

RECEIVED

2004 NOV 12 PM 3:44

REVIEW COPY

The Relationship between Contracting and Livestock Waste Pollution

Tomislav Vukina

This paper investigates factors and mechanisms that influence the relationship between contracting and animal waste pollution. The questions raised are whether contracting worsens livestock waste management problems and how to apportion the burden of regulation between the contracting parties in a socially optimal way. The paper shows that the potential linkages between contracting and animal waste depend on scale, specialization, and concentration of animal units, as well as on division of inputs and contract settlement rules. The long-run apportioning of an increase in costs of environmental compliance depends on the integrator's market power for grower services.

Agricultural contracts are an integral part of the production and marketing of selected livestock commodities, such as broilers, turkeys, eggs, and hogs. The potential impact of livestock production on environmental quality has become a nationwide concern, particularly in areas with high concentrations of large-scale confined animal operation units, such as North Carolina and the Delmarva Peninsula. It is increasingly common for environmental advocacy groups to argue that contracting per se is a cause of environmental problems related to livestock production. Contracting increases the scale of livestock operations and simultaneously reduces opportunities for economies of scope in livestock utilization through increased specialization. An opposing view promulgated in corporate agriculture circles is that large, intensive livestock production units are, in fact, environmentally friendlier than small, family farms because they can afford technologically advanced waste management systems because of significant economies of scale.

The Clean Water Action Plan recognizes the importance of animal waste pollution as a cause of water quality problems. As of 2002, the U.S. Environmental Protection Agency (EPA) is proposing to revise and update two regulations that

■ Tomislav Vukina is a Professor in the Department of Agricultural and Resource Economics, North Carolina State University.

address the impacts of waste generated by concentrated animal feeding operations (CAFOs) on water quality. The National Pollutant Discharge Elimination System (NPDES) defines which operations are CAFOs and establishes permit requirements. The Effluent Limitations Guidelines for feedlots (beef, dairy, swine, and poultry) establish the technology-based effluent discharge standards for CAFOs. The EPA is proposing these revisions to address changes that have occurred in the livestock industries in the last 25 years. The environmental concerns addressed include ecological and human health effects. The public comment period on the proposed regulations ended July 31, 2001. The EPA plans to take final action by the end of 2002 (U.S. Environmental Protection Agency).

Two distinct characteristics of modern livestock production systems have potentially important environmental implications. The first is the shift to large-scale, intensive, specialized operations, the process often described as industrialization. There are two relevant issues here. One is the problem of different spatial allocation and land-use patterns that industrialization would bring compared with the traditional livestock production systems. The other is the issue of technological change in production and waste management practices adopted by large-scale animal operations compared with small, family farm units.

The second characteristic of the modern livestock industry is the shift from independent sole proprietorships that exchange inputs and outputs through open spot markets to farms, feed mills, and processors linked by production contracts, marketing agreements, or common ownership, the process known as vertical coordination. There are two important issues here as well. First, contracts have emerged as a form of vertical coordination in response to some form(s) of market failure. Hence, changing regulatory constraints may change the incentives on both sides of the contracts, possibly rendering the entire institutional structure inadequate. Second, the way contracts are written reflects a solution to a particular set of incentive problems. The nature of the relationship between an integrator and growers is plagued by numerous asymmetric information-type problems that contract provisions attempt to mitigate. The new set of regulatory constraints will require contract renegotiations, with welfare implications difficult to predict.

The economics literature on the relationship between agricultural production contracts and environmental pollution is virtually nonexistent, with only one paper found that explicitly deals with this issue. Preckel et al. analyze implications of contract design for nitrate-based environmental externalities generated by seed corn producers. They argue that contract insecurity, in which the probability of contract renewal depends on yield performance, distorts input use, causing an increase in nitrogen use by about 12%, resulting in a 17% increase in nitrate leaching. They advocate change in contracting practices calling for either awarding contracts by lottery or possibly modifying the contract payment function. The welfare implications of those ad hoc proposals have not been studied.

I want to accomplish two objectives in this paper. The first is to identify the factors and mechanisms that characterize the relationship between contracting and animal waste pollution. I address the question of whether contract operators have the same incentives to act as good stewards of the environment as independent farmers by intersecting the main findings from the literature on agricultural contracts with that on the economics of waste management. The second

objective is to analyze the potential impacts of anticipated waste management regulatory changes on the contractual relationship between integrator companies and contract growers and on the industry as a whole. I focus on policies frequently discussed in industry circles as having high probability of being adopted. Given that the precise nature of future changes in animal waste regulation is yet unknown, the discussion in this paper is based on two reasonable assumptions. First, the division of responsibilities for the removal and disposal of manure will be regulated toward some form of a shared responsibility between the integrators and the growers, and second, the cost of waste management would increase as a result of new regulation. Three issues dominate my presentation in the rest of the paper.

First, from the perspective of optimal contract design, shifting some responsibility for waste management from the growers to the integrator may cause significant changes in the contract structure and potentially in the entire industry organization. Instead of focusing only on providing incentives for growers to feed animals efficiently, the new generation of contracts will also need to provide incentives for the removal and the disposal of manure in an environmentally friendly manner. The notion that determining grower compensation based on objective performance measures for one task can be harmful for the integrator's interest if objective performance measures are not applied to other tasks may explain the tendency of employment contracts to utilize fixed wages (e.g., Holmstrom and Milgrom; Baker). This is because complex contracts involving pay-per-performance schemes may distort incentives to the point where paying workers fixed salaries may be the best available option. In a regulatory context, one might similarly conclude that the frequent tendency toward command and control regulation in place of incentives-based instruments, such as taxes and subsidies, may be caused by similar multitasking concerns (Slade).

Second, given that a significant proportion of livestock production is taking place under contracts,¹ the question of whether growers or integrators will ultimately carry the regulatory burden becomes critical in all future policy discussions and evaluations. Traditionally, the economics literature has addressed the question of a cost pass-through (CPT). The CPT describes the concept of regulatory compliance costs or other shocks occurring at one point in the production-marketing-consumption chain being passed through to later levels by means of higher prices. If an industry can pass on some of the cost of compliance to others, the impact of the regulation on the regulated industry will be reduced. Whereas the concept of CPT under a perfect competition assumption is reasonably straightforward, the realities of market concentration, regional trading, and vertical integration complicate the analysis considerably.²

The final question is the issue of liability for damages caused by accidental waste spills among the contract parties. The recent trend in U.S. environmental law has shown a tendency toward increased liability faced by lenders to so-called judgment-proof firms, that is, firms that can cause accidents and go bankrupt without having sufficient assets left to compensate the victims (Pitchford). Making parties who are involved in a project liable, although they have little direct means to prevent the accident from occurring, is known as vicarious liability (Sykes). From the perspective of this paper, an interesting question involves the conditions under which the vicarious liability of the integrator contracting the grow-out of

animals with judgment-proof growers can increase the incentives for accident prevention.

In what follows, I describe the main characteristics of contracting in animal agriculture, review the economics of animal waste management, and discuss different frameworks to analyze the impacts of contract regulation. I also address the problem of compliance cost incidence and discuss the liability issues, followed by conclusions and an outline for possible future research.

The Nature of Contracting in Animal Agriculture

Almost one-third of the total value of production on U.S. farms is produced under contractual agreements (U.S. Department of Agriculture). The expanding role of contracting in total agricultural production is primarily the result of the increasingly sophisticated marketplace, where consumers are requiring a more uniform product supply and standardization in quality. Contracts are one vehicle through which food processors and marketers can rapidly respond to changes in consumer preferences.

The growth in contracts as a means of organizing agricultural production has been staggering. In 1969, only 156,400 farms, or about 6% of all farms, used production and/or marketing contracts. The value of production under contract totaled \$5.4 billion or nearly 12% of the total value of commodities sold. By 1993 11% of farms used production and/or marketing contracts and the total value of production under contract had increased almost nine times to \$47 billion or 32% of the total value of commodities sold. Most of the value of the contracted production was produced to fulfill marketing contracts. Only slightly over one-third of the contracted value was produced in conjunction with production contracts, where the contractor retains ownership of the commodity (U.S. Department of Agriculture).

Agricultural contracts can be classified into two broad groups: marketing and production contracts. *Marketing contract* refers to an agreement that sets a price or a pricing mechanism and an outlet for the commodity before harvest. Most management decisions remain with the growers since ownership is retained while the commodity is being produced. The farmer also assumes all risk of production but shares price risk with the contractor. Examples of marketing contracts are forward contracting and price setting after delivery based on a predetermined formula that considers grades and yields. *Production contracts* specify in detail production inputs supplied by the two parties, the quality and quantity of a particular commodity, and the remuneration mechanism for the grower. Because contractors control the volume of production and the practices used, they tend to dominate the terms of the contract. In addition, farmers themselves can be contractors. Oftentimes, a farmer will contract with another farmer to complete a stage of production in raising livestock. Various types of joint venture agreements between farmers and shippers/processors are also observed.

Livestock contracts are typical examples of production contracts. A production contract is an agreement between an integrator company and a farmer (grower) that binds the farmer to specific production practices. Livestock contracts have two main components: the division of responsibility for providing inputs, and the method used to determine grower's compensation. Growers provide land,

housing facilities, utilities (electricity and water), and labor, and are typically responsible for compliance with federal, state, and local environmental laws regarding disposal of dead animals and manure. They usually pay any charges imposed by a rendering plant or other dead animal disposal method. An integrator company provides animals to be grown to processing weight, feed, and medications and services of field men. Typically, the company also owns and operates hatcheries, feed mills, and a processing plant, and provides transportation of feed and live animals. Items like fuel or bedding can be the responsibility of either the integrator or the grower, or they can be shared. In some contracts, the integrator reimburses the growers for a percentage of the rendering plant costs but not for any costs associated with manure management (National Pork Producers Council). The integrator also decides on the volume of production both in terms of the rotations of flocks or batches on a given farm and the density of animals inside the house.

The various stages of animal production are typically covered by different contracts, and farmers generally specialize in the production of animals under one contract. For example, chicken production involves raising broiler breeder males and pullets, housing the mature breeding flock for the production of hatching eggs, and producing (growing-out) commercial broilers. Turkey production is mainly organized via contract production with a standard technological unit consisting of one brooder house and two finishing houses covered by one contract. Production technology is gradually changing towards separate (all-in, all-out) brooding and finishing operations. With this new management practice, the farmer specializes either in the brooding or finishing turkeys, and two stages of the production process are covered by separate contracts (Vukina).

The swine industry has the greatest variety of production contracts. Single production stage contracts (such as farrowing contracts), nursery contracts, and finishing contracts are the most frequently observed. Some integrators combine several production stages under one contract. These are known as farrow-to-finish contracts and the most recently introduced, wean-to-finish contracts.

Virtually all livestock production contracts are settled based on one of three compensation methods for growers. The first is a "base plus bonus" payment per pound of gain (live weight) transferred, where a bonus payment reflects some efficiency measure, such as feed conversion. The second compensation method is a "base payment per live animal transferred" with bonuses for efficiency. Bonuses for reduced death loss and uniformity are also common. A third compensation method popular in the upper Midwest for hog finishing contracts and wean-to-finish contracts involves paying the grower on a "per-pig space, per-year" basis (National Pork Producers Council). Most of the production contracts also have minimum guaranteed payment and disaster payment clauses. Neither one would apply if the grower were grossly negligent of production responsibilities.

