



LARAMIE COUNTY PLANNING & DEVELOPMENT DEPARTMENT

Planning • Building

MEMORANDUM

TO: Laramie County Board of Commissioners

FROM: Brad Emmons, Planning and Development Director

DATE: March 17, 2020

SUBJECT: A PUBLIC HEARING regarding a review of the odor footprint tool as an option regulating setbacks for Concentrated Feeding Operations (CAFO) within Laramie County, in relation to occupied dwellings, public or private schools and municipalities or to maintain a fixed distance requirement.

Executive Summary

A public hearing is being held to discuss the option of using an odor footprint tool to regulate setbacks for Concentrated Feeding Operations instead of fixed setback distance. An odor footprint tool uses data collected by researchers to come up with a setback distance based on site location, type of livestock and facility, the use of supplemental odor control and terrain. Combining each of these attributes with an adopted annoyance factor results in a distance in all four directions that a facility must be set back from a number of different land uses. There are positive and negative outcomes of using the tool as a setback requirement in Laramie County. It is important to understand that the discussion of using the tool or a fixed distance only relate to setbacks from occupied dwellings, public or private school and boundaries of municipalities. Other distances from water wells permitted for domestic use perennial streams and static groundwater may exist. It also does not take into account items governed by DEQ such as Air Quality and Water Quality. A CAFO would still need to comply with DEQ on these issues.

Positive Components of using the Odor Footprint Tool for setbacks:

- Data has been collected to get Odor Emission numbers for some species of livestock, livestock facilities, manure handling facilities, odor control and terrain.
- Takes into consideration weather data including, wind speed, temperature gradient, radiation and topography.
- Uses a level of annoying odor, which is a faint odor that the average person may detect if attention was called to the smell, but it would not change a person's behavior.
- Provides a numerical distance based on the above factors.

Page 1 of 2

- Facility setbacks are based on size and type of operation not a one size fits all.
- Provides alternatives to design for the applicant, which may reduce odor and therefore setback.

Negative Components of using the Odor Footprint Tool for setbacks:

- Not all species of animal have been studied for an odor emission number.
- The closest weather data is Alliance, Nebraska.
- Does not tell how far odor will travel.
- Setbacks can change with changing factors
- Verifying the entered components and correlating it to the curve table
- Does not account for extra area afforded the livestock (animal per square foot). Only uses total size of the facility.

Positive Components of a fixed distance

- Easy to measure and enforce
- Creates certainty regardless of situation
- More closely matches state requirements by using just a set distance

Negative Components of a fixed distance

- All Concentrated Feeding Operations are under the same setbacks no matter what size and type of livestock

ATTACHMENTS:

Attachment 1: Public Comment – Ron Butler

Attachment 2: University of Nebraska Lincoln Handouts

In considering the revision of Laramie County Land Board Regulation 2-2-111 many factors must be considered. Yet, after contemplating all these variables, the decision still rests upon the charge given the County Commissioners by the state of Wyoming in WS 18.5.201, "To promote the public health, safety, morals and general welfare of the county". What is the right thing to do for the betterment of Laramie County.

It is difficult to understand the rationale for manipulating the current regulation to encourage the siting of industrial feedlot facilities in our county.

These unaddressed questions beg honest answers:

- a. Why change this regulation if this is the first time the regulation has been "challenged" in 30 years?;
- b. Why change this regulation to accomodate a Federal Government mandated siting of a CAFO?;
- c. Why encourage the construction of a CAFO so an out of state entity can make a profit from tax payer dollars?;
- d. Why in light of the consumer trend toward organic, grass fed, cage free, non-HMO animals do we sanction CAFOs on organic farmland?;
- e. Why in light of all the known health issues, water issues, disease vectors, odor issues, and property value issues do we want to encourage this type of land use in Laramie County?
- f. Why as we face yet another zoonotic epidemic do we wish to concentrate disease vectors in Laramie County?

Contrary to arguments promulgated by some, CAFOs are not the future of agriculture. Between 2011 and 2017 29 states added no CAFOs or declined in numbers of CAFOs in their states. Nineteen states grew in total CAFOs. Alaska and Hawaii were not included in the data.¹

The current regulation as it stands is not a problem. It has not been challenged in over 30 years. It is only being tested now because the Bureau of Land Management is trying to mandate the siting of corrals to house their unmanaged problem of too many wild horses.

Regarding the Odor Footprint Tool (OFT), researched, data driven, field tested, scientific decisions certainly are preferable to anecdotal, personal, biased ones. However to reach a valid scientific decision the data and the science must be unambiguous. Basing

¹Investigate Midwest "CAFO Census"; <https://investigatmidwest.org/2018/06/07/large-animal-feeding-operations-on-the-rise/>

a regulation on distorted scientific data is undesirable. Distorted data and unfounded conclusions often lead to unintended and irreversible consequences.

If the Nebraska Odor Footprint tool as proposed for Laramie County is to be considered, there are several questions which must be addressed.

Allow me to enumerate concerns with the Odor Footprint Tool regulation as presented.

1. Item b of the 2-2-111 proposal states, "These regulations are intended to promote the public health, safety, and general welfare of Laramie County, specifically to address pollution of ground and surface water, minimization of odors for public health concern, and minimization of pathogens and vectors capable of transporting infectious disease."² The odor footprint tool only addresses odor. It does not address water concerns; it does not address health concerns; it does not address disease carrying pathogens and vectors. IT ONLY DEALS WITH ODOR. There is no provision to address other concerns related to CAFOs in the proposed change to Regulation 2-2-111. As Dr. Rick Stowell of the University of Nebraska, who is the developer of the Odor Footprint Tool, indicated in our conversation on 3/6/2020, pathogens and their spread are of great concern.³
2. Item b of the 2-2-111 proposal states, "...USING THE MOST SIMILAR WEATHER AREA TO LARAMIE COUNTY (THE PANHANDLE REGION)". The University of Nebraska, "Odor Footprints and Odor Footprint Tool, An Overview" states, "The science behind the separation distances comes from the use of best-available research on the rates at which farm odors are given off, move and disperse, in conjunction with historical weather records from **a representative location within an area.**"⁴ As mapped by Google Maps Alliance, Ne. is 150 miles from Cheyenne, Wy., nearly 2.5 hours driving time. This hardly constitutes, "a representative location within an area". This likening would be akin to intimating that Cheyenne's weather/wind is like that in Rawlins or Colorado Springs. All the Nebraska regions used for the OFT are considerably less distant from one another than 150 miles. The wind data from National Oceanic and Atmospheric Administration (NOAA) reveals great variance between Alliance, Ne. and Cheyenne, Wy. The wind direction variability approaches 20% rendering this model only as good as the data (see attached spreadsheet graphs and data).⁵ Inadequate data results in a flawed model. Using data because it is expedient totally negates the premise that we are making a science based decision.

² Proposed "Concentrated Feeding Operations Amended Regulations for Public Comment", distributed to the public on 3/3/2020.

³ Phone Conversation between Ron Butler and Dr. Rick Stowell on 3/6/2020, 12:00-1:00 PM.

⁴ University of Nebraska "Odor Footprints and Odor Footprints Tool, An Overview."; <https://water.unl.edu/documents/OverviewOdorFootprint%20Tool.pdf>.

