

# Concentrated Animal Feeding Operations: Health Risks from Water 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 about 575 billion pounds of manure dry matter yearly.<sup>2</sup> Manure concentration contributes to water pollution, air pollution, and likely to antibiotic resistance, posing serious risks to human health.



Manure can contaminate water with microbes causing severe gastrointestinal disease, complications, and even death. Manure can carry arsenic and other toxic metal compounds as well as antibiotics into water, contributing to antibiotic resistance. Manure nutrients also can cause disease if concentrated to excess in drinking water.

## Manure concentration contributes to water pollution ...posing serious risks to human health.

**Manure storage and spreading contaminates water.** Concentrated untreated manure typically is kept in storage pits or lagoons—around 5,000 in Iowa alone—until it is sprayed or spread on nearby land. Precipitation or drift can carry land-applied manure directly into surface waters; such runoff also infiltrates into soils. Scientists on a 2002 panel of Iowan experts opined that current CAFO production systems dispose of too much manure on too little land to expect acceptable water quality, given uncontrollable rain, snow and other weather conditions.<sup>3</sup>

Pit siting and leakage, in addition to manure spreading, contribute to the contamination of surface waters and groundwater, posing a threat to 42 million Americans who drink groundwater from untreated private wells.<sup>4</sup> Among a representative sample of Iowa's earthen manure pits, 18% were built over alluvial aquifers (those most widely used for drinking water and vulnerable to contamination). Most were constructed below the water table, raising the likelihood of groundwater contamination.<sup>5</sup> State laws allow manure storage pits to regularly leak untreated waste—in Iowa, for example, legal leakage would be up to 16 million liters of untreated waste each year for a single large, 7-acre lagoon. Yet more than half such structures tested in Iowa were found to leak at rates above the legal limits.<sup>5</sup> Accidents also occur regularly. Ten Midwestern states recorded around 1,000 manure lagoon spills from 1995 and 1998.<sup>6</sup> In 1995, two huge North Carolina hog lagoons burst, releasing 34 million gallons of animal waste into nearby waterbodies.<sup>7</sup>

**Health impacts of manure-related microbes.** Microbes that normally inhabit the gut of livestock can cause illness and even death in infected humans. Most such infections are foodborne; however, three microorganisms cause serious outbreaks via contaminated water: *E. coli*, *Campylobacter*, and *Cryptosporidium*.

► *E. coli*. Studies have found *E. coli* bacteria in the manure of about



Photo: Rick Dove

one-quarter of the beef cattle at large feedlots, and at a Midwestern slaughterhouse.<sup>8,9</sup> *E. coli*—including virulent O157:H7 strains—can remain viable in soil for months and migrate to groundwater.<sup>10</sup> A 1994 study detected *E. coli* in more than 11% of midwestern wells; detections were over 20% in Iowa and Missouri. Wells on farms spreading manure were 30% more likely to be contaminated.<sup>11</sup>

Each year, an estimated 73,000 foodborne and waterborne *E. coli* infections occur in the U.S. Life-threatening kidney failure results in 2-7% of cases (up to 5,000 people a year), higher among children and the elderly. Three to five percent of these patients die, and 40% develop lifelong complications such as abnormal kidney function, blindness or paralysis.<sup>12</sup> In May 2000 in Walkerton, Ontario, an estimated 2,321 people became ill and seven died after drinking water from a municipal well contaminated with *E. coli* and *Campylobacter* from runoff resulting from manure spread onto fields by a nearby livestock operation.<sup>13</sup> Five of these deaths were attributed to *E. coli* infections.<sup>14</sup>

► *Campylobacter*. Two Walkerton deaths were attributed to *Campylobacter* bacteria, which affect an estimated 2.4 million Americans annually of whom nearly 130 die. Most infections stem from contaminated water or food, particularly poultry.<sup>15</sup> Infants are more than twice as likely to develop such infections,<sup>16</sup> which, if entering the bloodstream, will result in death more than 30% of the time.<sup>17</sup> Each year, around 2,400 people with *Campylobacter* infections develop acute paralysis called Guillain-Barré syndrome; one in five suffer some permanent disability.<sup>18</sup>