The most widely used compensation schemes in the livestock sector are payments per pound of live weight delivered plus bonuses for efficiency. Most of the finishing contracts are based either on a tournament or some form of a fixed performance standard. In a tournament, the payment is determined by comparing the individual grower's performance (e.g., the feed conversion ratio—the pounds of feed used to produce a pound of live weight) with the group average. For a below-average feed conversion (i.e., above-average performance), the grower

receives a positive amount over the base payment. If feed conversion is above average (i.e., below average performance), the grower receives a penalty.

A second type of grower remuneration is based on a fixed performance standard. Unlike a tournament where the benchmark for comparison is determined by a contest among growers, in a fixed performance standard, growers are competing against a predetermined constant feed conversion ratio.

The efficiency gains from contracting in the livestock sector have been substantial. Vukina explained the emergence of contracts with independent farmers in the poultry industry by the formation of economic circumstances that required adequate mechanisms to facilitate risk sharing (provision of insurance), technological progress and innovation dissemination, response to consumer demand for product reputation and uniform quality, and access to capital. At the same time, these four categories summarize the most important benefits that the widespread adoption of production contracts has generated.

The form of contracting used in the broiler industry (cardinal tournaments) shifts nearly all risk to the integrator, except for the small portion of the growers' idiosyncratic risk (Knoeber and Thurman). The likely explanation for the weak relation between price risk and broiler supply (Aradhyula and Holt) is not that price risk is small, but that all risk is shifted to large, sometimes publicly owned integrator companies who have small risk-bearing costs even though the risks themselves are rather large. The rapid technological change generated tremendous productivity gains resulting in a significant reduction in the cost of production that has been largely passed on to consumers via lower poultry meat prices. This increased productivity came about through disease control, development of genetically superior breeding stock, and innovations in animal nutrition. Contracting and vertical integration have given the poultry industry greater control over product volume and quality, which turned out to be especially important in meeting the needs of large food-away-from-home establishments and supermarket chains. The rapid expansion of the broiler industry was also facilitated by relatively easy and inexpensive access to capital through federally insured loans for construction of housing facilities. Grower provision of capital provided an efficient way for integrators to finance expansion, with a positive employment feedback to the growers.

Substantial benefits of vertical coordination via contracts with independent growers are visible in the hog industry as well. According to Key and McBride, contracting appears to be increasing the total factor productivity of the swine industry by 24%, resulting in 29% more output for a contract operator compared with an average independent farm. Contracting appears to raise productivity despite the fact that contract operations do not use more capital per unit of output or take on relatively more debt. The authors argue that higher productivity of contract operators may be due to a transfer of know-how from integrators to growers, especially concerning feed mixtures and feed timing, that results in better feed efficiency and lower labor costs. In addition, other inputs provided by the integrator, such as veterinary care and genetic selection, may be superior to those available to an independent producer, resulting in healthier animals and greater weight gain.

Despite unprecedented success of production contracts, recent years have been characterized by an increasing number of dissatisfied contract growers

and more concentrated efforts on both federal and state levels to place some legal constraints on the type of contracts integrators and growers can sign. The Producer Protection Act is advocated by 16 state attorneys general and a similar bill has been introduced by U.S. Senator Harkin.³ Growers' complaints in the broiler sector focus primarily on tournament schemes. They are opposed to a system that bases payments on how well or how poorly their neighbors perform. In addition to concerns about the settlement process, growers have also complained about the genetic quality of animals they receive, the way that live animals and feed are weighed, and the length of time between flock/batches placements. They also complain about contract nonrenewal, contract terminations, requirements that facilities be modified or upgraded (excessively), their limited choice of integrators or their inability to change integrators, and alleged integrator reprisals for joining grower associations and for seeking redress of grievances.

The literature on the economic impact of integrator practices and procedures on contract growers and the need for government regulation of contracts is rather small. Lewin argued that by requiring growers to make large specific investments in housing facilities, integrators can increase grower incentives without increasing compensation, since the risk of losing the investment will increase growers' fears of low performance. Lewin concludes that grower complaints about excessive investments may be theoretically justified, especially in geographical regions where the integrator enjoys market power.

Analyzing the welfare effects of the regulatory proposal to ban tournaments and replace them with fixed performance standards, Tsoulouhas and Vukina (2001) showed that such a regulation, absent more specific rules, could actually be harmful to growers. Growers will be unequivocally better off only under a fairly complicated regulatory mechanism that includes the prescription regarding the slope coefficient of the bonus payment, the so-called piece rate. This improvement in grower welfare will invariably come at the expense of the integrator, and society may or may not be better off depending on the technology and preferences.

Economics of Animal Waste Management

Pioneering work by Henry and Seagraves presented the basic economics of animal waste management more than 40 years ago. While addressing the economic aspects of broiler production density, they recognized potential environmental problems that may arise with the expansion of the industry. They noted that manure is a valuable by-product if it can be used to fertilize crops located near the livestock production facility. Because the marginal productivity of fertilizer drops towards zero as higher levels are applied, there are finite limits to the amounts that can be used profitably. Since manure is bulky relative to its fertilizer value, it is unprofitable to haul long distances. Therefore, if the available manure per acre of cropland in a given supply area exceeds the level of profitable application, its value should drop sharply.

Manure Value

The central task in most of the empirical literature on economics of animal waste is the determination of the manure shadow value under different scenarios. The

two most important factors that determine the net value of manure are its nutrient content (as a fertilizer or feed ingredient) and the distance it needs to travel before it can be used. The main problems in using manure are that nutrients in manure are diluted, they are mixed in relative proportions that are inappropriate for most plant and animal uses, and nutrient content in manure varies over time and with disposal practices. The low concentration of nutrients in manure means that the costs of storage, transportation, and application per pound of nutrient are high compared with commercial fertilizers or other feed ingredients. As an example, a ton of fresh swine manure may contain only 12 pounds (0.6%) total N, 9 pounds (0.45%) P₂O₅, and 9 pounds (0.45%) K₂O (Martin and Zering).

The inappropriate mix of nutrients means that the value of manure in use is less than the sum of the value of the nutrients it contains. For example, an acre of bermuda grass hay receiving 300 pounds of N from anaerobic lagoon effluent may utilize only 45% of plant-available P₂O₅. If manure is spread over a larger area so that phosphorus is fully used by the crop, the additional cost of applying the manure exceeds the value of the additional phosphorus utilized. A supplemental application of nitrogen also is required to meet plant needs, so total application costs may be further increased (Martin and Zering).

Finally, the nutrient availability in manure and its value depends on the waste management technology used by the livestock farm. For example, the value of manure treated in an anaerobic lagoon is greatly reduced because much of the nitrogen is lost to the atmosphere and much of the phosphate precipitates to the bottom of the lagoon. Hence, with anaerobic lagoons, the cost of delivering nutrients is always greater than the value of nutrients (Fleming, Babcock, and Wang).

The negative shadow value of the lagoon-based manure has been confirmed in other empirical studies as well. In frequently cited studies, Roka and Roka and Hoag developed a model of a prototypical swine finishing operation representative of North Carolina conditions where livestock management decisions and manure handling decisions are treated as a joint product. Using a mixed-integer-programming algorithm, they solve for optimal manure management decisions in a system that could simultaneously consider multiple management alternatives such as treatment, transportation, and crop type. A sensitivity analysis on herd size, crop type, crop yield, treatment type, and transportation distance yielded consistently negative manure value and found that it had no impact on live-weight decisions of market hogs. In addition, since the bulk of irrigation costs are fixed, manure production exhibited significant economies of scale. A 5,400-head operation experienced 10% lower costs of manure disposal than a 600-head operation.

In a complementary study of swine production conditions in Iowa, Fleming, Babcock, and Wang found that when slurry basins are used for storage, the cost of delivering manure nutrients can be less than the value of the nutrients. However, as herd size increases, marginal delivery costs eventually become greater than marginal benefits. The largest profit from slurry storage is earned for a herd size of 6,900 hogs when the facility is located in an area where only corn is grown (instead of typical corn-soybean rotation), basing manure applications on a P-standard and incorporating the manure into the soil. Using a P-standard rather than an N-standard forces a producer to apply manure to more

acres, but more of the potential value of the manure is captured because less excess nutrients are applied. Also, the benefits from conserving N through soil incorporation outweigh the additional costs of soil incorporation. As herd size increases, costs of following a P-standard rise faster than the costs of following an N-standard. Therefore, following an N-standard on continuous corn would eventually minimize net losses.

Despite the results showing slurry basins as the optimal manure storage technology for Iowa conditions, some Iowa hog producers still use anaerobic lagoons for several reasons. The first is that the amount of land available to actual farms for spreading manure is much more limited than is assumed in Fleming, Babcock, and Wang simulations. This, *ceteris paribus*, favors the use of the lagoon as the cost minimizing method of disposing of manure nutrients.⁴ Second, as the number of hogs on a site increases, the cost disadvantage of a lagoon decreases. Hence, producers with a large concentration of hogs may choose an anaerobic lagoon to minimize losses from manure handling. Finally, certain types of swine operations work more efficiently with lagoon systems than with slurry basins. For example, modern farrowing facilities typically use lagoon effluent for flush water instead of fresh water. The production cost advantages in these facilities likely outweighs the disadvantages of higher manure delivery costs.

Size and Concentration

The production and management of animal waste generates many potential external effects. Innes (1999) mentions three groups of externalities: (a) nutrient runoff and leaching from application of manure to cropland, (b) accidental spills and leaks from waste storage facilities, and (c) direct ambient air pollution from feedlots and storage facilities including odors and ammonia gases. The surveyed literature seems to indicate that the environmental impact of livestock production is largely independent of asset ownership and market organization but is mainly determined by production technology and the nature of environmental externalities. Therefore, our investigation of the links between contracting and waste management reduces to the investigation of the systematic differences in the size and the concentration of contract-based versus the independent livestock production units.

Innes (2000) shows that given the existing government standards for waste handling systems,⁵ livestock producers have incentives to produce too many animals in operations that are either larger or more populated than is efficient, or both. This is because increased animal production raises environmental costs by increasing the size of potential waste spills, the level of excess manure application, and ambient pollution generally. Also, a given level of regional production could be achieved with smaller than efficient numbers of facilities.⁶ When the government cannot directly regulate manure application, producers will always choose to spread more manure to nearby croplands than the exact substitution for chemical fertilizer would require. The degree of excess manure application rises with the size of an operation and with the proximity of the field to the storage facility. The intuition is that by applying manure on any given field, a farmer not only receives the nutrient benefits but also saves on the transportation costs

relative to applying the same manure on a more distant field. These results show that the use of animal waste as a fertilizer worsen nutrient runoff and leaching from croplands regardless of whether the livestock producer is a contract operator or an independent farmer.

A meaningful comparison between the sizes of the livestock production units owned by independent producers versus contract operators can only be done with hog production data because virtually all broilers and, to a large extent, turkeys are produced under contracts. Using the 1998 USDA Agricultural Resource Management Survey (ARMS) data, Key and McBride showed that contract hog growers produce on average over three times as much as independent producers and are much more likely to be in the larger-scale categories. While the impact of contracting on productivity appears to be sizeable, Key and McBride found that contracting did not have large scale-effects. In other words, contracting appears to be raising productivity for all size operations. This result suggests that greater productivity of contract operators is not a major force driving the increase in the scale of production of hog farms. On the other hand, production technology, which displays increasing returns to scale regardless of the ownership structure, does serve as a motive for increasing the size of the operation.

