transfer records

Phillip Musegaas – generally supports the 30 day temporary storage and would like to see some way to collect the amendment data. Understands the staff constraints for reporting requirement. Appreciates everyone's time and coming back for another meeting.

Mike Thompson – concerned for storage on end-user – we are at a balance now and concerned that if we make it harder to use then the end-user will stop using the litter. Would like to see the timeframe for uncovered storage for end-user be extended.

Pete Watson – supports regulation as it is, concerned if you keep regulating it where will it go, the litter has to go somewhere.

Seth Mullins – supports regulation as it is, considering no changes to NMP section.

Jacki Easter – supports regulation as it is, and echoes Mike and Pete’s concerns about regulating the end-user that they can easily pick up the phone and order fertilizer. Jackie also volunteered to test a web-based reporting tool.

Kevin Dunn – supports regulation as it is, likes the likes that we will request the data for transfers, believes that it would be good if DEQ could ask for additional information from growers during inspections. Appreciates the time.

Hobey Bauhan – echoes the producer’s comments

Melanie Davenport expressed appreciation for the TAC’s work in developing the regulatory requirements.

Betsy expressed her appreciation for the members time, and acknowledges that not everyone will be happy with her. It is good to have a cross section of folks on the committee and the points made by those folks; it makes it a better product.

Next Steps

The comments and suggestions made at the meeting will be taken into consideration and revisions will be made to the language if the agency determines them necessary.

Betsy will take it to the proposed language to the spring State Water Control Board meeting. Betsy indicated that a Spring Board meeting date has not been set. Betsy will let the Committee know when the proposed regulation will be presented to the State Water Control Board. At that meeting, DEQ will request Board to move to proposed stage that will include a 60-day comment period, including public hearings. DEQ will then respond to comments including those made at the hearings. Betsy and Melanie explained when comments are allowed by the public including the TAC members.

Betsy will take the final regulation to the State Water Control Board at its meeting in September. This timing will provide for the regulation to become effective by December 1, 2020.

Public Participation

There were no comments from the public.

Adjourn

Betsy thanked everyone for his or her time and participation on the Technical Advisory Committee. Betsy adjourned the meeting at 2:45 PM.

Action Items:

1. Betsy will provide to the TAC members, Alternates and Interested Parties – a final draft of the proposed amendments to the Regulation language.



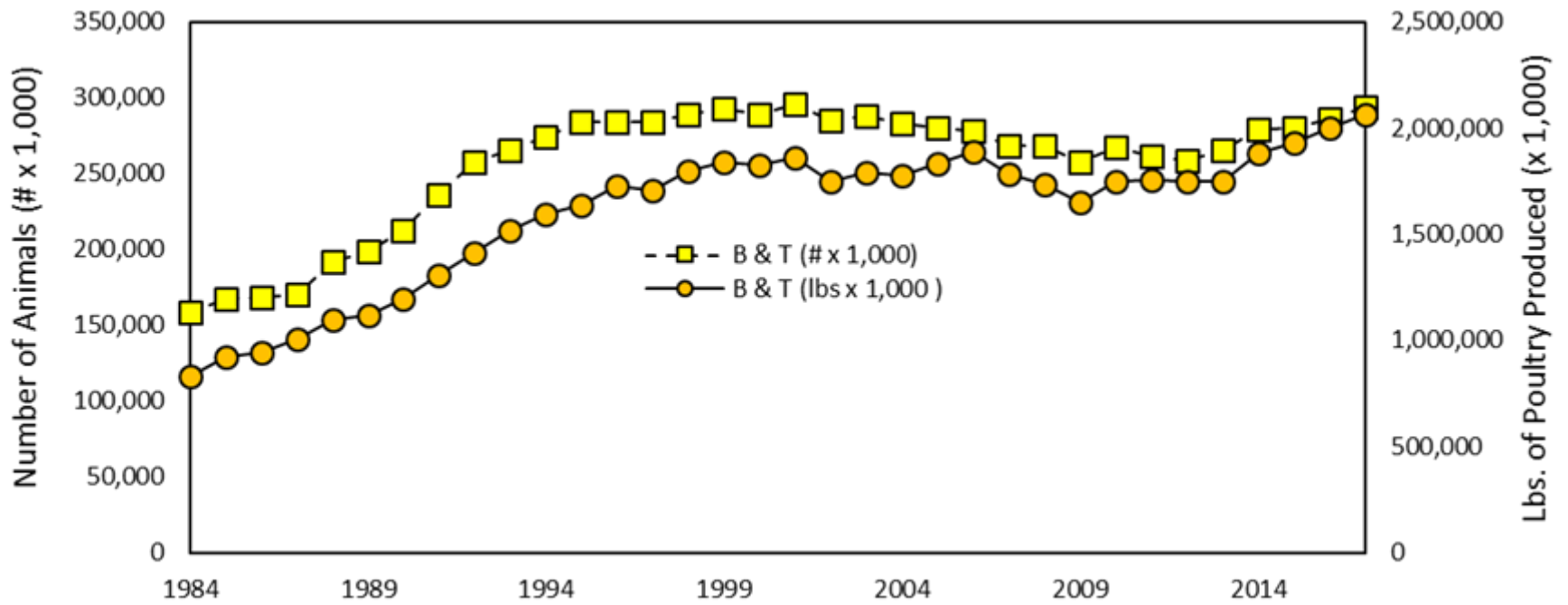
Conclusions from a Literature Review on Poultry Stockpiling



