Public Health and Livestock Confinements: Identifying Threats to Human Health

Prepared by:
Plains Justice
100 First Street SW
Cedar Rapids, IA 52404
info@plainsjustice.org
(319) 362-2120
Public Health and Livestock Confinements: Identifying Threats to Human Health

EXECUTIVE SUMMARY

This report highlights recent scientific research on potential public health risks associated with confined animal feeding operations or CAFOs. In particular the report focuses on impacts to air quality, water quality, and pathogens such as viruses and bacteria. The purpose is to provide reliable information, based on a broad review of scientific research currently available, for regulators, individuals, and organizations.

Air quality can be damaged by CAFO emissions including ammonia and hydrogen sulfide, as well as airborne particles. These and other CAFO air pollutants can contribute to respiratory problems such as asthma and difficulty breathing. Ammonia and hydrogen sulfide exposure are associated with strong odors and can result in serious health impacts for CAFO workers. In addition to respiratory effects, particulate matter can increase the risk of heart problems.

Impairments to water quality from manure pollution are also a public health concern. The presence of CAFO-sourced bacteria in recreational waters increases the public health risk associated with water recreation. High levels of ammonia and the resulting hypoxia can impair other recreational activities such as fishing. Bacteria or chemical contamination of ground and surface waters can negatively affect drinking water supplies for those living near or downstream from CAFOs when manure spills occur.

The role of CAFOs in increasing antibiotic resistance among bacteria and the emergence of new strains of viruses is the subject of growing scientific inquiry. Although other factors are also likely involved, the link between CAFOs and pathogens has triggered a number of recent studies. This research indicates that the use of nontherapeutic antibiotics to promote growth or prevent disease is a risky, and perhaps unnecessary, practice.

The report concludes by summarizing various solutions that can reduce possible threats to public health without lasting negative impacts on animal production. Greater awareness of and precautions against air emissions could reduce respiratory and cardiac symptoms associated with CAFOs. Appropriate storage and handling of manure can reduce the likelihood of water contamination, and the elimination of nontherapeutic antibiotics could help reduce the prevalence of antibiotic-resistant bacteria. The report cites successful examples where implementation of these solutions has created little or no economic impact on producers, while significantly improving quality of life near and downstream from CAFOs.

**This report has been supported by a donation from Roxanne Conlin of Des Moines, Iowa and by contributions from other Plains Justice supporters.**
Public Health and Livestock Confinements: Identifying Threats to Human Health

INTRODUCTION

Changing consumer demands, an increased emphasis on speed and efficiency, and a shifting agricultural economy have led farmers and farm owners to specialize to meet an ever-fluctuating market. Animal production, in particular, has increasingly shifted toward high density confined animal feeding operations (CAFOs) to produce many animals on a small area of land.

Many individual and family farmers have turned to CAFOs as a way to maintain their livelihood. For some, the expected or proposed benefits have not been fully realized. Public health researchers have also raised concerns about the safety of this form of animal agriculture.

The World Health Organization (WHO), Centers for Disease Control and Prevention (CDC), Union of Concerned Scientists, American Academy of Pediatrics, Environmental Integrity Project, Pew Commission on Industrial Farm Animal Production, and Iowa Policy Project are among the organizations that have expressed concerns over the potential threats to public health that CAFOs pose. This report examines some of these concerns, including possible health risks related to air quality, water quality, heavy metals, and pathogens (viruses and bacteria). The goal of this report is to help educate the public about potential health risks associated with industrial animal agriculture practices. Recent research highlights threats to air and water quality and implications for effective medical treatment. The report concludes with possible solutions for mitigating these risks. Through the combined efforts of farmers, regulators, and the public, animal food production practices can be both safe and profitable.