⁵ Data from National Oceanic and Atmospheric Administration (NOAA); Presented in graphical form on Weather Spark:

<https://weatherspark.com/y/4377/Average-Weather-in-Alliance-Nebraska-United-States-Year-Round>,

<https://weatherspark.com/y/3765/Average-Weather-in-Cheyenne-Wyoming-United-States-Year-Round>.

3. Item b of the 2-2-111 proposal states, "IF A SPECIES TYPE IS NOT LISTED APPLICANT SHALL PROVIDE DATA TO THE COUNTY HOW THAT SPECIES CORRELATES TO A LISTED SPECIES." It can be expected the applicant seeking to situate a CAFO will identify their species as having the least odor impact. Additionally indicating a similarity to another species without data and field testing undermines the notion of having a scientific model. As Dr. Rick Stowell of the University of Nebraska, who is the developer of the Odor Footprint Tool indicated in our conversation on 3/6/2020, that extrapolating from one species to another compromises the credibility of the data and compromises the model.⁶
4. Item e-ii of the 2-2-111 proposal states, "AN ANNOYANCE FREE 98% CURVE TABLE WILL BE USED." Why 98%? This number was arbitrarily selected. There is no scientific reason that this standard was nominated. As the University of Nebraska documents in "Understanding an Odor Footprint Tool", 98% percent entitles a newly sited CAFO to impinge on the air quality of their neighbors in such a manner as to cause the harmed neighbor to change their plans, lifestyle, activities on average two hours every four days.⁷ The analogy used by the University of Nebraska in this article likens the annoyance to a dog barking continuously for two hours every four days at any hour day or night. This amounts to more than 200 minutes per week, 10,483 minutes per year on average of annoyance which alters the existing landowner's behavior on her/his own land. In fact Dr. Stowell stated that most odor events are not two hours every four days but more likely one eight hour odor event in a 16 day period⁸, or two days of intolerable odor per month. This dramatically worsens the impact of the odor events on the neighbors. In addition the University of Nebraska article, "Understanding Odor Footprints and the Odor Footprint Tool" suggests, "The Odor Footprint Tool presently does not account for odors that may result from land application of manure." and "These events need to be considered separately for additional odor impact."⁹ There is no additional odor consideration in this Laramie County regulation proposal for this most common means of disposing of the tons of excreta from the CAFOs. Also as stated by the article "Understanding Odor Footprints and the Odor Footprint Tool", an odor annoyance free level does not profess NO ODOR, just diminished sufficiently to allow neighbors to proceed with their normal activities or an odor that is below the appointed threshold of two. Furthermore, the damages to the air quality of the neighbors and community is

⁶ Phone Conversation between Ron Butler and Dr. Rick Stowell on 3/6/2020, 12:00-1:00 PM.

⁷ University of Nebraska "Understanding Odor Footprints and the Odor Footprint Tool"; https://water.unl.edu/documents/OFT_FAQ.pdf.

⁸ Phone Conversation between Ron Butler and Dr. Rick Stowell on 3/6/2020, 12:00-1:00 PM.

⁹ University of Nebraska, "Understanding Odor Footprints and the Odor Footprint Tool"; https://water.unl.edu/documents/OFT_FAQ.pdf.

uncompensated by the ones creating the liability. In fact the perpetrator is financially benefiting in part by harming the air quality of the neighbors.

5. Regulation 2-2-111 proposal, Table 1 “Odor emissions numbers for animal housing facilities”, has alterations not on the University of Nebraska’s, “DETERMINING SEPARATION DISTANCES USING THE ODOR FOOTPRINT TOOL”. The first edit concerns cattle, dirt lot (area is regularly dry), listed with an odor emission number on the proposed 2-2-111 regulation of 5. The original University of Nebraska table based on scientific research and field testing lists the “Odor Emission Number” as To Be Determined (TBD). Meaning there is as yet insufficient data and field testing. In fact the University of Nebraska in the “OFT User’s Manual” states in STEP 5, “Odor emission numbers are not presently available for some facilities commonly found in Nebraska and other central plains states – such as open cattle feedlots (“dry lots”) and anaerobic treatment lagoons. A reasonable amount of information is needed on both the amount of odor emitted by the facility and how odor leaves the site. In both cases, this information is less challenging to obtain from animal housing/buildings than from open, expansive surfaces that are directly influenced by the elements. As more research is conducted and more data becomes available, more categories of facilities may be added and listed values may be updated. Until then, recognize the implications of assuming scaled odor emission values.”¹⁰ Dr. Stowell of the University of Nebraska confirmed that the current data is insufficient and too unreliable to render an Odor Emissions Number for open lots.¹¹ In fact Dr. Stowell said he would not assign this category an Odor Emissions Number because it would reduce credibility of the tool.¹² Without sufficient and reliable data all pretense of being based on valid, defensible inquiry is erroneous. Fabricating the lowest Odor Emissions Numbers for cow (5) and horse (2) CAFOs because one wishes to allow more cattle or horse CAFOs is mendacious.
6. Scrutiny in comparing the University of Nebraska Table 1 “Odor emissions numbers for animal housing facilities” to that proposed by Laramie County Planning and Development in regulation 2-2-111 uncovers a second mutation. In the University of Nebraska table there is **NO HORSE** “SPECIES” listed, nor is there a “TYPE/STAGE OF PRODUCTION”, “TYPE OF FACILITY” or “ODOR EMISSION NUMBER”. This category is found nowhere in literature promulgated by the University of Nebraska related to their Odor Footprint Tool. Contriving a

¹⁰ University of Nebraska, “Determining Separation Distances Using the Odor Footprint Tool, User’s Manual for the Worksheet Based Tool”;

<https://water.unl.edu/documents/OFTUsers%20manual%20WorksheetTool.pdf>.

¹¹ Phone Conversation between Ron Butler and Dr. Rick Stowell on 3/6/2020, 12:00-1:00 PM.

¹² Phone Conversation between Ron Butler and Dr. Rick Stowell on 3/6/2020, 12:00-1:00 PM.

new species category with no related data or research and assigning it the lowest “Odor Emission Number” on the table is not science, nor is it defensible. Again, Dr. Rick Stowell adamantly stated there is no data available with regard to horses to render an Odor Emissions Number.¹³ Furthermore this concocted category of species suffers from the same flaw as the previously noted revision. The University of Nebraska in the “OFT User’s Manual” states in STEP 5, there are NO odor emission numbers for “dry lots” due to insufficient data.¹⁴

7. Comments by Dr. Rick Stowell of the University of Nebraska: Dr. Stowell shared that he has backed away from recommending the use of his Odor Footprint Tool as part of a regulation for siting CAFOs. He instead recommended the tool be used to provide credibility or scientific validity to an existing regulation. Dr. Stowell categorically denied having sufficient data to assign an Odor Emissions Number for dry lot horse and cattle CAFOs.¹⁵
8. Table 3 “Odor Control Factors”. Who verifies and how often do they verify the proposed Odor Control Technology is in place and working?
9. Table 4 “Terrain Adjustment Factors”. Who determines the terrain figures to be used?
10. Annoyance Free Set-Back Graphs: What constitutes a small, medium and large facility? When does a facility become extra large? Obviously numbers of animals confined is a large determinant in odor variation. How many animals would be sufficient to exceed the large facility designation?
11. Why is there no provision for damages from CAFOs who either violate their application for and agreed to odor management plan or negligently cause additional damages to neighbors?

