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Regulating Air Pollution from Open Lot Livestock Facilities

Animal feeding operations (AFOs) are subject to several layers of air quality regulations. Through the federal Clean Air Act Amendments (CAAA), Congress has delegated the authority to the Environmental Protection Agency (EPA) to regulate sources of any air quality impairment that may compromise public health or well-being. In turn, the EPA has delegated the responsibility to the states to implement federal air quality standards as well as the federal monitoring and permitting functions. Some states have adopted their own air quality regulations that either (a) address issues not addressed by the federal program or (b) impose standards that are more stringent than the federal standards. Municipalities and administrative units of comparable scale may also impose air-quality standards exceeding federal and state requirements. Other air quality regulations that may apply to AFOs are promulgated and enforced by the Occupational Safety and Health Administration (OSHA), but such regulations are beyond the scope of this lesson.

Federal air quality regulations

Clean Air Act (CAA). The open lot AFO operator should be familiar with three major aspects of federal clean air statutes. The first concerns so-called “major sources” of air pollution and the assessment of emissions fees. The second pertains to the combined effect of industrial operations on regional air quality, to which significant human populations would be routinely exposed in the course of their regular activities. The third concerns the suite of management techniques, operating parameters, air pollution abatement measures, maintenance and training procedures, self-monitoring, and recordkeeping under which the facility will be permitted to operate to meet emissions targets.

Definitions, major source classification, and emissions fees. Major sources of air pollutants are determined on the basis of emissions thresholds. In the case of routine, regulated pollutants such as particulate matter (PM) and nitrogen (N) oxides, a facility having the potential to emit more than 100 short tons of a single pollutant annually to the atmosphere would be considered a major source. In the case of constituents listed as hazardous air pollutants (HAPs; e.g., trichloroethylene), the major source threshold may be 10 tons/year or even less, depending on the constituent. *Potential to emit* refers to the amount of emitted pollutant that would be expected from a facility operating year-round at full capacity. The list of all applicable regulated pollutants and their expected annual emissions is known as a facility’s *emissions inventory*. Facilities classified as major sources can be assessed emissions fees. For industrial sources, these fees average about \$30 per ton of emissions, but states have the flexibility to set the fee structure however they wish.

Until recently, the emissions inventory for an industrial facility was based only on (a) point source emissions, which are emissions that can be traced to a specific point such as the end of a pipe, the top of a stack, or a cyclone exhaust and (b) process fugitive emissions, which are identified with a discrete process but are not traceable to a single emission point (e.g., hay grinding). In the case of a cattle feedlot, the emissions inventory has generally been limited to emissions from the flaker cyclones, hay grinding, grain unloading, and feed loading. Fugitive emissions, which are analogous to

nonpoint source (NPS) pollution, are not included in the emissions inventory for the open-lot AFO source category. (Fugitive emissions from a cattle feedlot or an open lot dairy include dust resulting from cattle activity on the feedlot surface or from vehicle traffic on unpaved roads.) As a result, open lot AFOs have not typically been classified as major sources and therefore have not been assessed emissions fees.

Within the last two years, however, legislatures in a few western states have explicitly authorized their state air pollution regulatory agencies (SAPRAs) to include fugitive emissions in the statewide emissions inventory. In 1998, for example, the state of Washington introduced language to that effect into the Washington Administrative Code. Special air quality districts in the State of California also consider fugitive emissions in the enforcement of their air quality regulations. Lesikar et al. (1996) showed that including fugitive emissions of PM_{10} (particulate matter having a diameter less than 10 micrometers) in the inventory would suddenly require that cattle feedlots as small as 8,000-head one-time capacity be reclassified as major sources. Emissions fees for those feedlots would be set by the state in question.

If warranted by public health considerations, the EPA could conceivably reduce the major source thresholds, bringing smaller operations into the major source classification. The pollutants of primary concern to the open lot livestock facility are hydrogen sulfide (H_2S), PM_{10} , and $PM_{2.5}$ (particulate matter with a diameter less than 2.5 micrometers). Odors are not a regulated pollutant per se, but they may create nuisance conditions that would be the basis for action by the SAPRA or for litigation. Despite its ubiquity near AFOs and its reputation as an odorous gas, ammonia (NH_3) is not a federally regulated pollutant under the CAAA¹.