EPIDEMIOLOGICAL EVIDENCE

Epidemiology has a variety of definitions, but it is generally accepted as the study of populations and diseases and of factors that affect health or disease. These can include both internal factors such as genetics and external factors such as environmental exposure. Although direct and irrefutable causal relationships cannot always be identified through epidemiological research, epidemiology is considered a cornerstone of public health and is credited with many historical and current improvements in human health such as vaccinations and smoking prevention. Some of the specific concerns highlighted in this report warrant additional study, but based on existing information there is sufficient evidence to support suggestions and recommendations for protecting public health. Much of the research cited in this report is also consistent with epidemiological guidelines for causal relationships, such as the following:
Replication of findings – multiple sources reporting similar findings

Specificity of the association – symptoms or health factors that are specific, though not necessarily unique, to an identified cause or causes

Biologic plausibility – associations that agree with current knowledge regarding physiology

Temporal relationship – appearance of symptoms that occur in an appropriate time frame relative to the proposed causative event or events

In short, epidemiology takes advantage of both observational and medical data to try to identify and characterize factors that influence disease. Based on this perspective, this report addresses the role of CAFOs as a likely contributing factor to public health problems.

ANIMAL CONFINEMENT OPERATIONS IN IOWA

According to a recent U.S. Department of Agriculture report, Iowa ranks first in the nation for both hog and egg production and second in the nation for commercial red meat production. This translates into large numbers of animals being raised in the state while the total number of farms in Iowa has declined. The result is a smaller overall number of facilities housing many animals in a relatively small area. This also results in each facility generating a quantity of animal waste (such as manure or urine) that may have previously been equivalent to many farms spread out over a larger area. The CDC notes that a small percentage of CAFOs account for more than half of the manure generated nationally, which is further evidence that the concentration of animals in confined animal facilities also concentrates potential sources for public health risks.

While swine and poultry are generally housed in confinements with full roofs, cattle are more often confined to open feedlots. Air emissions from swine operations have been more commonly studied as sources of air quality impairment (as will be discussed in further detail later) although cattle and poultry facilities also generate manure and particulate matter that can impair air quality. Both full confinement and open feedlot facilities have the potential to generate large quantities of manure, and both have the potential to result in contamination of waterways. Consequently, this report refers to both full confinement and to feedlot operations as CAFOs in terms of public health risks, though specific risks may vary based on characteristics of individual facilities. Heavy metal pollution is exclusive to poultry operations, while contamination from endocrine disrupting compounds is most associated with cattle operations. Concerns regarding pathogens apply to multiple types of CAFOs. Specifics of these concerns will be addressed in separate sections.
AIR QUALITY ISSUES

Impaired air quality represents serious risks to human health

Researchers have expressed concerns over air quality for residents living near CAFOs. These include odors, which are generally regarded as a nuisance issue, and impaired air quality, which can be a more serious health hazard. Both have similar causes, and in some cases offending odors are an easily identifiable indicator of poor air quality. For example, ammonia, which is a potentially dangerous air emission, also has a distinctive odor. Gases such as ammonia and hydrogen sulfide and the associated odors are perhaps the most recognizable CAFO air emissions, but other emissions include volatile organic compounds, particulate matter, and microbes. These emissions can pose serious potential health risks not only to CAFO workers, but to neighboring homes and communities as well.

Ammonia gas is an irritant, particularly to the eyes and respiratory system. Even short-term exposure may cause eye irritation, coughing, and breathing difficulties. Long-term exposure may impair normal lung function and accelerate normal declines in lung function, such as those associated with increasing age or with preexisting respiratory disease. Persons with existing respiratory problems such as asthma or chronic obstructive pulmonary disease may be particularly sensitive to the negative effects of inhaled ammonia, which can trigger potentially fatal respiratory distress.

Hydrogen sulfide, like ammonia, can irritate the eyes and airways. Even short-term exposure may cause breathing difficulties in persons with asthma. It is unknown if long-term exposure causes changes in lung function because potential effects have not been well-studied to date, but it is likely that long-term effects would be similar to those observed with ammonia exposure.

