



# AEM Tier 2 Worksheet

## Livestock Odor Management

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### Purpose of this Worksheet

The purpose of this worksheet is to help the farmer identify the air quality issues that his/her farm operation may be contributing to. The worksheet's low risk categories offer potential practices which may help minimize odor impacts. This worksheet can be completed independently by the farmer, but is best done with the help of a knowledgeable conservation agency staff member or private consultant.

### Glossary

**Airshed:** An area of impact downwind from a source that is variable in size, depending on conditions. The area generally depends on the direction of prevailing winds, the concentration and characteristics of the source, and the dispersion downwind.

**Earth storage basin:** A facility to hold animal wastes constructed out of appropriate soil. The sides are sloped, giving a larger surface area to volume ratio.

**Manure ridges:** Manure pushed up from barnyard cleaning operations that escape under the fence, forming lateral piles of decaying solids that potentially will pollute surface or ground water and provide fly larvae habitat.

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### Background

**Odors:** With the trends of larger and more concentrated farms, more nonfarm rural residents, and more manure storage systems, farms are experiencing more problems in dealing with their neighbors over odors. Odor is one of the major sources of conflict between livestock producers and the general public. Presently, there is no low cost, complete and easy way to control odors from manure.

In a state wide survey of dairy farmers in NY State in 1997, 61%, 42% and 24% of large, (>300 animal units) medium (<300 but >100 animal units) and small farms (<100 animal units) respectively, received complaints about their operations in the past five years. Forty-two percent of these complaints were about odors. Odor sensation is a personal response. Not all persons are equally sensitive, nor do they always agree to the severity of an odor once it is detected. Non-farm people who move into rural areas may not tolerate as much odor as a neighboring farmer.

The further the farm is from homes, public use areas, or businesses, the lower the risk of odor. Neighbors located at lower elevations can be subject to air drainage during still nights and can be surrounded by odiferous air.

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### Integration of Agricultural Water Quality & Odor Issues:

While reducing the potential for water quality problems, it is important that farms integrate a whole systems approach so that they do not create or increase air quality impacts for neighbors or those living in the airshed.

## Glossary Continued...

**Structural manure storage:** A facility to hold animal wastes constructed out of metal, concrete, or wood; usually with vertical sides and no roof.

**Undersized anaerobic lagoon:** A facility designed to treat animal waste that was built too small or the herd expanded to more than originally designed.

**Windbreak:** Linear plantings of multiple rows of trees and/or shrubs.

## Background Continued...

Surveys indicate that farmstead appearance can influence how odors are perceived. More attractive farms generate fewer complaints. More attractive farms generate fewer complaints.

The land application of manure from livestock and poultry facilities is the most frequent source of odor complaints from the public. Where feasible, injecting or incorporating liquid manure and incorporating solid manure will significantly reduce odor emissions during land application. In addition, early morning spreading and consideration of neighbors by avoiding spreading on weekends, holidays, and special events should help reduce the risk of generating neighbor complaints.

**Gases:** There are several gases that can be produced in large enough quantities to cause health problems from manure. Table 1 lists these gases. Good ventilation of farm buildings and controlled access in confined spaces is critical to avoid discomfort, injury, or death. Outside the farm buildings these gases disperse and become less detectable. The gases in Table 1, while occasionally produced in quantities that can affect the health of people or animals in the barn, rarely affect the health of people or animals outside the barn. Ammonia and hydrogen sulfide are often the ones measured for odor control but seldom are the main odor produced. Over 160 gases have been identified that may be produced from manure. Many of these cause odors even in low concentrations. There is a growing concern that ammonia produced from agricultural operations can add to smog and acid rain as well as redeposit on nutrient rich water surfaces, adding to eutrophication.

Table 1. Common gases from decomposition of livestock wastes.

Gas	Toxicity	Odor	Density
Hydrogen Sulfide H <sub>2</sub> S	Toxic at 500 - 600ppm, causes respiratory paralysis, loss of consciousness, and death.	Rotten egg odor detectable at 100 ppm often deadens sense of smell at higher concentrations	Heavier than air
Methane CH <sub>4</sub>	Nontoxic, high concentration limits oxygen supply, explosive at certain concentrations.	Odorless	Lighter than air
Ammonia NH <sub>3</sub>	Mildly toxic, irritates eyes, nose and throat above 25ppm.	Odor of bleach	Lighter than air
Carbon Dioxide CO <sub>2</sub>	Nontoxic, high concentration limits oxygen supply.	Odorless	Heavier than air

**Dust:** Dust can be an air quality problem from dry laneways and barnyards, dry tillage operations, some crop operations, and soils subject to wind erosion. Dust can also contribute to odor dispersion. This issue is worse in drier times of the year and arid climatic regions of the country. Measures that control dust should be considered.