Passing an incomplete regulation based on extrapolated, uncollected and untested data is not science. Instead it is using the veneer of science to disguise a biased position. I would ask that you “First do no harm!” Once the current protective regulation, which has proven effective for more than 30 years, is rescinded, there is no reprieve for damage to quality and enjoyment of life in the rural Laramie County community. There is no easy way to put this genie back into the bottle. As a co-worker commonly opined, “If you don’t know what lever A does, lever B.” This might be wise counsel concerning Regulation 2-2-111.

¹³ Phone Conversation between Ron Butler and Dr. Rick Stowell on 3/6/2020, 12:00-1:00 PM.

¹⁴ University of Nebraska, “Determining Separation Distances Using the Odor Footprint Tool, User’s Manual for the Worksheet Based Tool”; <https://water.unl.edu/documents/OFTUsers%20manual%20WorksheetTool.pdf>.

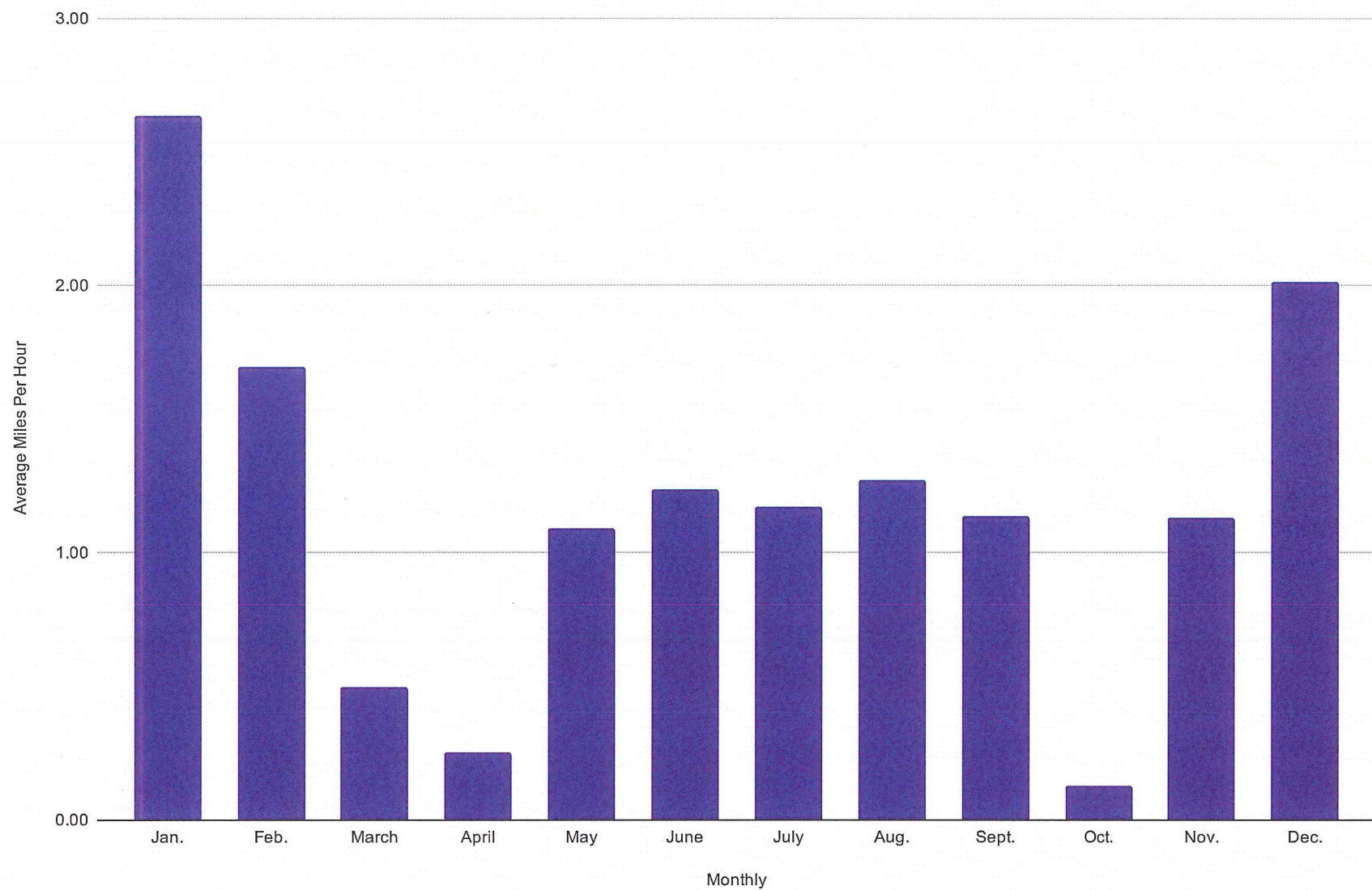
¹⁵ Phone Conversation between Ron Butler and Dr. Rick Stowell on 3/6/2020, 12:00-1:00 PM.

Wind Direction Data									
	Jan.						variability		
		north	south	east	west		north	south	east west
	Alliance, Ne.	15.42	4.61	52.71	12.11				
	Cheyenne, Wy.	8.10	4.19	71.45	14.75				
							7.32	0.42	-18.74 -2.63
	Feb.								
		north	south	east	west				
	Alliance, Ne.	17.79	7.59	43.97	12.10				
	Cheyenne, Wy.	10.34	5.76	63.55	13.79				
							7.45	1.83	-19.59 -1.69
	March								
		north	south	east	west				
	Alliance, Ne.	23.13	11.03	34.52	12.27				
	Cheyenne, Wy.	14.48	7.19	53.45	12.76				
							8.65	3.84	-18.94 -0.50
	April								
		north	south	east	west				
	Alliance, Ne.	26.27	14.20	25.6	12.22				
	Cheyenne, Wy.	18.03	10.57	42.87	11.97				
							8.23	3.63	-17.27 0.25
	May								
		north	south	east	west				
	Alliance, Ne.	33.06	16.74	20.77	11.31				
	Cheyenne, Wy.	24.87	13.35	36.13	10.22				
							8.19	3.39	-15.35 1.09
	June								
		north	south	east	west				
	Alliance, Ne.	39.30	19.10	17.23	10.32				
	Cheyenne, Wy.	29.67	15.17	33.90	9.09				
							9.63	3.93	-16.67 1.23
	July								
		north	south	east	west				
	Alliance, Ne.	43.48	21.74	13.58	9.33				
	Cheyenne, Wy.	29.16	18.42	31.81	8.16				
							14.32	3.32	-18.23 1.17