Although exposure to airborne particulate matter is often associated with living in densely populated areas where vehicle and other emissions are a concern, CAFOs also have the potential to generate particulate air pollution in the form of fecal matter, fur, feathers, and dust. The health risks of particulate air pollution are well-documented. Exposure to particulate air pollution affects heart function and the ability of the heart to respond properly following changes in heart rate. Particulate air pollution is a contributing factor in early death due to respiratory and cardiac effects. Evidence shows that short-term exposure to airborne particulates can contribute to an increased risk of heart attack and may even play a role in triggering heart attacks. Risk is higher for those with pre-existing cardiovascular disease. Long-term exposure to particulate air pollution also increases the risk of cardiac mortality. Respiratory problems, such as those associated with living near CAFOs as a result of exposure to ammonia and hydrogen sulfide, further increase the risk of early mortality. Importantly, similar respiratory and cardiac effects have been shown for larger particulate matter and in healthy young adults, suggesting that air quality may be a serious concern for individuals of all ages and that these effects are not limited to smaller particles.
Public Health and Livestock Confinements

Taken individually, ammonia, hydrogen sulfide, and particulate matter each represent a serious potential risk to human health. In and around CAFOs, however, this combination leads to documented evidence of health problems. Among the health effects documented for CAFO workers are altered lung function and an assortment of respiratory complications including a worsening of existing asthma, asthma-like symptoms, and chronic bronchitis. Workers in hog confinement facilities have also been identified as being at risk for hydrogen sulfide poisoning as a result of prolonged exposure. CAFO workers are not the only ones at potential risk, however. A study of air quality at residences near a swine CAFO found levels of hydrogen sulfide that were higher than recommended by the Agency for Toxic Substances and Disease Registry for chronic exposure, indicating that those living near CAFOs may also be at risk.

Even short-term exposure can result in symptoms, as illustrated by a study which examined responses to air from a hog CAFO. This study found that even healthy individuals who were exposed for relatively short periods of time reported symptoms such as nausea and eye irritation. This research further illustrates that CAFOs can contribute to health problems for neighbors and communities as a result of air quality impairment, since air samples were diluted to levels that might be found at distance from the generating facility.

Additional evidence that CAFOs may contribute to breathing difficulties can be found by looking at the development of chronic respiratory problems. In Iowa, a study examining asthma rates in schoolchildren found that children living near a CAFO had a significantly higher prevalence of asthma than children who did not live near any large scale farming operation. Although development of asthma is a complex physiological process, it appears likely that environmental exposure to the combination of particulate matter, toxic gases, and airborne pathogens contributes to the development of this serious and costly respiratory illness. The development of chronic respiratory problems, like asthma, in children is a more sensitive measure of the impacts of poor air quality because children and infants are likely to be at higher risk from potential air pollution from CAFOs. This is due to the fact that infants’ lungs continue to develop after birth and children are generally more likely than adults to be outdoors and active and have higher rates of respiration. The elderly are also considered a high risk population for air pollution effects since they are more likely to suffer from health problems that will affect cardiac or respiratory function and may be more likely to have declining lung function.

Airborne bacteria pose a separate risk, as discussed in greater detail in a separate section. Briefly, air plumes from CAFOs can carry bacteria to neighboring homes and communities, where they can be inhaled by neighbors and other residents. Although many factors such as wind direction and speed and air temperature may influence the range and area of effect of airborne pollutants, a 2006 study identified airborne bacteria downwind of a swine CAFO. This study recommended that any CAFO be a minimum distance of 200 meters or approximately 0.12 miles from residential areas. Unfortunately, this figure does not take into effect the broader effects of water quality and water supply contamination.
WATER QUALITY

The concept of sanitation – separating human waste from drinking water supplies to limit the spread of disease - is thousands of years old, dating back at least as far as ancient Rome. This common practice is a part of everyday life in developed countries, and a precaution that most city dwellers generally take for granted. This practice, however, does not fully extend to the separation of animal waste from drinking water supplies. In fact, the vast majority of animal manure generated by CAFOs (approximately 500 million tons annually) is untreated and often poorly regulated. Numerous spills have affected rivers and other waterways that provide drinking water both in Iowa and elsewhere, though this report will highlight some of the impacts to water quality in Iowa.