National Ambient Air Quality Standards (NAAQS). Ambient air quality refers to the quality of the outdoor air to which humans are exposed during the course of their normal lives. The EPA has established a list of maximum concentrations–pollutant thresholds–above which human exposure may result in adverse health effects. The NAAQS, as the list is called, serves as an administrative benchmark for clean air. Those areas found to exceed the NAAQS for any one or more *criteria pollutants* (carbon monoxide, lead, PM, sulfur oxides, nitrogen oxides, and ozone) are subsequently classified as nonattainment areas (NAAs), which are then required to develop and implement a plan to reduce emissions and bring the area into attainment. Under EPA’s oversight, SAPRAs determine compliance with the NAAQS by installing and operating a monitoring network.

The NAAQS are derived from a synthesis of epidemiological and clinical data relating exposures to human health effects. As such, the NAAQS for an individual pollutant may consist of one or more acute (short-term) standards and/or one or more chronic (long-term) standards. The multiple standards reflect the idea that humans can endure exposures to relatively high concentrations for a short duration and relatively lower concentrations for longer periods. For example, the current NAAQS for PM_{10} consists of two standards, a 24-hour average concentration of 150 micrograms per cubic meter ($\mu g\ m^{-3}$) and an annual average concentration of $50\ \mu g\ m^{-3}$.

¹In 2002, EPA is scheduled to promulgate rules implementing the new NAAQS for fine particles ($PM_{2.5}$). Because ammonia is a *precursor gas* (i.e., ammonia reacts with other atmospheric gases to form fine particles), these new federal rules may contain provisions related to ammonia emissions.

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Because rural areas have a relatively low population density, ambient monitoring stations tend to be concentrated in urban areas. That fact should not obscure the true regulatory meaning of “ambient,” which refers to any area to which the public has access. That definition implies that the NAAQS apply not only in population centers but also at a facility’s property line irrespective of that facility’s proximity to population centers.

Federal operating permits (FOPs). In addition to emissions fees, FOPs are a fact of life for facilities classified as major sources of air pollutants. Again, no U.S. AFOs are currently classified as major sources. Because the FOP program was authorized under Title V of the CAAA, states that have been delegated authority to administer it typically refer to their permit-issuing program as the “Title V Program.” Your state’s Title V office may have published a guidance document outlining the permitting requirements for your AFO type or livestock species.

Because open lot AFOs are seldom classified as major sources, they are rarely required to obtain FOPs. They may be required, however, to apply for state authorization in the form of (a) a standard exemption from permitting, (b) a standard air permit or (c) an individual air permit. In states where the AFOs are sometimes required to obtain individual permits, the process of evaluating permit applications may involve the use of dispersion modeling to predict worst-case downwind concentrations of any pollutants of local or regional concern. Dispersion modelers use complex mathematical algorithms to predict downwind pollutant concentrations from the interaction of the AFO’s orientation, pollutant emission rate, and mesoscale weather conditions. Permit reviewers then compare the predicted concentrations to the NAAQS (or, if more stringent, to the state’s own air quality standards) to determine if additional abatement measures are necessary. The relevant air quality standards are applied at the property line, and if modeled property line concentrations exceed the NAAQS, regulators may deny permit applications for remote sources based on the modeled limits. Open lot AFOs, particularly in arid and semi-arid regions where dust is a persistent challenge, may be susceptible to increased regulatory requirements in that regard.

OSHA. The cattle-feeding industry has long suspected that dusty feedlot conditions contribute to impaired livestock health, feed-to-gain performance and overall profitability. MacVean et al. (1986) was the first major, peer-reviewed study to link the health and performance of feeder cattle to the onset and magnitude of dust events, and the effects they showed received increased attention from research animal scientists, veterinarians, and engineers. Superficially, it is reasonable to expect that an increased risk of impaired livestock health implies an increased risk to human health, but in the case of cattle feedlots and open lot dairies, that link has not yet been demonstrated in the refereed literature. Researchers (Donham et al. 1995; Reynolds et al. 1996; Schiffman 1995; Thu et al. 1997) have linked adverse health responses of both workers and neighbors to dust and odors emitted from swine confinement. Extrapolating those results to open lot AFOs, which are typically bovine confinements in which worker exposure is outdoors rather than indoors, is difficult to justify

without experimental data. Still, outdoor exposure to molds and fungi (and their active biochemical components) emitted from agricultural operations such as hay grinding and cotton processing have long been linked to both acute health responses (Campbell 1932) and chronic conditions such as farmer's lung (Gudmundsson and Wilson 1999). Occupational safety and health are not regulated by EPA but by the OSHA. Specific pollutants such as hydrogen sulfide (H_2S) have clear occupational health implications ranging from irritation to nausea to sudden death of agricultural workers (Doss et al. 1993).

