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The Explosion of CAFOs in Iowa and Its Impact on Water Quality and Public Health

James Merchant
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January 2018

The Iowa Policy Project

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The Iowa Policy Project

Formed in 2001, the Iowa Policy Project is a nonpartisan, nonprofit organization located at 20 E. Market Street, Iowa City, IA 52245.

The Iowa Policy Project promotes public policy that fosters economic opportunity while safeguarding the health and well-being of Iowa's people and the environment. By providing a foundation of fact-based, objective research and engaging the public in an informed discussion of policy alternatives, the Iowa Policy Project advances accountable, effective and fair government.

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EXECUTIVE SUMMARY

The Explosion of CAFOs in Iowa and Its Impact on Water Quality and Public Health

By James Merchant and David Osterberg

Iowa has more than four times as many large concentrated animal feeding operations (CAFOs) as it did in 2001, and over the last decade has added nearly 500 new or expanded state-permitted CAFOs annually — now an estimated 10,000 CAFOs of all sizes.

This remarkable expansion is fueled by Iowa's robust export market for slaughtered hogs, nearly \$6 billion in 2016, up 7 percent in one year. Exports to Hong Kong/China broke the \$1 billion mark for the first time in 2016. Exports are expected to further expand to meet China's insatiable appetite for pork, and with export demand come new pork processing plants and sustained CAFO growth.

Iowa's lax "Master Matrix" process for CAFO siting is broken — 97 percent of requested permits are approved — even in fragile karst topography, over objections of county supervisors in now 20 counties, and despite the protests of neighbors and citizen groups. All have been disenfranchised by the considerable clout of the livestock industry.

A tipping point has been reached. Rural Iowans have every reason to be concerned.

While water quality is a stated priority of Iowa lawmakers, livestock production is an important contributor to water degradation and goes unchecked. Manure leaks and spills are associated with fish kills, nitrate and ammonia pollution, antibiotics, hormones, bacterial contamination, algae blooms, water quality impairments, closed beaches and are a major contributor to the "dead zone" in the Gulf of Mexico.

Continued CAFO expansion will only worsen these documented environmental impacts and must be part of the solution to Iowa's widely recognized water quality problem.

The Explosion of CAFOs in Iowa

In 2001, there were 722 Iowa Department of Natural Resources (DNR) permitted (93 percent hog) large CAFOs. By federal definition, these are 1,000 animal units (AU); smaller animal feeding operations (AFOs) are classified as permitted medium sized (500 AU to 999 AU), or small (below 500 AU in Iowa, but generally below 300 in other states). In this report, all animal feeding operations will be referred to as CAFOs.

The number of large and medium CAFOs in Iowa is not exact. In 2013, EPA Region 7 compelled the DNR to determine the total number of CAFOs of all sizes. DNR reported to EPA in 2016, through the use of satellite imagery, that it had found over 5,000 "new" CAFOs of undetermined size. In its July 31, 2017, report to EPA, DNR reported that it had identified more medium or large CAFOs, only some of which have been added to its database.* The number of animal facilities in the DNR database exceeds 10,000. Accounting for all new CAFOs the total will certainly be more.

* 2017 Annual Report for Work Plan Agreement between the Iowa Department of Natural Resources and the Environmental Protection Agency, Region 7. Iowa DNR. Aug. 1, 2017
<http://www.iowadnr.gov/Portals/10>

* See also Iowa Concentrated Animal Feeding Operation Air Quality Study, Table 12:
<https://www.public-health.uiowa.edu/ehsrc/CAFOstudy.htm>

Numerous studies in the last decade also have documented the impact of CAFO air emissions on the health of neighbors, finding significant increases in childhood asthma, adult asthma, airway obstruction, and irritant-linked eye and upper airway symptoms.

Other studies have documented negative impacts of CAFO air emissions on mood (more tension, depression, fatigue, confusion and less vigor), other psychosocial measures, and between odor and multiple quality-of-life measures. Several studies now find that property value near animal feeding operations, depending on distance, wind direction and other factors, is depressed 20 to 40 percent.

While one cannot ignore this now extensive scientific evidence, there is every indication that the industry intends business as usual. Not only happy with the Master Matrix, the industry is fortified by a new anti-nuisance suit law that prevents or severely limits real nuisance damages and seeks to eliminate from consideration evidence-based adverse health effects research.

To control and eventually diminish these negative impacts, and sustain long-term farm animal production in Iowa, we suggest six policies for rural Iowans, supervisors and legislators to consider:

- reform and revise the Master Matrix,
- pass a moratorium on new CAFOs,
- consider land covenants and other local legal strategies to limit local CAFO growth,
- challenge the constitutionality of anti-nuisance suit and ag-gag legislation,
- consider renewable energy from animal waste legislation, and
- fund communicable disease and sustainable agriculture programs.

The current industrial model is not sustainable given its high input costs, rising energy demands, fresh water needs, climate change, and adverse environmental and public health impacts. The very real pushback from rural residents and communities will, however, be sustained.

James Merchant is Professor Emeritus of Public Health and Medicine, and Founding Dean Emeritus, College of Public Health, at the University of Iowa. David Osterberg is Professor Emeritus of Occupational and Environmental Health at the University of Iowa, and co-founder of the nonpartisan Iowa Policy Project in Iowa City.



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INTRODUCTION

Iowa has more than four times as many large Concentrated Animal Feeding Operations (CAFOs) as it did in 2001. (See box.) For pork production, this industrial infrastructure has enabled the state to remain the nation's No. 1 producer, not just for the U.S. markets but to meet export demand as well. This has come at a price. There is conflict within the state on the value and cost of such an expansion and the nature of the industry. This report examines data and science to enhance understanding of the issue by Iowans and their policy makers, and presents policy options.

Iowa pork producers set an all-time record of 2.31 metric tons of pork in 2016, up 8 percent year-over-year and over 2 percent higher than the previous record in 2012.¹ Converting metric tons into the number of animals shows how hogs dwarf the human population of roughly 3 million in the state of Iowa. According to the USDA, 21,370,000 of the total of 65,435,000 market hogs nationally came from Iowa.²

China: A Booming Market for Iowa Pork

Export value of slaughtered hogs increased 7 percent from the previous year to \$5.94 billion and exports accounted for nearly 26 percent of total 2016 pork production. Mexico remains the No. 1 export market for Iowa pork, but exports to Hong Kong/China set a new volume record in 2016 and broke the \$1 billion mark for the first time (\$1.07 billion), up 53 percent from the previous year.³

To understand the extraordinary demand for exported pork to China, which already produces and consumes over half of the world's pork, one need only consider the continued expansion of its population of 1.41 billion combined with the seemingly insatiable appetite of the Chinese people for pork. With an annual growth rate of about 0.45 percent, China's population will grow by over 6 million in the next year.⁴ So important is pork to the Chinese diet that in 2007

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* See also Iowa Concentrated Animal Feeding Operation Air Quality Study, Table 12: <https://www.public-health.uiowa.edu/ehsrc/CAFOstudy.htm>

China established a National Pork Reserve.⁵ While China's Ministry of Agriculture seeks to further expand its national pork production through building U.S.-style very large CAFOs, it has increasingly turned to cheap, nutritious and safe imported pork to meet national demand. In 2011 a Chinese holding company, W.H. Group, bought Smithfield Farms, which remains the largest U.S. pork producer.

The marked growth in pork exports to China is fueling the rapid expansion of CAFOs in Iowa. Pork packing plants are expanding to meet this export demand, with two pork processing plants now open or breaking ground in Iowa. Seaboard Triumph Foods, a \$264 million plant in Sioux City, and Prestage, a \$240 million plant in Eagle Grove.⁶ This news is welcome to the industry, which is concerned that production of hogs could run up against constraints in capacity to process them. This is a real concern since Iowa producers are in an expansionary mood.⁷

WHY RURAL IOWANS SHOULD BE CONCERNED

There has been conflict among neighbors and CAFOs regarding odor, siting policy, size, density, distance to neighboring property or communities, impacts on the rural environment, water quality, the public's health, quality-of-life, property values as well as rural development. The environmental and public health scientific literature underlying this conflict and concern is more substantial than when the industry was the subject of previously widely cited reviews.^{8 9}

An Open Access, industry-sponsored Systematic Review concluded that, apart from Q fever from goats, that MRSA colonization and CAFO proximity was "unclear" and that "there was "inconsistent evidence of a weak association" between respiratory disease and CAFO proximity.¹⁰ A response from several investigators, whose studies had been excluded or misinterpreted, observed that O'Connor et al had "utilized a bias tool not designed for environmental health research, erroneously excluded important studies, and incorrectly interpreted others."¹¹ The following review seeks to include relevant peer reviewed studies, respects authors' interpretations, and concludes that there is a substantial and growing scientific literature linking adverse health outcomes with living near to animal feeding operations.

IMPACTS ON PUBLIC HEALTH

The Definition of Health

Health, as defined by the World Health Organization, is "a state of complete physical, mental and social well-being."^{12 13} The broad definition of health is widely recognized in the developed world and is increasingly being adopted by American employers as they seek to enhance the health, productivity and well-being of their employees; and by communities as they seek to make decisions about industrial and agricultural development. It is an appropriate definition to apply when considering CAFO emissions and associated adverse health effects among exposed neighbors and communities. When considering adverse effects of CAFOs on nearby neighbors, *health should be defined broadly* because the question of harm involves the nature of home. Any resident associates their family and home life as the center of their well-being, as well as the place there they most need to have — and are entitled to have — a sense of health and security.

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The WHO definition of health is consistent with evaluation and analysis of CAFO peer-review publications by interested scholars from a variety of disciplines including epidemiology, environmental health and behavioral health. While adverse health effect endpoints may not always rise to that of a diagnosable disease or injury, such endpoints are measurable, reproducible and valid for assessing community risk.

Considerations of the Population at Risk

For many reasons, Agency for Toxic Substances and Disease Registry health-based guidelines, U.S. Environmental Protection Agency (EPA) standards, and state-based community health regulations must be stricter for the general public than for those exposed occupationally.¹⁴ Such protection is because CAFO neighbors and nearby communities are composed of susceptible subgroups including children, the elderly, those with pre-existing conditions — such as asthma, chronic obstructive lung disease (COPD), and those with allergies and with compromised immunity. While workers are exposed for only a few hours each day, community residents are exposed continuously. While workers have a choice as to where they work, CAFO neighbors and nearby communities have little or no choice under existing Iowa law and regulations. Therefore, community exposure emissions arising from CAFOs — hydrogen sulfide, ammonia, other airway irritants, volatile organic compounds and inflammatory and infectious bioaerosols — would be expected to have adverse health effects at lower concentrations, and therefore need greater margins of safety, in community settings.

State and local governmental bodies should err on the side of caution when considering permitting strategies. The immediate population at risk is informed by consideration of the demographics, location of susceptible subpopulations such as schools, nursing homes, parks and recreational areas, community residential growth trends, water bodies, and local industry that may emit pollutants that add risk. In addition to these local considerations, the location and size of other CAFOs is important as it is known that, in addition to size and proximity, CAFO density is an important risk factor for airway disease.¹⁵ Some of these factors are included in the currently used DNR Master Matrix, which will be described below.

Asthma and Airway Obstruction

Acute physical responses to airborne CAFO emissions, such as watery eyes, runny nose, coughing and nausea, occur temporarily and typically abate after exposure to gases and odors. Such adverse health effects involve biological (short-term physiological responses to emissions from CAFOs. EPA Human Research Studies for air pollutants noted a distinction between “biological responses” and “clinical responses.”¹⁶ While this distinction is important for experimental human exposure studies, biologically this is a continuum of response to environmental agents, ranging from very early physiological responses, such as runny nose, to chronic airway inflammation — manifest by coughing, wheezing, chest tightness, shortness of breath and measurable airway obstruction — which may be diagnosed and classified as asthma, chronic bronchitis and/or chronic obstructive lung disease.