Impairment of Iowa’s waterways has been documented

Information from the Iowa Department of Natural Resources (IDNR) provides evidence that manure contamination of Iowa’s waterways is a serious problem. IDNR reports that manure spills were responsible for killing over 1 million fish over a five-year period. Similarly, Environmental Integrity Project reported that IDNR had documented at least 329 manure spills, resulting in fish kills totaling more than 2.6 million over the course of a decade. From September 2005 until November 2009, there were at least 66 confirmed or suspected manure spills documented by IDNR, nearly 30% of which resulted in documented fish kills. Manure, ammonia, and bacteria have resulted in many of the state’s rivers and streams being declared “impaired” by IDNR. This includes waterways that provide drinking water to Iowa citizens, such as the Raccoon River, as well as hundreds of other bodies of water.

In April 2009, an IDNR report listed 439 waterbodies with a total of 581 impairments. These impairments include indicator bacteria (E.coli), biological impairments, or fish kills for rivers and streams; and algae, indicator bacteria, and suspended sediment for lakes. All of these impairments can be attributed, at least in part, to manure spills. In a recent event, an estimated 500 gallons of manure from a hog facility, approximately half of a 1,000 gallon spill, reached a tributary of the Raccoon River. Although manure spills or fish kills in Iowa are often reported by individuals and these reports may or may not be confirmed by IDNR personnel, this event illustrates the type of manure spill events which contribute to impaired waterway designations.

CAFOs may affect entire watersheds

Although there are many public health risks associated with working in or living close to a CAFO, the actual area affected by a CAFO can be considerably larger. Spills that impact waterways can pollute drinking water supplies for hundreds of thousands of residents downstream, many of whom may have not even realize that a CAFO or CAFOs are located upstream. To arrive at appropriate protections against CAFO-sourced water pollution, it is critical to consider impacts on the watershed and not simply the areas immediately surrounding an individual CAFO. It is also important to recognize the cumulative impacts of multiple CAFOs in a particular area.
Improperly handled manure contaminates rivers, streams, and groundwater

Manure from CAFOs is often handled in one of two ways – liquid manure may be stored in lagoons on the CAFO property or manure may be stored in piles to dry. Liquid manure can be sprayed onto fields or injected into soil as a fertilizer, while solid or dry manure can be spread directly on fields. Manure application can provide vital nutrients for crops, but even when applied at recommended rates there is the possibility of contamination of waterways as a result of runoff or leaching. A range of physical and mechanical problems can also lead to manure spills, including incidents identified by IDNR such as severed or failed hoses and couplings, plugged or cracked pipes, and storage overflows. Manure runoff is also a common source of water contamination. Siting of a CAFO is also a possible cause for concern, particularly if it is near a shallow water table or in a flood plain.

Concerns over leaching of manure or manure spills are associated, in part, with concerns that pollutants from animal waste can contaminate recreational or drinking waters. Evidence has shown that both surface and ground water have been contaminated with pollutants from animal waste. Contamination can include pathogens such as fecal bacteria, parasites, and viruses. Animal waste spills can also result in hypoxia and high ammonia levels in the receiving waters, which can contribute to kills of fish and other aquatic wildlife. In contrast to arguments that these effects are transient and short-lived, evidence shows that bacteria and other pathogens may survive for week or months following a spill, resulting in a significant and prolonged risk after only a single manure spill event. Although the risks of drinking water contaminated with pathogens are relatively low for communities with water treatment facilities, contamination can and does occur. One report estimates that as many as 19.5 million illnesses occur each year in the United States, often as a result of often temporary failures at water treatment facilities. These failures mean that contaminants, including fecal bacteria from CAFOs, can infiltrate drinking water supplies. In addition, private water wells are a source of potential exposure. Contamination of recreational waters is also a concern because contact with contaminated water can cause irritation or infection or accidental ingestion may occur.

