

# Concentrated Animal Feeding Operations: Health Risks from Air Pollution

Just 5% of U.S. farms account for 54% of its beef and dairy cattle, swine, and poultry, concentrating manure as well as animals.<sup>1</sup> These industrial-scale operations, called CAFOs (concentrated animal feeding operations) or factory farms, produce 575 billion pounds of manure yearly.<sup>2</sup> Manure concentration contributes to air and water pollution, and likely to antibiotic resistance, impacting both workers and neighbors.



Degrading manure waste and bedding from confined animals can generate a toxic mixture of gases such as hydrogen sulfide as well as airborne particles including dust from animal feces, feed, hair and dander, and odors, microbes and bacterial toxins.<sup>3,4</sup> Along with antibiotic residues, manure may carry antibiotic-resistant bacteria.

Manure-related air pollutants are emitted from confinement buildings and from manure stored in pits or lagoons, or spread or sprayed onto nearby fields. These CAFO air emissions may consti-



Photo: USDA

tute a public health hazard, concluded scientists convened by the Centers for Disease Control (CDC) in 1998, and more recently by the University of Iowa and Iowa State University.<sup>3,4</sup> Young children, asthmatics, the elderly and others with respiratory conditions are especially vulnerable. Individual pollutants pose risks, and cumulative impacts are likely, but rarely studied.

## Air pollutants of concern

### ► Dust particles and toxins.

Large and small particles can travel up to six miles, or more, on wind currents. Smaller particles—around 50% of CAFO particulates—pose a greater hazard because they penetrate deeper into the lungs, carrying toxic gases adsorbed onto them.<sup>5,6</sup> Endotoxins are parts of bacteria remaining toxic long after the organism dies. Even at low concentrations in CAFO dust, they can affect white blood cell counts, cause fever and respiratory distress, and worsen asthma.<sup>7</sup>

► **Ammonia.** Ammonia adsorbed onto CAFO dust particles can be carried deep into lungs, where it irritates tissue even at low concentrations.<sup>3</sup> Ammonia impedes lung cilia from clearing dust particles, leading to worse than additive impacts from dust and ammonia exposure together.<sup>7</sup> In the general vicinity of livestock operations, both ammonia and hydrogen sulfide have been measured at concentrations posing health concerns for neighbors experiencing prolonged exposure. Recommended maximum exposure is 7 parts per million, but human smell begins detecting ammonia at just 5 ppm.<sup>8</sup>

► **Hydrogen sulfide.** H<sub>2</sub>S, a cyanide-like manure gas, prevents cells from using oxygen. It can have a rotten egg odor. High-level exposure (>500 ppm) can cause loss of consciousness, coma and death. H<sub>2</sub>S levels downwind of CAFOs more likely are associated with irritation of the eyes and respiratory passages (at 20 ppm), nausea and vomiting (at 50 ppm), and dizziness (at 200 ppm).<sup>8</sup> In limited study, neighbors of H<sub>2</sub>S-emitting facilities with insidious downwind exposures (average levels under 1 ppm, peak exposures up to 5 ppm) have been found with permanent nervous system impairment.<sup>9</sup>

► **Antibiotic-resistant bacteria.** Any antibiotic exposure helps make bacteria resistant. Bacteria in U.S. livestock and poultry are routinely exposed to antibiotics in feed, many identical or nearly so to human medicines.<sup>10</sup> Up to 75% of feed antibiotics will pass unchanged into manure, along with resistant bacteria.<sup>11</sup> Limited studies suggests air emissions from confined facilities using antibiotic feeds will contain drug-resistant bacteria at concentrations several-fold higher than facilities avoiding them.<sup>12</sup>

## CAFO air emissions may constitute a public health hazard

**Lung and respiratory problems.** While the contribution of CAFO air pollutants to respiratory and other health problems in workers has been well-established, the exposure (and therefore risk) to neighbors living downwind of facilities has not been accurately measured.<sup>13</sup> Studies of CAFO neighbors do, however, reveal a pattern of symptoms consistent with those found in workers.

