

# Nebraska Odor Footprint Tool

Odor Risk Assessment & Setback Estimation for Livestock Facilities

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## 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

NEBRASKA ODOR FOOTPRINT TOOL Setback Distance Results				
Project title:	Example: Northeast, NE		Prepared for:	Example
Site location:	Norfolk, Neb. (Northeast Neb.)		Date prepared:	Example
Type of facility:	Source Facility 1	Source Facility 2	Source Facility 3	Source Facility 4
	Swine finishing/killg	Manure storage	Earthm basin	
Total plan area (sq. ft.):	32,000	75,666		
Total number of animals:	4,000	4,000		
Base odor control:	No supplemental odor control implemented	No supplemental odor control implemented		
Percentage of total odor alternate odor control:	40%	50%		
New Percentage of total odor:	24%	49%		
Terrain:	Flat terrain	Flat terrain	Unconfined, low-lying area	Flat terrain
Setback Distance (miles)				
BASE PLAN	Northeast	Southwest	Southwest	Northeast
90% Odor Annoyance-Free Frequency	0.17	0.13	0.13	0.13
95% Odor Annoyance-Free Frequency	0.43	0.39	0.34	0.43
98% Odor Annoyance-Free Frequency	0.51	0.48	0.44	0.52
99% Odor Annoyance-Free Frequency	0.55	0.46	0.49	0.55
99% Odor Annoyance-Free Frequency	1.39	1.00	0.75	1.73
ALTERNATE PLAN	Northeast	Southwest	Southwest	Northeast
90% Odor Annoyance-Free Frequency	0.24	0.11	0.11	0.24
95% Odor Annoyance-Free Frequency	0.30	0.14	0.18	0.31
98% Odor Annoyance-Free Frequency	0.36	0.28	0.27	0.37
99% Odor Annoyance-Free Frequency	0.57	0.49	0.35	0.59
99% Odor Annoyance-Free Frequency	0.82	0.57	0.54	1.18

## 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

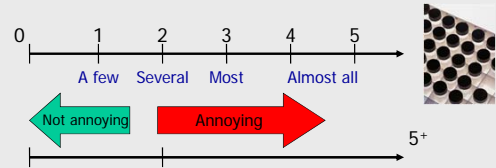
### What is an 'annoying state of odor'?



An objective basis for defining an annoying odor level is needed

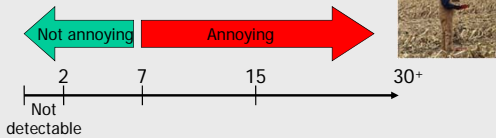
### Annoying Odor Level: Intensity Basis

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

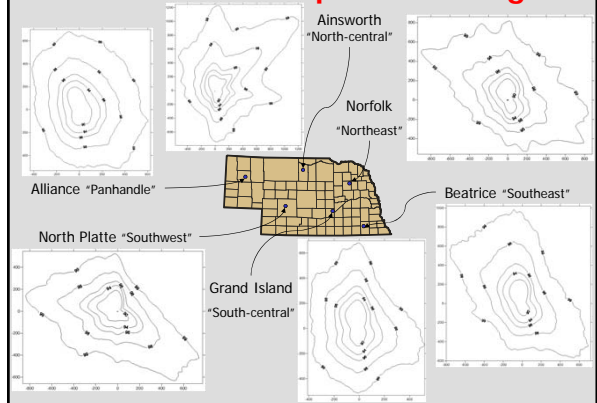


### Annoying Odor Level: Field Detection Threshold Basis

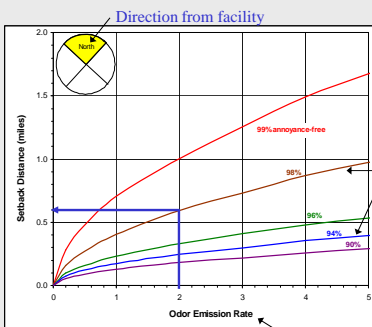
Consider 'annoying' livestock odor to be detectable at 7 dilutions to threshold (D/T) in field conditions or 2 D/T under extended exposure.



### 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.

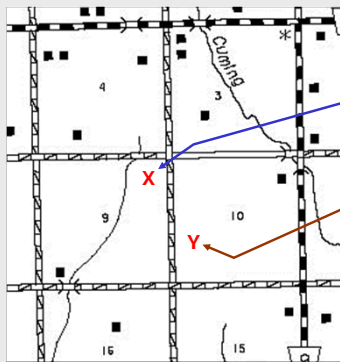
Parameter has a large effect on setback.

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

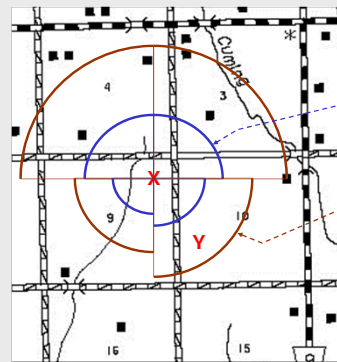


X indicates preferred site for livestock facility of given size

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

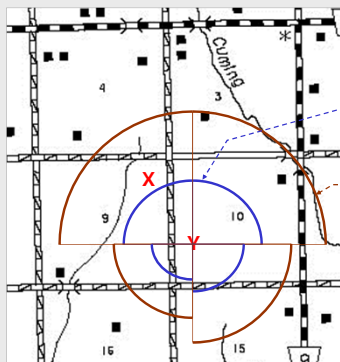


No residences within 94% annoyance-free setbacks for site X

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

Seems site Y may have advantage.

### Improve Siting of Livestock Facilities

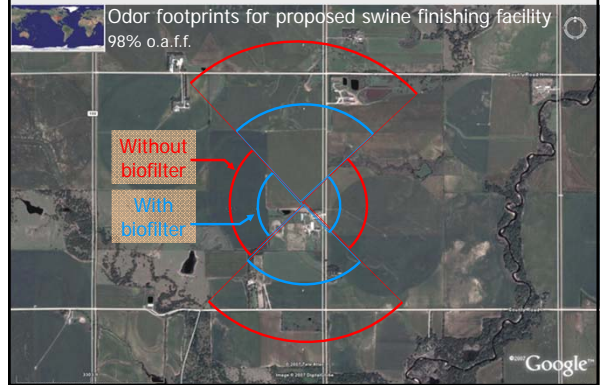


No residences within 94% annoyance-free setbacks for site Y

Two within 98% annoyance-free setbacks for site Y

Shows site Y's advantage over X.

### Show Effect of Odor Control



Odor footprint for proposed swine finishing facility 98% o.a.f.f.

Without biofilter

With biofilter

### 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?

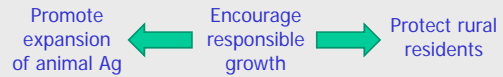
Which is fairer?

- 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

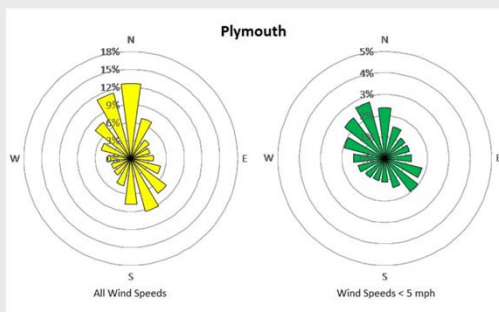
- Additional step(s) involved?
- Perceived mystery/uncertainty?

## 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](http://Manure.unl.edu)



**Thank You!**



For more information:

Nebraska Odor Footprint Tool

[Manure.unl.edu](http://Manure.unl.edu)

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