Toxic air emissions from CAFOs often adversely affect immediate neighbors and may adversely affect nearby communities. Those with allergies, asthmatics — especially children in which asthma is more common — and adults with COPD, are at particular risk.

Early studies of typically small deep-pit CAFOs established that farmers working in these independent farm operations were at substantial risk to increased rates of chronic bronchitis, asthma and acute and chronic airway obstruction.^{17 18} The risk of ARDS (acute respiratory disease syndrome) and death from high levels of hydrogen sulfide from manure agitation was similarly documented.¹⁹ These occupational respiratory disease risks persist, but are not the focus of this report.

Toxic air emissions from CAFOs often adversely affect immediate neighbors and may adversely affect nearby communities. As already noted, those with allergies, asthmatics — especially children in whom asthma is more common — and adults with COPD, are at particular risk. Research among neighbors living proximate to CAFOs in Iowa, North Carolina and Germany have established that rates of acute respiratory symptoms, asthma and airway obstruction are increased, especially with proximity to and density of swine CAFOs.

Childhood Asthma

Children are particularly vulnerable — given their growing lungs and the known relatively high rate of asthma — to environmental exposures. Research from the Keokuk County Rural Health Study (KCRHS), a three-round prospective study of over 1,000 Iowa families, provided a particularly rich dataset to examine childhood asthma risk among rural children living on, or close to, farms with CAFOs.²⁰ Nearly all of these operations were under 500 AU deep-pit CAFOs. The study was able to control for multiple demographic, medical, health care and environmental risk factors in its analysis of 644 Round 1 children (1994-1999). Four “asthma outcomes,” doctor-diagnosed asthma, doctor-diagnosed asthma/medication for wheeze, current wheeze, and cough with exercise were measured. Doctor-diagnosed asthma (which is known to be underdiagnosed) prevalence was 12 percent, while a more accurate estimate of asthma prevalence, doctor-diagnosed asthma/medication for wheeze, was 16.7 percent. The prevalence of any asthma outcome among children living on a farm raising swine was significantly elevated at 42.9 percent (compared to 26.6 percent among non-swine farm children) and was 55.8 percent among children living on swine farms that added antibiotics to feed. Multivariable models found three (doctor diagnosed asthma/medication for wheeze, current wheeze and cough with exercise) of the four asthma outcomes were significantly related to farms raising swine that added antibiotics to feed. The high prevalence of asthma among these children was striking, but was likely due in part by children who did farm chores in the CAFOs and thus had some occupational level exposures.

Sigurdarson and Klein studied two rural Iowa elementary schools, one school within a half-mile of a large CAFO housing some 3,800 hogs, while the control school was located more than 10 miles from any CAFO.²¹ The prevalence of doctor-diagnosed asthma was 19.7 percent among children in the CAFO-proximate school, while the control school prevalence was a significantly less, 7.3 percent. The adjusted odds ratio for doctor-diagnosed asthma was a highly significant 5.71. Possible confounding risk factors were considered but were not significant in multivariable models.

In 2006, Mirabelli and colleagues published two papers on childhood asthma among North Carolina school children.²² Based on a sample of public schools, they estimated potential exposure using both record-based and survey-based exposure indices. Of the sample of 226 schools, the nearest swine CAFO ranged from 0.2 to 42 miles. Sixty-six schools were located within 3 miles of any CAFO. Livestock odor was reported outdoors in 47 (21 percent) of the surveyed schools. In 19 schools (8 percent), the odor was noticeable indoors, including in classrooms and hallways. The percentage of schools reporting livestock odor and the ratings of the strength of the odor each decreased with increasing distance to the nearest swine CAFO. An accompanying paper assessed

estimated exposure to airborne CAFO effluent and asthma symptoms among adolescents, ages 12-14 years.²³ During the 1999-2000 school year, 58,169 adolescents answered questions about their respiratory symptoms, allergies, medications, socioeconomic status and household environments. Estimates of school-based exposure were calculated from available data from the 265 schools and 2,343 swine operations. The prevalence of wheezing, adjusting for confounders, was slightly higher at schools exposed to airborne effluent from CAFOs. Among students who had reported allergies, the prevalence of wheezing was significantly increased by 5 percent among children in schools within three miles of a CAFO, and 24 percent higher at schools in which livestock odor was noticeable twice per month compared to those with no reported odor. Students with allergies who lived within three miles of a CAFO also reported higher rates of doctor-diagnosed asthma, doctor/emergency room visits, asthma medication, activity-limitation and missed school. The authors concluded that airborne pollution from CAFOs was associated with adolescent wheezing symptoms.

Data from Round 2 (2000-2004) of the KCRHS allowed analysis of the risk to childhood asthma among children (n=565) living in proximity (within 3 miles) to mainly small deep-pit CAFOs.²⁴ The prevalence of doctor diagnosed asthma (11 percent) did not differ significantly from Round 1, but doctor-diagnosed asthma/medication for wheeze in Round 2 was increased to 22.7 percent. A metric, based on CAFO footprint, distance to CAFOs, and low wind-speed, was developed to assess relative environmental exposure to CAFO emissions. Children with higher relative exposures to CAFOs had significantly increased odds for both asthma outcomes, while those with doctor-diagnosed asthma/medication for wheeze were found to have a dose-related increase with increasing CAFO exposure metrics.

The Pavilonis study is important as it demonstrated that proximity to even small swine CAFOs was dose-related to childhood asthma risk. Further, this study confirmed Marabelli study findings, again finding that increased risk to childhood asthma symptoms may extend as far as three miles from swine CAFOs.

Airway Disease among Adults

Early cross-sectional surveys of neighbors living proximate to hog CAFOs reported elevated respiratory symptoms, including runny nose, cough and wheeze.^{25 26} These findings were not surprising as they were similar to repeatedly documented increased rates of respiratory symptoms among swine farm exposed workers.

Well-controlled epidemiological studies include a large community-based study of adults (n=6,917) living in four rural German towns with high-density swine CAFOs, and who were surveyed by questionnaire.²⁷ Exposure was measured by collecting data on a four-point scale of odor annoyance together with geo-coded data on number of CAFOs within 500 meters (1,641 feet) from homes. Analyses were restricted to those not working in farming. The prevalence of wheezing without a cold, doctor-diagnosed asthma and allergic rhinitis were significantly increased with higher levels odor annoyance (none, somewhat, moderately, strongly). Increased CAFO density (dose), as measured by the number of animal houses within 500 meters, was associated with significant increases in wheezing without a cold (27.1 percent with 12 CAFOs) and physician diagnosed asthma (10.4 percent with 12 houses). Importantly, subjects living within 500 meters of 12 CAFOs also had significantly lower levels of forced expiratory volume in one second (FEV1) (-7.4 percent), as compared with age and height adjusted predicted levels. The authors concluded these findings were likely due an "asthma-like syndrome" arising from CAFO emissions.

Wing et al studied 101 nonsmoking volunteers living within 1.5 miles of swine CAFOs in 16 rural neighborhoods of eastern North Carolina.²⁸ Based on twice-daily odor diaries over a two-week period, objective measures of swine odor were made — hydrogen sulfide, particulate (PM10, PM2.5), and endotoxin. Swine odor was reported in more than half of the 1,655 episode reports. Odor was found to increase in a dose-response fashion with H2S, PM10, temperature and wind speed. The study demonstrated that self-reported measures of odor were objectively related to measures of pollutants well-known to be contained in CAFO emissions. Further analyses of this study population found these repeated measures (hundreds) were related to acute eye irritation (odor, H2S, and PM10).²⁹ Also, respiratory symptoms in the previous 12 hours were associated with odor and H2S, and difficulty breathing was increased with unit-dose of odor. An increase in wheezing and decrease in FEV1 was associated with increased concentration of PM2.5. Increased sore throat, chest tightness and nausea were dose-related to increases in level of endotoxin. The authors concluded, and an independent invited commentary concurred, that measured emissions within 1.5 miles of swine CAFOs were related to acute physical symptoms and changes in lung function, and that the findings were protected from unmeasured confounding by an innovative study design.³⁰

These several studies of adult airway disease (up to 1.5 miles to a swine CAFO) establish that airway symptoms and changes in lung function, indicative of upper airway irritation and asthma, are related in a dose-response fashion to objective measures of environmental exposures from swine CAFOs.

Antibiotic Resistance

Antibiotic resistance is widely acknowledged to be public health crisis, perhaps the most serious of all global health threats.³¹ Antibiotic use in both human medicine and animal agriculture are well recognized as drivers of antibiotic resistance, and there is broad agreement (World Health Organization, United Nations, European Medicines Agency, and the Centers for Disease Control) that there is a need to optimize use of antibiotics in people and animals.³² The CDC estimates that at least 23,000 Americans die each year from antibiotic-infections, but the real number of deaths is acknowledged to be much higher.³³ A major report released in 2016 estimated that globally at least 700,000 people die due to infections that are resistant to currently available antibiotics, and that by 2050 drug-resistant infections will take an estimated 10 million lives each year.³⁴

Two recent reviews have addressed this public health challenge using a One Health approach: The Expert Committee on Addressing the Contribution of Livestock to the Antibiotic Resistance Crisis Combating Antibiotic Resistance,³⁵ and Combating Antimicrobial Resistance: A One Health Approach to a Global Threat: Proceedings of a National Academy of Medicine Workshop.³⁶

As was recognized by the Pew Commission on Industrial Farm Animal Production, the use of antibiotics in animal agriculture is a threat to public health,³⁷ and more recently stated unequivocally by the CDC, “antibiotic use in animal agriculture can harm public health.”³⁸ Poultry and livestock production account for 70 percent of medically important antibiotics (the same class of antibiotics used in human medicine) sold in the U.S. Compared with the rest of the world, the U.S. is among the most intense users of antibiotics in animal agriculture.³⁹ But, while the U.S. Food and Drug Administration (FDA) Action Plan for Combating Antibiotic-Resistant Bacteria (CARB) has proposed concrete and measurable goals to curb misuse of antibiotics in human medicine, no such goals have been set for curbing misuse of antibiotics in food animal production.⁴⁰

As the Expert Commission and the National Academy of Medicine Workshop agreed, human, animal and environmental ecosystems are interconnected and a One Health approach is therefore

needed. Antibiotic resistance is “a numbers game” — the greater the quantity of antibiotic the more resistance and spread; the greater the number of humans and animals given antibiotics, the greater the likelihood that resistance will emerge and spread; and the longer the duration of antibiotic use, the longer period of time over which antibiotic resistance can emerge and spread.⁴¹

As summarized by the Expert Commission, as early as 1977, the FDA determined that use of certain antibiotics (penicillin and tetracycline) for growth promotion, feed efficiency and disease prevention posed a threat to human health.⁴² While the FDA proposed withdrawing approvals for use of these drugs in animal production, it did not proceed; the FDA then provided no meaningful guidance for over 30 years. Prodded by the Pew Commission on Industrial Farm Animal Production (and the subsequent Pew Antibiotic Resistance Project) recommendations — restrict use of antimicrobial in food animal production, phase out and ban use of antimicrobials for nontherapeutic use, clarify antimicrobial definitions, improve monitoring and reporting of antimicrobial use, improve monitoring and surveillance of antimicrobial resistance, increase veterinary oversight in use of antimicrobials for therapeutic and prevention use, implement a national disease monitoring database with 48 hour trace-back.⁴³ The FDA issued Guidance for Industry #213, which urged drug makers to voluntarily remove growth promotion claims from their medically important antibiotic products.⁴⁴ The FDA, however, estimated that only 10-15 percent of antibiotics used in animal agriculture were used only for growth promotion. And, the FDA still approved the use of these drugs at similar levels and durations for disease prevention. The FDA did put antibiotics for use in prevention under the oversight of a veterinarian, but it did not put in place directives to monitor and track antibiotics used in animal production, as has been successfully implemented in Denmark and the Netherlands.

