COLORADO DEPARTMENT OF PUBLIC HEALTH and ENVIRONMENT ENVIRONMENTAL AGRICULTURE PROGRAM

OLFACTOMETRY POLICY FOR ALTERNATIVE AEROBIC COVERS ON ANAEROBIC IMPOUNDMENTS AT HOUSED COMMERCIAL SWINE FEEDING OPERATIONS

Colorado Department of Public Health and Environment

Environmental Agriculture Program
and Air Pollution Control Division
4300 Cherry Creek Drive South
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Introduction

The Colorado Department of Public Health and Environment's (department) Environmental Agriculture Program (Ag Program) and Air Pollution Control Division (division) developed this Olfactometry Policy to provide owners and operators of housed commercial swine feeding operations (HCSFOs) with the testing parameters, methods and reporting requirements associated with the olfactometry performance standard for division-approved alternative aerobic covers on anaerobic impoundments.

The alternative aerobic cover was accepted by the division as an approved cover for anaerobic impoundments in 2001. The history of the development of a numerical performance standard is included in the division's "Performance Standard for the Implementation of Colorado Air Quality Control Commission's Regulation No. 2, Part B, Section IV.A. Anaerobic Process Wastewater Vessels and Impoundments" (Standard), dated January 26, 2001.

Based on field-testing data, the division determined that alternative aerobic covers were as effective as other covers at controlling the emissions of odorous gases as long as samples of air, properly collected from the surface of the impoundment, meet an odor detection threshold at or below 6,000 olfactometer unit per cubic meter (OU/m^3) as measured by an olfactometer at a recognized olfactometry laboratory.

Regulatory Requirement

According to Regulation No. 2, Part B., Section IV.A., all new or expanded anaerobic impoundments, shall employ an approved cover, or be operated with technologies or practices that are as effective as covers at minimizing odor from the operation to capture, recover, incinerate, or otherwise manage odorous gases to minimize, to the greatest extent practicable, the emission of such gases into the atmosphere.

All existing anaerobic impoundments, "shall employ an approved cover or be operated with technologies or practices that are as effective as covers at minimizing odor from the operation", as provided in Sections IV.A.3.a., - IV.A.3.d., of Regulation No. 2, Part B, so as "to capture, recover, incinerate, or otherwise manage odorous gases to minimize, to the greatest extent practicable, the emission of such gases into the atmosphere."

Compliance Standard

To be in compliance with the olfactometry standard, the odor threshold for samples taken from the surface of an anaerobic impoundment shall be at or below 6,000 OU/m^3 using olfactometry in accordance with this policy and the January 26, 2001 Standard referenced above.

An impoundment that fails to demonstrate compliance with the olfactometry standard (at or below 6,000 OU/m^3) during the two required sampling events in any year shall be considered in violation of Regulation No. 2, Part B.

Olfactometry Sampling Method

The detection of odorous gas emissions from the impoundment must be measured by dynamic forced choice olfactometry.

The sampling method must use a standardized equilibrium chamber for collecting samples off the surface of the impoundment. Utilization of an equilibrium chamber will reduce the variability from wind effects. This is necessary because of the variability and strong winds that are experienced in eastern Colorado.

The chamber must be made of stainless steel or PVC plastic equipped with a flotation collar to allow it to float on the surface of the impoundment. To avoid the drawing of a vacuum on the chamber during sampling, a source of make-up air must be provided. This is done by drawing air into the chamber and inflating the Tedlar® bag approximately half way, and then deflating the bag prior to taking the first sample. After "equilibrium" conditions have been achieved, a sample is ready to be drawn from the chamber. The chamber shall be 0.4 meters in diameter with a volume capacity of 0.03 cubic meters. The sweep airflow rate shall be approximately 0.004 m^3/min (4 1iter/minute) (Bowker. et. al. 1994).