	Aug						variability			
		north	south	east	west		north	south	east	west
	Alliance, Ne.	43.71	19.42	15.77	9.33					
	Cheyenne, Wy.	28.68	15.74	34.61	8.06					
							15.03	3.68	-18.84	1.27
	Sept.									
		north	south	east	west					
	Alliance, Ne.	35.20	14.87	23.40	10.21					
	Cheyenne, Wy.	23.30	12.13	41.03	9.08					
							11.90	2.73	-17.63	1.13
	Oct.									
		north	south	east	west					
	Alliance, Ne.	25.23	9.71	34.97	10.90					
	Cheyenne, Wy.	16.55	8.06	52.00	10.77					
							8.68	1.65	-17.03	0.13
	Nov.									
		north	south	east	west					
	Alliance, Ne.	20.00	5.83	46.80	11.35					
	Cheyenne, Wy.	12.07	4.57	64.43	12.48					
							7.93	1.27	-17.63	-1.13
	Dec.									
		north	south	east	west					
	Alliance, Ne.	15.65	4.00	53.71	11.76					
	Cheyenne, Wy.	9.29	4.06	69.52	13.77					
							6.35	-0.06	-15.81	-2.01
Wind Speed Data										
	Alliance	Cheyenne	Variability							
Jan.	12.11	14.75	2.63							
Feb.	12.10	13.79	1.69							
March	12.27	12.76	0.50							
April	12.22	11.97	-0.25							
May	11.31	10.22	-1.09							
June	10.32	9.09	-1.23							
July	9.33	8.16	-1.17							
Aug.	9.33	8.06	-1.27							
Sept.	10.21	9.08	-1.13							
Oct.	10.90	10.77	-0.13							
Nov.	11.35	12.48	1.13							