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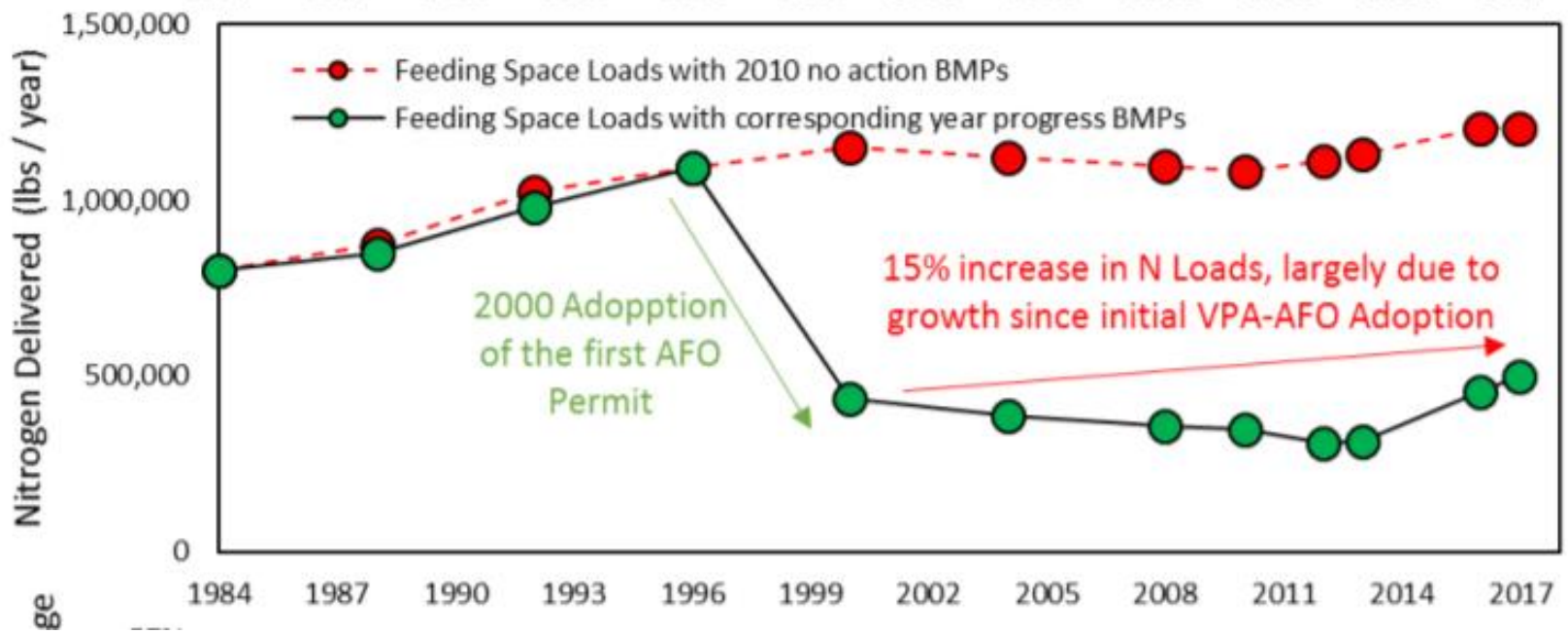
Joe Wood, Ph.D.

Virginia Senior Scientist



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VA Poultry Production is increasing



- Point # 1: The scientific literature on stockpile nutrient leaching *and* runoff is variable, with some clear instances of leaching/runoff and other instances of minimal loss.
- Point #2: The impact of covering is also variable, although in many cases, covering provides a nitrogen and phosphorus benefit through various mechanisms. There were no clear/significant instances where covering increases overall nutrient loss.
- Point #3: Ammonia Emissions from litter piles are substantial and potentially a more important nutrient considerations than leaching. Literature suggests covering piles immediately can substantially reduce ammonia emissions, although the long term fate (i.e. after spreading) of ammonia depend on various management factors. Litter additives are recommended to manage ammonia and have potential benefits for bird health.



- Point # 1: The scientific literature on stockpile nutrient leaching and runoff is variable and at times conflicting, with some clear instances of leaching/runoff and other instances of minimal loss.



Example #1

- Binford et al 2008

Annual estimates of nitrogen loss (Runoff/Leachate):
~17 lbs inorganic DIN per 100 tons of poultry litter



- Example # 2

- Costello et al. (2001) reported that litter properties changed very little in a tarp-covered stockpile, whereas N and C concentrations decreased in an uncovered stockpile over a 13-month study in Arkansas. The uncovered stockpile had surface runoff concentrations of suspended solids and nutrients comparable to liquid animal waste. Unlike Shah et al. (2009), who reported considerable leaching of pollutants into the soil (loamy sand), Costello et al. (2001) reported very little leaching, which may also be due to differences in soil properties (not reported).