State air quality regulations

States have a key role in regulating air pollution. As mentioned previously, they are free to establish their own air quality standards provided that they are at least as stringent as any corresponding federal standards. States may regulate pollutants not listed as federally regulated pollutants. They may also impose their own permit requirements in addition to administering a delegated FOP program. To meet the CAAA air quality requirements, states are required by the regulations implementing the Act to write a State Implementation Plan (SIP) and submit it for EPA approval. When non-attainment designations are made as a result of ambient monitoring, states must also submit, for EPA approval, an amendment to the SIP that shows how their non-attainment areas will be brought into compliance with the NAAQS.

SAPRAs. State air pollution regulatory authorities are the “heavy lifters” in the regulation of air pollution. They administer ambient monitoring programs, operating permits, compliance inspections, and federally mandated emissions-reduction programs for NAAs. In relation to EPA, SAPRAs have sovereign authority only with respect to regulations that are either (a) not addressed by EPA or (b) more stringent than the federal rules.

State-level air quality standards. Some SAPRAs have elected to set air quality standards that are more stringent than their federal counterparts (either EPA or OSHA). For example, the state of Minnesota has set an ambient standard for H_2S at 30 parts per billion (ppb) on a 30-minute average. Although H_2S was originally included in the list of HAPs, it has been “delisted” and currently has no federal ambient air quality standard attached to it.

SIPs for NAAs. When results of ambient monitoring indicate that the region represented by a monitoring site is not in compliance with the NAAQS—i.e., is designated as an NAA—the responsible SAPRA is required to develop and submit, for EPA approval, an amendment to the SIP that will bring the NAA into compliance with the NAAQS within a reasonable time. In the plan, SAPRAs will include all significant sources of the pollutant in question that contribute to the non-attainment condition. In the case of the San Joaquin Valley in California, a serious NAA for PM_{10} , agricultural practices such as tillage and harvesting are subject to abatement requirements. Although the nationwide distribution of open lot AFOs differs greatly from the distribution of federal ambient monitoring sites (which tend to be located near population centers), managers of open lot AFOs need to be aware of attainment classifications that may affect their operations.

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Nuisance and liability

Another means of addressing air pollution from open lot AFOs is the nuisance complaint. In its mildest form, it may consist only of a phone call from a neighbor to the AFO manager or company headquarters, followed by informal meetings to determine an appropriate response. In persistent, adversarial, or emergency cases, the nuisance complaint may be registered with the SAPRA headquarters, the nearest SAPRA field office, or law enforcement authority. In these cases, SAPRA inspectors may visit the site of the complaint in an attempt to verify it, although quite often the time lag between complaint and inspection makes verification difficult or impossible. In severely adversarial cases or where dust or odor problems may have contributed to documented accidents or injury, the last recourse may be litigation. Litigation may take the form of a lawsuit based on either a nuisance or a tort.

Definition of nuisance. Nuisance is commonly defined as any condition that inhibits the reasonable use or enjoyment of property. Nuisance doctrine implies that private property rights include an expectation that future use of that property will not be unreasonably affected by the activities of others. In the case of open lot AFOs, for example, neighboring property owners have the right to expect that they can schedule an outdoor barbecue with the reasonable assurance that dust or odor will not detract from their enjoyment. In some cases, special topographical features such as ravines, canyons, or draws may transport a dust plume for several miles, causing a nuisance in towns and residences not obviously adjacent to the AFO.

Liability issues for open lot livestock facilities. The principal liability issue facing open lot AFOs, such as cattle feedlots, concerns reduced visibility on nearby roadways. Severe dust storms from cattle feedlots may reduce visibility to a mile or less, especially in the early- to mid-evening when the atmosphere is becoming more stable and winds are light. Feedlots and open lot dairies located on major thoroughfares and highways where tractor-trailer traffic is substantial are highly exposed, especially where prevailing winds push the dust cloud toward the roadway. As with nuisance conditions, liability exposure may exist miles from the AFO where special topography serves as a conduit for dust plumes.