The difference between contract-based and independent production operations seems to be insignificant when it comes to industry concentration. Arguably, contract production would always result in high concentration of livestock production facilities in a given area. To minimize transportation costs, an integrator company would want its growers to be located close to the feed mill and processing plant. However, there is also a tendency for the independent livestock producers to concentrate in certain geographical areas due to significant agglomeration economies. Vukina and Wossink found an excellent example in the manure surplus regions in the Netherlands. The established network of feed mixers, slaughtering plants, specialized construction companies, extension specialists, veterinarians, and banking services geared around the specific needs of livestock producers, as well as the local availability of skilled labor, became an important factor of industry growth.

Even if industry concentration in a region dominated by contract producers is larger than in a region dominated by independents, in contrast to Innes (2000), one can argue that the high concentration of livestock facilities in a given geographical area is not necessarily inefficient. In a hedonic study of rural residential house sales in North Carolina, Palmquist, Roka, and Vukina showed that proximity to hog operations caused a statistically significant reduction in house prices of up to 9%. However, the negative effect on property values caused by constructing a new hog farm is felt more where the initial hog population is low. As an area becomes more saturated with hogs, both the dollar loss and the percentage price reduction from the addition of a new hog operation become smaller. For example, in an area with few hogs, building a 2,400-head finishing operation within one-half mile of a house reduces its value by over 8%. However, if the area already has a large number of hogs, adding the same operation within one-half mile of a house causes less than 0.3% reduction in value. These results suggest that social welfare would be enhanced by directing livestock industry expansion towards areas where concentration of animal units is already high rather than

trying to distribute future animal industry growth more evenly across the entire landscape.⁷

Contracts as Incentives Mechanisms

Among the three groups of externalities that production and management of animal waste generates, nutrient runoff and leaching and air quality problems (ammonia emissions) are the most pervasive ones. For all of them, nutrient management plays a critical role. Nitrogen and phosphorus are the nutrients of greatest concern. The amount of nutrients that ends up deposited in the environment is directly related to the composition of animal feed. Tension in the production contract arises because the integrator owns the feed and decides about its composition, thus determining the nutrient content of the manure. Growers own the manure and are legally liable for its removal and disposal. In a frictionless economy, assuming that the nutrient content of feed and therefore of manure can be costlessly observed by the grower, the net benefits of nutrient application (or costs if the shadow price is negative) should be, in principle, incorporated into the payment schedule of a production contract. The Coase theorem⁸ would suggest that, from an efficiency perspective, it matters little who bears responsibility for waste disposal and who decides on feed formulations.

One of the reasons the net costs or benefits of the nutrient application cannot be easily incorporated into the payment schedule of a production contract is that shadow value of the manure and its individual components depends on many exogenous factors. As mentioned earlier, most empirical studies on the economics of animal waste suggest that the majority of producers derive little or no economic benefit from applying manure to cropland. However, these results are not only spatially and scale sensitive, but also significantly dependent on the relative prices of agricultural commodities.⁹ The shadow price of manure can also change in response to frequent changes and fine-tuning of the environmental regulatory policies and requirements. The change in the shadow value of the manure would require adjustment of the payment mechanism and other possible contract provisions through renegotiations. Frequent contract renegotiations impose substantial transaction costs on both parties and are highly impractical, so parties may seek alternative ways to regulate their relationships.

A Standard Agency Theory Approach

The asymmetric information nature of the livestock contracting and waste management problems is perhaps the most important reason for the failure of the negotiated settlement to produce a socially desirable outcome. Since the interests of growers and integrators are not in unison, an integrator offering a contract needs to align the incentives to induce growers to act in the company's interest. The problem is magnified by the fact that the integrator (principal) cannot directly observe the grower's (agent's) action (effort) and the outcome (output) is influenced by immeasurable effects of random factors (such as weather).¹⁰

The conflict of interest between the contracting parties arises because the agent's effort contributes to increased output—the same output that the principal's income positively depends on. Therefore, the principal wants the agent to work

hard. But the effort generates disutility to the agent who has a tendency to work less hard than the principal would like. Because of imperfect information on the agent's effort, the principal cannot specify and enforce the desired level of effort. In addition, because of the stochastic nature of the production process, the principal cannot verify whether the agent's shirking or the unfavorable state of nature causes a bad outcome. Making the agent's income dependent on the consequences of his effort mitigates the nonalignment of work incentives. However, this design makes the agent's income variable as a consequence of the presence of random shocks that influence the outcome. Hence, the result of the agent's effort would depend not only on his own actions, but also on uncertain factors beyond his control. Being risk averse, the agent prefers a certain income to an uncertain income. The optimal contract needs to strike a balance between providing incentives for the agent to exert effort and alleviating his exposure to risk.

As mentioned before, the payment mechanism in most of the livestock contracts combines the existing division of production responsibilities with a piece rate and some type of a relative performance bonus. The literature on agricultural contracts has shown that when it comes to efficient utilization of standard inputs (such as conversion of feed into pounds of live animal weight), such relative compensation schemes solve the moral hazard problem of both the agents and the principal (Tsoulouhas). In fact, absent bankruptcy concerns, a two-part piece-rate tournament provides a linear approximation of the optimal incentive scheme when agents are homogeneous in their abilities (Tsoulouhas and Vukina, 1999). With heterogeneous agents whose abilities can be observed by the principal, a menu of individualized contracts is optimal. The fact that individualized contracts are rarely observed is most likely the consequence of sizeable screening, administrative, and other transaction costs (Levy and Vukina). The currently observed payment mechanisms are unlikely to be optimal after contemplated regulatory changes take effect because different kinds of moral hazard problems would emerge over and above those already inherent in efficient animal fattening practices.

The intensity and bias of the moral hazard would depend on the division of responsibility for waste disposal because monitoring the nutrient content of feed and manure disposal is costly and imperfect. Each party cannot observe the effort exerted by the other. Also, some companies may perceive the exact feed formulations as trade secrets, and may be unwilling to disclose them publicly, fearing competition.

There are two ways the integrator can impact the nutrient content of manure through changing feed formulations. First, substituting synthetic amino acids for crude proteins (corn, soybeans) in animal feed can reduce the nitrogen content in manure up to 20% (Ferket et al.). The cost-efficiency of feed formulation is highly dependent on relative prices of competing inputs. When prices of corn and soybeans are high, replacing crude proteins with synthetic ones may be profitable. When prices of feed grains are low, absent any regulatory or other incentives, the feed rations will be based on crude proteins with high nitrogen in manure.

Second, changing animal diet can also reduce phosphorus pollution. Phytic acid constitutes approximately 65–75% of the total phosphorus in corn and soybeans. However, the problem is that phytic acid phosphorus cannot be digested by monogastric animals (pigs, poultry) and is excreted in manure. Therefore,

producers add inorganic phosphorus to diets to meet nutritional requirements of these animals. One way to increase the availability of phytic acid phosphorus is to add phytase to the ration to convert phytic acid into inorganic phosphorus. When phytase is added to the diets, inorganic phosphorus supplementation can be reduced 30–50% and still maintain optimal performance. The rations based on phytase are \$2–3 per ton more expensive than the regular inorganic phosphorus diets (Ferket et al.). While the use of phytase in animal rations benefits society by reducing phosphorus pollution, the cost is exclusively borne by the integrators. When responsibility for waste disposal remains with the growers, absent other incentives or regulation, the integrator will have limited incentives to mix the feed using environmentally friendly formulations.

While the integrator determines the feed composition and the type of waste management technology (slurry basin, lagoon, etc.) utilized, the growers can control nutrient pollution from animal waste by implementing environmentally friendly management practices. For example, reduced tillage, cover crops, and buffer strips can appreciably reduce phosphorus inputs to surface waters. If the waste disposal responsibility lies with the integrator, growers will have limited incentives to use best management practices that reduce nutrient runoff and leaching. Consequently, the contracts will have to be changed to accommodate the new circumstances.

Bontems, Dubois, and Vukina studied the problem of optimal regulation of private production contracts with environmental externality using generic policy instrument (tax/subsidy). They modeled a trilateral relationship between the regulator (EPA), the principal (integrator), and the agents (growers) with the technology characterized by a joint production of output (live animal weight) and pollution (waste). They found that in this three-tier hierarchy involving either a single-sided or a double-sided moral hazard problem, the principle of equivalence across regulatory schemes generally holds. In both situations, regardless of the tax legal incidence, for a given amount of tax revenue, the regulator can obtain the same outcome. The only task is to determine the optimal total tax revenue in each state, because any sharing of the tax burden between the principal and the agent would result in the same optimal solution. The results provide an important extension of earlier work by Segerson and Tietenberg, who studied the structure of penalties in a three-tier hierarchy under risk neutrality for all parties and moral hazard on the agent's side. They showed that the efficient outcome can be reached by imposing a penalty on either party.

Multitasking

In light of new regulation potentially forcing integrators to accept part or all responsibility for waste management, designing a new incentive-compatible contract may be so complicated that companies may seek alternative ways to organize their livestock production. The potential problem can be best explained by understanding that the standard agency theory considers only the agent's incentive to exert a single-dimensional effort. However, the production of animals involves at least two distinct types of effort, one related to the job of fattening the animals and the other related to manure management. Compensation schemes often

have unintended consequences resulting from agents changing their actions in ways privately beneficial to them, but harmful to their employers. Therefore, a potential cost of the pay-for-performance schemes is not only that they impose risk on agents, but also that the agents can "game" the evaluation procedure to their advantage (Prendergast). This arises because many jobs are too complex for all their aspects to be contracted over. Consequently, an agent could focus too much on the tasks covered by the explicit contracts at the expense of those not included. This type of distortion has become known in the literature as "multitasking" (Holmstrom and Milgrom). For example, if the integrator offers a higher return for feeding animals efficiently than for spraying the lagoon effluent according to the agronomic rates, the grower will allocate all his effort to reducing the feed conversion ratio, assuming that the cost of effort is the same for both tasks. This would happen even if the integrator would prefer that a grower allocate time to both tasks. To induce the agent to allocate time to both activities, the same incentives must be offered, even if this is not otherwise optimal. As a result, multitasking imposes constraints on the trade-off between risk and incentives.

Starting with the seminal papers of Holmstrom and Milgrom and Baker, economists have increasingly speculated that the existence of multitasking concerns may partly explain the tendency of employment contracts to use fixed wages rather than pay-for-performance schemes. This argument could be extended to the problem of integrator/grower shared responsibility for animal waste management. Once waste management becomes the responsibility of the integrators, they would have to contract with growers based on some type of waste management performance measure. For the most part, the measure would be different and independent of feed conversion ratio or other similar cost efficiency measures. Also, the waste management job is probably too complex for all aspects to be contracted. Instead of offering rather complicated contracts, which growers can possibly game to their advantage, the integrators may be tempted to offer simple wage contracts. Notice, however, that this type of remuneration changes the nature of the relationship dramatically and brings it substantially closer to the model of vertical integration via company-owned livestock farms that employ wage labor.

Finally, some of the multitasking problems may be solved through the ownership of assets (Prendergast, footnote 24). For example, a worker employed on piece rate may not take due care of the machinery because the incentives are simply to produce as much as possible in a given interval of time. In contrast, an agent who owns his machinery has better incentives to exercise proper care and would allocate his time to both production and maintenance. Notice that in the context of integrator-grower relations, the ownership of assets solution to the multitasking problem is similar in spirit to transferring the responsibility for waste management back to the grower.

The Incidence of Regulatory Compliance Costs

Regardless of the final version of the new EPA livestock waste management regulation, it is safe to assume that new CAFO rules will increase the cost of producing livestock. Independent of the federal government, states are also considering new initiatives to regulate the concentrated livestock production

facilities within their jurisdiction. For example, North Carolina signed an agreement with Smithfield Foods, Inc., and Premium Standard Farms to provide resources for the development of "environmentally superior technologies" to traditional lagoon/spray field systems for treating swine waste. It is not known which of the alternative technologies will show the most promise; however, it is almost certain that the new technology will be more costly to implement than the traditional lagoon and spray field. If mandated by law, the implementation of alternative waste management technologies could have significant negative effects on the ability of the swine industry to compete successfully in increasingly open domestic and foreign markets.