Shah, Sanjay B., Kimberly J. Hutchison, Dean L. Hesterberg, Garry L. Grabow, Rodney L. Huffman, David H. Hardy, and James T. Parsons. "Leaching of Nutrients and Trace Elements from Stockpiled Turkey Litter into Soil." *Journal of Environmental Quality* 38, no. 3 (May 1, 2009): 1053–65. <https://doi.org/10.2134/jeq2007.0639>.

Example #3

- In a study in eastern North Carolina, soluble chemicals (N, P, C species) leached into the soil to a depth of at least 24 in. from uncovered turkey litter and cake stockpiled for 12 months (Shah et al., 2009). At the end of the study, ammonium (NH₄) concentrations were 62 times higher in the 12- to 24-inch soil layer beneath the stockpile than in the same layer in the adjacent soil outside the stockpile footprint (Shah et al., 2009).
- Soil cores 12 to 24 in. beneath the stockpiles were dark because of dissolved organic C (DOC) leaching from the stockpiles and had a strong smell of ammonia. Leaching of DOC and soluble P from the stockpiles likely solubilized arsenic (As) in the soil, resulting in elevated soluble As levels beneath the stockpiles (down to 24 in.) compared to levels outside the stockpile footprint.



- Example #4

- Zebrath et al. (1999) stockpiled solid turkey manure on coarse-textured soil in British Columbia, Canada, over six years from fall through winter. Nutrient concentrations down to 12 ft were much higher beneath the stockpile than outside, with NH₄ concentrations 120 times higher, similar to the findings of Shah et al. (2009).



- Point #2: The impacts of covering on leaching/runoff are variable, although in many cases, covering provides substantive benefit. Nitrate loss tends to be higher in covered piles but Total Nitrogen loss is generally greater than or equal than uncovered piles.



Example #1

- Binford et al 2008 annual estimates of nitrogen loss:
“The results showed that on average the no-cover treatments lost 16 pounds of inorganic N, while the polyethylene cover was not significantly different and lost an average of 13 pounds of inorganic N.”



- Example# 2

- During a 592-day study in Nova Scotia, Canada, Sullivan et al. (2009) reported that poultry litter stockpiles covered with tarps had about 20% lower runoff mass losses of total P, total Kjeldahl N (TKN), and total ammoniacal N (TAN) than uncovered stockpiles.
- Runoff loss of nitrate was slightly higher in the covered stockpiles. Leaching losses of the N species were 20 to 30% lower in the covered stockpiles.
- In both, covered and uncovered stockpiles losses were higher due to leaching than in runoff. (Sullivan et al., 2009).



• Example #3

- Zebrath et al. (1999) stockpiled solid turkey manure on coarse-textured soil in British Columbia, Canada, over six years from fall through winter.

Nutrient concentrations down to 12 ft were much higher beneath the stockpile than outside, with NH₄ concentrations 120 times higher, similar to the findings of Shah et al.

(2009). Zebrath et al. (1999) reported that they did not find elevated nitrate levels beneath the stockpile—probably because high free ammonia in the soil solution was toxic to the nitrifying bacteria.

Table 3. Soil inorganic N to 210 cm depth below either a covered or uncovered field stockpile sampled at three times

Depth (cm)	Covered			Uncovered		
	NH ₄ ⁺ -N	NO ₃ ⁻ -N	Total (kg N ha ⁻¹)	NH ₄ ⁺ -N	NO ₃ ⁻ -N	Total
<i>Before pile formation (27 October 1992)</i>						
0-15	8	33	40	9	54	64
15-30	8	27	35	7	31	37
30-210	116	129	246	125	210	335
Total	132	189	321	141	295	436
<i>After pile removal (11 May 1993)</i>						
0-15	371	237	607	2123	8	2131
15-30	54	130	184	33	60	391
30-210	5	2	341	270	2	572
Total	5	2	1132	270	2	3094
<i>After leaving soil uncovered (September 1993)</i>						
0-15	54	326	380	552	252	804
15-30	9	147	156	257	176	433
30-210	21	312	334	578	772	1350
Total	84	785	870	1386	1201	2587

3.5X initial

7X initial

“The results highlight the high potential for nutrient loss from uncovered fall and winter field storage of poultry manure”

N Leaches from piles, and this is 2 folds higher in uncovered piles



Example # 4: Conclusions from North Carolina Agricultural extension Literature Review:

- 1. When allowed by regulations and if the quantity of waste to be stored is not excessive (say, hundreds of tons), enveloping a poultry waste stockpile will be economically and environmentally acceptable. If the waste is not excessively wet, if the site does not pond, and if it is protected from run-on, then covering the stockpile may be adequate.
- 2. Between short-term stockpiling events at the same site on soil, covering the stockpile footprint will reduce leaching or runoff losses (or both) of remnant stockpile pollutants.



