INSTITUTE of SCIENCE, TECHNOLOGY AND PUBLIC POLICY

Concentrated Animal Feeding Operations (CAFOs)

ASSESSMENT OF IMPACTS ON HEALTH, LOCAL ECONOMIES, AND THE ENVIRONMENT

WITH SUGGESTED ALTERNATIVES

Institute of Science, Technology and Public Policy
Maharishi University of Management
1000 North Fourth Street
Fairfield, Iowa 52556

EXECUTIVE SUMMARY

The state of Iowa raises more hogs than any state in the country — 17.2 million as of December 2006 — generating $3.65 billion a year in revenues.[1]

Yet today, although Iowa produces roughly the same amount of pork it did a century ago, the number of hog farmers in the state has dropped dramatically. In the past 25 years alone, the number of Iowa farms with pigs has declined 83% — from 59,134 farms in 1978 to 10,205 farms in 2002.[2] Why?

Most of the 17 million Iowa hogs today are raised in factory farms, large facilities known as Concentrated Animal Feeding Operations or CAFOs, where thousands of hogs are contained before being shipped to the meatpacking plant. The corporations that derive economic benefit from these CAFOs assert that this industrialized farming method is the future of agriculture and a boon to rural regions. Research studies indicate, however, that CAFOs are causing measurable harm across a broad range of environmental, biological, and economic parameters.

These studies have found that factory farms present a variety of problems:

- Significant amounts of toxic animal waste are released into water and air without environmental controls in place, causing pollution to air, soil, and the water supply.
- This pollution, in turn, appears to be a causative factor in the increased illness rates observed among people who live near CAFO facilities.
- The widespread, routine administration of antibiotics to confined hogs increases bacterial drug resistance and thereby endangers public health.
- Land values and quality of life in areas near CAFOs have been shown to decrease markedly and consistently.
- The local economy suffers rather than improves, and small-scale farming declines.

This report examines the impact of CAFOs on health, the economy, and the environment. It highlights how factory farms have impacted Jefferson County in particular, and explains the laws relevant to construction of these facilities and how citizens can get involved in this issue. It also presents viable alternatives to farmers and communities so that the livestock industry can continue to prosper while safeguarding and sustaining a community's health, economic vitality, and environmental resources.

PUBLIC HEALTH IMPACT

How can a CAFO affect my health?

The health threats from a hog factory are due to the tremendous amounts of manure generated in one place by a large number of hogs, whose waste is dropped into anaerobic "pits" that, lacking oxygen, putrefy the matter quickly. A typical swine livestock factory of 10,000 hogs will create as much waste as 25,000 to 50,000 humans.[3]

Hog waste contains viruses, parasites, and bacteria, including bacteria that can contribute to antibiotic resistance in humans. This waste is often contained in large cesspools called lagoons, from which it is applied to surrounding land or sprayed into the air.

Hog waste contains viruses, parasites, and bacteria, including bacteria that can contribute to antibiotic resistance in humans.

The air around CAFOs can contain unhealthy concentrations of hydrogen sulfide, ammonia, inhalable particulate matter, and endotoxin.[4,5]

What are the physical symptoms and illnesses CAFOs can cause?

In addition to nausea, headache, and vomiting, more than 25%–30% of employees working in CAFO facilities report serious respiratory problems,[6,7] some of which are due to toxins (e.g., endotoxin, glucans) from inhaled microbes. One study found that Iowans living within a two-mile radius of a 4,000-hog unit reported more respiratory and other symptoms than a control group of Iowans not living near a CAFO.[8]

Iowans living within a two-mile radius of a 4,000-hog unit reported more respiratory and other symptoms than a control group of Iowans not living near a CAFO.