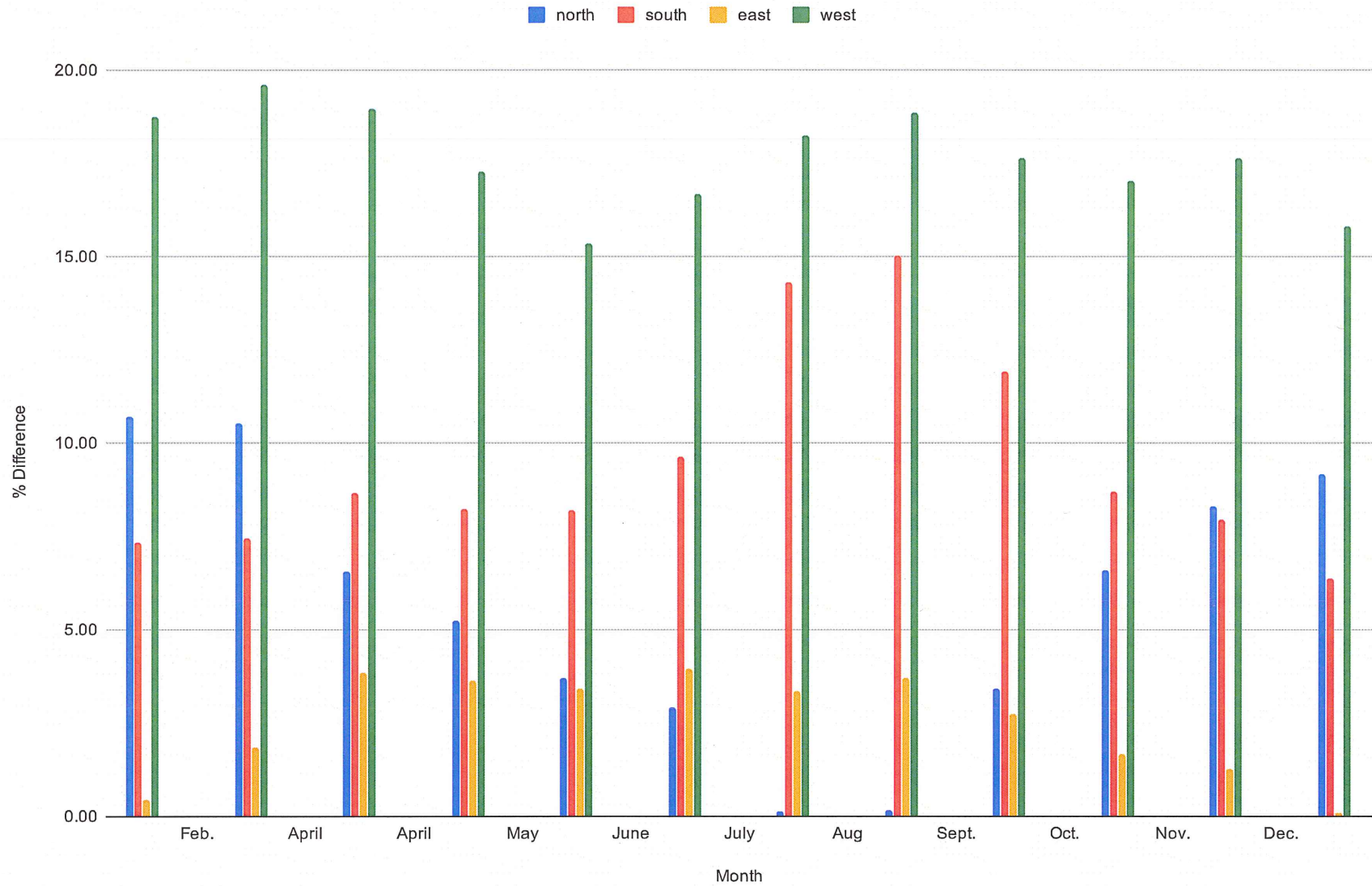
Monthly Average Wind Speed Variation

Between Alliance and Cheyenne

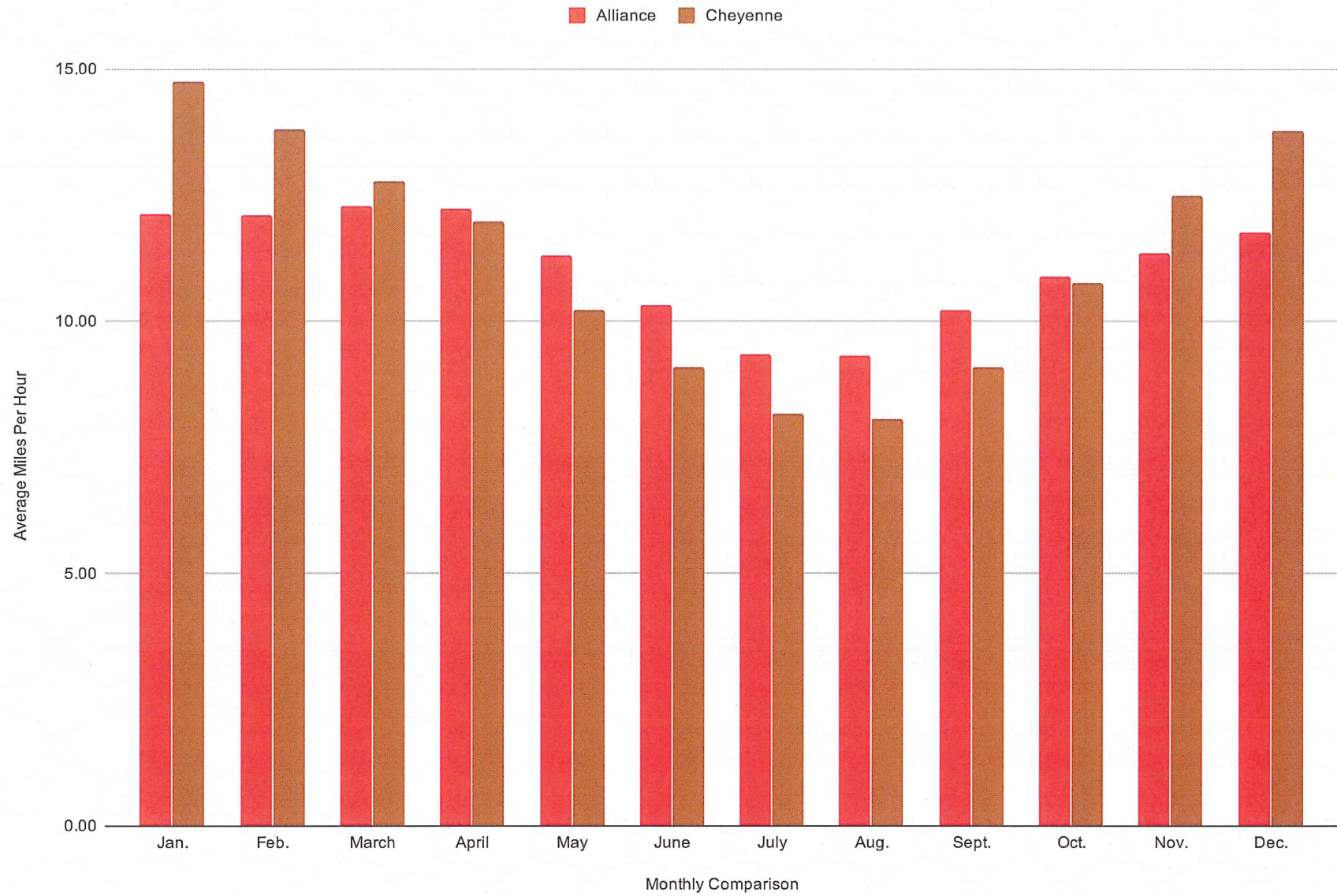


Monthly Average Variation of Wind Direction

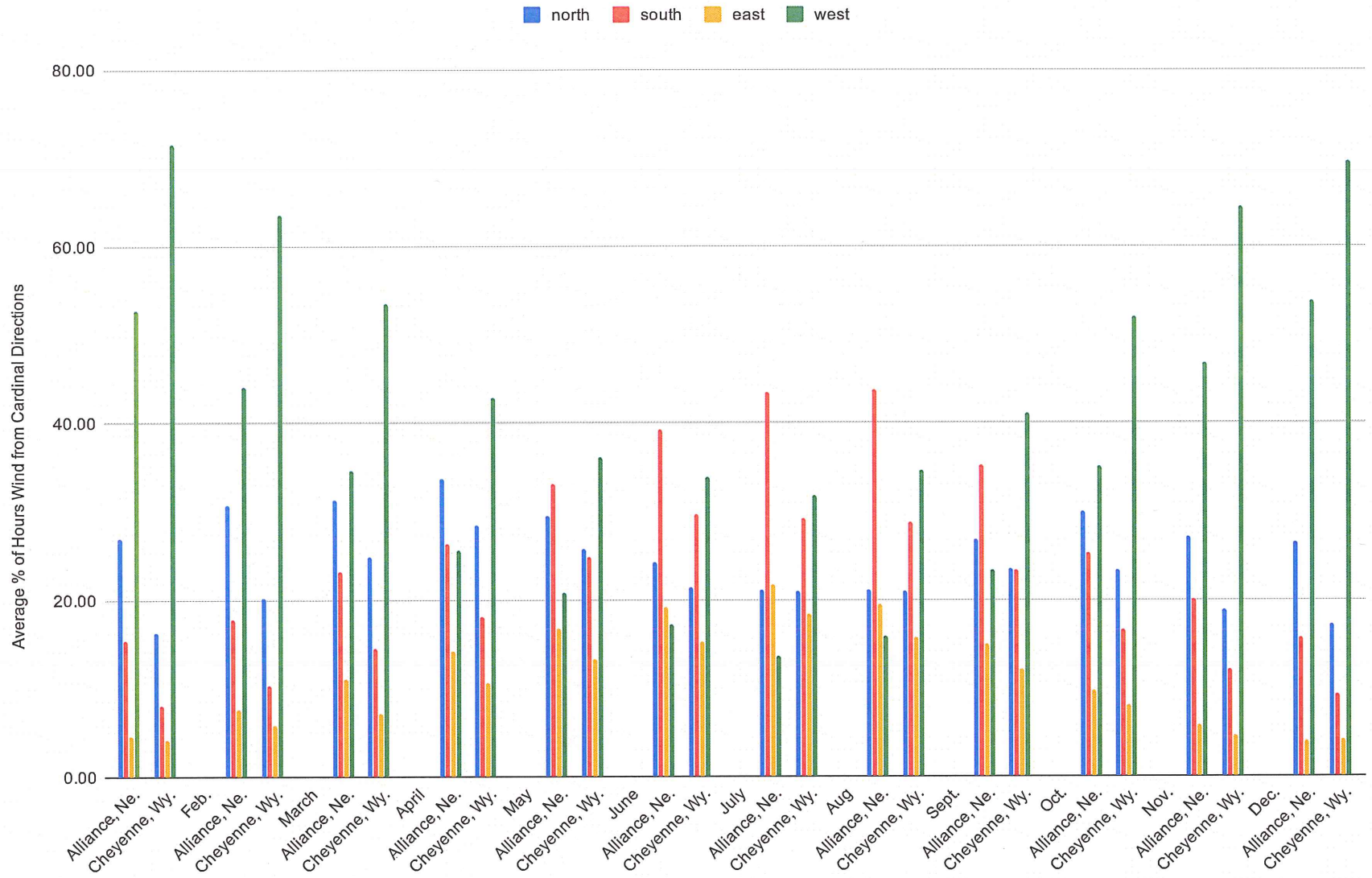
Difference Between Alliance & Cheyenne



Average Monthly Wind Speed



Average Monthly Wind Direction



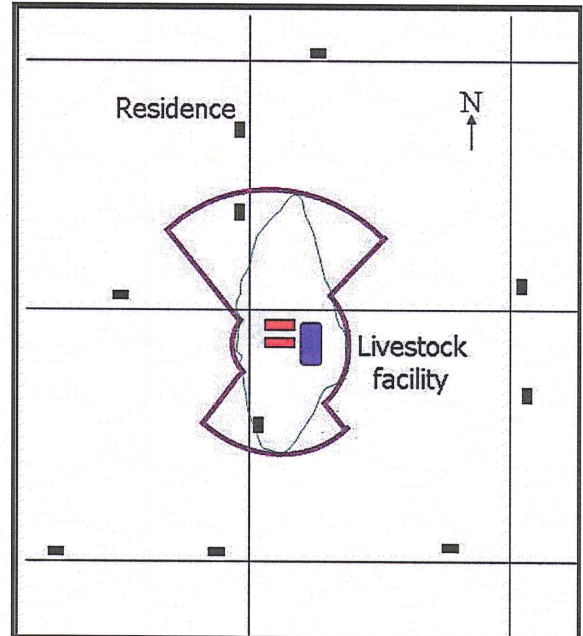
Location Comparison: Alliance & Cheyenne

Understanding Odor Footprints and the Odor Footprint Tool

Q. What is an *odor footprint*?

- A. An odor footprint is a visual picture (top view) of the risk-based odor impact of livestock facilities. Specifically, it outlines the area that is not expected to meet a selected target for avoiding odor annoyance. The minimum separation (or 'setback') distance needed from the livestock facility in a given direction is the extent of an odor footprint in that direction.