The degree of cost pass-through is an important assumption in the analysis of the welfare consequences of government regulation. If an industry can pass on some of the cost of compliance to producers or consumers, the impact on the directly regulated industry will be reduced. Much of the empirical research in this area has tried to quantify the extent of packer/processor control in the livestock sectors, notably in the beef industry. Because of the high level of market concentration in this industry, there is concern that beef packing firms could exercise market power in the purchase of finished cattle by keeping cattle prices below competitive levels. In addition to oligopsony issues, cattle producers have expressed concerns about packer-owned feedlots and captive supplies (Azzam and Anderson). If any of these issues substantially affect finished cattle prices, they will affect the cost pass-through. The idea is that if meat packers can force the price of live animals below the perfectly competitive price, then producers will have little opportunity to pass on costs of regulatory compliance.

The organization structure of livestock production is characterized by independent producers, vertically integrated firms with company-owned production facilities, and vertically integrated firms with production contracts with independent farmers. The issues related to the farm-level price formation in livestock industries dominated by production contracts, such as broilers or turkeys, are different from those in the industries dominated by independent producers, such as the beef sector. One important difference is that the payment per pound of live weight that a contract grower receives does not reflect the marginal cost of producing a pound of meat. Instead, it represents only the compensation for production factors that contract growers provide (housing, utilities, labor). Of course, these payments can also reflect a degree of market power of the integrator on the market for growers' services. Also, the contract-based price received by growers is de facto net of the risk premium that farmers are implicitly paying to the integrator for income volatility insurance. As mentioned earlier, all production contracts transfer significant aggregate risk from growers to integrators, a phenomenon that is entirely absent when goods are exchanged via regular market transactions.

Figuring out the distribution of regulatory costs in the hog industry will surely prove even more difficult because of the parallel existence of spot markets and production contracts. Kliebenstein and Lawrence characterize the pork industry in transition, with the shift from the beef to the broiler production model occurring at different rates in different regions of the country. Old production areas (Iowa) tend to function with spot markets while newer production areas (North Carolina) tend to use contract production. This dichotomy creates problems, as spot markets

are getting thinner and risk seems to be shifting from those with contracts to those without them. The increasing share of the production contracts between integrators and independent growers, as well as the integrator-owned farms in the overall supply of live hogs, can be perceived as deteriorating competition and price discovery in the swine industry. The phenomenon is quite similar to the effect of increasing captive supplies in the beef sector. The argument is that, as captive supplies replace independent swine production and provide a substantial portion of packers' needs, the price received by independent producers must necessarily go down (see Perry). Alternatively, spot market prices may be depressed because of higher transaction costs, product variability, and poor quality, regardless of whether market power is exercised or not (Paarlberg et al.).

Aside from the standard market power issues well documented in Azzam and Anderson, the degree of CPT in a vertically integrated industry using production contracts with independent farmers is likely to depend on the market power of the integrator on the market for growers. The large national companies (Smithfield Foods, Tyson, etc.) that run their businesses through smaller profit centers spread throughout the country dominate livestock contract production. Different areas are characterized by different levels of competition for growers. In some areas companies have difficulties signing up enough growers; in others growers have no feasible opportunity to defect and seek contracts with other companies.

In situations where an integrator has a substantial monopsony power in the market for growers, it is reasonable to observe contracts where growers earn zero expected rents. The CPT solution in this kind of market structure may show that regardless of how the regulatory burden is initially levied, the cost of compliance always ends up being borne by the integrator. This is because the growers' participation constraints were binding even before the new regulation was imposed (i.e., they are making exactly their reservation wage), so growers would not accept contracts offering worse terms.¹¹ However, assuming that contracts between the firm and the agents can be optimally revised following a change in the regulatory structure, all regulatory schemes would generate essentially identical results (Bontems, Dubois, and Vukina).

Liability

Another possibility for providing incentives to livestock producers to act like good stewards of the environment is to make them liable for the actual damage they cause rather than regulating them *ex ante*. The liability arises under the common law of private and public nuisance and is enforceable through courts. The theoretical literature dealing with liability as a policy instrument descends mainly from the Coase theorem, and its main focus is on the efficiency properties of liability schemes and their comparison to explicit government intervention of the classical Pigovian sort. Under certain assumptions (small number of both polluters and damaged parties and negligible transaction costs) the liability approaches have been shown to be roughly equivalent in efficiency properties and superior to Pigovian taxes when behavior of agents is not cooperative (see Bohm and Russell).

The liability system may be a desirable way to approach problems for which information is scarce and expensive. An example of this is accidental waste spills

from large-scale confined animal operations, which occur quite rarely.¹² In such circumstances a designation of liability with the payment guaranteed by a performance bond or insurance policy could be appealing. However, the choice of a liability approach suffers from some serious disadvantages. Unless some special process of enforcement was designed up front, damaged parties would still suffer real damage, have to hire lawyers, and go to court to claim their entitlements and they would have to prove the connection between their damages and the act of the responsible party (Bohm and Russell).

One of the important goals of liability law is to provide the potential injurers with proper incentives to take adequate care in their actions. However, making firms liable for damages they cause fails to achieve a socially efficient outcome if the firm lacks resources to pay. In other words, injurers may sometimes cause damages in excess of their resources. This is what has been labeled in the literature as the *judgment proof* problem (Shavell) or the problem of the *disappearing defendant* (Summers). These authors suggested that the potential insolvency can cause a reduction in care levels under strict liability because firms care only about the costs that they might actually have to pay. Second, wealthier firms or individuals may take greater care than poorer ones because they have more to lose and are less likely to escape paying damages through bankruptcy.¹³ Translated into the context of livestock production contracts, facing increasingly stringent environmental regulation, growers are exposed to substantial risks of large penalties for environmentally hazardous disposal practices and especially catastrophic waste spills. Because growers generally have limited assets, the likelihood of bankruptcy is much larger for them than for the integrators, which are large, sometimes publicly owned companies. Ignoring externalities associated with animal waste, the observed contracts should be efficient in the sense of maximizing joint integrator plus grower surplus. This explains why the existing contracts specify the contract growers as solely responsible for waste management and disposal. The internalization of animal waste externalities may require different allocation of liabilities for waste handling than that currently observed. This is the question that I will try to answer in this section.

A substantial increase in the number of environmental clean-up cases during the 1980s coupled with an increase in the entry rate of small judgment-proof firms into hazardous sectors (Ringleb and Wiggins) has stimulated interesting literature on vicarious liability. The results from this literature could be extended to other cases of vicarious liability, such as the integrator-grower relationship. Instead of being a lender, the principal can be an integrator company and the owner of the judgment-proof firm can be an independent contract operator. The early literature on judgment-proof firms has produced contradictory results. For example, Pitchford has argued that the incentives for accident prevention of a small judgment-proof firm may actually be reduced if the lender's assets are used to pay for liabilities that the firm cannot afford. On the other hand, Hayes and Boyer and Laffont have suggested that lender liability would increase the incentives for accident prevention. The solution to this apparent contradiction is found in Balkenborg, who claims that the distribution of bargaining power between the lender and the owner of the firm is the key to the puzzle.

Making the lender liable for the damage caused by the owner of the firm can have two effects. First, it may induce the lender to provide stronger financial

incentives for the owner to take better care. Second, in order to be compensated for the risk of high liabilities, the lender may demand higher interest payments when no accident occurs, thereby reducing the owner's gain from accident prevention. Balkenborg shows that the first effect is decisive when the lender has high bargaining power and can extract a high share of the surplus from the financed project. On the other hand, if the lending market is close to perfectly competitive, the second effect dominates and Pitchford's results continue to hold. From the social welfare point of view, it is never optimal to set a joint and strict liability¹⁴ so high that the deep pockets of the lender are employed if the bargaining power of the lender is low. Contrary to that, for high bargaining power of the lender, the optimal joint liability employs deep pockets of the lender and may in fact be punitive (i.e., exceed the actual damage costs).

The implications of these results for the vertically integrated livestock sector that contracts the production of live animals with small independent farmers are straightforward. In geographical areas where the market for growers is fairly competitive such that the integrator's bargaining power is rather low, making integrators liable for environmental damages caused by the growers is not theoretically justifiable. On the other hand, if the integrator is the only game in town and the probability of growers defecting to another integrator is low, making integrators liable for environmental damages caused by the growers may be socially optimal. This result is especially important in light of the newly proposed CAFO regulations, which envision both the integrator and the grower being jointly co-permitted for the operation of any intensive livestock facility.

Conclusions

The policy discussions about the potential linkages between contracting and livestock waste problems have been focused on two sets of issues. One set relates to the emergence of livestock waste as a major environmental problem that requires urgent regulatory intervention. Implicit in this debate is the notion that animal waste-related environmental problems have been caused or exacerbated by the organizational structure of the livestock industry, notably its high degree of vertical integration via production contracts with independent farmers. Another set of issues relates to the design of regulatory policies that could be implemented given the existing organizational structures of various livestock industries. As far as the emergence of animal waste as a major environmental problem is considered, the central objective of this paper is to try to answer the question of whether contracting worsens livestock waste management problems and if yes, then how and to what degree? When it comes to designing an appropriate regulatory regime, the paper focuses on the question of how to apportion the burden of regulation among the contracting parties in a socially optimal way.

The evidence about the potential linkages between contracting and animal waste management problems presented in the paper fits into four categories: (1) scale, (2) specialization, (3) concentration, and (4) division of inputs and contract settlement.

1. While the impact of contracting on productivity is sizeable, contracting does not appear to have large-scale effects. This result suggests that the increased

productivity of contract operators is not a major force driving the increase in the scale of production of hog farms. On the other hand, the production technology, which displays increasing returns to scale regardless of the ownership structure, does serve as a motive for increasing the size of both independent and contract operations. Also, large is not necessarily bad. Again, because of significant economies of scale, this time in waste management, intensive livestock production units could, in fact, be environmentally friendlier than small, family farms because they can make technologically advanced waste management systems economically feasible.

2. It is true that contracting creates more specialized animal production operations, thereby breaking the tradition of joint production of crops and livestock that characterizes traditional independent family farms. However, the joint production of crops and livestock may not necessarily be friendlier than specialized production. Farmers tend to apply livestock manure in excess of the amount that would require just substitution of the chemical fertilizer. By applying manure on any given field, they not only receive the nutrient benefits of that application but also save on the transportation costs relative to applying the same manure on more distant fields. This result shows that the use of manure can be expected to worsen nutrient runoff and leaching from croplands regardless of whether the livestock producer is a contract operator or an independent farmer.
3. Contract production results in high concentration of livestock production facilities in a few geographic areas. However, there is also a tendency for the independent livestock producers to concentrate in certain geographical areas because of significant agglomeration economies. The established network of feed mixers, slaughtering plants, specialized construction companies, extension specialists, veterinarians, and banking services geared around the specific needs of livestock producers as well as the local availability of skilled labor could become important factors of industry growth in certain regions. However, concentration is not necessarily bad either. An empirical estimate of environmental damages caused by the proximity of large-scale hog operations suggests that social welfare would be enhanced by directing the industry expansion towards areas where the concentration of animal units is already high, rather than distributing the future animal industry growth more evenly across the landscape.
4. The amount of nutrients from animal waste deposited in the environment is directly related to the composition of animal feed. The tension in the contract arises from the fact that integrators determine the nutrient content of manure through decisions about genetic makeup of animals and their feed rations, but growers own the manure and are legally liable for its removal and disposal. Given the fact that monitoring the nutrient content of feed and manure is costly and imperfect and each party cannot observe the effort exerted by the other, the net benefits (cost) of nutrient application may fail to get incorporated into the payment schedule of a production contract. Therefore, the question of the division of responsibilities for providing inputs in livestock production and the resultant payment schemes used to settle the contracts becomes important for purposes of optimal contract design.