Drawing on successful programs in Denmark and the Netherlands, the Expert Commission made 11 recommendations that refine and extend those made by the Pew Commission. Lessons learned from Danish and Dutch intervention programs, as described in appendices to the Expert Commission report, include:

- The Dutch government and livestock industry have been able to reduce sales and use of antibiotics by more than 60 percent.
- Combined with target setting, Denmark and the Netherlands have phased out antibiotic growth promoters and their use in the absence of disease, resulting in reductions in use of 45-60 percent.
- The Royal Netherlands Veterinary Association has developed a system for classifying and prioritized veterinary antibiotics into three tiers of use in order to reduce antibiotic resistance.
- Stricter veterinary oversight has been implemented in both Denmark and the Netherlands to assure that restrictions on use of antibiotics in growth promotion and disease prevention are followed. Safeguards also include restrictions on veterinarian profits from antibiotic sales and accountability measures, such as use of benchmarks and “yellow card” notifications for misuse.

Antibiotic Resistant Colonization and Disease in Industrial Farm Animal Production

Concern over a new methicillin-resistant *Staphylococcus aureus* (MRSA) was first raised in Europe in 2005 from molecular typing, ST-398, and related strains clonal complex 398 (CC 398) that arose from swine with transmission to humans. Zoonotic MRSA became responsible for more than 20 percent of all MRSA cases in the Netherlands by 2007.⁴⁵ Screening of Dutch pigs found that nearly 40 percent of the pigs were colonized with a comparable strain of MRSA (MLST 398) and some 80 percent of pig farms were affected.⁴⁶ Since its discovery, MRSA CC398 has been recognized as a

common cause of human colonization and disease in Europe — up to 40 percent of new cases of MRSA in Denmark, the Netherlands and parts of Germany, all countries with intensive livestock production.⁴⁷

Whole-genome phylogenetic analyses now show multiple *Staphylococcus aureus* CC398 lineages in circulation in Europe, one of which is found primarily in livestock, CC398-IIa.⁴⁸ A study of MRSA CC398-IIa isolates in Denmark between 1999 and 2011 reported an annual increase of 66 percent from 2004-2011.⁴⁹ There was clear evidence that those with these MRSA infections had temporal and spatial relationships to both those with and those without livestock exposure. The authors concluded that there had been substantial dissemination of MRSA CC398-IIa from livestock or livestock workers into the Danish population. The isolates demonstrated high levels of resistance to several medically important classes of antibiotics — tetracycline, clindamycin, erythromycin, and norfloxacin, which represent some of the most commonly used antibiotics in Danish swine production.

While much less common in North American than in Europe, MRSA CC398 human infections have been reported in the United States.⁵⁰ Some of these infections were reported before recognition of distinct lineages for CC398, so whether of human or livestock origin is not clear. However, a recent report confirms repeat infections with CC398-IIa in an Iowa farmer, suggesting these are likely under-diagnosed and reported.⁵¹

A survey of MRSA ST398 (as well as ST9 and ST5, also common genotypes in U.S. pigs) in 38 swine herds in 11 states in major swine-producing regions found only the positive control farm to have any of these common lineages.⁵² These findings suggest a relatively low herd prevalence of MRSA in the swine industry, and are supported by a multicenter surveillance study (2011-2013) that collected 2226 *Staphylococcus aureus* isolates around the state of Iowa.⁵³ Nearly 74 percent were methicillin resistant (MRSA) and 26 percent methicillin susceptible (MSSA). Twenty-five isolates were of the common livestock ST398 and ST9-associated strains. Forty percent of these livestock-associated strains were multi-drug resistant MRSA, compared with 5 percent of the MSSA isolates.

While uncommon in the U.S., two studies suggest that non-livestock strains may spread within areas proximate to swine farms. Independent studies in Iowa and Pennsylvania found an increased risk of MRSA colonization or infection in those living close to farms or in areas where manure had been spread on fields.^{54 55} However, neither study found that increased MRSA were livestock associated strains raising questions about the origin, evolution and genetics of MRSA in the agricultural setting and the spread of the methicillin-resistance gene, *mecA*, from livestock-associated strains to other “human” strains of *Staphylococcus aureus*.⁵⁶

While, based on the European experience, the potential for important transmission and disease to arise from livestock is clear, at present no generalization can be made about MRSA isolate origin or disease risk in the U.S. Nevertheless, the current widespread use of antibiotics that may result in the emergence of a novel pathogen from livestock production is of concern and cause for adoption of the multiple intervention steps recommended by the Expert Commission on Addressing the Contribution of Livestock to the Antibiotic Resistance Crisis.⁵⁷

Influenza

In 2007, a controlled, cross-sectional study of 111 Keokuk County farmers, 97 meatpacking workers, 65 veterinarians and 79 control subjects, demonstrated markedly elevated serology levels for swine influenza virus strains.⁵⁸ The odds ratios, indicating exposure to swine influenza, was strongest among farmers (35.3), followed by veterinarians (17.8) and then meat processing

workers (2.7). This Iowa study documented that pigs have an important role in interspecies transmission of influenza strains, and that occupational exposure to pigs greatly increases workers' risk of swine influenza. The ease with which these porcine viruses infect man have implications for global influenza transmission and pandemic influenza.

It has long been known that pandemic influenza strains originate in nonhuman species. China has been implicated as the site of origin of the 1957 and 1968 influenza pandemics,⁵⁹ and is thought to be the epicenter of future novel influenza virus emergence.⁶⁰ With its increasingly dense populations of pigs, poultry and people, coupled with often weak farm and animal market biosecurity, it is not surprising that novel influenza A viruses (IVAs), resulting in increased morbidity and mortality among both livestock and humans, have emerged in China.⁶¹ China is also recognized as the site of the emergent novel pig-only pathogen, porcine reproductive and respiratory syndrome virus in 2006,⁶² and porcine epidemic diarrheal (PED) virus in 2014,⁶³ resulting in hundreds of millions of dollars of agricultural losses in China and the United States. Iowans are very familiar with such costs from the 2015 avian influenza (H5N2) epizootic that resulted in the deaths of 30 million chickens and 1.5 million turkeys. The estimated cost of this epizootic was \$1.2 billion, 8,400 lost jobs, \$427 million in lost wages and \$145 million in lost taxes.⁶⁴

Pigs have an important role in interspecies transmission of influenza strains, and occupational exposure to pigs greatly increases workers' risk of swine influenza. The ease with which these porcine viruses infect man have implications for global influenza transmission and pandemic influenza.

Most recently, these swine “variant” influenza A viruses have been increasingly infecting swine workers, likely family members and those attending agricultural fairs.⁶⁵ A recently reported intensive study of swine and swine workers in China documented strong evidence of virus mixing, likely reassorting, and cross-species infections.⁶⁶ This study also documented a notable lack of worker protection (personal protective equipment), biosecurity (restricted access and seasonal worker influenza vaccination), and public health pandemic preparedness. The 2018 centennial anniversary of the great influenza pandemic provides an opportunity — indeed an imperative need — to adopt best practice prevention and epizootic preparedness in the poultry and livestock industries.

Studies in North Carolina of the 2009-2010 and 2010-2011 influenza seasons, during which the pandemic 2009 H1N1 influenza virus circulated, documented that in counties with higher numbers of permitted swine operations, influenza-like illnesses peaked earlier than in other counties.⁶⁷ The authors concluded that swine CAFOs amplified transmission of influenza and called for influenza vaccination targeting swine workers and enhanced virologic-surveillance in counties where swine CAFOs are located.

These research findings have important implications for both animal and human influenza surveillance and preparedness. Linked One Health virologic-surveillance for novel influenza viruses and influenza vaccination of poultry and swine workers and their families are high preparedness priorities. Also, poultry and livestock industries need to be fully integrated into community, state and national pandemic preparedness efforts. Lawmakers must be made to understand, not only the potential for loss of human and animal life from pandemic and epizootic diseases, but also the potentially catastrophic economic costs to animal agriculture and all who depend on animal agriculture. The risk of devastating epizootic diseases in swine and poultry production, and recommendations for inclusion of prevention measures in the 2018 Farm Bill,

were recently addressed in a *Des Moines Register* op-ed by Dr. Patrick Halbur, Professor and interim dean of the Iowa State University College of Veterinary Medicine.⁶⁸

Physiological and Psychological Health Effects

Studies of odor have long been known to affect mood, cognition, physiological responses including heart rate and electroencephalographic (EEG) patterns.⁶⁹ Exposure to environmental malodor has been linked to worry, annoyance and physical symptoms.^{70 71} Controlled studies of these health outcomes are remarkably consistent in their findings and conclusions.

Thu and colleagues⁷² conducted an Iowa controlled study of neighbors (n=18 living within two miles of a 4,000 sow-swine CAFO, and a comparable control group of neighbors with minimal livestock production. Neighbors living near a CAFO experienced higher levels of several symptoms consistent with exposure to ambient irritants and similar to those found in the occupational setting: burning eyes, runny nose, plugged ears, increased cough and phlegm, shortness of breath, wheezing, chest tightness. But, also described were symptoms more commonly arising from exposure to malodor: headache, nausea, dizziness, weakness and fainting. Questions designed to indicate depression and anxiety revealed no differences between CAFO exposed and control groups. Wing and Wolf⁷³ surveyed 55 residents living in three eastern North Carolina communities: 23 neighbors living within 2 miles of a 6,000-head swine CAFO, 13 living within two miles of an intensive cattle operation, and 19 living in a rural area without any livestock operation. Residents in the vicinity of the hog CAFO reported increased rates of headaches, runny nose, sore throat, excess coughing, diarrhea and burning of the eyes compared to the control community residents. These two controlled studies from the two most intensive pork producing states closely agree regarding symptom patterns experienced by neighbors living in proximity to swine CAFOs.

In 1995, Schiffman and colleagues reported results of a study of 22 subjects living close to a swine operation and 22 gender, race, age, and years of education matched control subjects without nearby CAFO exposure. All subjects were residents of North Carolina. All subjects completed a Profile of Mood States (POMS) questionnaire, which is known to be sensitive to transient mood shifts. The 65 questions on the POMS allow assessment of six domains: tension/anxiety, depression/dejection, anger/hostility, vigor/activity, fatigue/inertia, and confusion/bewilderment on a scale of 0 (not at all) to 4 (extremely). Results indicated subjects living near a swine CAFO and who experienced odor reported more tension, more depression, more anger, less vigor, more fatigue, and more confusion than control subjects. Those exposed to swine odor also had more total mood disturbance, than did control subjects, based on total POMS ratings. The authors cite numerous studies of odor arising from intensive livestock operations and the impact of environmental odor on population well-being and physiological and psychological health.⁷⁴

Dose-response relationships arising from chronic exposure to animal waste/farming odors in six non-urban Danish regions were developed and reported by Blanes-Vidal et al.⁷⁵ Selection of the 12 km by 12 km regions assured a gradient in odor. A total of 1,120 households within the six regions were randomly selected and a standard questionnaire on indoor climate was mailed to each household. The mailing was timed to coincide with the period when application of animal waste to fields was banned per Danish policy. A five-point odor annoyance scale (not annoyed, slightly annoyed, moderately annoyed, very annoyed, and extremely annoyed) measured perceived odor annoyance. While animal waste odor is well known to consist of a complex mixture of irritant gases, volatile organic compounds, and bioaerosols, in this study ammonia (NH₃) concentration was chosen as the proxy for airborne exposures. An objective NH₃ exposure estimate was made via emission/dispersion modeling combining information from two validated methods. An estimated prevalence of odor annoyance (18 percent annoyed 10 percent of the time) exceeded

the WHO threshold level (5 percent of the population affected 2 percent of the time).⁷⁶ Measures of psychosocial responses were made after controlling for individual covariates. About 45 percent of the respondents reported any annoyance from residential odor. Exposure estimates of NH₃ were significantly associated with annoyance, health risk perception and behavioral interference (for each unit increase in NH₃ exposure). Annoyance was found to be a strong mediator of exposure-behavioral interference (altering plans to avoid exposure) and exposure-health risk perception. This is the first study to provide quantitative estimation of dose-response associations between ambient NH₃ exposures and psychosocial effects arising from odor pollution in a non-urban outdoor environment.

