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Management of Manure Odors

Developed by the ASAE Agricultural Sanitation and Waste Management Committee; approved by the ASAE Structures and Environment Division Standards Committee; adopted by ASAE December 1975; reconfirmed December 1980, December 1985; revised December 1986; reconfirmed December 1991; revised November 1997; reaffirmed February 2003; revised July 2005; revised January 2007; revised April 2012; reaffirmed October 2016.

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1 Purpose and scope

1.1 Principles of odor generation, emission, transport, and detection are the subject of continuing investigation. Many aspects of the relevant processes are not completely understood at this time. Decisions relating to odor management therefore represent judgments based upon available knowledge.

1.2 Animal manure odors are presently considered a nuisance. The practices described in this standard were based on the assumption that manure odors have no effect on human health, albeit the effect of odor on human health is under investigation. Odorous gases produced by manure that are considered a human health risk are specifically addressed under ASAE EP470, Manure Storage Safety standard.

1.3 This Engineering Practice is prepared to assist engineers, pollution control officials, land use planners, and animal producers in the location, planning, construction, and operation of animal holding and production enterprises so that potential societal conflicts and air quality deterioration caused by manure odors might be managed. Areas covered are: Source and identification of odors, Measurement of odor intensity, Techniques to manage the formation of manure odors and Managing animal enterprises for odor.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies unless noted. For undated references, the latest approved edition of the referenced document (including any amendments) applies.

2.1 ANSI/ASAE EP403, Design of Anaerobic Lagoons for Animal Waste Management

2.2 ASTM E679, Standard Practice for Determination of Odor and Taste Thresholds by a Forced-Choice Ascending Concentration Series Method of Limits

2.3 ASTM E544, Standard Practices for Referencing Suprathreshold Odor Intensity

3 Source and identification of odors

3.1 Odors associated with animal enterprises are most frequently attributable to manure management practices. Odorous compounds include inorganic and organic vapors and gases. They can be generated at a number of sites around an animal enterprise. The most common odor sources, however, are open feedlot surfaces; manure collection, transport, storage, and treatment facilities; floors and other surfaces of buildings; animal body surfaces; feed handling and storage facilities; dead animal storage and disposal areas; and land on which manure has been applied.

3.2 Objectionable odors exist whenever odorous compounds are emitted and transported to an area in which their presence is offensive to people. Emission of an odorous compound from manure is related to the volatility of the compound in question, the physical and chemical properties of the manure in which the odorous compound is produced, temperature, and air movement over the manure surface.

3.3 Odorous compounds are produced primarily from anaerobic decomposition of manure. More than 150 compounds have been identified to contribute to the malodors of the decomposing manure. The major groups of these compounds are listed in Table 1.

Table 1 – Typical compounds resulting from the anaerobic decomposition of animal manure

Volatile Fatty Acids	Sulfides
Acetic	Hydrogen sulfide
Propionic	Dimethylsulfide
Butyric	Diethylsulfide
Isobutyric	Disulfides
Isovaleric	Ammonia and Amines
Alcohols	Ammonia
Aldehydes	Methylamine
Esters	Ethylamine
Phenols and Cresols	Dimethylamine
Phenol	Trimethylamine
p-Ethyl-phenol	Diethylamine
p-Cresol	Nitrogen Heterocycles
Mercaptans	Indole
Methylmercaptan	Skatole
Ethylmercaptan	Odorless Gases
Propylmercaptan	Carbon Dioxide
	Methane

3.4 Odor nuisance is generally defined by four factors: frequency, intensity, duration, and offensiveness. Odor sensation is a personal response. Odor observers are not equally sensitive, nor do they always agree as to the severity of an odor once it is detected. Odor intensity fluctuates with climatic conditions, such as wind direction, temperature, and atmospheric stability. Thus documentation of the strength and nature of odors should focus on specific sites and specific sources at those sites. If it is not possible to visit the site in question, a comparative site can be used if the nature of the operation and climatic conditions are similar.

4 Measurement of odor concentration and odor intensity

4.1 The odorant (or odorous compound) in the air may be expressed by two types of odor thresholds, odor detection threshold and odor recognition threshold. The odor detection threshold is defined as the lowest concentration of the compound in the air that can be detected by the human olfactory sense, i.e. the presence of odor is noticed. The odor recognition threshold is defined as the lowest concentration of the compound in the air that can be recognized by humans, i.e. what the odor smells like. The odor threshold of manure odors is a measured mixture of odorous compounds. Odor threshold is used to evaluate the effects of different manure treatment and management practices on odor reduction at animal production enterprises.