This worksheet is divided into general questions (page 4) and then those areas that potentially can impact neighbors with odor issues. These topics are continued on the following sheets: barnyard-page 5, barnyard-page 6, land application-page 7, liquid manure storage-page 8, and solid manure storage-page 9. Use only the appropriate work sheets.

**Odor Control:**

For each issue in the left column of the worksheet, read across to the right and circle (or check) the statement that best describes conditions on the farm. Leave blank any categories that don't apply.

<b>AEM Tier 2 Worksheet: Agricultural Air Quality General</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment:</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b>Has the producer received complaints from the neighbors about odors or dust from the farm?</b>	Never		Occasional complaints within recent years.	Several complaints within the past year.
<b>Has the producer ever asked neighbors about odor or dust concerns?</b>	All of the neighbors have been approached		Some of the neighbors have been approached	No.
<b>How visible is the facility being evaluated?</b>	Topography and vegetation visually screen the facility.	Only neighboring residents are aware of facilities due to partial screening.	Facility is recessed from neighbors and road but visible.	Facility is highly visible and location is close to the road.
<b>What is the relative odor risk associated with the type of manure storage/treatment system used?</b>	Anaerobic digester or other treatment system is included with any manure storage. OR Composted manure storage. OR Manure is stored for less than one week before land application. OR Properly covered manure storage. OR Daily Spread.		Partially covered manure storage. OR Open lot runoff holding pond. OR Dry manure storage where liquids are separated and drained to separate storage or absorbed by bedding.	Structural manure storage, earthen storage basin, or undersized anaerobic lagoon.
<b>What is the appearance and public/neighbor perception of the farm and its operation?</b>	Appearance of facilities is well maintained. Manure piles well hidden from view, site is neatly landscaped and well groomed.	Facilities appear well maintained. Manure piles are generally hidden from public view.		Facilities do not appear clean and organized. Manure piles in plain view of the public.

<b>AEM Tier 2 Worksheet: Agricultural Air Quality Indoor Confinement Animal Housing</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment:</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b>How is manure handled?</b>	Properly composted.	Solid with limited bedding or amendment additions.		Slurry or liquid.
<b>How is the drainage around animal housing facilities?</b>	A well-drained site.			Not as dry as other facilities. Poorly drained site. Water ponds for several days after rain.
<b>Is manure controlled and collected?</b>	All manure is contained within housing and not allowed to collect around animal housing.		Some manure occasionally pools or accumulates in areas around the animal housing.	Some manure regularly pools or accumulates in areas around animal housing.
<b>What is the frequency of manure and waste feed removal?</b>	Manure is removed from a facility at least once a day. OR Animals are heavily bedded to maintain dry conditions.		Weekly.	Less than once per week.
<b>Is there dust from confined facilities?</b>	No duct problems exist. OR Dust is controlled.		Few efforts are made to control dust.	Dust regularly builds up on fans or ventilation outlets.

<b>AEM Tier 2 Worksheet: Agricultural Air Quality Barnyard Design</b>		<b>Potential Concern</b>			
<b>Factors Needing Assessment:</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>	
<b>Is the barnyard or feedlot well-drained?</b>	The barnyard is sloped to limit ponding and the surface is smooth.			Ponded water exists in barnyard depressions.	
<b>Is the barnyard cleaned completely?</b>	Barnyard shape allows complete manure removal. Curbs are installed to assist clean-up.			Barnyards are irregularly shaped and not conducive to complete manure removal.	
<b>What is the barnyard or feedlot surface?</b>	Barnyard or feedlot surface is concrete.		Barnyard or feedlot surface is soil treated with stabilizer, or constructed of firm stable soil.	Barnyard or feedlot soil is easily erodible and prone to rills, gullies, and potholes and therefore difficult to clean.	
<b>Frequency of manure removal from barnyard: How often do you clean the barnyard?</b>	Daily.	Periodically during the week.	Weekly.	Monthly.	
<b>Are there manure ridges at fence lines?</b>	Curbs are installed to assist in scraping and manure ridges do not form.	Manure ridges are removed with each pen cleaning.		Removal of manure ridges is not a priority.	

**Objective: Odor and air quality**

Many of these issues deal with social concerns or public or community perception of agriculture. A positive appearance does not imply regulations have been followed or all appropriate Best Management Practices (BMP) implemented.