Quality of Life — Well Being

The impact of CAFO exposure on quality-of-life, or well-being, have been described in two reviews by Flora and colleagues, an Iowa Animal Feeding Operations Air Quality Study⁷⁷ and an Iowa Policy Project Report.⁷⁸ The 2007 Flora study systematically analyzed the impact of swine CAFOs on Iowa communities by examining natural, financial, human and social capital in Iowa's 99 counties. Using multivariate analysis over the decade of the 1990s, when Iowa swine CAFOs grew rapidly, Flora evaluated the various types of community capital change compared to change in CAFO growth. They noted that sociologists generally regard three elements to be essential for community sustainability: social equality and well-being, economic viability, and environmental soundness. Study results found that counties that expanded the number of swine CAFOs also experienced significant regional private-sector employment growth (but not in the county in which swine production increased); also, there was no positive contribution to population retention, in-migration, employment of residents, or school enrollments. The quality-of-life related measure of non-school aged adults found this increase to be true only for adults without a high-school education. In regard to social capital, CAFO growth was not related to changes in civic engagement, but did relate modestly to reduction in crime, to increases in home ownership and the number of religious adherents — unlike other studies that have found that CAFOs depress social capital. Indicators of environmental soundness found that manure from swine CAFOs was strongly and positively related to three of the four contamination measures — manure spills, fish kills, and impaired waterways (lakes, streams and rivers). The authors conclude that these findings raise serious questions as to whether the growth of swine CAFOs has generated sustainable development. They comment further that in certain regions of Iowa, CAFO growth may have hampered rural tourism, recreation and destination retirement development. Whereas CAFO growth in this study contributed modest income growth, they point out that studies of recreational amenity income find growth is more than five times as great, and that recreational amenities and swine CAFOs, given their negative impact on surface water quality in Iowa, cannot co-exist.

Another review cites a Minnesota Generic Environmental Impact Statement (GEIS) for animal agriculture description of quality-of-life as related to perceptions of: 1) having alternatives in what one does on a daily or life cycle basis, and 2) being respected by family and communities of interest and place.⁷⁹ Similarly, an important construct of community quality-of-life is social capital, which includes mutual trust, reciprocity, and shared norms and identity.⁸⁰ These papers cite numerous studies and policy discussions that document the impact of CAFOs on neighbors and neighboring communities.

The most consistent source of impact on neighbors' quality-of-life is exposure to CAFO odor. Paul Lasley's Iowa Farm and Rural Life Polls in 1992 and 1998⁸¹ reported substantial concern among CAFO neighbors as early as 25 years ago. Three-fourths of the farmers surveyed lived within three quarters of a mile of a neighbor. In the 1998 poll, 14 percent were unwilling to tolerate odor from

a neighbor's livestock operation more than two days a year, 34 percent were willing to tolerate only a week or less, and 50 percent would view odor a "major nuisance" if it affected them as many as 10 days a year. Respondents agreed with the following statement: "Increasingly, manure management is a major issue in the livestock industry" 61 percent of the time in 1992 and 85 percent by 1998.

Wing and Wolf (2000) also assessed quality-of-life measures in the previously cited study of two CAFO-exposed rural communities and one control rural community in eastern North Carolina.⁸² Quality-of-life, as indicated by the number of times residents could not open their windows or go outside, even in nice weather, was similar between residents near a cattle operation and the control population, but was greatly reduced among residents living within two miles of a swine CAFO. Problems cited by swine CAFO neighbors included limited child and adult recreation, cannot open windows, contaminated well, and decreased property values.

Tajik and colleagues conducted detailed interviews using both open-ended and semi-structured questionnaires designed to assess the impact of CAFO exposure on neighbors' quality-of-life in another eastern North Carolina study.⁸³ All participants (n=49) were adult non-smokers, nearly 90 percent were black and all lived within 1.5 miles of a swine CAFO. The authors cite recurring themes in almost all interviews. Several descriptors of beneficial use of property were evaluated and frequently cited: cannot sit outside, have guests over, have cookouts, have family reunions; cannot play, garden or work outside; cannot use well water or need to buy bottled water; had to buy air conditioner/dryer; and had a hard time sleeping at night. The authors commented that these findings are notable as the study population was a low-income, predominantly minority rural population known to have higher rates of chronic disease and limited access to health care. Indeed, Wing and colleagues have documented environmental justice as a major issue for people of color who live in proximity, often very close, to swine CAFOs in eastern North Carolina. Many of these black families owned their property, some dating to their ancestors' emancipation from slavery, well before the construction of a swine CAFO in their neighborhood. Many feel tied to the land by history, family, and lack of economic opportunity.⁸⁴

IMPACTS ON WATER QUALITY AND RURAL LIVING

Property Values

A year and a half after we bought our home, a hog confinement was built 1,650 feet from our home. If you have ever driven past one of those things, you know what it smells like. Houses don't drive; we have had to live with that odor for five years. Now, Iowa Select has an application filed to double that amount to 5,000 pigs. This county is already saturated with confinements. The DNR has told us there are only four counties with more confinements than ours. Property values are dropping and people are moving out of the area, and Iowa Select wants to build dozens more. The matrix that allows this is outdated and must be fixed now before the smell in this state becomes worse. ⁸⁵

This letter to the editor in *The Des Moines Register* on December 15, 2017, from Donna and Bob Juber of Eldora, Iowa, describes one reason there is a conflict between rural residents and CAFOs. Iowans value their homes. It is the way they save for their retirement and future. Even residents, who may not object to being a neighbor to a CAFO, must wonder about the resale value of their property — and there is a clear effect on the value of property near a CAFO. A recent article by Kilpatrick in the *Appraisal Journal* demonstrates the extensive devaluation in property caused by proximity to a neighboring CAFO.⁸⁶ The article reports that property value decreases are confirmed by actions by county tax assessors. Reductions of the assessed value range from 20 to

40 percent of value in counties in farm states including Colorado, Missouri, Michigan, Illinois and Iowa. One study cited finds that “only landfills have a worse effect on adjacent property values.”⁸⁷

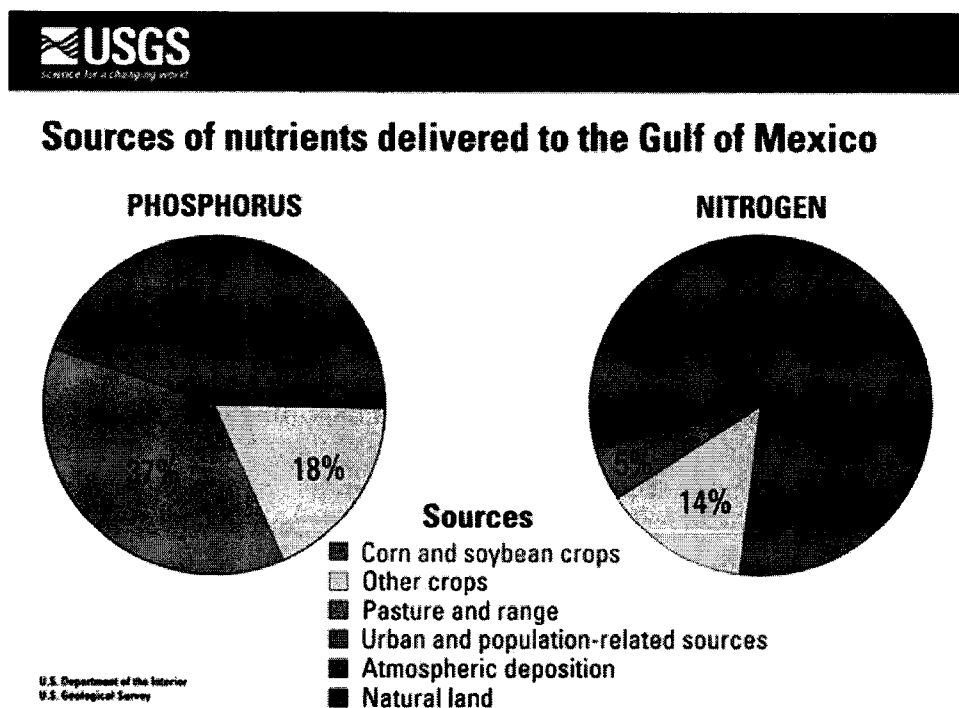
One of the studies cited by Kilpatrick is from Iowa researchers who not only find a decrease in property value, but also suggest that having the ability to bring suit might make the industry more accountable and that nuisance suits may prove to be a powerful incentive for CAFO owners to reduce emissions in Iowa and other states.⁸⁸ This potential “incentive” has been largely removed by the Iowa Legislature, as will be explained later in this report.

Distance from the source seems to have a big effect on the amount of the decrease in value according to another survey article that looked at property values near CAFOs.⁸⁹ That distance matters and that the decrease in value is significant is made clear by the following quote in the Kilpatrick article that refers to CAFOs as AOs:

Overall, the empirical evidence indicates that residences near AOs are significantly affected, and data seems to suggest a valuation impact of up to 26 percent for nearby properties, depending on distance, wind direction, and other factors. Further, there has been some suggestion that properties immediately abutting an AO can be diminished as much as 88 percent. One study estimates the total negative impact to property values in the United States at \$26 billion. Mitigation makes a marginal impact. Not only are residences affected, but nearby small farms can be impacted by such factors as water degradation and insects.⁹⁰

CAFOs and Water Quality

Agriculture in general has been found to cause a decrease in water quality in the Mississippi River Basin watershed as is seen in the following figure from the U.S. Geological Survey. These sources are the primary cause for the hypoxic zone at the mouth of the Mississippi River, or “Dead Zone” that occupies an average of 5,300 square miles each year. The problem is not improving. In fact, the size of the zone in 2017 was a record high of 8,776 square miles.⁹¹



Source: United States Geological Survey. <https://tinyurl.com/yar8hk5g>

While agriculture in general cause the bulk of the nutrients contributing to the hypoxia in the Gulf of Mexico, animal agriculture and its manure make up a measurable part of this nutrient contamination. According to University of Iowa researchers, “The high correlation between nitrate concentration and animal unit density suggests that CAFOs produce measurable impacts on water quality.”⁹² The significance of animal agriculture to total agriculture pollution was earlier described by the U.S. Department of Agriculture’s Economic Research Service: “In the Mississippi River’s drainage basin, animal manure was estimated to contribute 15 percent of the nitrogen load entering the Gulf of Mexico.”⁹³

Earlier, Osterberg was co-author of a report published in the American Journal of Public Health on a similar topic to the present report. That paper found that between 1992 and 2002 there were 329 manure spills in Iowa.⁹⁴ These data, reprinted in Table 1, show that a limited number of such discharges were deliberate, according to the DNR.