Sampling Location
The sampling location is the opposite side of the impoundment from the building discharge, or at a point more distant from the building discharge if the inlet pipe is opposite the narrowest part of an impoundment. At this location the sample should be taken on the impoundment at a distance of approximately five feet from the berm. The location opposite or distant the inlet will allow for treatment processes to stabilize and reduce variability from the waste being discharged from the building. Wind speeds must be less than 25 mph during sampling.

Number of samples
Two samples must be taken on the surface of each impoundment being tested at each of two sampling events during the June 1 to August 31 testing period of any testing year.

Collection and Evaluation of Samples
Samples shall be collected in two 10-liter Tedlar® bags using a vacuum pump to create a vacuum between the rigid container and the Tedlar® bag in the container. This allows for the Tedlar® bag to be filled without the contamination of air being pulled through the pump.

The samples must be shipped within 24 hours of sampling to allow for evaluation by an approved olfactometry laboratory. If this timeframe is not met, the HCSFO should contact the Ag Program to receive further instructions, including, for example, a requirement that the olfactometry sampling be repeated.

The following are olfactometry laboratories that the Ag Program is aware of, please contact them at least one week ahead of shipping samples to be sure they can process them in a timely manner:

- West Texas A&M University, Core Facility – Olfactometry Lab
  2403 Russell Long Blvd., Canyon, TX 79015
  Contact: Eddie Caraway, *Olfactometry Lab Manager*
  Phone: (806) 651-5290, Email ecaraway@wtamu.edu
  http://www.wtamu.edu/academics/palo-duro-research-facility.aspx

- St. Croix Sensory, 1150 Stillwater Blvd N, Stillwater, MN 55082
  Contacts: Michael A. McGinley, P.E**.** *Laboratory Director* or
  Donna McGinley, *President*
  Phone: (800) 879-9231, (651) 439-0177, email: donna@fivesenses.com
  http://www.fivesenses.com/

- Pennsylvania State University, 101 Agricultural Engineering Building,
  University Park, PA 16802-1908
  Department of Agricultural and Biological Engineering
  Contact: Robin Brandt, Phone: (814) 865-2809, email: rcb100@psu.edu

Variations in test results can occur between different laboratories. To avoid discrepancies in test data, the same laboratory should be used to analyze the air samples.

Monitoring Frequency

Samples shall be collected two times during the period of June 1 to August 31, with a minimum of 30 days separating the first and second sampling events.

After two consecutive years of compliance with the olfactometry standard (i.e., where the odor threshold of the impoundment is at or below 6,000 OU/m^3), the impoundment may qualify for a three-year test exemption period.

Exceptions to the test exemption include one of the following scenarios:

1. Two consecutive years of test data do not meet the olfactometry standard.
2. An odor complaint is received and validated.
3. A property line standard is exceeded.
4. Management of that impoundment has changed.

If an impoundment(s) fails to meet the 6,000 OU/m^3 performance standard during either the first or second round of testing, testing shall continue until two consecutive years of tests meet the standard.

Olfactometry Laboratory Protocol

The odor evaluation shall use a triangular-forced-choice olfactometer. The odorous sample shall be evaluated using a dilution-to-threshold determination by a minimum of four trained odor panelists[1] with a minimum of eight odor panel observations per sample. The evaluation is to determine the detection threshold of the odor.

The olfactometer shall be manufactured by St. Croix Sensory in Stillwater, MN (or a similar olfactometer as approved by the division) and shall follow the ASTM standard E679-91 (1997) (superseded) or ASTM-E679-04 using a binary (2-fold) dilution series and has a range of 2^3 to 2^{16} on 14 levels of presentation.

When testing the sample, the panelists are given three stimulus presentations in random order. One of the three presentations contains the diluted test sample; the other two presentations are fresh air. Each panelist is required to identify or guess which stimulus presentation contains the odorous air. If the panelist is unable to discriminate between the presentations, the panelist responds with a guess and the panel leader decreases the dilution factor by one increment. If the odor is detected, the panelist selects the presentation containing the odor and indicates detection. If a panelist correctly detects an odor on the first dilution level presented, the panel leader increases the dilution by two increments until the odor cannot be detected. Following a

[1] Each panelist is appropriately screened in accordance with ASTM-E679-04 or panelists meet the criteria for training in accordance with International Standard EN13725-03 prior to being hired to sniff odors. Smokers and individuals living with smokers are not used. Panelists are not allowed to eat spicy foods on the day of sniffing odors or wear perfume in the laboratory. Panelists are retrospective screened on each sample.

correct detection, the panelist is required to have an additional correct detection at the next highest dilution level of the olfactometer.