<b>AEM Tier 2 Worksheet: Agricultural Air Quality Land Application Odor and Air Quality</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment:</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b>What are the procedures for neighbor relations and considerations (generally within a 2-mile radius)?</b>	All neighbors receive prior notification of odorous activities; complaints or inquiries are always addressed in a timely fashion. Farm owner/manager(s) are active members of the community.	Most neighbors approached about odorous activities; complaints are addressed, but acted upon slowly.	Some neighbors approached about odors; complaints are largely unaddressed, and seldom acted upon.	Neighbors are not notified in advance of odorous activities (applications), neighbor's complaints or inquiries have gone unanswered. Farm owner/manager(s) are distant from community.
<b>What is the timing of manure application?</b>	Manure is applied on weekdays in the early morning. Holidays and local special events are avoided.	Manure is applied in the early morning.	Manure is applied in the afternoon.	Manure is applied on weekends and holidays and during the late afternoon when the air is warm and stagnant.
<b>Is incorporation used?</b>	Manure is immediately and completely incorporated. *Early fall incorporation may create nitrogen leaching problems. **Incorporation may increase the potential for soil erosion.	Tillage, timing, and amount is used to facilitate manure movement into the soil on crop and/or hay fields.		Incorporation of manure is never used.

<b>AEM Tier 2 Worksheet: Agricultural Air Quality Liquid Manure Storage Structure</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment:</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b>What are the characteristics of manure surface in the manure storage?</b>	Manure inlet pipe is below liquid surface AND Stored manure forms undisturbed crust over the entire surface, OR Manure is held in enclosed manure storage tank OR Completely covered year round with crop residue, plastic membrane or other type of cover, OR Surface aeration maintains oxygen concentration of 1 mg/liter or greater.	Manure inlet pipe is below liquid surface AND Crust forms over only part of storage surface due to regular agitation, wind or other factors, OR Crop residue cover is in place at least six months of year during periods of greatest odor concern.		Manure surface is exposed and does not form crust.
<b>What is the amount and timing of agitation during emptying?</b>	No agitation used during storage emptying. *Samples are taken to determine concentrations as manure storage is emptied to ensure proper nutrient application.	Storage is agitated by stream of manure directed below manure surface. AND Timing of agitation is done to avoid weekend odors.		Storage is aggressively agitated by stream of manure directed above manure surface AND Timing of agitation to avoid weekends is not considered.

<b>AEM Tier 2 Worksheet: Agricultural Air Quality Solid Manure Quality</b>		<b>Potential Concern</b>		
<b>Factors Needing Assessment:</b>	<b>Lower 1</b>	<b>2</b>	<b>3</b>	<b>Higher 4</b>
<b>How are manure pile areas (MPA) managed?</b>	MPAs are avoided for most of year and collected manure is directly land applied.  OR MPAs are done in remote locations away from neighbors. All precipitation and seepage drains away from manure pile.  AND MPAs are removed at least once a year.			Manure piling often occurs near public roads or neighbors  OR Precipitation and seepage pools in vicinity of manure pile.
<b>How is composting managed?</b>	Only manure (<70% moisture) is stockpiled  OR Stockpiled manure is turned weekly to encourage composting until no additional heating occurs.	Crop residue or bedding is mixed with stockpiled manure but no turning or stockpile occurs.		Wet manure (>70% moisture) is commonly stockpiled and never turned.

## **Other**

### **General:**

1. Has a Comprehensive Nutrient Management Plan (CNMP) been developed?
2. How clean are the animals?
3. Is manure or spilled feed allowed to accumulate?
4. Are mortalities disposed of quickly and appropriately?

5. Is trash disposed of without burning?
6. Is dust controlled on roadways during farm operations?
7. Will expansion, or potential changes create additional odor production, for example, changes from daily spread to storage?

### **Indoor Confinement:**

1. Are waters inspected and repaired to control leaks?

### **Barnyard Design:**

1. Can windbreaks be installed downwind from barnyards to disperse odors and screen views?

### **Land Application:**

1. Does your manure spreading plan take into account field specific neighbor impacts from odors?
2. Is spreading equipment kept clean?
3. Have you considered application equipment that discharges manure closer to the ground?
4. Are records of manure spreading kept?
5. Do you use a big gun to irrigate manure and if so, do you limit application to when the wind is less than 5 mph?

### **Liquid/Solid Storage:**

1. Are there windbreaks around the storage?
2. Is the manure storage surface visible from neighbors or the road?

### **Additional Comments:**