Poultry Waste Stockpiling Methods: Environmental Impacts and Their Mitigation

A guide for federal and state agencies, poultry producers and integrators, extension personnel and researchers, students, and waste management companies



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NC Agricultural Extension recommends cover for
runoff and leaching protection

Liu, Jian, Peter J. A. Kleinman, Douglas B. Beegle, Jennifer L. Weld, Andrew N. Sharpley, Lou S. Saporito, and John P. Schmidt. “Phosphorus and Nitrogen Losses from Poultry Litter Stacks and Leaching through Soils.” *Nutrient Cycling in Agroecosystems* 103, no. 1 (September 1, 2015): 101–14. <https://doi.org/10.1007/s10705-015-9724-3>.

- Example # 5
- Covering stacks reduced leachate total P losses by 25–100 times and total inorganic N losses by 25–770 times, such that leachate nutrient losses from covered stacks were similar to that in the controls with no manure stacking. Despite relatively small nutrient losses from litter stacks over the 2-year study, results point to substantial nutrient accumulation in soil after repeated stacking. Water-extractable P concentrations in upper 5-cm soils were similar between covered (120–240 mg kg⁻¹) and uncovered stacks (140–250 mg kg⁻¹), but soil nitrate-N concentrations were much higher under the covered stack (80–140 mg kg⁻¹) than the uncovered stack (5 mg kg⁻¹).
- “This study clearly points to benefits of covering litter stacks, but highlights long-term concerns with regard to soil nutrient accumulation.”
- “New regulations should require that poultry litter stacks are relocated to a new area each year.”



- REVIEW OF POLLUTANT LOSSES FROM SOLID MANURES STORED IN TEMPORARY FIELD HEAPS Report for Defra Project: WT1006
- Example #6
- Covering poultry manure field heaps (with an impermeable sheet) was shown to be an effective method of decreasing leachate volumes and pollutant losses.



Point #3: Ammonia Losses from litter piles are substantial and potentially a more important nutrient consideration than leaching/runoff. Literature suggests covering piles immediately will substantially reduce ammonia emissions, although the long term fate of ammonia depends upon further management actions.



Example #1

- Ammonia loss per unit surface from the tarp treatment was 45 % lower than the other treatments

Table 2 Comparison of average daily NH₃ flux on a real (J_a) and volume (J_v) among the treatments in the lab (this study) and with large summer and winter stockpiles (Yao et al. 2011)

Study and scale	Treatment and season	Average NH ₃ flux		<i>p</i> -value ^a	Time *treatment
		J_a (g m ⁻² day ⁻¹)	J_v (g m ⁻³ day ⁻¹)		
This study, lab	Control	21±0 ^b a ^c	304±6a	<0.01	<0.01
	Tarp	12±1b	166±19b		
	Double-depth	23±0a	164±3b		
Yao et al. (2011), field	Uncovered in shed, summer	17 ^d	30 ^d	– ^c	–
	Uncovered in shed, winter	26 ^f	42 ^f	–	–

^a Repeated measures ANOVA

^b Mean±SD (*n*=3, average value for each replicate was obtained by averaging 13 daily values)

^c Treatment least square means followed by the same alphabet are not significantly different at $\alpha=0.05$ using Tukey's honestly significant difference

^d Study duration was 9 days but first 2 days of data were discarded



Sagoo, E., J. R. Williams, B. J. Chambers, L. O. Boyles, R. Matthews, and D. R. Chadwick. "Integrated Management Practices to Minimise Losses and Maximise the Crop Nitrogen Value of Broiler Litter." *Biosystems Engineering, Gaseous emissions from Agricultural Systems*, 97, no. 4 (August 1, 2007): 512–19.
<https://doi.org/10.1016/j.biosystemseng.2007.03.032>.

- Example #2

- The plastic-covered treatment lost less than 5%. The other treatments had losses of 12 to 16% (Sagoo et al., 2007)

- Ammonia loss from the litter that had been stored under plastic was higher following land application than from litter that had been stored outside in a flat pile, indicating that most of the ammonia conserved during storage was lost during land application but incorporation of manure was critical to prevent ammonia losses. (Sagoo et al., 2007).

- These measurements provide a good example of 'N pollution swapping' (i.e. an NH₃ reduction strategy increasing NO₃ leaching losses) and highlight the need to develop integrated manure management strategies that consider all N loss routes and forms



- Example #3,
- Covering stockpiles with plastic ranked the most effective manure storage measure for reducing ammonia emissions from poultry litter with up to a 60% reduction expected.

Table 3. Measures for reduction of emissions in pig and poultry manure storage in farm

Abatement measure	NH ₃ reduction, %**	Priority	
		Points	Group
Covering of poultry litter or solid manure with plastic covering or other synthetic sheeting	up to 60%	75	I
Usage of chemical or biological additives for slurry	up to 68%	75	I
Installation of light construction roofs over tall open tanks	up to 80%	70	III*
Replacement of lagoon slurry storages with covered tank or tall open tanks	30–60%	66	III*
Reduction of slurry storage surface (mirror surface) in new built storages	up to 60%	55	III*
Increase of litter stockpile height	up to 30%	55	II

* State support is needed to implement the measure; ** Bittman et al., 2014; UNECE, 2014; UNECE, 2015.