The number of fish kills continues to grow with the expansion of the industry. A brief submitted to the DNR asking for changes in the

Master Matrix in August of 2017 stated. “The state has documented more than 800 manure releases to surface water, groundwater, and land due to improper waste handling, excessive waste application, mechanical failures, and other problems associated with CAFOs since 2000.”⁹⁵ Clearly there continue to be environmental impacts that may be related to the decreases in water quality.

The 2004 American Journal of Public Health paper referred to above reported that three microbes commonly found in livestock — *Escherichia coli*, *Campylobacter*, and *Cryptosporidium* — have caused disease outbreaks. Dairy feedlots in the streams above the intake for the City of Milwaukee water treatment plant were implicated in the famous 1993 *Cryptosporidium* event that sickened 400,000 people.⁹⁶

Nitrate and Health

Nitrates that originate from several agricultural activities including CAFOs are regulated under the federal Safe Drinking Water Act. The allowed standard (MCL) of 10 mg/L or 10 ppm nitrate nitrogen was originally based on methemoglobinemia, a disease commonly called blue-baby syndrome. While the number of cases of this disease is rare in public water supplies in the United States, well water continues to be a concern for infants who consume formula prepared with private well water.⁹⁷

New research has led researchers to identify other adverse outcomes from consuming water with high levels of nitrate, mainly using research from the Center for Health Effects of Environmental Contamination (CHEEC) at the University of Iowa. A recent report by the Iowa Environmental Council used these data in a report on Nitrate and Health:⁹⁸

Table 1. Errors, equipment/structure failure main causes of manure spills
Determined causes of 307 major Iowa manure spills, 1992-2002

Identified Causes	No. Spills	Percent of total
Failure or overflow of manure storage structures	74	24
Uncontrolled runoff from open feedlots	56	18
Improper application to cropland	43	14
Equipment failure	73	24
Deliberate spills (pumping manure to ground; deliberate breaches in storage lagoons, etc.	18	6
Other (e.g., transportation accidents)	43	14
Total	307	100

Source: American Journal of Public Health, October 2004, Vol. 94, No. 10. Merkel M. Data from 3 Iowa Department of Natural Resources (IDNR) databases: IDNR Fish Kill Database; IDNR Enforcement Database/ and IDNR Emergency Response Database.

Many people, however, have not been aware that the health risks of nitrate in drinking water go beyond blue-baby syndrome. Research from Iowa and around the world has associated a number of human health problems, including birth defects and cancers, with elevated levels of nitrate in drinking water.

The IEC study documents the association between nitrate and birth defects, bladder cancer and thyroid cancer. Many of the studies were of residents in the state of Iowa and, often, effects were seen at nitrate levels lower than the MCL for public drinking water systems.

Phosphorous and Health

Manure runoff into local waterways, especially lakes, can promote the growth of cyanobacterial algal blooms. Some species produce toxins that have forced beach closures in Iowa and other states, compromised sources of drinking water, and caused outbreaks of illness in both animals and humans. According to a recent report, adverse health effects to humans include acute hepatotoxicity (liver damage), neurotoxicity, gastrointestinal problems, and a wide range of allergic reactions.⁹⁹

The dangers of cyanobacteria became national news in 2014 when a water treatment plant in Toledo, Ohio, warned its 500,000 customers not to use water from the tap because algae blooms surrounded water intakes at its Lake Erie source. The catastrophic algal bloom prompted the mayor to declare a state of emergency, as the city was forced to find alternative sources of drinking water since boiling the water did not remove the toxin. As noted in a 2014 *Washington Post* story about this incident:



Blue-green algae — or cyanobacteria. Photo credit: Illinois Environmental Protection Agency, <http://tinyurl.com/jembwqy>

“And with these algal blooms predicted to worsen in Lake Erie and other lakes and reservoirs — thanks to a mix of global warming, invasive species and pollution — the issue is expected to pop up more often. Some believe Toledo could be a tipping point.”¹⁰⁰

Recent scientific papers have demonstrated why potentially toxic cyanobacterial blooms may increase in severity. Warmer temperatures and heavy rainfall events with long dry periods in between will lead to acceleration of the eutrophication* process that the high levels of nitrogen and phosphorus make possible.^{101 102} The EPA has noted these weather patterns are predicted to occur more frequently as the Midwest climate changes.¹⁰³ A 2014 statement by 180 scientists and educators at 38 Iowa colleges and universities states that climate conditions will affect public health in several ways including the increased possibility of cyanobacteria outbreaks.¹⁰⁴

The DNR monitors 39 state park beaches weekly in the summer for microcystin, a toxin produced by at least some forms of blue-green algae. There had been a steady increase in beach closings beginning in 2010 until data was added for 2017. The exceeding low number in that year is surprising and questionable, as it follows a large cut in the DNR budget and the resignation of staff

* Eutrophication is “The process by which a body of water acquires a high concentration of nutrients, especially phosphates and nitrates. These typically promote excessive growth of algae. As the algae die and decompose, high levels of organic matter and the decomposing organisms deplete the water of available oxygen, causing the death of other organisms, such as fish.” (USGS, Website, “Definition of Eutrophication,” 2014)

involved in the monitoring. The table below from the Iowa Environmental Council uses DNR data to show the changes in advisories over time.

Table 2. Blue-Green Algae: Steady increase in Iowa beach closings until 2017 cuts and resignations of IDNR monitors

State Park Beaches with Microcystin exceeding 20 ug/L State Parks (Beach Name)	Year												Total
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	
Beeds Lake State Park (Beeds Lake Beach)			*				1						1
Black Hawk State Park (Black Hawk Lake Campground Beach)			*	1	3	2	1	1	3	7	2	1	21
Black Hawk Lake State Park (Denison Beach)			*					4	7	1	2		14
Big Creek State Park (Big Creek Lake Beach)	1		*		1	2	5			1			10
Brushy Creek State Park (Brushy Creek Lake Beach)			*					1			1		2
Clear Lake State Park (Clear Lake State Park Beach)			*				1						1
Clear Lake, McIntosh Woods State Park (McIntosh Woods Beach)			*				1		3				4
Geode State Park (Geode Lake Beach)		3	*		1			6	1	1	1		13
Green Valley State Park (Green Valley Lake Beach)	12		*				3	2	1	9	7	3	37
Lake Anita State Park (Lake Anita Beach)	1		*				1		1		2		5
Lake Darling State Park (Lake Darling Beach)			*							2		1	3
Lake Keomah State Park (Lake Keomah State Park)			*		1	2					4		7
Lake of Three Fires State Park (Lake of Three Fires Beach)			*		1	4	1	3		2	1		12
Lake Wapello State Park (Lake Wapello Beach)	1		*							2	1		4
Marble Beach State Park (Marble Beach, Spirit Lake)	2		*			1	3						6
near Mini-Wakan State Park (Crandall's Beach, Spirit Lake)			*				2	1		1			4
Pine Lake State Park (Pine Lake Beach)			*							3	6		9
Pleasant Creek State Recreational Area (Pleasant Creek)			*							1	1		2
Prairie Rose State Park (Prairie Rose Lake)			*								2		2
Red Haw State Park (Red Haw Lake Beach)			*							1			1
Rock Creek State Park (Rock Creek Lake Beach)	5		*		1		1	3			1		11
Springbrook State Park (Springbrook Lake)			*							1	1		2
Twin Lakes State Park (Twin Lake West)			*							1			1
Union Grove State Park (Union Grove Lake Beach)	1		*		1			2	6	1	1		12
Viking Lake State Park (Viking Lake Beach)			*			1		1			4		6
Total	23	3	0	1	9	12	20	24	22	34	37	5	190

Updated Sept. 5, 2017 — After Monitoring Week 15, data as updated by IDNR.

Source: Iowa Environmental Council

In addition to nutrients, N and P, studies document many other contaminants from animal feeding operations. A report by the National Association of Local Boards of Health identifies new contaminants in water contaminated with manure.

Manure emitted by AFOs can contain “nutrients such as nitrogen and phosphorus, pathogens such as E. coli, growth hormones, antibiotics, chemicals used as additives to the manure or to clean equipment, animal blood, silage leachate from corn feed, or copper sulfate used in footbaths for cows.”¹⁰⁵

The report further states some novel pollutants associated with CAFOs.

Water tests have also uncovered hormones in surface waters around CAFOs (Burkholder et al., 2007). Studies show that these hormones alter the reproductive habits of aquatic species living in these waters, including a significant decrease in the fertility of female fish. CAFO runoff can also lead to the presence of fecal bacteria or pathogens in surface water. One study showed that protozoa such as Cryptosporidium parvum and Giardia were found in over 80 percent of surface water sites tested (Spellman & Whiting, 2007). Fecal bacteria pollution in water from manure land application is also responsible for many beach closures and shellfish restrictions.¹⁰⁶

Other data from Burkholder, the author cited above, is consistent with other, less exotic contamination. Bacterial contamination surface water including fecal bacteria or protozoa such as

Cryptosporidium parvum and *Giardia*. Many of the pathogens (e.g., *Clostridium perfringens*) present in manure that can contaminate water supplies are concerning because they can cause severe diarrhea, which can be fatal for animals, very young children, and the immunocompromised. "Fecal bacteria and other pathogenic microorganisms typically settle out to the sediments where they can thrive at high densities for weeks to months following CAFO waste effluent spills."¹⁰⁷

Another more recent review cites articles that show CAFO generated animal waste is associated with pathogens, pharmaceuticals, metals and hormones.¹⁰⁸ The Fry study also reviews articles showing the impact on public health is also related to CAFO air emissions.

FAILURE OF THE MASTER MATRIX AND PUBLIC POLICY IN IOWA

Past Iowa Regulations on Confined Animal Feeding Operations (CAFOs)

When a citizen becomes aggrieved by the actions of a neighbor, such as a CAFO, there are different routes to seek redress. First, there are three levels of legislative/administrative action, (federal, state and local). Second, the courts can intervene on behalf of the aggrieved party either by acting on the constitutionality of actions by the legislative branch or the courts can hear an individual action under nuisance. This section of this report will address all these possible routes for neighbors of CAFOs.

To fully understand why the state of Iowa regulation of its pork industry is weak and that individual nuisance action now has severe limitations, one must know there is something in law called the "right to farm." This is a legal concept that, according to the National Agricultural Law Center, University of Arkansas, is common:

*All fifty states have enacted right-to-farm laws that seek to protect qualifying farmers and ranchers from nuisance lawsuits filed by individuals who move into a rural area where normal farming operations exist, and who later use nuisance actions to attempt to stop those ongoing operations. While the overall statutory schemes might be similar, each state has noticeably different content in the specific details of the laws...*¹⁰⁹

While the power of this defense of agricultural production may have severe limits, as enumerated by Drake Law School Professor Neil Hamilton, who states that such laws "are proving to not be such a good idea after all."^{110†} Still there is an expectation that agricultural operations have preference in rural areas of Iowa.

This preference for agriculture in rural areas explains much of the interaction of CAFOs, neighbors and the law. These laws arose when farmers were independent operators, but independent livestock farmers have now been largely replaced by contractors for integrated industrial agriculture, which is in the driver's seat and is unwilling to relinquish the wheel.