Algae blooms, which can include increased levels of toxic forms of algae, can also result from manure spills. In addition to producing unsightly algae masses that can impair recreational waterways by clogging watercraft motors or impeding swimming or fishing, these algae blooms can also affect drinking water supplies. In 2009, the Iowa water utility Des Moines Water Works ceased using the Raccoon River as a source of drinking water due to high levels of algae. Although other factors may also contribute to high levels of algae, the link between manure spills and algae blooms suggests that CAFOs may be at least partially responsible for the algae levels found in the Raccoon River.

In addition to concerns over pathogen contamination of in waterways as a result of manure spills, there are concerns specific to the type of waste generated at CAFOs. Manure from CAFOs may also contain hormones, heavy metals, and bacteria or other...
Public Health and Livestock Confinements

pathogens – all of which pose potential hazards to human health if they reach drinking water or infect humans through recreational contact with contaminated water.

**Manure runoff pollutes waterways with endocrine disrupting compounds**

One of the emerging concerns about manure runoff and contamination of waterways relates to the presence of hormones in drinking and recreational water supplies. Growth-promoting compounds, which can contain estradiol, testosterone, or other steroids, are routinely administered to cattle to promote growth in both steers and heifers. These hormones, which are the same or similar to those found in humans and other vertebrates, are referred to as endocrine disruptors or endocrine disrupting compounds because they have the potential to alter or impair normal hormone regulation such as sexual development. These compounds have been detected in runoff from animal feeding operations, suggesting that the chemicals used in CAFOs to promote growth in livestock are not fully contained in the animals to which they are administered. Both intact hormones and their metabolites can be found in the urine and feces of treated animals, and their presence contributes to the risks associated with manure spills. Once introduced to a waterway, these compounds can have serious effects on aquatic life. Research from the University of Nebraska raises concerns about the effects of these hormones in waterways, including disruption of normal sexual development and sexual function in exposed fish. Although these effects have not been documented in humans, the possibility for similar disruption of human health exists as a result of exposure to these CAFO-generated endocrine disrupting compounds in recreational waters or in drinking water supplies.

**Arsenic in poultry litter increases the risk of human exposure**

The practice of adding arsenic to chicken feed is controversial. Although proponents argue that it improves poultry production by promoting growth and preventing disease, the presence of arsenic in poultry litter is a serious exposure concern. Arsenic is a dangerous heavy metal and a potent carcinogen that is implicated in a variety of health problems in humans. Instantaneous or rapid death can occur at high levels of arsenic exposure, but even lower levels have been implicated in a variety of health problems. Chronic or prolonged exposure to arsenic can contribute to the development of specific types of cancer, including cancers of the skin, lung, liver, and bladder. Arsenic exposure can also damage blood vessels, resulting in impaired cardiovascular function.

If arsenic-containing poultry litter is part of a manure spill, there is the risk of introducing a powerful and dangerous carcinogen into drinking water or recreational waters. Application of poultry litter that contains arsenic can also contribute to increased arsenic content of the soil on which it is spread. This also increases the risk of arsenic leaching into groundwater, where it can contaminate potential drinking water supplies. This combination of factors makes dealing with poultry litter particularly problematic. While solutions such as burning poultry litter or converting it into dry fertilizer pellets have been proposed, the arsenic content of the waste creates a prohibitive health hazard to fully implementing these alternatives to land application.
PATHOGENS

CAFOs are a potential breeding ground for new viruses

In June 2009, the WHO announced that the outbreak of influenza A (H1N1) or “swine flu” had reached pandemic status. Both in the United States and worldwide, the majority of cases of influenza over the months of April to November 2009 were identified as the new H1N1 variant. Although H1N1 mortality has been relatively low and most reported symptoms have been mild to moderate, the concerns expressed by federal, state, and local agencies echo concerns from researchers and scientists regarding animal-derived influenza strains. Unlike seasonal influenza, variations of the influenza virus that incorporate genetic material from swine or poultry, such as H1N1, are of particular concern to humans who may have no natural immunity or resistance to these variations.