- Example #4

- Miles, D. M., D. E. Rowe, and P. A. Moore. “Litter Ammonia Losses Amplified by Higher Airflow Rates.” *The Journal of Applied Poultry Research* 21, no. 4 (December 1, 2012): 874–80. <https://doi.org/10.3382/japr.2011-00468>.
- “Practical applications to reduce NH₃ emissions on the farm may include covering litter stockpiles to reduce wind flow over them or using intense ventilation between flocks coupled with an NH₃ scrubber.”



- Example # 5:

Sullivan et al. 2009

- Covering the stockpile reduced ammonia by 92%, nitrous oxide by 73%, and methane emissions by 71% (Sullivan et al., 2009).



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- Based on Yao et al. 2011, We estimate that ammonia flux from a stock pile the size reported in Binford et al. would produce ammonia emissions (A) 2-3 orders of magnitude greater than N losses associated with leaching/runoff. We further estimate that nitrogen loads delivered to the bay as a result of these emissions would be an order of magnitude greater than N losses associated with leaching/runoff as reported by Binford. While there are many extraneous factors that may influence this comparison, the vast difference is startling and suggests the need to manage ammonia emissions.

Uncovered pile
Leachate/runoff: 0.12
 $\text{g m}^{-3} \text{d}^{-1}$
(Binford et al 2009)

Uncovered pile
ammonia
emissions: 21 $\text{g m}^{-3} \text{d}^{-1}$ (Yao et al.
2011)

Estimated Delivery to
the bay of ammonia
emissions from
uncovered stockpiles
Via Volkswagen
settlement estimates
(8.9%):
 $2.7 \text{ g m}^{-3} \text{d}^{-1}$





Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv



Modeling and measurements of ammonia from poultry operations: Their emissions, transport, and deposition in the Chesapeake Bay



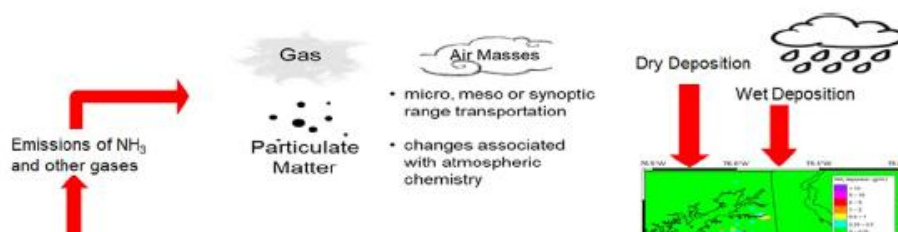
Jordan Baker, William H. Battye, Wayne Robarge, S. Pal Arya, Viney P. Aneja*

Department of Marine, Earth, and Atmospheric Sciences North Carolina State University, Raleigh, NC 27695-8208, United States

HIGHLIGHTS

- Ammonia deposition to the Chesapeake Bay from Poultry CAFOs.
- AERMOD Modeling study.
- Sensitivity of ammonia deposition to deposition velocity.
- Measurements of atmospheric ammonia on Delmarva Peninsula.

GRAPHICAL ABSTRACT



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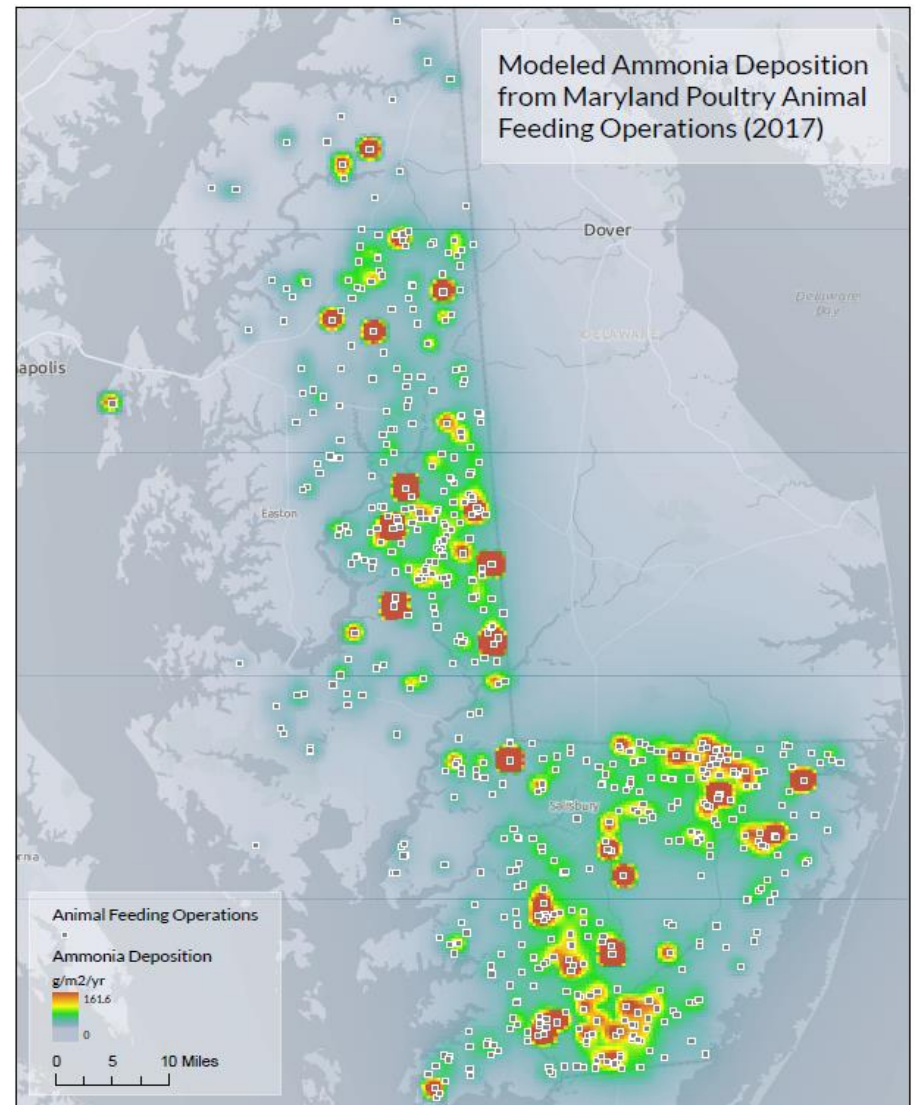
Ammonia is clearly a challenge that needs to be dealt with