Hydrogen sulfide gas is known to be a potent neurotoxin that can cause damage to the brain and nervous system. People exposed to atmospheric concentrations of even 0.1–1 part per million (ppm) display neurobehavioral dysfunction, including abnormal balance and delays in verbal recall.[9]

Another study showed that people living near North Carolina hog CAFOs reported more confusion, tension, depression, and fatigue than did those not living nearby.[10]

University of Iowa scientists released a study in June 2006 showing that children who attend school near CAFOs may be at higher risk for asthma. Students at the study school, located ½ mile from a CAFO in northeast Iowa, showed a prevalence of physician-diagnosed asthma in 19.7% of cases; only 7.3% exhibited asthma from the control school more than 10 miles from a CAFO.[11]

The American Public Health Association (APHA), in a 2004 resolution, urged federal, state, and local governments to impose a moratorium on new CAFOs until additional scientific data has been collected. This resolution was based on an analysis of the health and economic impacts of CAFOs on workers, children, and CAFO neighbors from exposure to large concentrations of manure, dust, toxins, microbes, antibiotics, and pollutants.[12]

Is the odor from CAFOs harmful, or merely unpleasant?

Odor pollution, even at low concentrations, can cause gastrointestinal, stress-related, and respiratory symptoms, and may negatively impact the brain and organ systems.[13,14]

How can the antibiotics fed to hogs threaten my health and the health of my community?

An estimated 70% of the antimicrobial drugs used in the U.S. are fed to nondiseased livestock in order to promote growth and to compensate for the stress and health risks of CAFO confinement.[15] This widespread use of antimicrobials by CAFOs contributes to the evolution and global increase of antibiotic-resistant bacteria, which transmit their resistance to humans typically (but not only) via contaminated food.[16] Since the drugs used in human medicine are identical or very similar to the antimicrobials used by CAFOs,[17] humans infected by antibiotic-resistant bacteria can no longer be treated effectively by standard antibiotics. Consequently, the widespread use of antimicrobials by CAFOs directly jeopardizes public health.

CAFO-raised hogs contain not only more antibiotics but also more hormones, which have been administered to enhance growth. The animals also produce increased adrenaline and other chemicals due to the stressful environment in which they are raised, potentially causing the meat to be less healthy for human ingestion. These chemicals are not usually found in low-stress livestock situations.

Do CAFOs affect the social health of a community?

Studies indicate that CAFOs disrupt the quality of life for neighboring residents. The rural lifestyle, which has always prized outdoor activities and visits from friends and family, is threatened when homeowners need to protect themselves from the air and manure coming from the CAFO. Social capital declines, and deep-seated rifts often arise between CAFOs and their neighbors.[18,19]

University of Iowa scientists released a study in June 2006 showing that children who attend school near CAFOs may be at higher risk for asthma.

The American Public Health Association (APHA), in a 2004 resolution, urged federal, state, and local governments to impose a moratorium on new CAFOs until additional scientific data has been collected.

ECONOMIC IMPACT

Prior to their construction, CAFOs are often promoted locally through claims that they will bring economic vitality to the area. However, the research conducted after operations begin indicates otherwise. The evidence shows a loss of jobs, depressed property values, loss of income for local businesses, and a huge drain on county resources resulting from CAFOs

coming into a rural area. A significant cost to counties lies in the road and bridge upgrades and repairs necessitated by hog and manure transport traffic.

Do factory farms bring jobs?

A farmer who contracts with a corporation to build and operate a CAFO actually ends up being more like a facilities manager than a farmer. Instead of being independent entrepreneurs, many hog farmers are now contract growers. Every CAFO worker replaces nearly three independent family farmers.[20] CAFO crews are often made up of itinerant workers who spend little money in the communities where they work. A Congressional Research Report also found that communities with industrial animal facilities had higher unemployment rates.[21]

The evidence shows a loss of jobs, depressed property values, loss of income for local businesses, and a huge drain on county resources resulting from CAFOs coming into a rural area.

Studies show that independent family farmers offer far more benefits to rural communities: 10% more permanent jobs, 20% more local retail sales, and a 30% increase in per capita income.[22]

Do hog confinements generate additional county tax revenue?