Regulation by Local and State Government

Calls for new regulation on siting of facilities and treatment of the tons of manure produced by CAFOs have all but gone unheard in the Iowa State Capitol. Individual counties have asked the DNR to reject the location of individual CAFOs.^{111 112} Supervisors in more than 20 of Iowa's 99 counties have called for changes in regulating the industry.¹¹³ Community groups have had their requests for changes turned down by the regulators when they requested changes in how CAFOs are sited.¹¹⁴

[†] The original protection of farming starts with the notion that a landowner should not come to an area that has always had a certain smell and noise and then complain. That notion of fairness has been expanded in states like Iowa, according to Hamilton, to include new industrial swine operations that move into the neighborhood and this is why Right-To-Farm is not such a good idea. (Hamilton, 1998)

State and Local Government Interaction

A series of Iowa Supreme Court cases established that the Iowa Legislature can limit any local government action governing locations of large CAFOs or placing limits on their discharges to water or air. The Iowa Supreme Court held that all agriculture, including an animal feeding operation, is exempt from any county zoning.[‡] Humboldt County later attempted to put controls on CAFOs as a proper application of “home rule” authority but lost in the Iowa Supreme Court.[§] In the face of this state preemption, a Worth County ordinance sought to regulate CAFO operators based, not on home rule, but on the county’s ability to protect public health. This ordinance was also struck down as being void and unenforceable as contrary to state law.^{**} The opinion of the court was that “We conclude the Worth County ordinance is the type of ordinance expressly preempted by the state statute. Our legislature intended livestock production in Iowa to be governed by statewide regulation, not local regulation. It has left no room for county regulation.”^{††}

In exchange for eliminating local governmental action, Iowa legislators provided an opening for local advice and limited consent when the Master Matrix went into effect in 2003. This is a scoring system that forces an operation to adopt measures such as greater separation distances and more stringent manure practices and will be examined later in this report.

In exchange for eliminating local governmental action, Iowa legislators provided an opening for local advice and limited consent when the Master Matrix went into effect in 2003.

State and Federal Interaction

Since the state of Iowa has preempted much of the possibility for local government to act on CAFOs, we must ask how well the state, and the administrative organization that takes on enforcement and regulation of these facilities, the DNR, has behaved in the past.

Three environmental groups approached the U.S. EPA’s Region 7 office in 2007 to request the agency investigate the DNR’s administration of the Clean Water Act. Little came of the request, so in 2011 the groups threatened suit. Region 7 responded this time and in a survey of DNR enforcement of animal agriculture facilities found inadequacies. While EPA Region 7 and the DNR worked out an agreement for improvement, the Iowa Citizens for Community Improvement (ICCI), the Environmental Integrity Project and the Iowa Sierra Club kept up pressure on both agencies. Negotiations centered on five issues. One was easily measured — the number of inspectors. The DNR acknowledged in the official response to Region 7 that there were too few:

*“Since 2007, the DNR has had a significant reduction in its animal feeding operations staff. To better meet our responsibilities, the DNR needs both an increase in staffing and to reprioritize workloads.”*¹¹⁵

While the DNR did not explain the extent of the “significant reduction” in agency field staff in the official response, they had answered elsewhere in a 2011 report on manure on frozen and snow-covered ground:

“The scope and complexity of confinement program work increased disproportionately beginning with legislation in the late ‘90s. With this, public awareness of environmental issues also grew, resulting in a significant increase in local demand for education, compliance assistance and compliance assurance. To

[‡] *Kuehl v. Cass County*, 1996

[§] *Goodell v. Humboldt County*, 1998

^{**} *Worth County Friends of Agriculture v. Worth County*, 2004

^{††} *id*

address these needs, animal feeding operations field staffing gradually increased to a high of 23 by SFY 2004. In SFY 2008, four staff people were shifted into a newly established open feedlots program. Then in the fall of 2009, as General Fund expenditures declined, confinement staffing was reduced again. This reduced staff numbers from 19 to 11.5. Further reductions leave the total of field staff for confinement work at 8.75 full time equivalents. This reduction means that the DNR will not be able to maintain an adequate level of compliance and enforcement activity in confinements.”¹¹⁶

The EPA Region 7 initial report on DNR shortcomings led to an agreement between the two agencies dedicated to improving how CAFOs and their manure is treated and controlled in the state of Iowa. (See Appendix 1 for a fuller explanation of Region 7 and DNR interaction.) The initial agreement envisioned a 13 staff-person increase, which would only bring numbers back to approximately the 2004 staffing levels — before the addition of many more CAFOs. However, the final agreement only called for seven new staff members.

ICCI, one of the three environmental organizations that caused the EPA to request changes in how DNR regulated CAFOs, described the agreement as a victory although a limited one. After all this organization was instrumental in getting the DNR to go even this far. Still, that the main Iowa environmental agency was forced to enhance its regulation on CAFOs casts doubt on the effectiveness of state regulation and puts into question the preemption of local government involvement.

Individual Action by Neighbors

Neighbors have a second route to proceed when they feel they have been aggrieved — they can also sue under nuisance. The first Iowa legislative action on CAFOs in 1995 (House File 519) included limiting individual action.

Besides limiting the rights of neighbors to seek relief from county government, HF 519 attempted to make it more difficult to successfully sue a livestock operator, by requiring a plaintiff to meet a tough standard of proof. The Iowa House Democratic caucus staff described the limits HF 519 placed on individual plaintiffs:

“There is a “rebuttable presumption” that an animal feeding operation is not a public or private nuisance. This rebuttable presumption may be overcome by clear and convincing evidence of both of the following:

the animal feeding operation unreasonably and continuously interferes with another person's comfortable use and enjoyment of life or property; and

the injury or damage has to be caused by the negligence of the operation.

*All operations are included in the protection regardless of the established date of the operation or expansion.”*¹¹⁷

Individuals were also dissuaded from going to court against a CAFO operator because the losing party in a case was made liable for all costs and expenses of the winning party, if the court determined that the claim was frivolous.

The attempt to limit nuisance was voided by the Iowa Supreme Court. The courts determined the Iowa Legislature went too far with this action. Since 2001, three Iowa district court judges have ruled against the attempt to protect CAFOs against nuisance suits.^{## 118 119} Also, in Iowa a case by neighbors against a CAFO owner was decided with a judgment for the plaintiff of \$1 million for actual damages and \$32 million for punitive damages.^{§§ 120} The case was settled out of court.

^{##} (Weinhold v. Wolff (Iowa 1996); Bormann v. Kossuth County Bd of Supervisors (Iowa 1998); and Gacke v. Pork Xtra LLC (Iowa 2004)

^{§§} (Blass, et al v. Iowa Select Farms, L.P 2004)

In the spring of 2017, a new law was passed by the Iowa General Assembly and signed by the Governor revisiting the rights of neighbor to sue a CAFO operator. The new law may well be challenged on grounds of constitutionality, as was the 1995 law. However, as Kristine Tidgren, assistant director of the Center for Agricultural Law and Taxation at Iowa State University, explained in a recent blog:

*The constitutionality of this legislation, if enacted, would no doubt be challenged as prior legislative attempts to limit nuisance actions against agricultural operations have been rejected by the Iowa Supreme Court. This legislation, however, is very different in that it does not seek to dismiss a nuisance lawsuit, but to limit the types of damages that can be recovered against “responsible” producers. The stated legislative purpose of this bill is to encourage the “expansion of responsible animal agricultural production in this state which provides employment opportunities in and economic growth for rural Iowa, contributes tax revenues to the state and to local communities, and protects our valuable natural resources.”*¹²¹

The new law limits damages that can be awarded to a person who wins a lawsuit against an animal feeding operation, under a claim that the CAFO is a public or private nuisance or an interference with another person’s “comfortable use and enjoyment of the person’s life or property.” The new law limits damages that can be awarded to a person impacted by a CAFO to (a) any actual reduction in property value caused by the facility, (b) past, present, and future adverse health impacts as determined by objectively documented medical evidence and proven to be caused by the facility, and (c) any award for damages due to annoyance and the loss of comfortable use and enjoyment of the property to 1.5 times the sum of property value and objective medical evidence of deterioration of health. By requiring “objectively documented medical evidence and proven to be caused by the facility” in question, this new law seeks to eliminate consideration of the substantial literature on CAFO exposures and causation of adverse health effects, disease and impairment.¹²²

Additionally, according to an analysis of the Iowa Environmental Council, if the person suing wins the lawsuit, the facility is classified as a “permanent” nuisance rather than a temporary/ Intermittent nuisance. This means that a person gets one shot at damages — they cannot file additional lawsuits even if the facility causes additional impacts in the future.¹²³ The constitutionality of the new law has yet to be tested. Analysis of this new law in relation to the real possible public health issues surrounding the location of facilities and their manure application is the subject of a recent IPP report.¹²⁴

HOW THE STATE OF IOWA SHOULD PROCEED

Revise the Master Matrix

The background on CAFOs and neighbors leads us to one of our main questions in this report, the adequacy of the Master Matrix, which — in exchange for preemption of local government action — gave local governments something to do. If a large CAFO operation attains a minimum score on the Master Matrix, it will be approved by the DNR even if there is public opposition to the operation and the county recommends against it.¹²⁵

The Winneshiek County Board of Supervisors does not feel the Master Matrix gives the environment enough protection. That body voted 5-0 and two supervisors appeared before the Iowa Environmental Protection Commission to appeal a DNR approval of a permit for a CAFO in the county in a karst region in October of 2013. They were turned down.¹²⁶ This is not an exception.

An earlier Iowa Policy Project report documented that the Master Matrix does not distinguish between types of rivers that are near facilities and could receive pollution from a CAFO. In 2008, the Master Matrix did not treat differently two facilities that could drain into the pollution-impaired Raccoon River above where the City of Des Moines Water Works receives water that must be treated to potable levels for more than half a million Iowans.¹²⁷

In September 2017, ICCI, the same organization that was among the three environmental groups that forced EPA Region 7 to require the DNR to revise its regulations of CAFOs, along with Food and Water Watch, was turned down in its petition to the Environmental Protection Commission (EPC). The EPC, the citizen board that oversees the DNR, followed the recommendations of the DNR to resist any changes to the Iowa's Master Matrix.¹²⁸

The two organizations' brief was thorough. It included sections documenting the failure of the Master Matrix to give counties the authority to protect resources. It demonstrated that the many new animal feeding facilities since the Master Matrix was implemented made the need for changes more necessary. The brief produced data to support changes and requested revisions in the specific scoring criteria. It maintained the DNR has the ability and the duty to make changes.¹²⁹

Included with the brief were resolutions or letters to the legislature signed between November 2016 and the spring of 2017 by 13 counties that requested strengthening of local control and in some cases calling for a moratorium on new facilities until changes were made.^{130***} In addition to this demonstration of support, in 2014 Dickinson County surveyed all Iowa counties and found that more than a third of those county supervisors who responded wanted changes in the Master Matrix.¹³¹ Furthermore, the number of counties have stated their objections to the Master Matrix has now increased to 20.¹³²

It is clear that some counties in Iowa see a route to prosperity that puts local limits on the number of animal feeding operations that choose to locate there. This is not surprising since the IPP report by Flora covered earlier in this paper, found that counties who choose to go with hog confinement operations give up other local development possibilities.¹³³ *The Des Moines Register* pointed out in a February 15, 2015, editorial — “Livestock confinements need local control” — that different counties may choose to differ on their desire to add livestock facilities to their suite of economic development opportunities:

*While Sioux County is apparently comfortable with having the equivalent of 35 hogs for every resident of the county, there is mounting concern in Dickinson County about the growing numbers of livestock confinement operations in one of the state's premier tourism destinations.*¹³⁴

Iowa State Senator David Johnson has introduced a number of bills calling for a moratorium on new, mid and large CAFOs and proposed expanded public participation in CAFO decisions currently captive of the Master Matrix. His bills were supported by a demonstration at the Iowa State Capitol by a coalition of about two dozen state, local and national groups calling itself the Iowa Alliance for Responsible Agriculture. The group rallied in support of all 15 of Senator Johnson's bills to tighten oversight of CAFOs.¹³⁵ Senator Johnson is quoted that there will be consequences if nothing is done:

*“Failure to take legislative action this year could hurt lawmakers when they seek re-election...If not a single one of these bills are passed, legislators will face a real challenge if they're up for election in the fall,” he said.*¹³⁶

*** The counties were Adair, Allamakee, Buchanan, Cedar, Cerro Gordo, Dickinson, Floyd Hardin, Howard, Johnson, Pocahontas, Webster and Winnebago.