Emission Estimates

- Total ammonia N **emissions** from 600+ AFOs in MD was 16,914 tons or 33.8 M lbs/yr

Deposition Estimates

- Total ammonia N **deposition** of 12,220 tons or 24.4 M lbs/year
 - 30% within 500 m of source
 - 70% within 50 km (31 miles)



Data Source: North Carolina State University, Maryland Department of the Environment

Map created by: K. Leaverton | Chesapeake Bay Foundation | 9/6/2019



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Modeling Results

Recommendations to be protective of surface waters

- In the absence of alum data, stockpiles should be covered immediately. We urge DEQ to require reporting on litter additives (i.e. acidifiers) to control ammonia emissions under this permit. Understanding Alum is not only important to understanding air quality impacts and deposition, but also has implications upon the nutrient content of litter which could be incorporated into NMPs. Including this information will help the agency manage impacts of poultry production across Virginia.
- In the presence of documentation of litter additive to stabilize ammonia, stockpiles should still be covered promptly although a longer length of time may be justifiable.



Recommendations to be protective of surface waters

- We urge DEQ to revise the regulations to require the growers, end users and brokers to submit the data, of which they are already recording, to DEQ on an annual basis. Users are already recording this data, thus we do not believe it would be a substantive burden to submit it to DEQ once a year.



Summary of Poultry Litter Stockpiling Research

Bud Malone

Malone Poultry Consulting

Princess Anne, MD

malonepoultryconsulting@gmail.com

Research Review
Considerations When
Evaluating Environmental
Impact of Temporary
Stockpiles

Size and Shape of Piles

Production Size, Conical Shaped Piles



Lab and Research Piles



100 ton pile has 300 times less circumference than ten, 10 tons piles.
Pounds of litter/sq ft increases by 10 for each ft of pile height.

Minimum surface area per unit of volume!!!

Research Procedures

- Type of “poultry” litter (broiler, turkey, total cleanout, cake, litter age, moisture, etc).
- Soil type, pads, effectiveness of removal, etc.
- Covered piles and materials used.
- Site used for repeated stockpiling.
- Soil and water sampling method, location and timing.



Research Location

- Study location
- Timing and duration of *temporary* (<180 days) stockpiling
- Temperature and rainfall during study



Rainfall and Temperature During Stockpiling Evaluation

<u>Month</u>	<u>Temp (F)</u>	<u>Rainfall</u>
Dec	38	3.4
Jan	34	3.4
Feb	36	3.1
Mar	44	4.2
Apr	54	3.3
May	63	3.7
Jun	71	3.5
Jul	77	4.0
Aug	75	5.2
Sep	69	3.8
Oct	57	3.2
Nov	49	3.3

UD Weather Data:
1946-2003

Brief Outline of Stockpiling Research

- Litter Stockpiling BMP Workshop
- Most Relevant Regional Field Scale Study
- Recommendations of Expert Panel based on relevant science

Not a comprehensive literature review of all stockpiling research!

Poultry Litter Stockpiling BMP Workshop

July 21, 2004

- Purpose: Establish most appropriate BMPs based on available research.
- Presenters: Researchers from DE, MD, MN, BC; EPA and farmer.
- Participants: UD, UMD, NRCS, DNREC, CD, MDA, DDA, DEP, DPI, CBF, EPA and DE/MD growers.