Odor footprints generated directly from dispersion modeling show the extent of risk-based odor impact in precise detail, but require specialized resources and expertise. Once baseline modeling is performed for a location, simplified footprints can be developed fairly readily for the region using commonly available resources and expertise. Simplified footprints show risk-based impact areas based upon the largest setbacks needed in one or more directions. The resulting footprints typically show fairly conservative pictures of risk-based impact areas.



Odor footprints illustrate the risk-based odor impact of livestock

Q. What is the **Odor Footprint Tool**?

- A. The Odor Footprint Tool is a worksheet/spreadsheet that provides objective, science-based information on the risk-based impact of odors generated by livestock facilities. The user enters information about the livestock facilities for a given site, the site location (for getting weather data), use of supplemental odor control, and special terrain. After using the Odor Footprint Tool, the user obtains minimum setback distances in four directions (matching up with targets for avoiding odor annoyance).

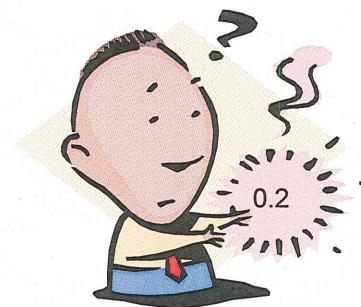
NEBRASKA ODOR FOOTPRINT TOOL Setback Distance Results			
Project title:	Example	Prepared for:	
Site location:	Southeast, NE	Prepared by:	
		Date prepared:	
	Source Facility 1	Source Facility 2	Source Facility 3
Type of facility:	Swine, Finishing Bldg Deep pit	Swine, Nursery Bldg Deep pit or Shallow pit	Manure Storage Steel/concrete tank
Number of identical facilities:	4	1	1
Total plan area:	32,000	6,000	707
Total number of animals:	4,000	1,500	1,500
Base odor control:	No supplemental odor control implemented	No supplemental odor control implemented	No supplemental odor control implemented
Alternate odor control:	Biofilter: All cool season air is vented.	No supplemental odor control implemented	Geotextile cover (at least 2.4 mm thick)
Terrain:	North Flat terrain	East Flat terrain	South Flat terrain
Terrain Adjusted Separation Distance (miles)			
BASE PLAN	North	East	South
90%	0.33	0.07	0.24
94%	0.45	0.14	0.39
96%	0.62	0.26	0.52
98%	1.12	0.41	0.98
99%	1.97	0.69	1.84

An example of information provided and results obtained when using the Odor Footprint Tool.

Q. What do the results mean?

- A. The separation distances produced using the Odor Footprint Tool correspond to levels of risk – or more accurately, risk avoidance. The Odor Footprint Tool is used to predict separation distances based on user-selectable frequencies of hours during which odor levels will be below the cutoff or threshold for annoyance (see following question on what constitutes an annoying odor). Odor annoyance-free frequencies listed in Nebraska's version of the tool are 90%, 94%, 96%, 98% and 99%.

For example, a 94% odor annoyance-free frequency means that at least 94% of the time, on an hourly basis, the odor level at locations the specified distance away from the livestock operation will either be undetectable or below the established threshold. The rest of the time (up to 6% or about 6 hours, on average, over a 4-day period), odors may exist at levels above the threshold. To reduce the risk that neighbors will experience annoying odor levels, either more separation is needed or some form of proven odor control needs to be implemented.



Setbacks are related to a frequency of annoyance.

Q. What is an annoying odor?

- A. What primarily defines an annoying odor is the likelihood that it will negatively influence behavior. When evaluating threshold levels for odor annoyance, the main question asked is “would this state of odor make more than one or two people in a large group want to change what they were doing to lessen their exposure to the odor?” For the modeling behind the Odor Footprint Tool, an annoying odor is ‘a faint odor that the average person might detect if attention was called to it, but would not otherwise attract attention’.



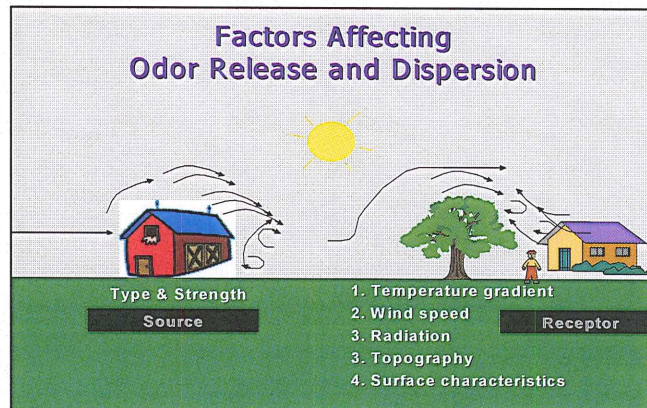
Odor intensity is used to define an annoying odor.

In measurable terms, annoying odors have an intensity of 2 or stronger on a standardized 0-to-5 reference scale. The nonlinear reference scale is designed so an odor intensity of 4 is much more than twice as concentrated as an intensity of 2. When someone asks if you like their new perfume or cologne, and you had not even noticed the smell until you were asked about it; the odor very likely had an intensity of 2. Since many people consider odors from livestock facilities unpleasant, a reasonably conservative intensity threshold was desired. In a Nebraska field study conducted near a swine finishing facility, the threshold intensity of 2 accounted well for the vast majority of odor conditions that would have made the non-partisan assessors modify plans for an outdoor gathering.

Q. What's the science behind the Odor Footprint Tool?

- A. The Odor Footprint Tool is based upon atmospheric dispersion modeling; specifically, a model developed and approved by the U.S. EPA for predicting the movement of airborne pollutants. Dispersion modeling is based upon the physics of atmospheric processes and requires access to quality meteorological data [weather records].

Dispersion modeling is not new, but has become more useful with dramatic improvements in computer capabilities. Advances in processing of data have also contributed to there being much more and higher quality weather information available.

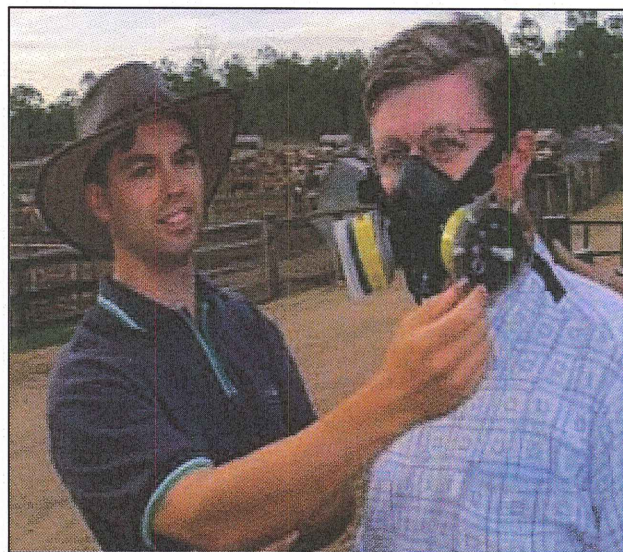


Dispersion models consider the primary factors that influence odor movement and concentrations at neighboring locations.

