Overview of Social Issues Related to the Swine Industry

Robert E. Mikesell[1], Kenneth B. Kephart[2], and Charles W. Abdalla[3]

INTRODUCTION

The past 20 years have resulted in significant financial and structural changes in the US swine industry. Production contracts, vertical integration and industry consolidation have been the forces behind these changes, not the least of which is an increase in the size and scale of swine producing facilities. The apparent shift away from independent pork production, on what rural residents often refer to as "family farms," creates concerns about the ownership arrangements and the implications for corporate trends in agriculture. In addition, the increased number of animals and amounts of manure produced raises the potential for conflict.

The primary sources of concern relative to swine production, are as follows:

- Odors, dust and various volatile compounds emitted from the production facilities or from the land application of manure.
- Nutrients and pathogens present in the manure and their potential impact on surface and ground water quality.
- Heavy demand for drinking and wash water in large facilities, and its impact on the local aquifer.
- Noise, flies and other nuisance factors.

As a result of these issues, neighbors often believe that the presence of large swine facilities negatively affects *quality of life, public health, and property values and the local economy*.

Pennsylvania may be unique in terms of its style and location of hog production. Our major hog producing county is Lancaster with an inventory of 339,300 hogs (NASS, 2002); it also ranks 6th in the state for human population (474,601) (US Census Bureau, 2001). Compare this to Henry County, IL with an inventory of 279,000 hogs (NASS, 2002) and a human population of 50,773 (US Census Bureau, 2001). In recent years high land prices and limited access to cropland for manure application in Lancaster County have moved most new swine facility construction to more rural counties. Despite this shift to less densely populated areas, we observe conflict with greater intensity and frequency, particularly during the proposal/permit application stage, in these rural counties compared to that of Lancaster County. For example, Tioga and Bradford counties, located in northern Pennsylvania, have seen increases in hog inventories of 6 to 10 fold over the past 10 years (5,700 to 32,100 and 3,000 to 37,900, respectively). Collectively, the human population in these counties is only about 104,000 (US Census Bureau, 2001). It's not clear why the level of concern is higher in these rural counties; it may be related to the novelty of intensive animal agriculture as well as the abundance of negative reports about swine production. See Figure 1.

[1] Senior Extension Associate, Pennsylvania State University.
[2] Professor of Animal Science, Pennsylvania State University. Presenter.
[3] Associate Professor of Agricultural Economics.

Impacts on Quality of Life

MacCannell (1988) reported that increased farm size (acres), farm sales, and mechanization all negatively affected community conditions by decreasing median family income, increasing poverty rate, and reducing retail sales. Rural residents perceive environmental risks to be higher for the larger farms, fearing a single, large scale, catastrophic environmental event more than multiple, small-scale events (Thompson, 1997).

For obvious reasons, quality of life is also related to odor. A survey of residents of Lancaster County, Pennsylvania indicated that 57% of respondents who complained about any aspect of a neighboring farm complained about odor (Jones et al., 1998).
Surprisingly, seventy two percent the participants in this study who complained about neighboring farms had direct family ties to agriculture.

Mikesell (2002) asked neighbors of eight swine operations to rate the impact of the local swine operation on neighborhood quality of life. Over one third of the 234 respondents frequently modified their outdoor plans because of odor from the local facility. More than 25% of respondents frequently complained to neighbors or friends about odors from the local facility, and over 18% frequently decided not to invite friends to visit because of facility odor. More than 20% frequently wished they lived elsewhere because of the local swine facility (Table 1).

In the same study, neighbors were asked to record a subjective odor score at their home score each evening between 1800 and 2400 during a 6-week period (0=no odor…5=intense odor). As expected, the neighbors' location (both distance and direction from the swine unit) impacted the intensity of reported odor. In general, neighbors closer to the swine facility recorded higher scores than those more distant. Neighbors to the East and South recorded higher scores than those living to the West and North. But there were also personal factors that significantly affected perceived odor intensity, including:

1) Whether the neighbor knew the operator/manager of the swine facility was related to the reported odor level. In general, the more the neighbor was acquainted with the swine producer, the lower the odor scores.
2) The more "attractive" the farm was perceived to be, the lower the odor scores.
3) As the neighbors' self-reported health rating increased, odor scores decreased.

Including the factors described above in a regression model accounted for about 33% of the variation in average odor scores.