Unless his bills or something similar becomes law, DNR has shown it is unwilling to make changes on its own to a 15-year-old law that many find inadequate.

Implement Moratorium on New CAFOs that Do Not Have Superior Waste Handling Technology

An essay by Fred Kirschenmann, on behalf of the Pew Commission on Industrial Farm Animal Production, observed that operation of CAFOs under the current model is unsustainable in the long term. The standard industry production methods externalize the costs and impacts of waste from livestock and poultry production, and rely on cheap energy, abundant fresh water and a relatively stable climate.¹³⁷ Add to this long-range sustainability challenge, the degradation of water quality, harmful air pollution, and the public health and rural community impacts reviewed in this report.

North Carolina has developed a state-based model for advancing industrial farm animal production that attempts to make new facilities more sustainable. In 2000, the North Carolina Attorney General entered into an agreement with Smithfield Foods, its subsidiaries and Premium Standard Farms to fund environmentally superior waste management technologies, a \$17.5 million development initiative.¹³⁸ North Carolina implemented its moratorium new or expanded swine farms in 1997, and made it permanent for swine farms that use anaerobic waste lagoons for primary treatment in 2007.¹³⁹ To comply with the moratorium, a new facility must have environmentally superior technology. This is defined as “any technology, or combination of technologies that (1) is permittable by the appropriate governmental authority, (2) is determined to be technically, operationally and economically feasible for an identified category or categories of farms as described in the agreements and (3) meets the following performance standards: 1. Eliminates the discharge of animal waste to surface waters and groundwater through direct discharge, seepage or runoff; 2. Substantially eliminates atmospheric emissions of ammonia; 3. Substantially eliminates the emission of odor that is detectable beyond the boundaries of the parcel or tract of land on which the swine farm is located; 4. Substantially eliminates the release of disease-transmitting vectors and airborne pathogens; and 5. Substantially eliminates nutrient and heavy metal contamination of soil and groundwater.”

The director of the North Carolina State Animal and Poultry Waste Management Center was designated to oversee the selection and evaluation of technologies, assisted by an advisory panel composed of individuals representing government, environmental and community interests, agreement member companies, and others with expertise in environmental sciences, public health, animal waste management, economics and business management. A nationwide RFP to research institutions and industry yielded 18 technology candidates that met these goals (See Appendix 2).

Under the right conditions, liquid manure will break down into biogas and a low-odor effluent. Biogas can be burned to produce heat, electricity, or both the anaerobically-digested manure, can be stored and applied to fields with significantly less odor than stored, untreated liquid manure. Anaerobic digestion does not reduce the volume or nutrient value of manure. If dilution water is added to the system, the volume of material to handle is increased.¹⁴⁰

The term “under the right conditions” applies when harvesting some of the energy contained in manure is proposed as one solution to some of the problems with CAFOs endorsed by the North Carolina law. A 2017 publication from Penn State University describes the benefits of modifying the normal CAFO production process to include energy capture.¹⁴¹ A 2015 EPA report on the status of anaerobic digesters in the several states lists five in Iowa.¹⁴² The 2016 Iowa Energy Plan estimates there are more than 1,000 potential locations for similar projects.¹⁴³ Capturing animal

waste to generate renewable energy is potentially a win-win-win — reducing harmful air and water emissions, preserving nutrients and generating renewable energy. Some, but not all CAFO externalities, are necessarily reduced by a policy to require this capture.

In 2007, North Carolina's Renewable Energy & Energy Efficiency Portfolio Standard (REPS) was passed overwhelmingly as part of Senate Bill 3.¹⁴⁴ At the same time, the 2000 moratorium on construction or expanding swine CAFOs was made permanent. The REPS established a clean energy market in the state by directing the state's electric providers (or utilities) to generate a portion of the state's electricity needs both from renewable energy resources and through energy efficiency. The amount, in percentage of total portfolio (natural gas, wind, solar, coal, nuclear) was designated to increase to 12.5 percent by the year 2021. The law also has "set-asides" for energy created from solar, swine waste and poultry waste, the only state to have such a specific carve-out. To meet REPS requirements, utilities must secure Renewable Energy Certificates (RECs), with one REC equal to one megawatt hour (MWh) of electricity. Utilities may purchase swine RECs or develop their own. To comply with the law, they must secure approximately 284,000 swine RECs by 2018.

While the 2015 EPA anaerobic digester report lists only 10 North Carolina projects, the new emphasis on policy in that state is boosting the number (See Appendix 3). In addition, the requirement that expansion of the industry requires new production techniques, like energy production, is an even bigger policy incentive.

An Iowa expansion of anaerobic digestion would address some problems of existing facilities and locating new CAFOs. However, the first line of the Penn State excerpt above begins with "under the right conditions." The "right conditions" would not be met with a 10,000-head cattle feedlot and biogas operation in northern Iowa karst country. The Walz Energy project is currently under construction there. According to neighbors it is too close to Bloody Run Creek, a cold-water trout stream that is one of the designated "Outstanding Iowa Waters."¹⁴⁵ Any leaks from such a large project could endanger the well-developed tourism industry in the area including Spook Cave located on land around Bloody Run. Karst is unusual topography that contains many sinkholes that can direct pollution to the many springs and streams in the region.¹⁴⁶

Quoted in a long *Des Moines Register* story on the project is Larry Stone, a retired *Register* outdoors writer, reports that the clean, clear waters around the Walz Energy project has been "a hot spot for fishing, picnicking, hiking, bird-watching and leaf-viewing in the fall," and that any problems with this industrial-sized facility will do great damage. He is opposed.¹⁴⁷ Clearly capturing energy from manure, a good thing, does not solve the problems of locating CAFOs if they impose external costs onto neighbors and degrade the local environment. Building a CAFO in the karst region of Northeast Iowa is something that should hardly ever happen.

Challenge the Constitutionality of the 2017 Iowa Anti-Nuisance Suit Legislation and Ag-Gag Law

The nuisance protection for CAFO owners that passed the Iowa Legislature in March of 2017 may or may not be sustained in a court of law. If the law is successfully challenged, it will not be the first time the Iowa Legislature has tried to protect agricultural producers only to find that the Iowa or U.S. Constitution prevents the action. Earlier in this paper it was mentioned that one section of the original 1995 Iowa CAFO law tried to limit neighbors' rights under nuisance only to be struck down by the Iowa Supreme Court.

Another example of the Iowa Legislature probably going too far is the so-called Ag Gag Law. As recently as January 2018 a federal court struck down parts of a law similar to Iowa's law in Idaho.¹⁴⁸ Iowa's law that limits and criminalizes efforts to expose animal cruelty and food safety

violations is still on the books. That might change. According to a *Cedar Rapids Gazette* report, “A coalition of public interest groups has filed a federal lawsuit challenging the constitutionality of the Iowa’s so-called ‘ag gag’ law that criminalizes undercover investigative efforts to expose poor conditions for workers, food safety violations, environmental harm and animal cruelty in agricultural facilities.”¹⁴⁹ The Iowa law passed in 2012 made it a misdemeanor punishable by up to a year in jail to falsely try to obtain a job in an animal facility in order to publicize what might damage the reputation of the industry.

The lawsuit is another sign — along with calls by Iowa County supervisors for a moratorium on expansion of CAFOs and Senator Johnson’s proposed bills — that opposition to industrial farm animal production is brewing.

Citizen Action Not Aimed at the Legislature

Develop Land Covenants and other Local Legal Strategies to Limit CAFO Growth

Some neighbors are uniting to limit the expansion of CAFOs in their county. According to the *Cedar Rapids Gazette*, a group of Howard County landowners, tired of Iowa lawmakers’ refusal to tighten rules on confined animal feeding operations, has banded together to outlaw these operations on their properties. Further, these 43 families owning more than 5,000 acres combined won’t accept liquid manure from large feeding operations — an unusual move they hope will keep those facilities from opening nearby.”¹⁵⁰ While such action is not a state policy suggestion, it demonstrates how citizens might act in the absence of policy.

Community Action to Block a Packing Plant

How do community residents respond to industrial development they find objectionable? A recent Iowa example is the rejection of a pork processing plant, which demonstrates what can happen when local governments are accountable to the communities they serve.

The citizens of Mason City took on the vertically integrated pork industry, specifically the proposed establishment of a Prestage pork processing plant in their community, and against all odds, prevailed. The \$240 million proposed facility had already procured vocal support from then Governor Terry Branstad, millions of dollars pledged by the Iowa Economic Development Authority (eventually \$11.5 million), and a Mason City incentive package of a 10-year, 5 percent tax rebate on a \$100 million minimum valuation.

The City Council initially appeared to be unanimous in its support for building the facility on the outskirts of Mason City. However, local residents had been given little information about this facility that promised to process at least 10,000 hogs daily, employ nearly 1,000 full-time employees with a payroll of nearly \$52 million, and a tax benefit to the city of over \$1.7 million. Once residents became fully aware of the likelihood of this development, many questions were raised — impact on air quality, impact on water supply and quality, growth of CAFOs in Cerro Gordo County and especially in the Clear Lake watershed, impact on local traffic and worker availability, housing, education, social services and health care. Mason City residents did not just accept the answers offered by Prestage Foods of Iowa, but independently researched environmental, public health and infrastructure impacts and the longer range history of similar packing plant impacts in other Iowa communities. The City Council, after it conducted public hearings rejected the project.¹⁵¹ The Mason City “No Prestage” movement is a model of citizens taking action through their local government. This is in contrast to the Iowa Legislature taking away the power of local governments to regulate the location of CAFOs.

CONCLUSION

It is impossible to avoid the very substantial scientific evidence showing the impact of livestock production and its rapid growth on the degradation of Iowa water and air, and consequently the health of the people of the state. Despite this mounting scientific evidence, and the mounting opposition to this explosion of CAFOs, there is every indication that industrial livestock production intends business as usual. Meanwhile state policy makers have refused, not only to strengthen state regulation or allow local regulation, but have also prevented those adversely affected by living near animal confinement facilities of opportunity for redress through the courts.

As we stated in a guest opinion in *The Des Moines Register* in September of 2017, the entire process of approving animal confinement facilities needs to be changed. Iowa policy makers are long overdue in reforming and revising the Master Matrix, passing a moratorium on new swine CAFOs that

cannot document superior emission and pollution controls, and in providing legal redress for neighbors adversely affected by the virtually unrestricted explosion of CAFOs in Iowa. This degradation of farmland, Iowa's most precious commodity, the rural environment, rural public health, and rural community social and economic welfare, are all interdependent and critical for long-term agricultural sustainability. As industrial agriculture will not, and elected and appointed officials apparently cannot, the outcome of this conflict is very much up to rural Iowans and all who care about sustainable agriculture.