Q. What has been done to ensure that the modeling / Odor Footprint Tool really works?

- A. Modeling odor dispersion requires research-based information on odors. This research includes developing sound methods for measuring odors and a database of odor emission rates from animal production and manure handling facilities. Land-Grant Universities and other public organizations have conducted research and obtained emissions data for several types of animal housing and manure storage facilities.

Modeling's credibility ultimately depends on there being a good correlation between predicted and observed odor events. The modeling behind the Odor Footprint Tool has successfully undergone field validation (ground-truthing) using trained odor assessors and local residents.



The credibility of the Odor Footprint Tool comes largely from comparisons of people's field measurements with model predictions.

Q. How is the Odor Footprint Tool intended to be used?

- A. The Odor Footprint Tool is intended to be used as a planning and screening tool to help make timely, well-informed decisions when siting livestock facilities and evaluating odor control options. Producers, their advisors, local officials, and interested rural residents should all find utility in using the Odor Footprint Tool on an informational basis. There are pros and cons of including the Odor Footprint Tool as part of local/county ordinances, and considerable thought needs to be given as to how this can be done expediently and fairly across differing types of animal production operations.

Q. What is the *right* annoyance-free frequency to use?

- A. It depends. While the Odor Footprint Tool is based upon science and best-available research information, selection of the annoyance-free frequency involves a judgment of acceptable risk. Generally speaking, the annoyance-free frequency should match up with the best interests of the rural community. Ideally, a community will determine its best interests by realistically considering its economic, environmental, and social visions for the future in advance of making official decisions about setbacks (e.g. a proposed livestock expansion becomes a ‘lightning rod’ event).

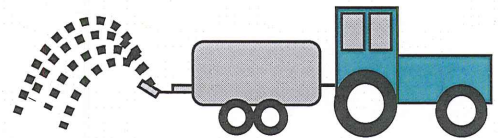
As a general guide, when local residents have a strong affiliation with animal agriculture and are accustomed to modern production practices, using an odor annoyance-free frequency near 94% may suit the local needs. When most residents are unaffiliated with animal agriculture, or when avoiding odor conflicts is a top priority, an annoyance-free frequency closer to 98% may be more appropriate.

The odor annoyance-free frequency selected greatly affects the resulting separation distances. Wanting to be free of annoying odors 99% of the time may be unrealistic for some areas due to limited options for finding enough land to meet large required setbacks and challenges of applying this high standard to existing operations wanting to expand. On the other hand, having annoying odor levels 6-10% of the time is unrealistic in many areas if good neighbor relations are desired.

Q. How does the Odor Footprint Tool account for spreading of manure on fields?

- A. The Odor Footprint Tool presently does not account for odors that may result from land application of manure. These infrequent, but not inconsequential events need to be considered separately for their additional odor impact.

Incorporating material directly into the soil is known to produce much less odor than does surface spreading of the same material. Beyond this, though, it is very challenging to account for application of manure at varying times on potentially differing fields, especially using a “simple tool”.



Odors from manure application need to be accounted for separately.

Q. What other clarifications should be made when discussing odor footprints?

- A. Like most good information, there are ways in which the information from the Odor Footprint Tool can be given unintended or inaccurate meanings. It may be helpful to consider the following:
- ***The Odor Footprint Tool does not report how far odor will travel.*** This information seems interesting to many people, but has little useful value in assessing odor impact. Under certain weather conditions, odors from even the smallest of farm operations or companion animal facilities will travel relatively long distances.
 - ***The separation distances correspond to odor annoyance-free frequencies, not odor-free frequencies*** – a subtle, but important distinction. Rural areas are seldom, if ever, truly odor free. A key element of odor modeling is distinguishing between annoying and non-annoying states of odor, in this case, odor associated with animal production. Most people do not find barely detectable odors to be annoying, so very faint odors are considered inconsequential.

- ***Odor footprints show areas of ‘risk-based odor impact’.*** Residents living beyond specified setbacks (outside an odor footprint) always have a small risk that they may be exposed to annoying odor levels, so use of phrases like “no odor impact” or “no risk” are not accurate or recommended. By analogy, someone who lives outside a 50-year floodplain may reside within the 100-year floodplain, so they should not be told that it will “never flood” on the property.
- ***The Odor Footprint Tool is not used to forecast when odor events will occur.*** Setback information is based upon looking at weather over long periods of time. Fairly consistent weather trends will develop over time within a given region, which helps make risk-based odor footprints more reliable than the weekend weather forecast.
- ***Odor footprints are generally produced for a portion of the year corresponding to an ‘odor season’.*** The odor season includes warm conditions when rates of odor generation are higher and people are more likely to be outdoors. The Odor Footprint Tool considers the odor season to extend from April 15th to October 15th. Excluding cold weather conditions and associated low generation rates for odor should result in conservative frequencies of odor annoyance (on a percentage basis) and larger setbacks compared to considering full calendar years.

Prepared by:

Chris Henry, P.E., Extension Engineer, University of Nebraska–Lincoln
217 LW Chase Hall, Lincoln NE 68583-0726
402-472-6529 chenny1@unl.edu

Rick Stowell, Ph.D., P.E., Associate Professor, Extension Engineer, University of Nebraska–Lincoln
213 LW Chase Hall, Lincoln NE 68583-0726
402-472-3912 rstowell1@unl.edu

Nebraska Odor Footprint Tool

Odor Risk Assessment & Setback Estimation for Livestock Facilities

Rick Stowell
Air Quality Group within
Biological Systems Engineering

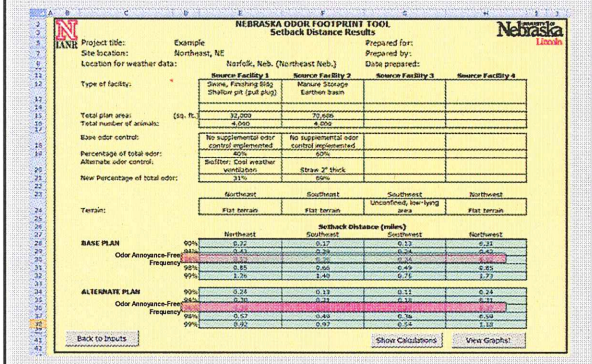


What is the NOFT?

The Nebraska Odor Footprint Tool is:

- Offspring of OFFSET
- A planning tool
 - Used to determine minimum separation distances at various levels of odor risk
- A 'simple tool'
 - Excel® spreadsheet
 - Worksheet, tables, and set of curves
- Based upon results of dispersion modeling
 - AERMOD (ISC3), Gaussian plume model

NOFT Results: Spreadsheet View



Objectives behind the NOFT

- Increase the use of objective, science-based information in decision-making related to livestock odor
- Encourage voluntary implementation of proven odor control technologies



Risk-Based Odor Assessment

Odor risk may be expressed as the projected percentage of hours over an extended period of time during which odor:

- Exists at annoying levels
 - 'Odor annoyance frequency'
 - e.g. values from 1 to 10%

OR

- Is not present at annoying levels
 - 'Odor annoyance-free frequency'
 - e.g. values of 90 to 99%



- wording utilized within the NOFT

Risk-Based Approach: Justification

- Commonly used for health, safety and nuisance issues
- Incorporates practical realities
 - Zero odor is unrealistic
 - >10% annoyance is unreasonable
- Recognizes that a guaranteed rate of annoyance is unattainable
- History and current use of the area affects acceptable risk

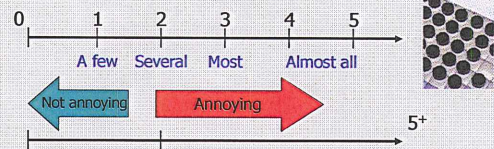
What is an 'annoying state of odor'?