CAFOs actually appear to place a burden on county governments. Proximity to a CAFO can reduce the value of a home by 40%, an Iowa study found.[23] This loss in value affects tax assessments and therefore county tax revenues.

Proximity to a CAFO can reduce the value of a home by 40%, an Iowa study found.

In addition, the confinements do not pay for the damage they cause to county roads and infrastructure — or for health costs, accidents, and environmental monitoring. One Iowa community estimated that costs for gravel-road upkeep increased about 40% due to truck traffic to industrial hog confinements. The annual estimated cost of local road upkeep around a 20,000 hog confinement is $6,447 per mile due to truck traffic.[24]

CAFOs are also eligible for tax write-offs that can decrease the amounts of taxes paid locally.[25]

Will a CAFO increase economic development in my county?

Unlikely. Large corporate agribusiness giants are vertically integrated, traditionally owning the hogs from before birth to post-market. These companies often contract with meatpacking plants to take the hogs (sometimes they own both the hogs and the packing plant), effectively shutting out the small family farmer from earning a living. Partly in response to this shift in production, the number of independent small farmers has decreased dramatically in the last two decades.[26]

CAFO operations with gross incomes in excess of $900,000 spend less than 20% locally, while farms with incomes under $100,000 spend 95% locally.[27]

Because of the undesirable aspects of living close to CAFOs, including the odor, exposure

to toxins, and polluted groundwater, hog confinements effectively *preclude* new businesses from relocating to a county. Studies have indicated that concentration and industrialization of agriculture have been associated with economic decline, both locally and regionally.[28]

The cost of cleaning up the air and water pollution caused by CAFOs rests on local taxpayers, not on the CAFO, thereby increasing its costs locally. Essentially, local economies seem to subsidize the operations of CAFOs and their large out-of-state corporations.

Millions of fish have been killed and drinking wells have been contaminated in the over 140 manure spills reported in Iowa and three surrounding states in the past two years.

77% of all Iowans want to buy humanely raised, environmentally soundly produced pork.

ENVIRONMENTAL IMPACT

Are CAFOs harming the environment?

Manure spills, leaking pits, spreading during inappropriate climatic conditions, and the overspreading of manure are major threats to Iowa's water sources. According to a report by the Environmental Integrity Project, there were 329 documented manure spills from livestock facilities from 1992 to 2002, killing over 2.6 million fish and contaminating groundwater.[29]

In 1995, in the biggest environmental spill in U.S. history — more than twice as big as the Exxon Valdez oil spill — a 120,000 square foot manure lagoon in North Carolina ruptured, releasing 25.8 million gallons of effluvium into the New River. Every living creature in the river died, including fish by the millions.[30]

Researchers at the Centers for Disease Control and Prevention said contaminants including pathogens, metals, antibiotics, bacteria, nitrates (cancer-causing agents), and parasites were found in manure lagoons and surrounding wells, drainage ditches, and underground water.[31]

Tetracycline-resistant genes have been found in lagoons and groundwater underlying swine CAFOs; also, 25%–75% of antimicrobials given to CAFO livestock pass unchanged into manure waste and may contaminate soil and water.[32]

What is the future for CAFOs?

Some researchers see a shift taking place away from industrial agriculture and back to family farms:

- A consumer trend toward natural, organic, and locally grown food is stimulating a resurgence of small family farms.
- The markets for sustainable/local meats and milk are the fastest growing sectors of the meat and dairy markets.
- A poll by the Humane Society of the United States found that 77% of all Iowans want to buy humanely raised, environmentally soundly produced pork.[33]

In light of the hazardous health problems pertaining to CAFOs, the influence of environmental and economic concerns, and the increasing reluctance of workers to spend time in a CAFO, it seems prudent to examine other ways to raise livestock.

Indeed, studies at Iowa State University have shown that hogs can be produced in hoop houses just as efficiently as in CAFOs.[34]

Most CAFO hogs in Jefferson County are not owned by county farmers.