Prior to the 2009 H1N1 pandemic, researchers described the likelihood that a pandemic influenza event would originate in animals. This prediction was based on evidence that swine workers are at elevated risk of becoming infected with swine influenza and on evidence that CAFOs in particular could serve as amplifiers of a new strain of influenza. Swine are not the only possible source of a new influenza strain, however. Further evidence also suggests that poultry workers may be at risk of infection from avian (bird) influenza variations.

Part of the risk of infection associated with CAFOs is based on the number and proximity of animals housed in such facilities. Crowded conditions in CAFOs increase the risk of transmission of variants of the influenza virus both among animals and between animals and humans. In a CAFO setting, a single worker may also be exposed to thousands of animals a day, each of which could potentially transmit a virus from animal to human. The possibility of transmission back and forth between species (humans or swine or poultry) and the possibility of transmission from animal to animal (swine to swine or poultry to poultry) also increases the risk of the emergence of a new variation of influenza that could be passed among populations and could contain genetic material from multiple species. Although full details of the origin of H1N1 are not known, the scenario of a pandemic influenza virus that incorporates genetic material from humans, swine, and birds is precisely what has unfolded over the last year.

CAFOs contribute to antibiotic resistance

Antibiotics, also known as antimicrobials, are drugs that kill bacteria which cause illness. Antibiotic resistance is the ability of a pathogen such as bacteria or viruses to withstand the intended effects of an antibiotic. In 2004, the American Academy of Pediatrics released a technical report calling antibiotic resistance “an increasing and serious problem.” It also identified the practice of nontherapeutic use of antibiotics in animal agriculture as directly and negatively affecting human health. Other researchers have agreed, citing the nontherapeutic use of antibiotics in animal food production as an important contributor to the emergence of some antibiotic resistant bacteria. Similarly,
the WHO has identified nontherapeutic use of antibiotic use in food animal production as a contributing factor in the rise of antibiotic resistant bacteria.\textsuperscript{43}

It is estimated that approximately 35\%-80\% of all antimicrobials used in the United States are used in animal agriculture.\textsuperscript{44,45} The majority of these drugs (approximately 75\%) are used not for therapeutic purposes such as treating sick animals, but to promote growth or improve feed efficiency in healthy animals.\textsuperscript{41} Many of these drugs are the same or similar to those used to treat human disease, which raises concerns over the development of antibiotic resistance.

Controlled study of the practice of administering nontherapeutic antimicrobials showed that (1) antibiotic resistance can develop quickly, (2) single-drug resistance can become multi-drug resistance, (3) drug resistance can spread from animal to animal and from animals to humans, and that (4) stopping the use of antimicrobials decreases drug resistance.\textsuperscript{46}

Antibiotic resistant bacteria can reach and infect humans through consumption of contaminated food, through direct contact with animals, or through contamination of soil or water with antibiotic resistant bacteria.\textsuperscript{41} The same resistant bacteria found in swine waste lagoons have also been found hundreds of meters downstream\textsuperscript{47}, which further illustrates concerns over the size of an area that can be affected by a CAFO. Environmental contamination has been demonstrated\textsuperscript{48}, and there is evidence that antimicrobial residues can be found in animal waste and, consequently, in waste lagoons and on fields where manure is used as a fertilizer. In addition, these residues have been found in both surface and groundwater supplies.\textsuperscript{49} Antimicrobials have also been found in private water wells, demonstrating that contamination of drinking water supplies is a reality and not simply a theoretical possibility.\textsuperscript{50}

Although antibiotic resistance is a public health concern for people of all ages, children are particularly at risk. \textit{Campylobacter}, the leading cause of bacterial food borne illness, affects infants younger than one year at a rate that is twice that of the general population\textsuperscript{51} and 20\% of all cases of illness occur in children under 10 years old.\textsuperscript{52} Following the approval of the antibiotic fluoroquinolone in poultry, infections in humans with a drug resistant form of \textit{Campylobacter} increased. Although a specific causal relationship is difficult to confirm, the increase in drug resistant \textit{Campylobacter} occurring subsequent to an increased use in poultry meets epidemiological evidence criteria. Yet another concern associated with a greater prevalence of antibiotic-resistant \textit{Campylobacter} is that drug-resistant strains of bacteria may be more dangerous than those that are sensitive to antibiotics.\textsuperscript{41}