Recommendations of participants:

1. Place pile at appropriate sites or pads, remediate site
2. Size and shape of pile important (maximum tonnage per ft²)
3. No consensus for covered vs uncovered piles
4. Lengthen of field storage; subsurface limit of 30-90 days, surface limit of 120-150 days, and 150 days for well designed large pile.
5. Most studies done with small research piles, **need for field scale research!**

Binford, G. and B. Malone. 2008. Evaluating BMPs for temporary stockpiling of poultry litter. Final Report

- Production scale stockpiles of 150-350 tons, 6.5 ft or higher used to evaluate BMPs over 3 years. Fall start dates.
- BMPs included; storage duration (15 to ~180 days), covers (poly, fleece and various spray-on products) and base layers (sawdust, bentonite clay, litter acidifier, spray-on products).
- Key measurements included: litter composition, soil and runoff nutrient loads, but no direct gaseous ammonia losses.

Key Observations of the Binford Study

- N losses from litter were small ($\sim 0.2\%$)
- In a 100 ton pile stored 90 days, mean N loss in soil was 12 lbs.
- Nutrients in runoff greatest after first rainfall event.

Forms cap that aids in sealing the pile.



Key Observations of the Binford Study

- No difference in soil N between uncovered and poly covered piles (13 vs 16 lbs, respectively). Suggest ammonia gas transport for N under piles.
- Pile temperatures at 150 days were 64 F (uncovered) and 109 F (covered) at 150 days.
- No benefit found with spray-on and base treatments in reducing N losses.
- ~75% of soil N found in top 24 inches under piles, planting crops would remove significant amount of this N.
- Not recommended to keep stockpiles from one growing season to another.

Better to keep litter in stockpiles regardless of storage duration rather than spread at the wrong time of year.

Poultry Litter Expert Science Forum. 2008. Chesapeake Research Consortium

- Consensus on stockpiling research by 10 poultry waste management experts.
- Limited data on temporary stockpiling used in the region and under realistic conditions (ie. Losses from small, saturated research piles not useful to predict that of properly formed field piles).
- Additional weight given to Binford study since it was the only study conducted under regional and realistic temporary field stockpiling conditions.

Poultry Litter Expert Science Forum. 2008.

Recommendations:

1. Minimize storage needs by scheduling cleanouts close to planting season.
2. Need proportional increase in on-farm storage with increased production capacity (designed for cake and not cleanouts).
3. Construct piles to minimize footprint (A shape, high as practical). Site pile to minimize nutrient losses. Little difference between 14 and 190 days storage, most risk occur first few days but impact is >0.
4. Stockpiling recommended (up to 190 days) when other options not available (field application, hydrological cycles, alternative uses).
5. Remediate pile footprint (surface soil removal, till, plant salt tolerant crop or one that removes nitrates).

Poultry Litter Expert Science Forum. 2008.

Recommendations continued:

6. Rotate storage site location. Literature supports covers reduce some ammonia losses but **no** data on losses from properly formed field stockpiles. No consistent effect of covers to reduce surface runoff or loading to soils under/adjacent to piles. N loading under piles from ammonia gas. Literature indicates covering increases plant available P.
7. Due to lack of consistent effect of covering, panel does not support mandatory covering of temporary field piles as means to reduce nutrient loading to soil and water.
8. Additional research needed on storage pad/BMPs to reduce nutrient loading below piles.
9. Avoid litter application during high-loss hydrologic conditions. Shallow incorporation recommended.

CBF Points: Research Methods Resulting in Conflicting and Questionable Results on Temporary Field Stockpiles

- Point # 1: The scientific literature on stockpile nutrient leaching and runoff is variable and at times conflicting, with some instances of drastic leaching/runoff and other instances of minimal loss.
- Point #2: The impacts of covering on leaching/runoff are also variable, although in many cases, covering provides a nitrogen and phosphorus benefit through various mechanisms and does not increase nutrient loss.
- Point #3: Ammonia Emissions from litter piles are substantial and potentially a more important nutrient considerations than leaching. Literature suggests covering piles immediately can substantially reduce ammonia emissions, although the long term fate (i.e. after spreading) of ammonia depend on various management factors. Litter additives are recommended to manage ammonia and have potential benefits for bird health.

Brief Review of CBP Stockpiling
References and Potential Risk of Using
This Information for Policy Decisions.

Covering Stockpiles to Reduce Nutrient Losses Is Justified for Some Situations

Small and improperly shaped piles



Stockpiles in production area of CAFOs



Caked litter



Nutrient Leaching and Runoff and Covering to Reduce These Losses.

- Binford and Malone. 2008

- Only field study on “temporary” field size stockpiles under regional climate and production practices.

- Based 3 year study with limited replications, no statistics and not peer reviewed.

- Costello, et al. 2001

- Major goal was to establish procedures for covering piles.

- Stockpiles of field height (6.2 ft) but duration of study was not temporary (**13 months**, from Feb to March following year) and included one 13 inch rainfall event.

- Does not state if litter from same source, no pile temperature or soil N loading data. On dwb uncovered litter had 0.25% more N than covered pile, 1 vs 13 months).

Nutrient Leaching and Runoff and Covering to Reduce These Losses.

- Nicholson. 2011.
 - Currently all manure without bedding must be covered. Temporary field storage piles on impermeable base OR <12 months storage.
 - Research review of several UK studies on field storage of manures (including broiler).
 - Additional research: Recognizes data from these experimental “heaps” are small in comparison to that found on farms.
 - Need to reduce storage time from 12 to 6-9 months.