From 1980 to 2003, the ten to fifteen counties in Iowa with the largest reduction in population were also counties with the largest number of hog confinements.

CAFO SITUATION IN JEFFERSON COUNTY

How many hogs live in Jefferson County?

Currently 34 CAFOs are located in Jefferson County, with most of these containing just under 2,500 hogs. A conservative estimate brings the total hog count in the county to about 60,000.

According to Jim Rubis, former head librarian at Fairfield Public Library and president of Jefferson County Farmers and Neighbors (JFAN), since 1980 the number of hogs in the state has remained stable while the number of producers has dropped sharply — significantly fewer people are involved in the livestock industry. As the CAFO industry has centralized, more control has been held outside the county; for instance, most CAFO hogs in Jefferson County are not owned by county farmers.

How have CAFOs affected nearby counties?

From 1980 to 2003, the ten to fifteen counties in Iowa with the largest reduction in population were also counties with the largest number of hog confinements. As CAFOs have proliferated, counties have been negatively impacted; not only has a positive economic impact been missing, but illness and social discord have been common.

Davis County in particular has noticed an impact. In Davis County, directly southwest of Jefferson County, the hog population has grown in the last decade from about 10,000 head to about 150,000–200,000 head. In addition to noxious odors affecting citizens living close to CAFOS, the factory farm proliferation has caused social disruption, as some residents have experienced that once amicable neighbors and cooperating farmers have turned against one another over issues stemming from CAFOs.[35]

Washington County, Jefferson's neighbor to the northeast, now has over 500,000 hogs.

What do Iowa laws have to say regarding CAFOs?

Lobbying efforts by the pork industry over the last two decades have had an impact on legislation, and state laws are now in effect that prevent counties from regulating local agriculture — including hog production.

In 1995, for example, the Iowa legislature passed House File 519, which prohibited local control over any land zoned for agriculture. Consequently, counties and local areas no longer have input over whether or where a CAFO is built.

A poll published by the *Des Moines Register* on February 5, 2007, indicated that 64% of Iowans now want more of a voice in how livestock operations are sited in their counties.

In November 2006, research scientists at the University of Iowa and the University of North Carolina called for a moratorium on livestock confinement construction and called for local control legislation. Minnesota, the third largest pork producer in the nation, and Missouri both have local control legislation in place, which has not negatively impacted hog revenues.

At the same time, the Department of Natural Resources (DNR) has seen a challenge to its power to regulate CAFOs. Bills have been introduced (none have passed) in the past year to minimize the DNR's regulatory power over factory farms.

At this point, a SAFO (Small Animal Feeding Operation) with fewer than 1,250 hogs could be built within the city limits of Fairfield with very few regulations, and manure from a confinement could be applied right up to the city limits. A CAFO housing between 1,250 and 2,499 hogs could be built 1,875 feet from the city.

A poll published by the *Des Moines Register* on February 5, 2007, indicated that 64% of Iowans now want more of a voice in how livestock operations are sited in their counties.

In November 2006, research scientists at the University of Iowa and the University of North Carolina called for a moratorium on livestock confinement construction and called for local control legislation.

What recent CAFO-related activities have affected Jefferson County?

- A proposed 5,900-head sow confinement in Batavia, which would create 6 million gallons of toxic manure a year, seems to be permanently stalled. Citizen action helped forestall the construction: Batavia homeowners and farmers were given a grant by Jefferson County Farmers and Neighbors (JFAN) to assist them in legally protecting their homes from the impact of this CAFO. This sow confinement could also have affected the county's waterways, particularly Cedar Creek, which runs northwest to southeast in Jefferson County.
- In a rare decision, a 4,300-sow facility proposed for Farson, just across the line from northwest Jefferson County, was denied a permit by the DNR because of a weak manure-management plan.
- In February 2006, landowners who had proposed a CAFO on Pleasant Plain Road across from the new Cambridge Investment Research building decided not to build, after lengthy legal discussion with opponents.
- In May 2006, the Pleasant Plain Property Association filed a lawsuit against a confinement proposed near Pleasant Plain Road and 167th Street.
- As of February 2007, six 4,800-unit CAFOs have been proposed for construction near

Martinsburg in Keokuk County, which is just over the border from Jefferson County. Two of these have already secured permits. (For five to six CAFOs of this size, nearly 5,000 acres are needed for manure application.)