Annual Reporting of Olfactometry Test Results
An annual report shall be compiled for each HCSFO and submitted to the Ag Program by February 1 of each year. The annual report shall include a table with the last three years of olfactometry test results for each impoundment and a column that provides the permit number for each impoundment. This reporting requirement is in addition to the semi-annual monitoring reporting requirements (Section X.D.I) and to the annual compliance certification (Section Vl.D.S.d.(l)) included in Regulation No. 2, Part B. In an attempt to avoid duplicative reporting efforts, the annual report can be submitted in lieu of the semi-annual report for the reporting period of July 1 - Dec. 31 due on February 1.

In addition, the annual report shall include any revisions to the Odor Management Plan and a summary of any changes in management procedures throughout the year. This can be accomplished by using a checklist designed specifically for each operation based upon the original Odor Management Plan. Each HCSFO shall include a section on best management practices and assure that necessary records and checklists are kept up to date to demonstrate odor control is included in their daily management of the facility. This may include any change in feed rations and management, waste removal from the swine facilities, impoundment pumping schedules and any other management changes that may affect the odorous gases emission from the farm. In addition, weather data, olfactometry testing and any other supportive data may be included to give an analysis of odor control and to help assess the management plan. This is to be done concurrently with any other reporting requirements presently in place.

Any deviation from the Odor Management Plan must be documented in the Annual Report with the reason(s) for the change and data to verify that there was an improvement in odor control or that there was no change in odor results from the previous plan. Any field data or testing that was conducted on the site should be summarized in the report.

Impoundments That Cannot Meet the Olfactometry Standard
If an impoundment fails to demonstrate compliance with the olfactometry standard for any two consecutive year period, the Ag Program may request one of the following:

1. Continued olfactometry testing of the impoundment.

2. Additional testing of the impoundment to determine ammonia, hydrogen sulfide and Volatile Organic Compound (VOC) emissions from the surface of the lagoon as per the protocol provided below.

3. An engineering evaluation of the impoundment, including a plan of action to bring the impoundment into compliance with the olfactometry standard.

4. Modification of the permit in order to operate the impoundment with an approved cover, technology or practice that is as effective as a cover at minimizing odor to the greatest extent practicable.

Additional Emissions Testing Protocol (as required by 2. above)
An investigation shall be done by a qualified independent third-party to determine the cause of the odor problems.[2] If the impoundment is found to be the cause of the odor, further data collection

[2] The independent third party shall not be a vendor of impoundment control technology.

of the impoundment will be required. Air samples shall be taken with the equilibrium chamber. Ammonia, hydrogen sulfide, VOCs and odor threshold data shall be taken to determine the odorous gas contaminant level of each of the gases.

Hydrogen sulfide shall be measured using a Jerome meter manufactured by Arizona Instrument. Ammonia shall be analyzed using NIOSH Method 6015. VOCs shall be measured using GC/Mass Spec with SMPE fibers from Supelco. Impoundment effluent may need to be sampled and analyzed to assist in determining the cause of the odor problem.

Other causes of odor intensities verified by scentometry must also be evaluated and a resolution obtained. Meteorological data, scentometer readings at the property line and the nearest receptor shall be collected over a 3-month period (minimum of one time every two weeks). At the end of the 3-month time period, the swine producer will provide a written report describing how the swine operation will be brought back into compliance. Nothing herein precludes or limits the department's authority or ability to instigate an enforcement action against a HCSFO for a violation of the 7:1 or 2:1 odor concentration standards.