Without precisely knowing the nature of the future changes in the regulation of animal waste that may emerge, the discussion in the paper is based on two assumptions: first, that the division of responsibilities for the removal and disposal of manure will be regulated toward some form of a shared responsibility between the integrators and the growers, and second, that the cost of waste management, as a result of new regulation, would increase. The conclusions reached in this paper belong to three larger groups of regulatory issues: (1) contract regulation, (2) regulatory compliance cost incidence, and (3) liability.

1. In light of substantial multitasking problems, the regulation toward some form of shared responsibility between the integrators and growers for manure disposal may render the currently used relative performance, piece-rate remuneration schemes obsolete. It is conceivable that rather than switching to fixed wage contracts as a method of rewarding their growers, integrator companies may gradually change their organization structure towards more company-owned farms. Such an important shift in the industry structure away from contracting may have dire implications for local rural communities in many parts of the country. Especially strong impact could be felt in the Southeast, where many small, family farms heavily depend on the supplemental income from contract poultry operations.
2. The incidence of anticipated increases in environmental compliance cost may depend on the market power of the integrator on the market for grower services. In markets with absolute monopsony power of the integrator, the increased cost of environmental regulation is likely to be borne by the integrator. However, when contracts are allowed to adjust optimally to changes in regulation, all regulatory schemes turn out to be welfare equivalent.
3. The concept of shared responsibility for accidental waste spills between the integrator and growers may or may not be welfare enhancing depending on the relative bargaining power of the integrator on the market for growers. In geographical areas where the competition for growers is fairly fierce, making integrators liable for environmental damages caused by the growers may not be theoretically justifiable. On the other hand, if the integrator is the only game in town and the probability of growers defecting to another integrator is low, making integrators liable for environmental damages caused by the growers may be socially optimal.

Finally, one has to admit that a lot of unanswered questions remain about how regulation should be imposed and how it will affect contract structure and organization of livestock industries. If the public policy in this area is to receive sufficient scientific guidance, it is essential that more research be conducted in three areas: the optimal regulation of production contracts with environmental externalities, the incidence of regulation compliance costs, and the optimal allocation of liability for accidental catastrophic waste spills. As several of the results may critically depend on the degree of market power of the integrator in the market for growers, the development of the methodology and the empirical estimation of the degree of integrators' oligopsony power may be especially important. The cooperation between academia, the livestock industries, and both federal and state agencies

may prove to be essential, because the empirical data for these types of analyses is rather difficult to obtain.

Acknowledgments

I thank Gerald Havenstein, Erik Lichtenberg, Jonathan Yoder, and two anonymous referees for their helpful comments and useful suggestions on the earlier drafts of this paper. This research has been supported by the National Center for Manure and Animal Waste Management, USDA. All opinions expressed in the paper are those of the author and not of the granting agency.

Endnotes

¹It has been estimated that well over 90% of broilers and 32% of hogs are currently produced under contracts (U.S. Department of Agriculture).

²Much of the empirical research in this area has tried to quantify the extent of packer/processor control in the livestock sectors. If meat packers can force the price of live animals below the perfectly competitive price, then producers have little opportunity to pass on the costs of regulatory compliance. For an extensive economic history and review of the empirical evidence, see Azzam and Anderson.

³Full text of the proposed legislation is available on the Iowa Attorney General website: <http://www.state.ia.us/government/ag>. For an overview of the history of attempts to regulate contracts, see Tsoulouhas and Vukina (2001).

⁴Gollehon et al. have shown that confined livestock and poultry farms produced over 1.2 million tons of recoverable nitrogen and 0.7 million ton of recoverable phosphorus in 1997. Most farms (78% for N and 69% for P) have adequate land on which it is physically feasible to apply the produced manure at agronomic rates. Still, manure produced on those operations that cannot fully absorb it at agronomic rates accounts for over 60% of manure nitrogen and 70% of manure phosphorus.

⁵The Clean Water Act is the major federal law affecting manure management on animal operations, under which the National Pollutant Discharge Elimination System (NPDES) program covers animal feeding operations meeting certain criteria. For an overview of current regulations under NPDES, see Gollehon et al.

⁶Notice that this result is valid only if the increased production dispersion (decreased concentration) causes the environmental costs to decrease. This will be true under the assumptions that manure applications of larger facilities cause more per-unit environmental damage than those of smaller facilities, and that ambient external costs of livestock operations are convex. Frequently, those assumptions are not likely to hold.

⁷As pointed out by an anonymous referee, this result hinges on the assumption that property values fully reflect the external cost of livestock waste pollution. Any information asymmetries or the complete lack of scientific information about long-run effects of waste pollution would prevent these effects from being capitalized on in the property values.

⁸For a nice summary of criticisms of the Coase Theorem, see Cooter.

⁹The same is true for the shadow price of carcasses. The prices that rendering plants pay livestock producers for mortality disposal vary dramatically (and can be negative) and are negatively correlated to the prices of other proteins, such as soymeal and fishmeal.

¹⁰For surveys of the principal-agent literature, see Hart and Holmstrom and Levinthal.

¹¹There is something to be said about the possibility of integrator's postcontractual opportunism of another kind. Realizing that a grower (tied down with the ownership of large relationship-specific investments) has nowhere to go, the integrator may change the contracts and offer worse payment than in the original contract. In the dynamic context, however, the integrator's reputation problem could alleviate the hold-up problem.

¹²In June 1995, after 21 inches of rain had fallen over a 3-week period, the dike impounding an above-ground lagoon near Jacksonville, North Carolina, broke, spilling more than 20 million gallons of sewage into the New River and causing a massive fish kill. Four other hog lagoons and a poultry lagoon experienced spills that summer. In response to those events, the governor ordered the inspection of all lagoons in the state. Among more than 4,000 lagoons inspected, 2.8% were found to have illegal discharge devices and 10% had lesser problems such as eroded banks or insufficient freeboards. One producer had no spraying field, but was discharging effluent into a swamp (Martin and Zering).

¹³Beard has actually shown that for the case of risk-neutral injurer, both of those conjectures are not completely general. Depending on the circumstances, the injurer can also take too much care and his care levels are not generally increasing in wealth.

¹⁴A *joint and strict liability* rule requires the owner and the lender jointly to pay the liability if an accident occurs.

References

- Aradhyula, S.V., and M.T. Holt. "Risk Behavior and Rational Expectations in the U.S. Broiler Market." *Amer. J. Agr. Econ.* 71(November 1989):892-902.
- Azzam, A.M., and D.G. Anderson. "Assessing Competition in Meatpacking: Economic History, Theory and Evidence." Washington, DC: U.S. Department of Agriculture, GIPSA, Rep. GIPSA-RR 96-6, 1996.
- Baker, G. "Incentive Contracts and Performance Measurement." *J. Pol. Econ.* 100(June 1992):598-614.
- Balkenborg, D. "How Liable Should a Lender Be? The Case of Judgment-Proof Firms and Environmental Risk: Comment." *Amer. Econ. Rev.* 91(June 2001):731-38.
- Beard, T.R. "Bankruptcy and Care Choice." *Rand J. Econ.* 21(Winter 1990):626-34.
- Bohm, P., and C.S. Russell. "Comparative Analysis of Alternative Policy Instruments." *Handbook of Natural Resource and Energy Economics*, Vol. I. A.V. Kneese and J.L. Sweeney, eds., pp. 395-460. Amsterdam: Elsevier Science Publishers B.V. 1985.
- Bontems, P., P. Dubois, and T. Vukina. "Optimal Regulation of Private Production Contracts with Environmental Externalities." Working paper, Institute National Recherche Agronomique (INRA), Toulouse, 2002.
- Boyer, M., and J.-J. Laffont. "Environmental Risks and Bank Liability." *Eur. Econ. Rev.* 41(August 1997):1427-59.
- Cooter, R.D. "Coase Theorem." *The New Palgrave: A Dictionary of Economics*. J. Eatwell, M. Milgate, and P. Newman, eds. London: Macmillan, 1987.
- Ferket, P.R., E. van Heugten, T.A. van Kempen, and R.C. Angel. "Nutritional Strategies to Reduce Environmental Emissions from Non-Ruminants." Symposium of Animal Production and the Environment: Challenges and Solutions Committee, FASS Committee on Environment, Waste Management and Ecosystems, Indianapolis, IN, July 26, 2001.
- Fleming, R.A., B.A. Babcock, and E. Wang. "Resource or Waste? The Economics of Swine Manure Storage and Management." *Rev. Agr. Econ.* 20(Spring/Summer 1998):96-113.
- Gollehon, N., M. Caswell, M. Ribaudo, R. Kellogg, C. Lander, and D. Letson. "Confined Animal Production and Manure Nutrients." Washington DC: U.S. Dept. of Agriculture, ERS, Agr. Info. Bull. No. 771, June 2001.
- Hart, O., and B. Holmstrom. "The Theory of Contracts." *Advances in Economic Theory*. T. Bewley, ed., pp. 71-155. Cambridge, England: Cambridge University Press, 1987.
- Hayes, A.G. "Lender Penalty for Environmental Damage and the Equilibrium Cost of Capital." *Economica* 63(May 1996):311-23.
- Henry, W., and J. Seagraves. "Economic Aspects of Broiler Production Density." *J. Farm Econ.* 42(February 1960):1-17.
- Holmstrom, B., and P. Milgrom. "Multi-Task, Principal-Agent Analyses: Incentive Contracts, Asset Ownership and Job Design." *J. Law, Econ. and Org.* 7 no. 3 (1991):24-52.
- Innes, R. "Regulating Livestock Waste: An Economic Perspective." *Choices* (Second Quarter 1999):14-19.
- . "The Economics of Livestock Waste and Its Regulation." *Amer. J. Agr. Econ.* 82(February 2000):97-117.
- Key, N., and W. McBride. "Does Contracting Raise Farm Productivity? The Impact of Production Contracts on Hog Farm Performance." Paper presented at AAEA Meetings, Chicago, IL, 5-8 August, 2001.
- Kliebenstein, J.B., and J.D. Lawrence. "Contracting and Vertical Coordination in the United States Pork Industry." *Amer. J. Agr. Econ.* 77(December 1995):1213-18.
- Knoeber, C.R., and W.N. Thurman. "Don't Count Your Chickens . . . : Risk and Risk Shifting in the Broiler Industry." *Amer. J. Agr. Econ.* 77(August 1995):486-96.
- Levinthal, D. "A Survey of Agency Models of Organizations." *J. Law, Econ. and Org.* 9(March 1988):153-85.
- Levy, A., and T. Vukina. "Optimal Linear Contracts with Heterogeneous Agents." *Eur. Rev. Agr. Econ.* 29(2002):205-17.
- Lewin, S.B. "Asset Specificity and Hold-Up in Franchising and Grower Contracts: A Theoretical Rationale for Government Regulation?" Working paper, Iowa State University, 1998.
- Martin, L.L., and K.D. Zering. "Relationships between Industrialized Agriculture and Environmental Consequences: The Case of Vertical Coordination in Broilers and Hogs." *J. Agr. and Applied Econ.* 29(July 1997):45-56.
- National Pork Producers Council. "Guide to Contracting: Production." Des Moines, Iowa, 2000.
- Paarlberg, P.L., M. Boehlje, K. Foster, O. Doering, and W. Tyner. "Structural Change and Market Performance in Agriculture: Critical Issues and Concerns about Concentration in the Pork Industry." Staff Paper No. 99-14, Dept. of Agricultural Economics, Purdue University, 1999.
- Palmquist, R.B., F.M. Roka, and T. Vukina. "Hog Operations, Environmental Effects, and Residential Property Values." *Land Econ.* 73(February 1997):114-24.