- In addition to the odor nuisance, Jefferson County could be affected if the CAFO operators arrange to have manure from these facilities applied to Jefferson County farms. (Many farmers are eager to receive the free manure and use it as fertilizer, which significantly reduces their corn production costs.)

A record number of requests for CAFO permits were filed in 2006, catapulting the CAFO issue to the forefront of recent political elections.

Various organizations have arisen across the state, on a grassroots level, to monitor the spread of CAFOs.

Iowa can raise hogs profitably, sustainably, and humanely without incurring the costs that now burden county governments.

What are the key strategies currently being pursued in the CAFO debate?

Key strategies include communicating with local government officials about CAFO concerns and the desire for local control; holding discussions with farmers or individuals who may be planning to erect a CAFO nearby (and pursuing litigation if necessary); and following the Good Neighbor Guidelines outlined by JFAN to promote openness between farmers and residents in working out logistics concerning confinement facilities.

A record number of requests for CAFO permits were filed in 2006, catapulting the CAFO issue to the forefront of recent political elections. Legislators are drafting a bill addressing separation distances, Matrix requirements, permit thresholds for CAFOs, and local control, to be presented before the House and Senate. Efforts are under way at the state level through April 2007 to rally support for this legislation.

ALTERNATIVES TO FACTORY FARMS

Is there a less harmful yet viable way for Iowa farmers to produce hogs?

It is important to realize that Iowa can raise hogs profitably, sustainably, and humanely without incurring the costs that now burden county governments. Iowa has over 1,000 hoop structures that raise hogs on deep-bedded straw without resorting to inhumane confinement, industrial manure disposal, and tax breaks.

Iowa independent hog producers also raise hogs for natural livestock producers such as Niman Ranch, Organic Valley, Patchwork Farms, Eden Pork, and a number of other "alternative" and "niche market" hog brands. With the consumer trend toward natural and organic foods, farmers can see a profit while employing sustainable practices that have minimal negative environmental impact.

Another option is the creation of small farm cooperatives or regional coops, such as Country Natural Beef of Oregon and Good Natured Family Farms of Kansas. Diversification

— having three or four income-producing enterprises stemming from the same farm — is another practical way to protect against a fluctuating hog market.[36]

As noted earlier, a Humane Society of the United States poll found that 77% of all Iowans want to buy humanely raised, environmentally soundly produced pork.

Iowa has always been a key center of agriculture for the country. Perhaps it is now appropriate for the state, situated in the middle of the trend toward high-tech agriculture, to begin to seek alternatives in farming so that a sustainable solution can be reached, one that nourishes everyone over the long term — the farmer, local residents, consumers, and the earth.

CONCLUSION: PUTTING CAFOs IN PERSPECTIVE

Pigs were once viewed positively in Iowa, a key piece of the bucolic, rural farm life. With the monopoly of confinement facilities, raising hogs now ranks very low on the list of desirable rural developments.[37]

Kendall Thu, Ph.D., of Northern Illinois University, who specializes in food systems and their relationship to the health of rural communities, presented this summation of confinement operations for livestock:

> This industrialized form of agriculture tends to become disarticulated from surrounding communities, resulting in social inequities, poverty and a range of attendant social, economic and environmental pathologies. . . . A whole generation of research has demonstrated that it is simply better for the social and economic fabric of rural communities to have more farmers providing food than to have production concentrated in the hands of a few.[38]

"A whole generation of research has demonstrated that it is simply better for the social and economic fabric of rural communities to have more farmers providing food than to have production concentrated in the hands of a few."
— Kendall Thu, Ph.D., Northern Illinois University

Iowa has always been a key center of agriculture for the country. Perhaps it is now appropriate for the state, situated in the middle of the trend toward high-tech agriculture, to begin to seek alternatives in farming so that a sustainable solution can be reached, one that nourishes everyone over the long term — the farmer, local residents, consumers, and the earth.