There were also personal factors that had little or no impact on odor scores. These included: income, gender, age, education, whether the neighbor had been raised on a farm, length of time the neighbor had lived there, and the neighbor's reported knowledge of swine production.

Many neighbors commented on their odor diary cards that the intensity of odor during the study was lower than normal because the swine producer was not spreading manure. Cooperating producers had been asked to postpone manure spreading until after the project so that the impact

of the buildings and/or storages could be evaluated alone. While the comments on manure spreading were unexpected, they do reinforce the concept that land application of manure may generate more odor complaints than the buildings or manure storage facilities.

In a North Carolina study, Wing and Wolf (2000) compared quality of life as indicated by the number of times residents could go outside or open their windows. Three communities were selected: one near a 6000–head hog operation, the second near two intensive cattle feeding operations, and a third with no livestock operations within a two mile radius. Over 50% of residents living near swine operations reported that odor prevented them from opening windows or going outdoors on more than 12 occasions within the past year, compared to less than 15% of those living near a cattle operation, neighbors or non-neighbors.

Impacts on Public Health

Water pollution from accidental manure spills, application run-off, storage facility structural failure, and illegal discharge are all potential threats to groundwater. In Pennsylvania's Lower Susquehanna River Basin, about 30% of sampled wells and about 20% of sampled stream contained more than 10 mg/l nitrate-nitrogen. The major identified source of nitrate-nitrogen was animal manure used as agricultural fertilizer (Lindsay et al., 1998). Although relatively few incidents have been reported, drinking water containing high concentrations of nitrate can lead to methemoglobinemia (blue-baby syndrome) (Fan and Steinberg, 1998).

Airborne emissions can affect health through direct irritant and psychophysiologic processes (Schiffman, 1998). Health effects on swine farm workers from odorous compounds and dust have been well documented (Donham, 1990; Reynolds et al., 1996; Cole et al., 2000), and are more prevalent than those reported by grain farmers and control subjects (Dosman et al., 1997). Typical symptoms include respiratory irritation, cough, phlegm production, chest tightness, eye irritation, headache, nausea and drowsiness. Four mechanisms for symptoms have been suggested: 1) toxicological effects of volatile organic compounds (VOCs, intermediate volatile gasses generated by anaerobic decomposition of manure); 2) direct irritation of the eyes, nose, and throat; 3) VOC stimulation of sensory nerves causing neurochemical effects that influence health; 4) emotional factors that bring about symptoms. Schiffman (1998) suggested that the cause of physical symptoms is probably a combination of these mechanisms.

Donham et al. (1995) reported that the correlation between pulmonary function and exposure is highest after 6 years' exposure. Reynolds et al. (1996) suggested that dust may an important factor related to chronic changes in pulmonary function whereas endotoxins are associated with acute health affects. Reynolds et al. (1997) reported that dust, endotoxins, hydrogen sulfide, and ammonia levels 60 meters downwind from swine operations were generally below detectable limits, except ammonia, which ranged from 0.01 to 0.46 ppm and was measured at significantly higher concentrations than those upwind.

Thu et al. (1997) compared health and quality of life issues for people (n=18) living within two miles of a single large-scale swine farm and found that swine farm neighbors reported more respiratory symptoms than control subjects (n=18). In a recent review, Thu (2002) provided

evidence that the health symptoms, which are well documented among swine workers, closely parallel those reported by neighbors of large swine operations.

Wing and Wolf (2000) interviewed North Carolina swine farm neighbors (n=55) and non-neighbors (n=50) regarding physical symptoms over the previous six months. Neighbors reported episodes of headache, runny nose, sore throat, nausea, diarrhea, and burning eyes at frequencies generally two fold higher than that of non-neighbors.

In 1995, Schiffman et al. reported that neighbors (n=44) of swine operations were more tense, more depressed, angrier, less vigorous, more tired and more confused than control subjects (n=44) who did not live near swine operations.

Mikesell (2002) discovered that neighbors (n=234) of commercial swine operations and non-neighbors (n=107) who lived in similar rural areas had nearly identical self-reported health scores (1.9 vs 1.9 on a scale of 1=very healthy…5=not at all healthy). Neighbors, however, reported more frequent incidence of nausea, fatigue, and throat irritation ($P < .05$) than did non-neighbors (Table 2). When demographic differences were controlled, there were no significant differences between the two groups in regard to frequency of cough, headache, muscular aches, or chest tightness (Table 2). Neither depression nor anxiety were different between the two groups, supporting the findings of Thu et al. (1997), but not those of Schiffman et al. (1995).