- Pitchford, R. "How Liable Should a Lender Be? The Case of Judgment-Proof Firms and Environmental Risk." *Amer. Econ. Rev.* 85(December 1995):1171-86.
- Perry, M.K. "Vertical Integration: The Monopsony Case." *Amer. Econ. Rev.* 68(September 1978):561-70.
- Preckel, P.V., G.E. Shively, T.G. Baker, M.-C. Chu, and J.E. Burrell. "Contract Incentives and Excessive Nitrogen Use in Agriculture." *J. Agr. Resource Econ.* 25(2000):468-84.
- Prendergast, C. "The Provision of Incentives in Firms." *J. Econ. Lit.* 37(March 1999):7-63.
- Ringleb, A.H., and S.N. Wiggins. "Liability and Large-Scale, Long-Term Hazards." *J. Pol. Econ.* 98(June 1990):574-95.
- Roka, F.M. "An Economic Analysis of Joint Production Relationships between Pork and Swine Manure." Ph.D. Dissertation, North Carolina State University, 1993.
- Roka, F.M., and D.L. Hoag. "Manure Value and Liveweight Swine Decisions." *J. Agr. Appl. Econ.* 28(July 1996):193-202.
- Segerson, K., and T. Tietenberg. "The Structure of Penalties in Environmental Enforcement: An Economic Analysis." *J. Environ. Econ. Manage.* 23(1992):179-200.
- Shavell, S. "The Judgment Proof Problem." *Internat. Rev. Law and Econ.* 6(June 1986):45-58.
- Slade, M. "Multitask Agency and Organizational Form: An Empirical Exploration." *Internat. Econ. Rev.* 37(May 1996):465-86.
- Summers, J.S. "The Case of the Disappearing Defendant." *U. Penn. Law Rev.* 132(December 1983):145-85.
- Sykes, A.O. "An Efficiency Analysis of Vicarious Liability under the Law of Agency." *Yale Law J.* 91(November 1981):168-206.
- Tsoulouhas, T. "Do Tournaments Solve the Two-Sided Moral Hazard Problem?" *J. Econ. Behav. Organ.* 40(November 1999):275-94.
- Tsoulouhas, T., and T. Vukina. "Integrator Contracts with Many Agents and Bankruptcy." *Amer. J. Agr. Econ.* 81(February 1999):61-74.
- . "Regulating Broiler Contracts: Tournaments versus Fixed Performance Standards." *Amer. J. Agr. Econ.* 83(November 2001):1062-73.
- U.S. Department of Agriculture. *Farmers' Use of Marketing and Production Contracts*. ERS, Agr. Econ. Rep. 747, Washington, DC, December, 1999.
- U.S. Environmental Protection Agency. "National Pollutant Discharge Elimination System Permit Regulation and Effluent Limitations Guidelines and Standards for Concentrated Animal Feeding Operations; Proposed Rule." Federal Register 66 no. 9. January 2001.
- Vukina, T. "Vertical Integration and Contracting in the U.S. Poultry Sector." *J. Food Dist. Res.* 32(July 2001):29-38.
- Vukina, T., and A. Wossink. "Environmental Policies and Agricultural Land Values: Evidence from the Dutch Nutrient Quota System." *Land Econ.* 76(August 2000):413-29.

Hughes, Marjorie

From: Nathan Dunleavy [nathan@tregacorp.com]
Sent: Thursday, November 04, 2004 3:34 PM
To: RegComments@state.pa.us
Subject: farming

RECEIVED

2004 NOV 12 PM 3:42

PUBLIC RECORD ACT REQUEST
PA. DEPT. OF ENVIRONMENTAL PROTECTION

I don't think I agree with these regulations. Even though the regs seem to have a positive reaction on the environment, I can see how it will turn farmland into more housing developments by causing farmers to resort to selling their land to make more money instead of making their farms a more prosperous source income. The farmers don't need more regulations. The environmentalists are gonna wind up doing more damage in the long run.

There are other forms of business that do far more damage they could be picking on other than the farmers. Why don't you try regulating what goes through the local sewers.

Sincerely,
Nathan Dunleavy

Original: 2412

Hughes, Marjorie**RECEIVED**

2004 NOV 12 PM 3:42

DEPARTMENT OF AGRICULTURE
REGULATORY
REVIEW COMMISSION

From: Jeff George [jmg@valleyforgeflag.com]
Sent: Thursday, November 04, 2004 2:20 PM
To: RegComments@state.pa.us
Subject: factory farms

I oppose factory farms and I oppose CAFO's (Concentrated Animal Feeding Operations).

I oppose because these operations are cruel to the animals, antibiotics used on the animals are a hazard to humans, environmentally the practice has proven disastrous, as in fish killed and polluted water in North Carolina due to corporate hog farms, and that corporate farming puts small farmers out of business, thus establishing a monopoly for a few big corporations. Finally, the proposed new regulations are not democratic---state regulators would be able to overrule local towns and townships who pass ordinances prohibiting factory farms.

Regards,
Jeff George
(610) 589-5888 x. 288

Original: 2412

Hughes, Marjorie

RECEIVED

From: Ed Gans [edgans@earthlink.net]
Sent: Thursday, November 04, 2004 8:40 PM
To: RegComments@state.pa.us
Subject: I oppose factory farms

2004 NOV 12 PM 3:43

PENNSYLVANIA REGULATORY
REVIEW COMMISSION

I oppose factory farms and I oppose CAFO's (Concentrated Animal Feeding Operations) because these operations are cruel to the animals, antibiotics used on the animals are a hazard to humans, environmentally the practice has proven disastrous as in fish kills and polluted water in North Carolina due to corporate hog farms, and that corporate farming puts small farmers out of business, thus establishing a monopoly for a few big corporations. Finally, the proposed new regulations are not democratic----state regulators would be able to overrule local town and townships that pass ordinances prohibiting factory farms.

Local control would be trumped by state control.

Sincerely,

Ed Gans
175 Hawthorne Court
Wyomissing, PA 19610

Original; 2412

Hughes, Marjorie

RECEIVED

From: JANKRISTINE@aol.com
Sent: Thursday, November 04, 2004 9:26 PM
To: RegComments@state.pa.us
Subject: Important

2004 NOV 12 PM 3:43

PENNSYLVANIA
REGULATORY
REVIEW COMMISSION

I oppose factory farms and CAFO's.

Thank you.

Jan Ferree
Kutztown, PA

Original: 2412

Hughes, Marjorie**RECEIVED****From:** Dan Butler [danbutler@prodigy.net]

2004 NOV 12 PM 3:42

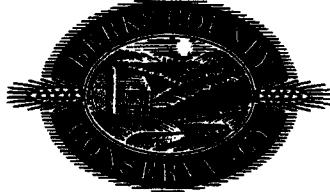
Sent: Thursday, November 04, 2004 2:37 PMPAUL S. RABINOWITZ, SECRETARY
REVIEW COMMISSION**To:** RegComments@state.pa.us**Subject:** Factory Farms and CAFO's**To Whom It May Concern:**

I oppose factory farms and I oppose CAFO's (Concentrated Animal Feeding Operations).

I oppose these operations for a number of reasons:

- They are cruel to the animals.
- Antibiotics used on the animals are a hazard to humans and are affecting the efficacy of human-use antibiotics.
- Environmentally the practice has proven disastrous, as in fish kills and polluted water in North Carolina due to corporate hog farms.
- Corporate farming puts small farmers out of business, thus establishing a monopoly for a few big corporations.
- Finally, the proposed new regulations are not democratic----state regulators would be able to overrule local town and townships who pass ordinances prohibiting factory farms. Local control would be trumped by state control!

Dan Butler
Reading



25 N. 11th Street • Reading, PA 19601 • 610-372-4992 • FAX 610-372-2917
 E-mail: info@berks-conservancy.org • Web: www.berks-conservancy.org

November 3, 2004

Environmental Quality Board
 P.O. Box 8477
 Harrisburg, PA 17105-8477

Gentlemen:

The Berks County Conservancy is involved in many facets of water quality protection in Berks County. We not only comment on legislation and, in this case, regulations, but also manage and expedite storm water, nutrient management, and stream bank fencing, restoration and enhancement projects. We are aware firsthand that a pound of prevention is worth a ton of cure.

Regarding the CAFO regulations, the Berks County Conservancy:

- Supports the Section 91.1 and 92.1 definitions for DEP to include mixed animal operations in the program.
- Supports Sections 92.5a and 92.1 that include dry manure-based poultry operations and large-scale horse operations as CAFOs.
- Does NOT support the exemption from NPDES permitting the discharges of industrial wastewater from manure processing facilities at industrialized agricultural operations mentioned in Sections 92.1 and 91.36. The Clean Water Act should govern these discharges.
- Supports the revision of Section 91.36 to require all manure storage facilities with capacity above 1 million gallons of manure to have water quality management permits. In addition, DEP should require water quality management permits for any new manure storage facilities in impaired waters and where cumulative impacts are of concern. DEP should prohibit construction of any new or expanded manure storage facilities in the floodplain, and should apply setback requirements to all surface waters, including wetlands and intermittent streams.
- Encourages the use of the Pennsylvania Technical Guide standards for Riparian Forest Buffers (391) and Filter Strips (393); and further encourages the modification of Sections 91.1 and 92.1 to specify setbacks and their application to sinkholes, drainage tiles, and agricultural well heads.
- Supports the revision of Section 91.36(c) to provide that DEP WILL (not may) require agricultural operations to develop and implement a nutrient management plan where a violation of the Clean Stream Law occurs.

Thank you.

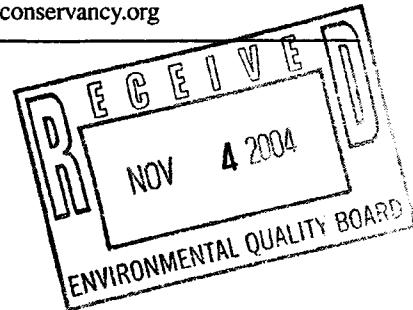
Sincerely,

A handwritten signature in black ink that reads "Lawrence E. Lloyd".

Lawrence E. Lloyd
 Conservation Specialist

The Berks County Conservancy is a registered 501(c)(3), nonprofit, charitable organization. A copy of the official registration and financial information may be obtained from the Pennsylvania Department of State by calling toll free, within Pennsylvania, 1-800-732-0999. Registration does not imply endorsement.

HELPING TO PROTECT OUR OPEN SPACES, FORESTS, WATERWAYS, FARMLAND, AND HISTORIC SITES



RECEIVED
 NOV 12 PM 3:41
 2004
 PENNSYLVANIA
 REGULATORY
 REVIEW COMMISSION
 C.A.C.S.C.