NOTES

1. United States Department of Agriculture, National Agricultural Statistics Service, "Quick Stats: Agricultural Statistics Data Base," 2005–2006. Available: www.nass.usda.gov/QuickStats.

2. M. Honeyman and M. Duffy, "Iowa's Changing Swine Industry," A.S. Leaflet R2158, Iowa State University Animal Industry Report 2006 (Ames, IA: Iowa State University, 2006).

3. K. Hudson and The Global Resource Action Center for the Environment (GRACE), "Factory Farming: A Health and Sanitation Nightmare," presentation given at LaGrange Park, IL, March 6, 2000. Available: www.factoryfarm.org/docs/lagrangespeech3600.pdf.

4. Iowa State University and University of Iowa, *Iowa Concentrated Animal Feeding Operations Air Quality Study* (Iowa City, IA: The University of Iowa College of Public Health, 2002). Available: www.ehsrc.uiowa.edu/CAFOstudy.htm.

5. M. Schenker et al., "Respiratory Health Hazard in Agriculture," *American Journal of Respiratory and Critical Care Medicine Supplement* 158, pt. 2 (1998): S1–S76.

6. K. M. Thu et al., eds., *Proceedings, Understanding the Impacts of Large-Scale Swine Production, June 29–30, 1995, Des Moines, IA* (Iowa City, IA: University of Iowa Printing Service, 1995).

7. K. J. Donham, "The Concentration of Swine Production: Effects on Swine Health, Productivity, Human Health, and the Environment," *Veterinary Clinics of North America: Food Animal Practice* 16 (2000): 559–597.

8. K. M. Thu et al., "A Control Study of the Physical and Mental Health of Residents Living Near a Large-Scale Swine Operation," *Journal of Agricultural Safety and Health* 3 (1997): 13–26.

9. K. H. Kilburn, "Evaluating Health Effects from Exposures to Hydrogen Sulfide: Central Nervous System Dysfunction," *Environmental Epidemiology and Toxicology* 1 (1999): 207–216.

10. S. Wing and S. Wolf, "Intensive Livestock Operations, Health and Quality of Life Among East North Carolina Residents," *Environmental Health Perspectives* 108 (2000): 233–238.

11. J. Kline and S. Sigurdarson, "School Proximity to Concentrated Animal Feeding Operations and Prevalence of Asthma in Students," *Chest* 129 (2006):1486–1491.

12. M. Winne, "Scientists Point Way to Greener Pastures," *Grist Magazine*, 8 March 2006. Available: www.organicconsumers.org/articles/article_59.cfm.

13. S. Schiffman, "Livestock Odors: Implications for Human Health and Well-Being," *Journal of Animal Science* 76 (1998): 1343–1355.

14. D. Schusterman, "Critical Review: The Health Significance of Environmental Odor Pollution," *Archives of Environmental Health* 4 (1992): 76–87.

15. M. Mellon, C. Benbrook, and K. Benbrook, *Hogging It: Estimates of Antimicrobial Abuse in Livestock* (Cambridge, MA: Union of Concerned Scientists, 2000). Available: www.ucsusa.org/food_and_environment/antibiotics_and_food/hogging-it-estimates-of-antimicrobial-abuse-in-livestock.html.

16. M. Barza and S. L. Gorbach, eds., "The Need to Improve Antimicrobial Use in Agriculture: Ecological and Human Health Consequences," *Clinical Infectious Diseases* 34 (2002): S71–S144. Available: www.journals.uchicago.edu/CID/journal/contents/v34nS3.text.html.