Impacts on Property Values and the Local Economy

Neighbors of large swine operations often comment that property values will be reduced because of proximity to the farm and its associated odors. A Michigan study of home values concluded that every additional hog found within a five-mile radius resulted in a decline in residential property value of $0.43. Homes located near larger operations were impacted proportionally more than homes located at a greater distance (Abeles-Allison and Connor, 1990). In 1997, Palmquist found that North Carolina home values declined by 4.75 and 0.56 percent if a 2400 head finishing building were constructed 0.5 or two miles away, respectively. Missouri data indicate that farmland prices were reduced an average of $58 per acre when located within two miles of a swine farm (Seipel et al., 1998).

However, a Minnesota group studied the values of 292 rural residential properties within 3 miles of feedlots (including swine and other livestock) housing over 500 animal units (AU). Results indicated that rural property values were positively influenced by nearby feedlots (Taff et al., 1996).

A recent study (Ready and Abdalla, 2003) in Berks County, Pennsylvania indicated that landfills, airports, mushroom facilities and large livestock operations have negative impacts on property values. An implicit house price function was estimated based on 8,090 single family houses sold between 1996 and 2002, using regression analysis. Information on surrounding land use, proximity to local disamenities, and structural attributes of the houses were used to explain variation in house prices. Only the results for several potential local disamenities are presented here. Details and additional results can be found in Ready and Abdalla (2003) (http://landuse.aers.psu.edu).

The potential local disamenities examined in the study were landfills, larger animal production facilities, mushroom production facilities, sewage treatment plants, high traffic roads and a regional airport. Animal operations studied included dairy and beef cattle, swine and poultry. Larger animal facilities were defined as those greater than 200 Animal Equivalents Units (AEUs) defined in Pennsylvania's Nutrient Management Act (Beegle et al, 1987). The study defined "larger" facilities as dairies with more than 155 cows, beef operations with more than 175 cattle, swine operations with more than 1380 finishing hogs, and poultry operations with 85,300 broilers.

Several local disamenities were found to have a negative impact on nearby house prices. A landfill located 800 meters from a house decreases that house's value by an estimated 6.9%. The impact of a large-scale animal production facility on house price was about two thirds as large as that of a landfill (4.1% at 800 meters). The impacts on house price from mushroom production and from the regional airport were much less (0.4% and 0.2%, respectively, at 800 meters). The impact from high-traffic roads was small, and extended only a short distance. No significant impact was found for sewage treatment plants.

Additional analysis attempted to investigate whether different types of animal production facilities had different impact on nearby house prices. Differences in the impact due to differences in the size of the operation (number of AEUs) were not statistically significant. Further, medium-sized production facilities (200 to 300 AEUs) were found to have a statistically significant negative effect on house prices when considered apart from larger facilities. Similarly, the impact did not vary significantly by species (poultry, swine, and beef/dairy). An analysis of proximity of animal production facilities and residential properties showed that the density of single family homes around animal production facilities was lower than the average for rural parts of the county, which had the effect of reducing the potential for conflicts.

The total impact on surrounding house prices was calculated for a landfill, the regional airport, and an animal production facility. The average impact of a single animal production facility on 119 single-family residences located within 1600 meters of the facility $1,803. The total impact on all 119 houses is $214,589, or 1.7% of the assessed value of the affected houses. These figures are intended as illustrations, and should not be considered averages for similar facilities. The impact from any given animal production facility will depend on the number of houses located near the site, and on the market value of those houses absent the facility.

These estimates capture only those impacts that fall on residents who live near the facilities. They do not include costs of impacts that occur farther from such facilities, such as impacts on downstream water quality, or positive or negative amenity impacts on tourists or commuters who travel past such facilities. Until more research is conducted in more counties, care should be taken in extrapolating the results from this research to other regions. At this time, the authors have no reason to expect ahead of time whether the impact of animal production facilities on house prices will be the same, larger, or smaller in other counties.