\textit{Salmonella}, another common bacteria that can be found in food, accounts for an estimated 600 deaths per year, mostly in the elderly and the very young.\textsuperscript{53} Once again, children are at particular risk since more than a third of all cases occur in children under the age of 10.\textsuperscript{52} As early as 1984, scientists had evidence that antibiotic resistant bacteria from animal fed sub-therapeutic doses of antibiotics could result in contamination of meat and subsequent infections in humans.\textsuperscript{54} As a result of increasing drug resistance,
Public Health and Livestock Confinements

the treatment of young children and adults infected with *Salmonella* has become increasingly difficult.

In addition to concerns regarding contaminated food, another risk to public health – *methicillin resistant Staphylococcus aureus* (MRSA) - has been gaining broad attention. The antibiotic vulnerable form of this bacteria (*Staphylococcus aureus*) is relatively widespread, occurring in approximately one-third of the United States population, while MRSA prevalence is considerably lower. Though individuals can carry either antibiotic vulnerable and antibiotic resistant strains without developing infections, there is evidence that infection with MRSA results in both longer and more costly hospital stays than infection with the antibiotic vulnerable bacteria. Historically, MRSA infections have been most commonly associated with exposure in a health care setting though exposure outside of health care settings, also referred to as community-acquired infections, may be on the rise. This potential rise in MRSA infection from community or unidentified sources has significant public health concerns. The United States’ burden of MRSA in a single year (2005) was estimated at 94,000 infections and 18,000 deaths, and personal and financial costs are likely to escalate as MRSA becomes more prevalent. While some sources of MRSA remain unidentified, evidence from the Midwest shows that both swine and swine workers can serve as a reservoir for MRSA. In fact, a study of swine and swine workers in Iowa and Illinois showed that both animal and human populations were colonized with the same strain of MRSA, suggesting that bacteria are transmitted between humans and animals and that swine and swine workers may be a potential source of MRSA. As with other bacteria, the increasing prevalence of resistant strains limits options for successful and effective treatment.

Quite simply, with few to no new antibiotics being developed, medicine is running out of effective drugs with which to treat those infections. And without effective treatments, these infections can become life-threatening more costly to treat and more likely to become life-threatening.

**SOLUTIONS**

This report highlights some of the public health concerns related to CAFOs. As with many potential public health threats, one of the crucial first steps is the identification of factors that may contribute to impaired health of affected populations. Once this is accomplished and likely contributing factors are known, subsequent steps can be taken to address these concerns. While some of the potential health risks associated with CAFOs are serious, the following recommendations could help reduce or eliminate many of the issues described in this report.

1. **Improve emission control to reduce air quality impairments**

Improved monitoring and surveillance of air quality in areas surrounding CAFOs would not only provide researchers with additional information on the extent of possible health effects, but it could also provide CAFO owners and operators with the necessary data to
measure improvements in air quality as a result of technological or procedural changes. A University of Iowa report on CAFOs and air quality lists a variety of possible solutions to reduce air emissions, including frequent manure removal and treating the air from building where animals are housed, covers for manure storage, and land application recommendations.  

2. **Proper manure management to reduce or eliminate spills**

As noted previously, a variety of equipment or storage facility failures can result in manure spills. These types of events might be avoided through better monitoring or maintenance of facilities and equipment. Improper manure management, including over-application, misapplication, and inadequate storage, also contribute to manure spills. Improved knowledge of and attention to proper manure management standards and recommendations, such as those outlined by the EPA and other agencies, could help reduce manure spills.