► After 1993 construction of one of the nation's largest industrial hog operations in Milford, Utah, hospital discharges for respiratory and diarrheal illnesses tripled and quadrupled, respectively, over the subsequent five years—a pattern not seen in Utah communities without such operations.<sup>14</sup>

► Iowans living within two miles of a 4,000-sow operation reported problems such as increased sputum, chest tightness, shortness of breath and wheezing significantly more often than did people not living near the factory. They also reported more frequent dizziness, weakness and nausea.<sup>15</sup>

► North Carolina residents within two miles of a 6,000-hog operation reported respiratory, intestinal and other symptoms significantly more often than did people from communities not near such facilities (see table). These residents also reported 13 to 15 more episodes where odors prevented them from opening windows or going outside than did non-CAFO neighbors.<sup>16</sup> Other North Carolinians experiencing odors from living near intensive hog operations for an average of five years reported significantly higher levels of tension, depression, anger, fatigue and confusion than did an unexposed group.<sup>17</sup>

**Odors and other health hazards.** Most odors stem from detection of volatile organic compounds that, studies suggest, are mostly associated with dust particles and gases. As a result, health effects from odors are inseparable from those of other CAFO gases and airborne particles.<sup>18</sup> At low exposure levels, odors from CAFOs can induce physical symptoms, the most commonly reported of which are eye, nose and throat irritation, headache, palpitations, shortness of breath, as well as stress and mood changes. Symptoms may or may not ease once odors cease. Some people are more sensitive to odors or have pre-existing conditions like asthma; for them, odors can trigger health effects lasting for longer periods of time.<sup>20,21</sup>

Odors can affect the brain even at concentrations below the brain's ability to register them as a "smell," altering behavior and likely other brain-regulated activities such as mood.<sup>19</sup> People downwind of swine operations can experience highly significant mood disturbance, perhaps reflecting physical connections between brain cells involved with emotion (the limbic system) and the sense of smell. Lack of control over the timing of odors can contribute to negative mood. Negative moods produced by unpleasant odors can persist beyond the odor event.<sup>22</sup>

Exposure to very low levels of hydrogen sulfide (H<sub>2</sub>S) over years may cause persistent illness and brain damage, recent study suggests. People living near industrial sources in Texas and Hawaii reported fatigue, restlessness, anxiety, short-term memory loss, and headaches at rates averaging five times higher than among people not exposed to H<sub>2</sub>S. They also reported, on average, 10 times higher rates of respiratory symptoms, including wheezing, shortness of breath, persistent cough and bronchitis.<sup>23</sup> Various tests of brain

### Symptoms reported by hog CAFO neighbors and non-neighbors

Average number of episodes per person over six months

| Symptom            | Neighbors | Non-neighbors |
|--------------------|-----------|---------------|
| Headache           | 15.5      | 7.8           |
| Burning eyes       | 9.4       | 3.8           |
| Runny nose         | 8.5       | 3.9           |
| Excessive coughing | 6.3       | 1.8           |
| Diarrhea           | 4.3       | 1.7           |

(neurobehavioral) function in 24 residents of homes constructed over petroleum deposits, and with long-term exposure to H<sub>2</sub>S concentrations ranging from 0.1 to 1.0 ppm (with a few peaks to 5 ppm), revealed abnormal balance and color vision, impaired verbal recall, and reduced grip strength.<sup>9</sup> Kilburn concludes "the only safe strategy is to avoid all exposures to any dose" of H<sub>2</sub>S.

**Conclusion.** Air emissions from CAFOs degrade air quality, injure workers and may harm the health of children and families living nearby. Decomposing manure creates volatile toxic gases, including ammonia and hydrogen sulfide, with short and long-term health effects possible. Dust particles and bacterial toxins in manure dust can exacerbate asthma and directly impact respiratory health. Iowa public health experts recently concluded that precautions should be taken to minimize exposure to specific air pollutants (hydrogen sulfide and ammonia) and to pollutant mixtures, including odors, arising from CAFOs.<sup>3</sup> ●

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