"No Prestage" — an insider's view

The following summary is offered by Deb Lassise, MSPH, as to how the residents of Mason City ultimately defeated Prestage, as the result of a 3-3 vote its city council at its final hearing:

"The 'No Prestage' effort started slow and small. A Facebook page played a big role — it had good oversight and was full of information. It was the beginning of identifying a group of people who did not know each other but shared the same concerns. A petition was started and circulated through Facebook and door-to-door. The door-to-door effort was important — residents had an opportunity for personal interaction. Some residents shared that they did not support Prestage coming to the community, but could not speak out because of their job or employer. Others actively sought the documents, chasing after petitioners and reaching out by phone. A critical part of the strategy was to listen to what Prestage was saying, then research their claims, challenge their language, and share the facts. This included following the money: exploring costs to schools, social services, and community infrastructure as well as the accompanying CAFO expansion in the immediate area. A GO FUND ME site was set up and a bank account opened. Contributions paid for newspaper ads, signs, YouTube videos, a website, billboards, and a forum with guest speakers. Everyone had their own way to contribute — in a public way or an anonymous way — whether it be technical or organizational skills, writing a letter to the editor, speaking at a city council meeting, financially supporting the effort, or talking with others. Residents who initially supported the project changed their minds as facts came out. Many North Iowa and regional neighbors expressed their concerns. Although publicly called racists and kooks, the effort was speaking truth to power and money. The process facilitated meeting new people, learning, accessing valuable national/state/regional resources, keeping a sense of humor, engaging young people, and fostering a strong sense of community."

APPENDIX 1

U.S. EPA vs. Iowa DNR

On July 12, 2012, Region 7 of the U.S. Environmental Protection Agency (EPA) — which covers Iowa, Kansas, Missouri, and Nebraska — found that the Iowa Department of Natural Resources (IDNR) was inadequately enforcing the Clean Water Act (CWA) in regard to Confined Animal Feeding Operations (CAFOs).

In a letter to IDNR Director Chuck Gipp, EPA Regional Administrator Karl Brooks outlined his agency's concerns over the lack of pollution control from the 7,000 animal feeding operations jeopardizing Iowa's waterways and cited that it was a violation of Section 402 of the CWA.¹ Brooks wrote: "Actions are necessary to ensure that Iowa's NPDES [National Pollutant Discharge Elimination System] permitting, compliance and enforcement program for CAFOs complies with the Clean Water Act." EPA gave IDNR 60 days to submit a plan and a schedule for addressing the issues outlined in the letter. EPA also required that IDNR allow the public to provide input on the plan.

EPA and IDNR came to agreement on a plan that outlined six major categories: on-site inspections for all (1) "large" factory farms (more than 1,000 beef cattle or 2,500 hogs) and (2) "medium" factory farms (300-999 beef cattle or 750-2,499 hogs), (3) desktop evaluations for other medium-sized factory farms, (4) issuance of new factory farm permits regulations within one year, (5) stronger manure applications setback requirements with one year, and (6) tougher enforcement protocols.

EPA became involved with the situation after a petition called for IDNR to relinquish its authority for managing the NPDES. The petition was submitted in September 2007 in a collaboration by the Environmental Integrity Project, Iowa Citizens for Community Improvement, and the Sierra Club Iowa Chapter.

Days after EPA's announcement, *The Des Moines Register* — the state's largest newspaper — issued an editorial lambasting state officials for their inability to address the problem.

"Our elected officials enact laws to ensure there is little regulation. They underfund state agencies that oversee agricultural operations. They send a message to go easy on polluters. And the rest of us pay the price with dirty water. That compromises recreational and tourism opportunities, which affects this state's economy."²

Water quality was a contentious issue at both the state and federal level at the time. Iowa Governor Terry Branstad claimed that IDNR was "too aggressive already in enforcing pollution regulation against agricultural operations"³ while U.S. Representatives Leonard Boswell (D), Tom Latham (R), and Steve King (R) voted in 2011 to limit EPA's ability to enforce the Clean Water Act.⁴

One year after EPA issued its indictment against IDNR, another report was released which found that IDNR had done little to improve Iowa's water quality. Iowa Citizens for Community Improvement issued a statement critical of IDNR's efforts to address the issue, writing "[i]t has now been almost a full year since the EPA published its report, and no action has been taken. That's 12 more months of degradation to Iowa's water while the DNR stonewalls implementation of the Clean Water Act."⁵

Despite the criticism from activist groups, EPA Region 7 spokesperson Kris Lancaster said "[the] proposed rules are consistent with federal requirements."⁶

¹ Noble, Jason. "EPA says DNR is lax on enforcing confinement permits, regulations." *Des Moines Register*, July 13, 2012.

² *The Des Moines Register*, Editorial: "EPA letter should be a wakeup call." July 1, 2012.

³ *Bleeding Heartland*: "EPA Finds Iowa DNR Not Enforcing Clean Water Act for CAFOs" July 13, 2012

⁴ *Bleeding Heartland*: "Boswell, Latham and King vote to undermine Clean Water Act." July 15, 2011.

⁵ Iowa Citizens for Community Improvement. "One Year after EPA Demands Compliance, DNR Continues to Obstruct Clean Water Act Implementation - Iowa CCI," July 8, 2013

⁶ Eller, Donnelle. "Groups say water rules aren't enough." *Des Moines Register*, Jan. 28, 2014.

APPENDIX 2

Phase 1 and 2 Superior Technology Projects Approved under the Smithfield Agreement

The following are the types of modifications necessary for a new CAFO to be built in North Carolina. Research has demonstrated environmentally better technology.

Phase 1:

- Solids separation/nitrification-denitrification/soluble phosphorus removal/solids processing system (Super Soils Systems USA)
- High solids high temperature anaerobic digester system
- In-ground ambient temperature anaerobic digester/energy recovery/greenhouse vegetable production system
- Solids separation/reciprocating wetland technology system
- Upflow-biofiltration system
- Belt system for manure removal
- Belt manure removal and gasification system to thermally convert dry manure to combustible gas stream for liquid fuel recovery
- Solids separation/combustion for energy and ash recovery centralized system

Phase 2:

- Solids separation/constructed wetlands system
- Sequencing batch reactor (SBR) system
- Manure solids conversion to insect biomass (black soldier fly larvae) for value-added processing into animal feed protein meal and oil system
- ISSUES (innovative Sustainable Systems Utilizing Economical Solutions). This project includes mesophilic digester, permeable lagoon cover, aerobic blanket and microturbine generator

APPENDIX 3

Anerobic Digester Development to Control Swine Waste in North Carolina

Anaerobic digestion is centuries old and varies from simple household digesters used by some 40 million people in China to the 17,000 commercial scale biogas systems in Europe. (North Carolina Bioenergy Council, 2017). According to the American Biogas Council, 2,000 biogas systems are now in operation in the U.S, the majority at sewage treatment plants, and estimates that there are at least 8,700 U.S. dairy and hog operations large enough to profitably produce biogas, but only 265 (12 percent swine) do so. The Smithfield Agreement research, together with incentives provided by REPS legislation, shows progress is being made.

With financing from Duke University, Duke Energy and later Google Inc., the Loyd Ray biogas system generates 600-megawatt hours of energy. Duke takes partial credit for methane capture to offset some on campus pollution and to achieve its aim of zero net greenhouse gas emissions (NC Policy Watch, 2017). Google gets the rest of methane reductions to meet its goal of 100 percent renewable energy. Beyond methane capture, the system meets North Carolina superior technology odor and nutrient pollution standards. Nine other digesters are operating in North Carolina, but none are currently meeting superior technology performance standards, even with state incentive funds and the promise of expansion.

Soon to come on-line is Legacy Farms, one of the state's few integrator independent farms, which will use dry bedding and swine waste to a series of digesters and retaining ponds (NC Policy Watch, 2017). It is expected to meet superior technology standards, will exempt the 560 acre farm from the moratorium and allow it to expand from 5,500 sows to 60,000 finished hogs. Some producers are hosting third-party renewable energy developers on their property. Revolution Energy Systems (RES), a Washington, D.C.-based company, is operating two waste-to-energy systems that generate 17 times the energy as the Lloyd Ray project while using the waste from 70,000 pigs from 10 adjacent CAFOs. The integrator/producer, Murphy Family Ventures, incurred no cost for the biogas system including retrofitting its barns with scrapers. The entire system is owned by RES, as are the benefits: renewable energy credits sold to Duke Energy under REPS, methane credits equal to the pollution of some 7,500 cars sold on the offset market, waste heat to aid digestion, and revenue from electricity sold to the grid. Another project, Vestal Farms in Duplin County, has eliminated burning biogas on-site, an added expense and operational burden, by purifying gas for direct injection — “direct biogas” or “renewable natural gas” — similar to how some utilities allow customers to add renewable energy to the electrical grid. Also in Duplin County, Optima KV is directly injecting biogas, which will be bought and used by Duke Energy to help fuel its gas plants in adjacent counties. It is expected to become the largest biogas project in North Carolina, enough to power more than 800 homes. Five CAFOs, including Vestal, have invested in the system and will benefit.

Duke Energy is expanding its renewable energy output through capturing waste generated methane, which it treats and injects into its pipeline system in four other counties (Waste Management World, 2017). Under a 15-year contract with Carbon Cycle Energy, it is expected to produce about 125,000 MWH of renewable energy per year from biogas — enough to power about 10,000 homes for a year, while at the same time adding RECs to help satisfy the state mandate. While North Carolina is clearly the leader in developing innovative waste-to-energy technology, Roeslein Alternative Energy has reached the halfway point of its \$120 million biogas project in partnership with Smithfield Farms in Northern Missouri. The project will inject renewable natural gas (RNG).

- ¹ <https://www.iowapork.org>, accessed 12/2/17
- ² USDA National Agricultural Statistics Service. Pork Data for Iowa and Nation 2016. https://www.nass.usda.gov/Quick_Stats/Lite/result.php?AC4E3044-F3E6-3BF2-9457-09C30172E6E0
- ³ <https://www.iowapork.org>, accessed 12/2/17
- ⁴ <https://www.un.org/popin/data.html>, accessed 11/20/17
- ⁵ <https://www.poi.org/.../hot-stock-inside-china--strategic-pork-reserve>, accessed 11/20/17
- ⁶ Iowa Welcomes New Pork Processing Plants. <https://www.nationalhogfarmer.com/.../iowa-welcomes-new-pork-processing-plants>.
- ⁷ Donnelle Eller. Iowa's Largest Pork Producer Adding 90,000 hogs amid calls for a moratorium. Des Moines Register October 26, 2017. <https://www.desmoinesregister.com/story/money/agriculture/2017/10/26/iowas-largest-pork-producer-adding-90-000-hogs-amid-calls-moratorium/800820001/>
- ⁸ Iowa Concentrated Animal Feeding Operation Air Quality Study. Available at <https://www.public-health.uiowa.edu/ehsrc/CAFOstudy.htm>
- ⁹ Pew Commission on Industrial Farm Animal Production (2008), Putting Meat on the Table: Industrial Farm Animal Production in America. The Pew Charitable Trusts and Johns Hopkins Bloomberg School of Public Health
- ¹⁰ O'Connor AM, Auvermann BW, Dzikamunhenga RS, Glanville JM, Higgins JPT, Kirychuk SP, Sargeant JM, Totton SC, Wood H, Von Essen SG (2017) Systematic Reviews 5:86, doi 10.1186/s13643-017-0465-z
- ¹¹ Nachman KE, Lam J, Schinasi LH, Smit TC, Feingold BJ, Casey JA (2017) Systematic Reviews 6:179, DOI 10.1186/s13643-017-0575-7
- ¹² World Health Organization, Constitution of WHO: Principals, at <http://www.who.int/about/mission/en/> accessed Jan. 22, 2018.
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