Nutrient Leaching and Runoff and Covering to Reduce These Losses.

- Liu, et al. 2015
 - Comprehensive, regional study on covering piles.
 - Study conducted over two, 14 months periods on silt loam and sandy soils using 4.9 ft high piles.
 - Covers reduced N and P leachate beneath piles but had higher nitrate levels.
 - Suggest relocating stack site to new area each year.
 - Recognized the need to conduct study on more realistic size field piles.

Covering Piles to Reduce Ammonia Losses

- Miles, et al. 2012.
 - Lab study on air flow on ammonia release from litter (1.5 inches/chamber).
 - Propose but did not study covering litter piles and using ammonia scrubbers. No consideration for pile depth or cap that forms on piles.
- Shad, et al. 2013.
 - Used screened cake in a 13-day lab study to measure ammonia release from covered (tarp), uncovered and double cake depth treatments.
 - On volume bases, ammonia was 45% less for covered and double depth than uncovered.
 - This suggest a lower surface area per unit volume would lower ammonia losses and larger piles may reduce emissions.

Covering Piles to Reduce Ammonia Losses

- Yao, et al. 2011.

- Measured ammonia emissions from broiler cake in manure shed during 2 summer and 2 winter months.
- Piles were only 2.9 to 3.6 ft high and contained 14 to 17 tons of cake (not representative of most sheds nor field stockpiles).
- Did not study covers but a companion lab study suggest covers and increase cake depth may reduce emissions.

Consolidate Small Piles to Increase Depth and Conserve Storage Space?



Covering Piles to Reduce Ammonia Losses

- Sagoo, et al. 2007.
 - **6 tons** of broiler litter placed in bunker with 1.6 ft walls from June to Nov (180 days) in UK climate (no rainfall data). Bedding type and litter age not specified.
 - Treatments were open air, poly covered, turned, A-shaped and roofed.
 - Ammonia storage losses most to least = roofed, turned, open air/A shape and poly covered. Covered had highest leachate.
 - Total N and moisture content of treatments not stated. Applied litters to field in Fall but did not plant until following Spring?
 - Need to rapidly incorporate poly covered litter to retain ammonia conserved in storage pile.
 - Conclude: Need litter management strategies to address all N loss routes and forms.

Covering Piles to Reduce Ammonia Losses

- Priekulis, et al. 2019.

- Panel of experts (researchers, specialists, farm managers, etc) ranked ammonia abatement technologies for effectiveness, appropriateness, cost and need for government support based on **Latvian** production practices.

- Top broiler litter stockpile abatements were covering piles (75 points, < 60% reduction) and increase litter depth (55 points and , <30% reduction).

- Housing ammonia abatements were 1) dry, well vented/temperature control houses, 2) nipple drinkers, 3) deep litter of shavings or sawdust and 4) alum treated litter. Given these technologies were adopted in US some 20, 30 and 50 and 40 years ago, respectively, must question how advanced they currently management their stockpiles.

Does Ammonia Emissions from Uncovered Stockpiles Reduce Litter N During Storage?

Willin, 2004.

- To avoid past issues with small piles and poly covers, demonstrated large, 600 ton pile (123'l x 50'w x 16'h)

<u>Lbs/ton*</u>	<u>Direct</u>	<u>120 d Storage</u>
Total N	72.8	72.6
NH4-N	14.5	18.6

*wwb

Binford and Malone, 2008.

- Avg of four trials comparing covered vs uncovered piles during ~135 d storage.
- Compared to covered, uncovered litter retained:

<u>Pile Section</u>	<u>Total N**</u>	<u>NH4-N**</u>
Dry zone	+10.1	+5.4
Wet crust	+0.7	-2.8
Mean (90% dry)	+9.7	+4.6

**lbs/ton on dwb



For production size piles, no change in litter N and perhaps greater retention in uncovered piles?

May Need Additional Research to Make Policy on Production Size Field Stockpiles

- Pad site options and remediation.
- Duration of field storage based on pile size and shape.
- Role of increase pile depth on ammonia emissions (cake stored in sheds and field cleanout litter)
- Determine the challenges, merits and/or consequences of covering production size stockpiles.
- Alternatives to poly or tarp covers to reduce ammonia emissions.
- N store management assessment, match storage method with land application procedures.

DEQ Draft Poultry Litter Fact Sheet

Malone's Comments

- **Permanent Storage Facility.**

- Agree with all points but have concerns about condensation under impermeable cover*

- **Temporary Storage – Option One**

- Agree with all points assuming these are small, unshaped piles*

- **Temporary Storage – Option Two**

- Agree with most points with the following suggestion:

- 30 day storage limit may be too restrictive.

CBF Recommendation to Cover All Stockpiles

Malone's Comments

- *Science panel and field scale temporary stockpile research do not support mandatory covering to reduce leachate and runoff. Results from most lab and small pile research studies not realistic or have many limitations.*
- *NO research data available on covering to reduce ammonia losses from field scale temporary stockpiles. Covering may cause some unintended negative consequences. Additional research needed.*

Questions