An objective basis for defining an annoying odor level is needed

Annoying Odor Level: Intensity Basis

Consider 'annoying' livestock odor to have an intensity of 2 or higher on a standardized 0-to-5 scale

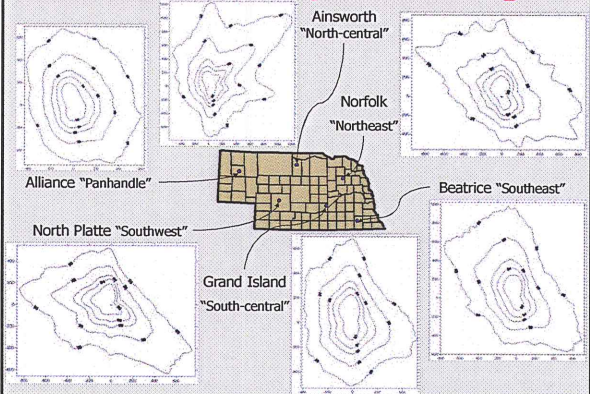


Annoying Odor Level: Field Detection Threshold Basis

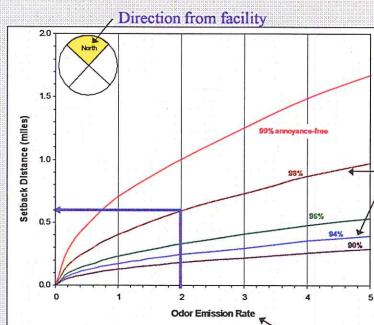
Consider 'annoying' livestock odor to be detectable at 7 dilutions to threshold (D/T) in field conditions or 2 D/T under extended exposure.



Nebraska Odor Footprint Tool Regions



Directional Setback Distance Curves



Lincoln, NE, data.
Each region has a unique set of graphs

Annoyance-free criteria.
'Bar' established for planning purposes.

Should reflect the rural community's view of animal production and tolerance for livestock odor.

Parameter has a large effect on setback.

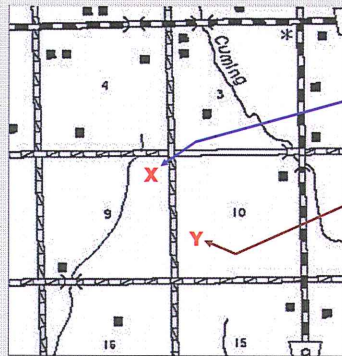
Emission number is based upon facility type, size, scaling factor, and odor control.

Common Uses for NOFT Results:

Develop simple odor footprints that:

- Check and/or improve siting of proposed livestock facilities
- Illustrate impacts of utilizing odor control technologies
- Help inform zoning policy-making

Check Siting of Livestock Facilities

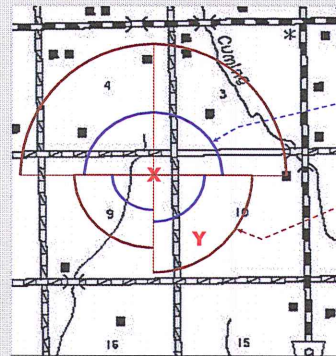


X indicates preferred site for livestock facility of given size

Y indicates an alternative site for the livestock facility

Objective: Assess odor risk of site X and compare to Y

Check Siting of Livestock Facilities

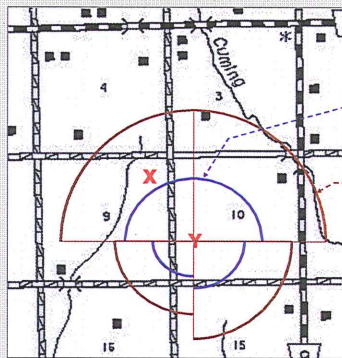


No residences within 94% annoyance-free setbacks for site X

Four or five within 98% annoyance-free setbacks for site X

Seems site Y may have advantage.

Improve Siting of Livestock Facilities

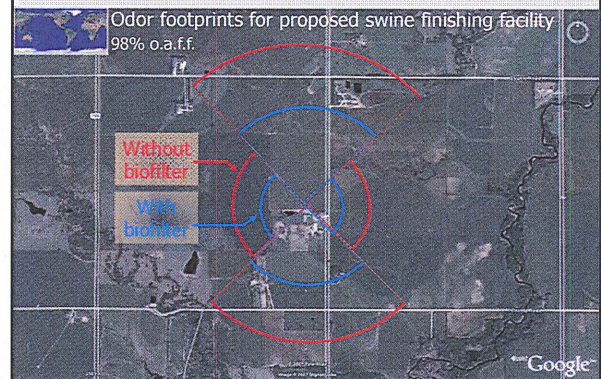


No residences within 94% annoyance-free setbacks for site Y

Two within 98% annoyance-free setbacks for site Y

Shows site Y's advantage over X.

Show Effect of Odor Control



NOFT Uses in Zoning

- Incorporate directly into setback rules
- Use to test or adjust setbacks
- Earn or lose points based upon residences in risk zones

What is basis of protection in setback distances?

Which is fairer?

- Same separation distance?
- Same risk of consequence?

Fair is Equal _____

- Equal distance may be fair for
 - Noise / vibration
 - Light
 - Visual effects
- Equal risk applies for weather-dependent issues
 - Dust
 - Odor

What is main objective?



For using the NOFT
What odor annoyance-free frequency is selected?

Different tools exist for different goals

How important is it to know up front what setback is required?

Specified setbacks

- + Early assurance for applicants
- + Transparency for public
- +/- Sliding scale

Required use of NOFT also

- Additional step(s) involved?
- Perceived mystery/uncertainty?

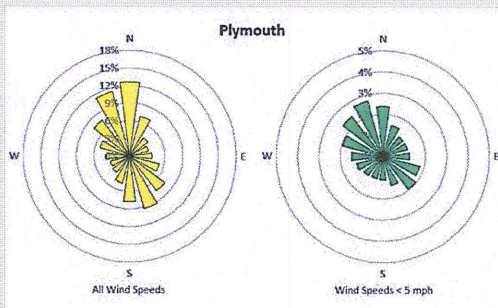
Fairness across Facilities

Process same or similar for?

- Confinement buildings
- Open feedlots
- Truckwashes
- Whatever else is proposed

- Judgement and assumptions required
 - NOFT has limited data set (buildings)

Scaling of setbacks?



Search for "downwind roses" at Manure.unl.edu



Thank You!



For more information:

Nebraska Odor Footprint Tool

Manure.unl.edu

<http://water.unl.edu/web/manure/odor-footprint-tool>