► *Cryptosporidium*. An estimated 420,000 U.S. cases of waterborne cryptosporidiosis occur each year. In a 1993 Milwaukee outbreak—the nation's largest waterborne disease event—over 403,000 persons suffered diarrhea, abdominal cramps, fever and vomiting due to *Cryptosporidium*, and 54 died.<sup>19,20</sup> Manure from feedlots along rivers contributing to the city's water supply was identified as a possible cause. A 1993 study found *Cryptosporidium* on about 90% of U.S. dairy farms; the risk of finding cryptosporidia in associated surface waters increases with how frequently dairy farms spread manure on fields.<sup>21</sup> *Cryptosporidium* also has been detected in at least two-thirds of U.S. surface waters tested, and in fully disinfected and filtered tap water from 27-54% of communities surveyed—23 million live in cities not filtering drinking water.<sup>22</sup>

**Health impacts of antibiotics and heavy metals in manure.** Bacteria inhabit the guts of food animals. An estimated 70% of U.S. antibiotics are fed to livestock that are not sick, as growth promoters, or to compensate for stress from crowding large numbers of animals together.<sup>23</sup> The majority of these antibiotics are identical or closely related to human medicines. Up to 75% of feed antibiotics pass unchanged into animal feces and urine.<sup>24</sup> Routinely exposing the bacteria in manure and in animals to antibiotics will make them more antibiotic-resistant. Exposure to the arsenic<sup>25</sup> and other heavy metal compounds also routinely added to animal feed, and therefore to manure, may also promote resistance.<sup>26</sup> Manure contamination of groundwater and waterways may facilitate the spread of bacteria carrying antibiotic resistance.

**Health impacts of excess nutrients: Nitrogen and phosphorus.** Nitrogen and phosphorus nutrients in manure can aid crop growth when applied in appropriate amounts. But U.S. livestock farms produce excess nutrients. The total nitrogen and phosphorus generated exceeds the absorptive capacity of crops on those farms by an estimated 60% and 70%, respectively. CAFOs produce two-thirds of the excess nutrients.<sup>1</sup> Since manure can be moved economically for only short distances, as CAFOs expand there is less nearby land for spreading the expanding amounts of manure at appropriate

### Phosphorus and microcystins

Excess phosphorus in water drives the growth of blue-green algae which can produce toxins associated with gastroenteritis, respiratory effects, skin irritations, allergic responses, and, more seriously, liver damage.<sup>33</sup> These toxins, called microcystins, are found in both untreated and treated U.S. water samples.<sup>34</sup>

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rates. Manure over-application will result, with harm to the environment and possibly to human health.

► **Blue-baby syndrome.** Microbes break down ammonia and nitrogen in manure into nitrate, which prevents red blood cells from carrying oxygen. Infants drinking nitrate-contaminated water can develop methemoglobinemia, or “blue-baby syndrome.” Certain adults also are at risk. Affected persons can die if untreated. The U.S. EPA sets a nitrate drinking water standard of 10 mg/L to prevent this disease, but an estimated 2 million households and 40,000 infants drink water from wells above this “safety” standards.<sup>27</sup> In North Carolina alone, 10% of 1,600 wells adjacent to hog and poultry operations exceed the limit, some by more than tenfold.<sup>28</sup>

► **Cancer and diabetes.** Long-term ingestion of nitrate-contaminated water, even at levels well below federal standards, may increase certain disease risks. Nebraskans drinking such water appear to have double the risk of developing non-Hodgkin's lymphoma (NHL), a cancer of the immune system's white blood cells.<sup>29</sup> Among Iowa women studied the risk of bladder and ovarian cancer also increases, but not for NHL.<sup>30</sup> Colorado children drinking nitrate-contaminated water had a higher incidence of diabetes, suggests one study;<sup>31</sup> among children in England drinking such water, the increase was 15%.<sup>32</sup>

**Conclusion.** Large-scale concentration of food animals also concentrates their manure with adverse impacts on water quality that may be inconsistent with public health. Possible human health impacts include water contamination with disease-causing microbes, worsening antibiotic resistance, and excess nitrates linked to increased rates of cancer, diabetes and blue-baby syndrome. ●

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