17. Mellon, Benbrook, and Benbrook, *Hogging It*.

18. L. B. DeLind, "Parma, A Story of Hog Hotels and Local Resistance," in *Pigs, Profits, and Rural Communities*, ed. K. Thu and E.P. Durrenberger (Albany, NY: State University of New York Press, 1998), 23–38.

19. North Central Regional Center for Rural Development, "Bringing Home the Bacon? The Myth of the Role of Corporate Hog Farming in Rural Revitalization," *Report to Kerr Center for Sustainable Agriculture* (Poteau, OK: North Central Regional Center for Rural Development, 1999): 1–67.

20. J. E. Ikerd, "Economic Fallacies of Industrial Hog Production," presented at Sustainable Hog Farming Summit, New Bern, NC, January 11, 2001. Available: www.ssu.missouri.edu/faculty/jikerd/papers/Econ-Fallacies-Hogs.htm.

21. Wing and Wolf, "Intensive Livestock Operations," 233–238.

22. Hudson and GRACE, "Factory Farming."

23. D. Park, K. H. Lee, and A. Seidl, "Rural Communities and Animal Feeding Operations" (Department of Agricultural and Resource Economics, Colorado State University, 1998).

24. J. D. Lawrence, "A Profile of the Iowa Pork Industry, Its Producers, and Implications for the Future" (Staff Paper No. 253, Department of Economics, Iowa State University, 1994).

25. 2007 Code of Iowa 427.1 (19). Note that manure pits fall under the category of "pollution control."

26. Honeyman and Duffy, "Iowa's Changing Swine Industry," 1.

27. M. Seipel et al., "Rural Residents' Attitudes Toward Increased Regulation of Large-Scale Swine Production," presented at the 1999 Meeting of the Rural Sociological Society, August 4–8, 1999, Chicago, IL.

28. P. Durrenberger and K. M. Thu, "The Expansion of Large Scale Hog Farming in Iowa: The Application of Goldschmidt's Findings Fifty Years Later," *Human Organization* 55, no. 4 (1996): 409–415.

29. M. Merkel, "Threatening Iowa's Future: Iowa's Failure to Implement and Enforce the Clean Water Act for Livestock Operations" (Washington, D.C.: Environmental Integrity Project, May 2004), 12–14. Available: www.environmentalintegrity.org/pub194.cfm.

30. J. Tietz, "Boss Hog," *Rolling Stone*, December 2006, 5–6.

31. Hudson and GRACE, "Factory Farming."

32. J. C. Chee-Sanford et al., "Occurrence and Diversity of Tetracycline Resistance Genes in Lagoons and Groundwater Underlying Two Swine Production Facilities," *Applied and Environmental Microbiology* 67 (2001): 1494–1502

33. "Iowan Attitudes Towards Industrial Animal Agriculture, January, 2003," a poll of 611 Iowans conducted by Hill & Associates of Woodlands, Texas, for The Humane Society of the United States.

34. M.S. Honeyman and J.D. Harmon, "Performance of Finishing Pigs in Hoop Structures and Confinement During Winter and Summer," *Journal of Animal Science* 81 (2003): 1663–1670.

35. G. Klicker, interview with N. Pfoutz, 15 February 2007.

36. N. Pfoutz, "Silk Purses or Silver Linings?" *The Heartland Spirit*, 27 January 2005.

37. Honeyman and Duffy, "Iowa's Changing Swine Industry," 3.

38. K. J. Donham et al., "Community Health and Socioeconomic Issues Surrounding Concentrated Animal Feeding Operations," *Environmental Health Perspectives* 115, no. 2 (February 2007), abstract.

INSTITUTE *of*
SCIENCE, TECHNOLOGY AND PUBLIC POLICY

Institute of Science, Technology and Public Policy
Maharishi University of Management
1000 North Fourth Street
Fairfield, Iowa 52556

641-472-1200
caforesponse@ISTPP.org