Frank Thomas
291 Red Bridge Rd.
Gettysburg PA 17325

Original; 2412

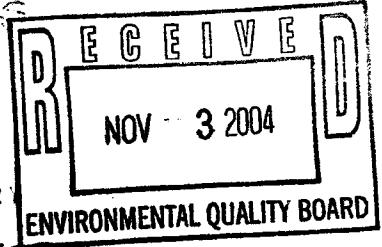
10-30-04

117

RECEIVED

2004 NOV 12 PM 3:41

ENVIRONMENTAL QUALITY BOARD
REVIEW COMMISSION



Revisions to CAFO Regulations

Environmental Quality Board Members:

I believe that no person, company or Corporation has the right to contaminate streams, bodies of water or ground water. I am appalled at what has happened in the past and welcome any attempts to improve conditions. We will never protect the environment too much, so it is important to do as much as is possible.

Since April 1998 I have been opposed to a Corporate owned CAFO proposed near my home. My opposition is motivated by knowledge of this companies negative environmental history at a site 3 miles away. On July 10, 2003 I gave testimony at a DEP hearing for a NPDES permit. Ten days later (July 20, 03) at the site 3 miles away, Egg wash water got into a tributary to Conewago Creek resulting in a fish kill. I have enclosed pictures of this violation.

On Dec. 8, 2003 employees of this company spread manure on a snow covered, frozen field, steeply sloped to the same tributary of the Conewago Creek as the previous violation. The weather forecast was for heavy rain and flooding.

On Dec. 9, 03, as Secretary Kathleen McGinty attended the Fairfax, Va meeting of the Chesapeake Bay Program Executive Council as Gov. Rendell's and Pennsylvania's representative, the employee's continued to load the snow covered field with chicken manure. On Dec. 10, 03 came heavy rains and flooding as forecasted and the main line flush to the Chesapeake was completed.

New regulations including buffer zones from creeks and extra zones on slopes would help. Manure should not be spread on frozen, snow covered fields.

I am also aware of farm owners that exempt themselves from responsibility when manure is exported. This does not lessen the damage done when streams or ground water are contaminated. Manure export regulations should help.

I am pleased to hear of many efforts by volunteers, companies and governments to aid in cleaning up the Chesapeake. In my opinion, no one enforces the Nutrient Management Regulations. If this continues, then any new regulations will not help. It's like having an unenforced 55 mph speed limit where everyone drives at 75 mph.

Thank you
Frank Thomas

7-20-03 Egg wash water contamination at Trub. to Penanggo Crk.





144

Hughes, Marjorie

RECEIVED

From: ALSLJR@aol.com
Sent: Thursday, November 04, 2004 10:58 PM
To: RegComments@state.pa.us
Subject: (no subject)

2004 NOV 12 PM 3:43

PENNSYLVANIA
AGRICULTURE
REGULATORY
REVIEW COMMISSION

I oppose factory farms and I oppose CAFO's. STOP NOW.

Original: 2412
Hughes, Marjorie

RECEIVED

From: SocratesSezz@aol.com
Sent: Thursday, November 04, 2004 2:33 PM
To: RegComments@state.pa.us
Cc: fritch@nni.com; emmamaggie@enter.net
Subject: (no subject)

2004 NOV 12 PM 3:42

PENNSYLVANIA MANDATORY
REVIEW COMMISSION

I oppose factory farms and I oppose CAFO's (Concentrated Animal Feeding Operations).

If you wish to type more say you oppose because these operations are cruel to the animals, antibiotics used on the animals are a hazard to humans, environmentally the practice has proven disastrous as in fish kills and polluted water in North Carolina due to corporate hog farms, and that corporate farming puts small farmers out of business, thus establishing a monopoly for a few big corporations. Finally, the proposed new regulations are not democratic----state regulators would be able to overrule local town and townships who pass ordinances prohibiting factory farms.

Local control would be trumped by state, federal and WTO control.

Frederick T. Brass
816 North 5 Street
Reading, PA 19601

Original: 2412

Hughes, Marjorie

RECEIVED

2004 NOV 12 PM 3:44

PENNSYLVANIA
AGRICULTURAL
REGULATORY
REVIEW COMMISSION

From: Mike [mas2102@comcast.net]
Sent: Wednesday, November 03, 2004 10:23 AM
To: RegComments@state.pa.us
Subject: CAFO regulations under review...

To the Environmental Quality Board,

As a taxpayer and resident of the Commonwealth of Pennsylvania I have a few comments regarding the current CAFO regulations under review:

SPECIFIC COMMENTS:

- Section 92.1 definition of CAFOs:** please include medium-sized CAFOs that are causing "discharges."
- Sections 92.1 and 91.36:** the proposal to exempt the discharges of industrial wastewater from manure processing facilities at industrialized agricultural operations is totally unacceptable. These discharges should be subject to the full water quality protection requirements under the Clean Water Act.
- Section 91.1 and 92.1:** the DEP is right to include these mixed animal operations in the definitions, and in the program.
- 92.5a and 92.1:** please support the inclusion of dry manure-based poultry operations and large-scale horse operations as CAFOs.

GENERAL COMMENTS:

- establish strong regulations that will discourage CAFOs from using cheap and dirty production methods that pollute the air and water (which in all probability will undermine small-scale, more sustainable operations)
- give local communities the ability to protect themselves from CAFO pollution
- support sustainable (and organic) farming practices

Thank you for your time.

Regards,

Mike Shirk
705 Jacques Circle
Chester Springs,
PA
19425

Original: 2412

Hughes, Marjorie**RECEIVED**

From: Potter County Conservation District [pccd@adelphia.net] **2004 NOV 12 PM 3:44**
Sent: Wednesday, November 03, 2004 10:17 AM
To: RegComments@state.pa.us
Subject: Concentrated Animal Feeding Operations (CAFO)

PA DEPARTMENT OF ENVIRONMENTAL QUALITY
REVIEW COMMISSION**Concentrated Animal Feeding Operations (CAFOs)"**

Submitted by the Potter County Conservation District
107 Market Street
Coudersport, PA 16915

The Board of Directors of the Potter County Conservation District would like to offer the following comments on the proposed CAFO Regulation changes:

Manure Storage Water Quality Permits: Virtually gives DEP unlimited authority to require any farmer that has a manure storage facility to obtain a water management permit based on a vague set of criteria. The proposed regulation goes way beyond its intended purpose of setting new guidelines for larger animal operations. Instead, they also target small and medium sized farms. Those family farmers would be placed at a huge economic disadvantage compared to farmers in other states if regulated more strictly than required by federal law.

Manure Application Setbacks: DEP is also proposing that other agricultural operation applying manure must meet "appropriate" setback and buffer requirements that are yet to be determined. The District is concerned by the proposal because it fails to provide any criteria to guide or limit the scope for setbacks and buffers, while putting the future of farmers at risk. This will subject small and medium-sized family farmers to mandatory setbacks that could significantly limit their use of productive land and increase production costs, potentially driving them out of operation.

CAFO Permit Costs: It is the District's opinion that these costs are exorbitant and seems to put these operations into a factory designation. Let us keep in mind that unlike factories, these CAFO operations can not set the cost of the product they produce and have no chance to recoup the costly expense of these permitting fees.

We thank you for the opportunity to comment on the proposed regulations and when considering the implementation of these regulations we ask that you remember: farmers are known stewards of the land and water resources they realize the importance of protecting and conserving those resources that sustain their ability as well as those of the next generation.

Sincerely,

Ed Kosa
District Chairman

Hughes, Marjorie

From: Susan Markowitz [puffin7@comcast.net]
Sent: Wednesday, November 03, 2004 1:15 PM
To: RegComments@state.pa.us
Subject: Water Quality at Risk: comments on proposed CAFO regulation

RECEIVED

2004 NOV 12 PM 3:44

PENNSYLVANIA
REGULATORY
REVIEW COMMISSION

November 03, 2004

Pennsylvania Department of Environmental Protection
PA

Dear ,

Subject: Comments on proposed CAFO regulation
 Centuries ago, we had little or no understanding of how certain farming and livestock practices could create dangerous pollution in groundwater, lakes and streams. We now know that all sorts of livestock-related waste has been a major source of water pollution in PA and elsewhere. Living in a rural area surrounded by farms, and former farms (whose soil, and groundwater, is still contaminated), and getting my water from a well, I have had firsthand experience with such pollution problems. This is a dangerous situation that urgently needs to be addressed in the strongest possible fashion.

Unfortunately, the proposed Concentrated Animal Feeding Operation (CAFO) regulation will simply not do enough to minimize nutrient pollution and protect water quality. Pennsylvania already has an estimated 3,903 miles of streams tainted by agricultural wastes, and this regulation will do far too little to correct the situation.

1. The proposed regulations fail to require a NPDES permit for medium CAFOs, as required by federal regulation.

The proposed definition of CAFO in § 92.1 is legally problematic because it fails to include certain medium CAFOs, that are required by the federal regulations at 40 CFR § 122.23(a), (b)(2) and (b)(6) to obtain permits. Inexplicably, while the proposed definition in § 92.1 correctly cross-references those facilities that are classified as large CAFOs, it omits the medium-sized facilities that also must be classified as CAFOs.

The federal rule includes specific language regarding "discharges" in the definition of small and medium CAFOs at 40 CFR § 122.23(b)(6)(ii). This provides an opportunity to regulate and enforce operations currently not covered by the Nutrient Management Act, that contribute heavy nutrient loads to the Commonwealth's waters. This definition would include operations with livestock in streams, stormwater flowing from manure management facilities, and other sources of stream degradation. A definition that includes operations with 300 to 1,000 AEUs that must have a Nutrient Management Plan may include more operations than the definition at 40 CFR 122.23(b)(6)(ii), but not those operations with the most serious pollution problems.

In the Chesapeake Bay watershed in Pennsylvania, agricultural operations are the largest source of nitrogen and phosphorous pollution. While many large confined animal operations have been subject to CAFO permit and nutrient management planning requirements, many medium and small size agricultural operations have operated under the regulatory radar. In order to comply with the federal Clean Water Act, to maintain NPDES delegation, and to take a positive step to ensure that major sources of agricultural nutrient pollution in the watershed are addressed, DEP must, as EPA has done, amend the definition of CAFO to include the appropriate medium-sized animal operations into the regulation.

2. The definition of CAFO in § 92.1 is vague and ambiguous.

In addition to not satisfying federal CWA requirements, the proposed

definition of CAFO in § 92.1 is vague and ambiguous. It is unfair to both citizens, and the potentially regulated agriculture community, since the regulation fails to give adequate notice to both groups of who is covered by the regulation. This uncertainty will only lead to litigation and the need for the paperwork, expenses, and wasted time of regulatory revisions in the future to correct the problematic language. Moreover, the regulation itself could be held by a court to be violative of due process since it is void for vagueness.

3. The proposed definition of CAFO at § 92.1 irrationally excuses unauthorized discharges from CAFO classification

The nonsensical definition includes one class of CAFOs that is: "any agricultural operation with a discharge to surface waters that is authorized by Department permit limits and conditions." It excludes from CAFO classification agricultural operations that are operating without necessary permits, or are otherwise not authorized by the Department. Thus, an agricultural operation could refuse to get a permit and by doing so avoid classification as a CAFO and the regulatory requirements that come with such a classification. In addition, the language does not specify which "Department permit limits and conditions" would result in a classification. In sum, the proposed language is completely irrational and must be amended to include agricultural operations with discharges regardless of whether they are authorized by any Department permits.

In order to eliminate irrational language, comply with the federal rule, and clarify the proposal, DEP needs to recraft the definition of CAFO in § 92.1 to read as follows:

CAFO--Concentrated animal feeding operation--A CAO with greater than 300 AEUs, any agricultural operation with greater than 1,000 AEUs, any agricultural operation defined as a large CAFO under 40 CFR § 122.23(b)(4) or a medium CAFO under 40 CFR § 122.23(b)(6) (relating to concentrated animal feeding operations (applicable to state NPDES programs, see 123.25)), or any other agricultural operation designated as a CAFO by the Department based on risk of pollution of surface waters using relevant criteria such as the size, location and management plan of the operation.