Martin and Zering (1997) listed employment opportunities as a significant economic benefit to rural communities hosting intensive pork production facilities. Otto (1998) reported that a new

3400-sow farrow to finish facility provides 40 direct and indirect jobs, and generates nearly $1 million in employee income per year. Additionally, contract production is a source of alternate farm income for small family farms (Martin and Zering, 1997).

Neighbors of large scale-swine operations often argue that the costs to a township's infrastructure (roads, etc.) are not sufficiently offset by the taxes paid by large-scale swine operations. Abeles-Allison and Connor (1990) estimated township benefit:cost ratios for 500 and 5000 head finishing operations to be 5.64 and 3.86, respectively. State tax revenues were expected to increase by $65,000. Martin and Zering (1997) noted significant tax benefits for communities near intensive swine production.

SUMMARY

Rural residents often believe, and some evidence suggests, that the proximity of commercial swine enterprises will negatively impact quality of life, personal health and property values. These impacts are probably effects of, or concerns about 1) odors and other emissions from the swine facility or land-applied manure; 2) nutrients and pathogens present in manure that could alter surface and ground water quality; 3) water draw-down from local aquifers; 4) Noise, flies and other factors.

Our industry has aggressively responded to these concerns through the development and implementation of educational programs, and research funding. Effective solutions to these issues problems are slowly beginning to emerge, but there are a variety of personal factors that comprise an individual's perspective and there is mounting evidence that public health maybe affected by the presence of a swine operation. Hence, it may be years before swine producing systems can be successfully developed and adopted that are deemed acceptable to the concerned neighbor.

Figure 1: County map of Pennsylvania

Table 1. Responses to eight statements regarding the impact of a neighboring swine operation in Pennsylvania on quality of life. [a]

Statement	Neighbor Response (%) Never/Rarely [b]	Occasionally	Frequently
a. I expressed concern to the operator of the facility about the odor coming from it.	82.9	13.0	4.2
b. I modified my outdoor plans because of the odors from this facility.	45.2	20.7	34.1
c. I decided not to invite friends to visit because of the odor from this facility.	64.1	17.5	18.4
d. The odor from this facility made me ill.	82.5	11.3	6.1
e. I complained to one or more neighbors or friends about the odor emanating from this facility.	49.8	22.6	27.6
f. I participated in a group or community meeting protesting the odor from this facility.	83.1	9.9	7.0
g. I've wished I didn't live in this location because of the swine facility.	63.4	16.0	20.7

[a] Survey instrument contained the following wording. "Now consider how, if at all, the *large-scale swine operation located near your home* has impacted you and your lifestyle. Indicate how *often* you have experienced each of the following *in the past year*." Adapted from Robert E. Mikesell PhD dissertation. 2002. Odor remediation and siting considerations for Pennsylvania swine farms. The Pennsylvania State University.

[b] Never and Rarely responses were combined.

Table 2. Comparative frequency of reported health symptoms between neighbors of one of eight swine operations in Pennsylvania and non-neighbors living in similar, rural areas. [a]

	Neighbors (%)		Non-neighbors (%)			
Symptom	0 to 5 times [c]	> 6 times [c]	0 to 5 times	> 6 times	Model P	Contrast [b] P
Cough	73.3	26.7	82.0	18.0	.36	-
Nausea	79.5	20.5	93.9	6.1	<.01	.01
Headache	48.3	51.7	59.8	40.2	.02	.28 [d]
Muscular aches	48.5	51.5	52.0	48.0	.70	-
Chest tightness	83.1	16.9	89.8	10.2	.27	-
Fatigue	49.3	50.7	64.0	36.0	.02	.03
Throat irritation.	67.3	32.7	82.8	17.2	.01	.03
Depression	85.2	14.8	87.8	12.2	.58	-
Anxiety	83.8	16.2	87.6	12.4	.66	-

[a] Survey instrument contained the following wording. "How often in the last year have you experienced each of the following symptoms?"
Adapted from Robert E. Mikesell PhD dissertation. 2002. Odor remediation and siting considerations for Pennsylvania swine farms. The Pennsylvania State University.

[b] Comparisons were controlled for three demographic variables that differed between neighbors and non-neighbors: gender, area of residence, and history of farm residence.

[c] Zero and 0 to 5 responses were combined. Six to ten and > 10 responses were combined.

[d] Headache differed significantly for "gender". Females had more frequent incidence of headache than males (P = .03).

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