3. **Remove arsenic from poultry feed to limit exposure**

Arsenic is not spontaneously generated by normal biological or physiological processes of poultry growth and development. The source of arsenic in poultry litter is entirely of artificial origin. The elimination of arsenic from poultry feed, would remove a potential challenge to waste disposal and remove a source of exposure for a toxic and dangerous compound. Furthermore, evidence from Denmark indicates that overall no negative effects on poultry production result from the elimination of arsenic from poultry feed.

4. **Utilize vaccinations and basic safety precautions to limit the spread of influenza**

According to researchers, including CAFO workers in vaccination programs could help limit or even prevent the spread of influenza. In addition, basic sanitary practices such as hand washing and the use of personal protective equipment could also help protect CAFO workers from infection. As discussed previously, limiting the spread of influenza to humans who work with animals could limit opportunities for viruses to proliferate and mutate into new strains.

5. **Eliminate the use of nontherapeutic antibiotics to reduce the prevalence of antibiotic resistant pathogens**

By 1999, Denmark had eliminated the use of antimicrobials as growth promoters in cattle, broilers, and hogs. Although some reports have inaccurately indicated that therapeutic use of antimicrobials increased as a result, both the WHO and Danish scientists have clarified that overall increases in antibiotic use were not found. The elimination of nontherapeutic antibiotics also did not affect productivity or profitability overall. Furthermore, this change resulted in significant reductions in observed antibiotic resistant pathogens and bacteria. The substantial reduction in antibiotic resistant bacteria subsequent to the elimination of nontherapeutic antibiotics in food
production serves as additional epidemiological evidence that CAFOs contribute to antibiotic resistance.\textsuperscript{59}

The preceding steps outline some of the methods possible for reducing or eliminating certain public health risks associated with CAFOs. Importantly, these steps may have no negative effects on overall food production or on profitability of CAFOs. Through cooperation and communication, food producers and regulators can protect human health by making CAFOs less likely to impair air or water quality without impairing food production. As stated previously, the purpose of this report is to help educate individuals and regulators about some of the possible public health risks associated with CAFOs while providing basic information on how to limit and eliminate those threats.

ENDNOTES/REFERENCES


3 “Concentrated Animal Feeding Operations (CAFOs): About.” Centers for Disease Control and Prevention. Previously available online at http://www.cdc.gov/cafos/about.htm#bg. Webpage has since been replaced; last accessed online July 2009. The author has requested a copy of the previous website, which was publicly available, from the Centers for Disease Control and Prevention.


18 Sigurdur T. Sigurdarson, and Joel N. Kline. “School proximity to concentrated animal feeding operations and prevalence of asthma in students.” Chest. 2006; 129:1486-1491. Available online at http://www.chestjournal.org/content/129/6/1486.full.html


20 “Importance of Iowa’s Aquatic Resources.” Iowa Department of Natural Resources. Available online at http://www.iowadnr.gov/education/plndwr.html

21 “Manure Spills and Fish Kills.” Iowa Chapter of Sierra Club. Information compiled from Iowa Department of Natural Resources news releases. Available online at http://iowa.sierraclub.org/Manure Spills and Fish Kills.pdf.


Public Health and Livestock Confinements


34 “2009 H1N1 Flu: Situation Update.” Centers for Disease Control. Available online at http://www.cdc.gov/h1n1flu/update.htm


Michael T. Meyer, Dana W. Kolpin, Joseph E. Bumgarner, Jerry L. Varns, and J.V. Daughtridge. Occurrence of antibiotics in surface and ground water near confined animal feeding operations and waste water treatment plants using radioimmunoassay and liquid chromatography/electrospray mass spectrometry [abstract 34]. Presented at the 219th meeting of the American Chemical Society; March 26–30, 2000; San Francisco, CA.


“CDC Interim Guidance for Workers who are Employed at Commercial Swine Farms: Preventing the Spread of Influenza A Viruses, Including the 2009 H1N1 Virus.” Centers for Disease Control and Prevention. Available online at http://www.cdc.gov/h1n1flu/guidelines_commerical_settings_with_pigs.htm