Odor Management Toolkit

- Right tools
- Skilled person
- Job well done
Odor Management Tools

• Understanding odors
• Concern & neighborliness
• Communications
• Siting tools
• Source assessment
• Mitigation practices
• Useful resources
• Implementation & follow up
No single solution

• Many things vary
  – Sources
  – Level of mitigation needed
  – Impact of practices on operations (ex. feeding, ventilation, manure management and sanitation)
  – Management and labor available
  – Capital and operating costs
Manure Odors

- Mixture of volatile gases
- Over 300 volatile compounds identified from animal manures
- Some compounds detectable by humans at extremely low concentrations
- Generally considered unpleasant or offensive
Odors

- Evoke emotional and physiological responses
Pleasant odors

- Evoke emotional and physiological responses
Offensive odors

- Evoke emotional and physiological responses
Points of View

• Source owner or manager
• Neighbor
• Parent of sensitive child
• Community leader or politician
• Regulator
• Academic

Actions

Values

Goals
Unpleasant Odor Concerns

- Smell
  - Nuisance, irritation, lost enjoyment
  - Invade private or public property
- Health
- Costs to manage
- Other
Odor Impacts

- Normally local, depends on source size
- Interfere with use and enjoyment of public areas, private land or home
- Offensive odors may
  - Annoy and agitate people
  - Trigger more symptoms
- Odors do not make people sick

Odor perception depends on:

- **Frequency**
- **Intensity** or detected concentration
- **Duration**
- **Offensiveness** or emotional reaction

**FIDO**
Odor Frequency

- Once or twice a month
- Twice a week
- Every day
- All the time
Odor Intensity

- Odor strength
- Analogous to sound loudness
- Ranges from
  - Non-detectable
  - Barely detectable
  - Detectable
  - Recognizable
  - Offensive – very loud
Odor Duration

- Seconds
- Minutes
- Hours
- Days
- Weeks
- Months
Odor Offensiveness

- Emotional & physiological reaction
Manage FIDO

- Some manure odors are commonly acceptable in agricultural communities
- Questions you and your neighbors need to answer and agree on
  - How often?
  - How intense?
  - How long?
  - How offensive?
Managing odors with good communications

• Talk to neighbors about odors
• Ask if they smell odors
• Tell neighbors you are concerned
• Tell neighbors what you are doing to manage odors
• Have process for complaints
• Visit annually
Develop good neighbor relations

- Discuss new building sites and/or expansions early in planning
- Inventory impacted areas
  - Nearby neighbors
  - Public areas (parks, lakes)
  - Schools and churches
  - Towns, cities and public roads
Managing odors with site assessment tools

- Minnesota – Odor From Feedlot Setback Estimation Tool (OFFSET)
- South Dakota Odor Footprint Tool (SDOFT)
- Nebraska – Odor Footprint Tool (OFT)
- Iowa – Community Assessment Model for Odor (CAM)
If owner wants to do something . .
now what?

- Identify odor sources and odor emitting activities
- Prioritize sources or activities
- Investigate mitigating practices
- Implement practice
- Assess impact
Mitigation planning

- For each source to mitigate
- Level of mitigation needed
- Impacts on production practices
- Management
- Capital and operating costs
Animal ag sources

- Barns and ventilation air exhaust
- Open lots
- Manure treatment and storage facilities
- Mortalities
- Land application
Mitigation approaches

- Reduce emissions
  - Generate less odor, emit less odor
- Capture and treat
  - Capture odors and treat, emit less odor
- Enhance odor dispersion
  - Odors emitted are diluted more
Possible mitigation practices

- Reduce Generation
  - Diet/ration modification
  - Additives
  - Manure treatment
    - Solid/liquid separation
    - Anaerobic digestion
- Enhance dispersion
  - Vegetative buffer
- Reduce emissions
  - Covers
  - Oil spraying
- Capture and Treat
  - Biofilters
  - Wet scrubbers
Diet and Feed Management

- Formulate diets to more accurately meet animal needs
- Reduce nutrients in feces and urine to reduce emissions from stored and land applied manure
Diet and Feed Management

• Examples
  – Phase and Split-sex feeding
  – Add amino acids to reduce crude protein
  – Reduce nitrogen and sulfur
• Reduce feed waste and dust generation
• Not consistent significant odor reduction
• Consistent NH$_3$ reduction
Additives

- Chemical
  - Oxidize volatile compounds
  - Adjust pH
  - React and form precipitates
  - Masking agents or counteractants

- Biological
  - Modify biochemical pathways
Enhance dispersion

- Dilutes odors
- Property line limits
- Does not reduce emissions

Methods
  - Vegetative buffers
  - Wind walls
  - Chimneys
  - Increased separation distance


http://rec.udel.edu/poultryextension/Vegetative%20Environmental%20Buffers/Vegeta1.jpg
Covers

- Permeable
- Impermeable
- Positive air pressure
- Negative air pressure
Permeable covers

- Geotextile fabric
- Straw
- Natural crust
- Limited life
- Emission reductions depend on % covered and thickness
Impermeable covers

- Highly effective
- Expensive
- Manage
  - Bubbles
  - Precipitation
  - Animals
  - Manure removal
Oil sprinkling

- Reduces dust levels and emissions
- Effective
- Questions about slippery floors and airborne oil mist impacts on health

https://www-mwps.sws.iastate.edu/sites/default/files/imported/free/aed_42.pdf
Wet scrubbers

- Liquid spray entraps particulates and absorbs gases
- Factors
  - Gas solubility
  - Liquid pH
  - Air to liquid flow rates
- Wastewater handling
- Potential nutrient recycling
Biofilters

Mechanically Ventilated Building

Exhaust Fan

Treated Air Exhaust

Biofilter Media

Media Support

Air Duct

Air Plenum
Media studied

- Wood chips and compost
- Pine nuggets & shredded wood
- Lava rock
- Birch mulch wood chips
- Corn cobs
Biofilter Effectiveness

% Reduction

• Odor detection threshold
  – 78 to 95%

• Ammonia
  – 50 to 82%

• Hydrogen sulfide
  – 86 to 97%
Biofilter Designs

Biofilters

Dairy

Vertical

Deep bed

A-Frame
Manure treatment

- Anaerobic digestion
- Changes odor character, some reduction
Manure treatment

- Solid-liquid separation
- Variable odor control, best soon after voiding
Manure agitation

- Major odorous activity
Land application techniques

- Broadcast – surface application
- Broadcast followed by incorporation
- Incorporation, injection
- Irrigation
Land application timing

- Avoid days prior to and of community and neighbor celebrations
- Sunny unstable weather day – lifts odors and mixes more
- Windy day – wind direction
- Dry day
Resources

- Air Quality in Animal Agriculture
- https://lpelc.org/air-quality/
Resources

- National Air Quality Site Assessment Tool (NAQSAT)
- naqsat.tamu.edu
Four video websites

- Policy Considerations
  https://lpelc.org/air-quality-resources-for-policy-makers/
- Neighbor Relations & Setback Estimate Tools
  https://lpelc.org/air-quality-resources-for-policy-makers/
- Manure Covers & Biofilters
- Health Impacts
  https://lpelc.org/health-impacts-of-air-emissions-from-animal-feeding-operations/
An odor management benefit

- Opportunity for income from new or expanded animal feeding operation
Take home points

- Odors evoke emotional and physiological responses
- Manage FIDO to manage odors
- Good communications are important
- There are effective odor control techniques
- Try methods and assess effectiveness
- Go to https://lpelc.org/air-quality/