The proposed rule's calculation of Animal Equivalent Units to define CAFOs is appropriate for Pennsylvania's mixed operations. Many operations may not reach any of the species-specific thresholds to be considered a CAFO, but would have more than 300 AEUs and need to be included.

4. The Clean Streams Law must be enforced effectively.

§ 91.36 (c) should be rewritten to state: Discharge of Pollutants. It is unlawful for agricultural operations to discharge pollutants to waters of the Commonwealth except as allowed by regulations or a permit administered by the Department. The Department SHALL take an enforcement action against any agricultural operation in violation of this requirement. In addition, when an agricultural operation is found to be in violation of the Clean Streams Law, 35 P.S. § 691.1 et seq., the Department SHALL require the agricultural operation to develop and implement a nutrient management plan under Chapter 83, Subchapter D, for abatement or prevention of the pollution.

5. The provisions relating to buffers and setbacks are vague.

The requirement for a 100-foot year round setback (or 35-foot vegetative buffer) from streams and other water bodies for land application of manure is a giant step in the right direction. However, a 50-foot buffer would capture much more pollution before it enters our streams and downstream waters. The language requiring "appropriate vegetated buffers and setbacks," is vague. The Pennsylvania Technical Guide standards for Riparian Forest Buffers (391) and Riparian Herbaceous Cover (390) would provide helpful guidance on how these buffers may be designed to capture pollution and protect water quality.

Thank you very much, and I look forward to a strengthened regulation and improved water quality.

Sincerely,

Ms. Susan Markowitz
PO Box 656
Lahaska, PA 18931-0656



Original: 2412

RECEIVED

2004 NOV 12 PM 3:41 **Stephen B. Graham, D.O.**
1227 Warm Springs Avenue, Suite 203
INDEPENDENT REGULATORY
REVIEW COMMISSION
Huntingdon, Pennsylvania 16652
(814) 644-6588



116

FACSIMILE TRANSMITTAL

To: Environmental Quality Board Date: 11/03/04

Fax Number: (717) 783-8470

RE: CAFO Regulations

Pages including this cover sheet: 3

From: Amanda /Dr. Graham

Urgent For Review Please Comment Please Reply

Notes: Original letter in the mail.

The information contained in this facsimile may be privileged and confidential and protected from disclosure. If the reader of this facsimile is not the intended recipient, you are hereby notified that any reading, dissemination, distribution, copying, or other use of this facsimile is strictly prohibited. If you have received this facsimile in error, please notify the sender immediately by telephone at (814) 644-6588 and destroy this facsimile. Thank You.

Stephen B. Graham, D.O.

*Women's Health Care, Obstetrics, Gynecology, and Gynecologic Surgery
Diplomate American Board of Osteopathic Obstetricians and Gynecologists*

J. C. Blair Memorial Hospital
Medical Office Building -Second Floor
Huntingdon, PA 16652
Office: (814) 644-0588
Home: (814) 342-8317

November 2, 2004

CAFO Regulations
Environmental Quality Board
P.O. Box 8477
Harrisburg, PA 17105-8477

To Whom It May It Concern

I am commenting on the proposed changes to the CAFO regulations. I write to you today as a single individual. However, I also write to you as one of over 600 individuals from the Wayne Township, Mifflin County area who recently participated in a petition to assert our opposition to a proposed, environmentally-dangerous CAFO near the village of Newton Hamilton. I would ask you to view this letter as representative of the views of the larger group.

Based on our personal experience with the current regulations, it is clear that they are inadequate in a number of ways and require improvement. Our specific comments on the proposed changes to the CAFO regulations are included below:

- Strengthen the CAFO definitions-Keep the Pennsylvania animal trigger and add federal animal number trigger to cover operations that have mixed animal species (chickens, swine, dairy, horses, etc.)(25 Pa. Code #92.1)
- Language must be added to cover operations that have pollution incidences and are not CAFOs.(Code #92.1)
- Geological features must be considered such as nearby streams, rivers, lakes, wetlands, karst features, including the cumulative effects of other operations in the same area.(Code #92.1)
- Operations with manure digesters should obtain NPDES industrial waste permits.(Code #92.1)
- Setbacks for the application of manure near streams, rivers, lakes, wetlands, sinkholes, drainage tails and other features that convey water should be at least 150 feet.(Codes #91.136(b)(2), #92.5a(d)(1)(i), #91.1 and #92.1)
- Phosphorus index must address the proximity to impaired watersheds, flooding potential, leaching potential, and the use of sludge. Phosphorus must be balanced on all fields and on lands receiving exported manure.(Code #92.5a(d)(1))
- Structures with 1 million gallon capacity and more must be required to obtain WQM permit.(Code 391.36(a)(3)(ii))
- Storage structures near an impaired watershed must be required to obtain WQM permit.(Code#1.36(a)(3)(i)(C))
- DEP must consider geology, cumulative impact of farming operations in the same area, high quality or exceptional streams, impaired streams and special protection waters, and TMDL restrictions.(Code #91.36(a)(7) and #92.1)
- Operations that conduct plowing and tilling must develop and implement an erosion and sediment control plan to limit runoff.(Code #92.5a(d)(2))
- Dry manure should not be allowed to be stockpiled uncovered in fields for more than 2 weeks.(Code #91.36(b)(2) and #92.5A(d)(1)(i))

DEP needs to ensure full compliance with the CAFO regulations not only by the owner, but also vicariously by the agribusiness corporations that contract with livestock operators or management. All parties must be required to co-sign the CAFO permits and be held jointly liable for violations. There are numerous facilities in Pennsylvania that have been shown to be out of compliance (some are listed on the DEP website). There must be more meaningful oversight and enforcement. Too many "bad actors" are given permits over and over again.

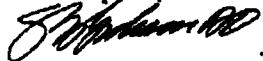
In our area of Pennsylvania, we have endured . . .

- manure spills from full lagoon pits
- spreading manure on snow covered ground
- spreading so near streams that the water turns brown
- spraying onto others private property including spraying the owner
- dead pigs strewn out in the open for wild animals to eat
- the stench

- a farm given a conservation award, yet every time it rains, the soil from the farm washes onto a state road, sometimes closing one lane
- manure haulers leaving a trail of manure and mud on the roads
- importers accepting the manure when they are not in compliance on their own land.

If there were meaningful oversight, enforcement, and stiffer penalties, these operations might clean up their act. Shut them down until they can prove that they are really "good neighbors".

Grace and peace,



Copy to:

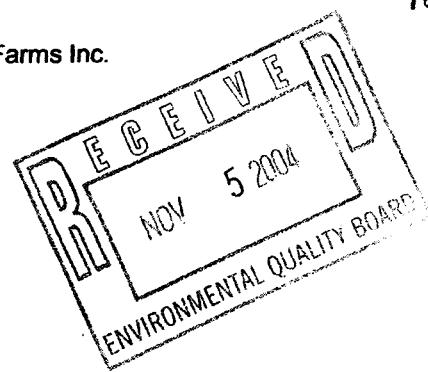
Governor Edward G. Rendell
State Senator Jake Korman
State Rep. Larry Sather

Original: 2412
2413

John Sperry, Sperry Farms Inc.
11420 Sperry Road
Atlantic, Pa. 16111
814-382-1860

November 2, 2004

Environmental Quality Board
P. O. Box 8477
Harrisburg, Pa. 17105-8477



Dear Sirs:

Sperry Farms has been in business producing eggs since 1945. Over the years we have grown to about 750,000 layers and 150,000 pullets. For the last 3 years we have sold all of the manure at auction. The usual thing, advertise, farmers get together, the auctioneer does his thing. In 2002 the remaining bid was \$5.00 a load, in 2003 it was \$10.00, in 2004 the last bid was \$20.00. This means the farmers etc. who expected a higher return on their manure dollars; bid higher. Then the remaining product was sold. We find the organic farmers and compost makers bid first.

Every day we try to maintain the driest manure possible. That is the key, it has to be hauled with regular trucks and easy to handle with the farm equipment. Over the years we have developed a market larger than the supply.

I ask the Committee for a level field with my competition in the fertilizer business. When a farmer considers a fertilizer source he will buy from the source with the least hassle (cost). The chemical business can be as polluting as the organic. Everyone selling fertilizer should have the same requirements. A farmer is as likely to overestimate needs with chemical as he is organic. And don't forget chicken manure is a time-release source not like nitrates.

I have heard two arguments for regulation on manure. The first is the CAFO exporter has a responsibility for the final use! So should the chemical dealer. The other is a "free" resource will be over-applied. Obviously nothing is really free and my chicken manure is sold at market value. The best use for much of my manure is to recycle it to crops and feed it back to animals.

In conclusion, I have no problem with the required changes. It is possible the state waters have been partly impaired by excessive nutrient on agriculture lands. But the requirements don't go far enough. The goal is to balance nutrient inputs with crop requirements. We should not forget the largest source of Nitrogen and Phosphorus in Pennsylvania, chemical fertilizer.

Thank you,

John Sperry

RECEIVED
2004 NOV 10 PM 3:44
INVESTIGATION AND
REVIEW COMMISSION
PA. DEPARTMENT OF
ENVIRONMENT

Original: 2412

Flanagan, Joann

From: Bevfrank75@cs.com
Sent: Wednesday, November 03, 2004 9:39 PM
To: Ag-scc@state.pa.us
Subject: CAFOs

Environmental Quality Board
Rachel Carson Office Building, 15th Floor
400 Market Street
Harrisburg, PA 17105-2301

Re: Definition of CAFOs (25 Pa Code Sec, 92.1

The exclusion of medium-sized operations from the definition of CAFOs is unwarranted, as many such farm operations contribute mightily to the current degradation of the Chesapeake Bay system. Medium-size CAFOs causing discharges must be included in the Section 92.1 definition of CAFOs.

In addition, the proposal in Sections 92.1 and 91.36 to exempt from NPDES permitting the discharges of industrial wastewater from manure processing facilities at industrialized agricultural operations is outrageous and unacceptable. Discharges from such facilities should be subject to the full water quality protection requirements under the Clean Water Act.

Sincerely,
Frank D. Davis
200 Gettysburg Pike
Mechanicsburg, PA 17055
Telephone: (717) 766-7130

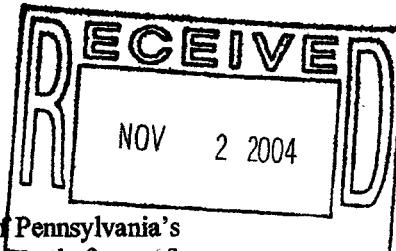
Submitted Nov. 3, 2004

RECEIVED
2004 NOV 16 PM 1:57
PENNSYLVANIA REGULATORY
REVIEW COMMISSION

Original: 2412 188

Original: 2413 132

RECEIVED



Dear State Conservation Commission,

I am writing to express my concern over the proposed new revision of Pennsylvania's nutrient management regulations. I am a sixth generation grain, hay, and beef cattle farmer from Union county. I fear the new regulations may have a severely negative impact on our local and state farm economy if some important details are not considered.

It has become clear the past several years that changes would need to be made to our current regulations to address the issue of overapplication of phosphorous from manure spreading. However, with the proposed phosphorous indexing system, some farmland that was historically used for manure application will no longer be eligible, thereby forcing producers to ship manure farther away or go out of business. Another problem that will greatly reduce the amount of land available for manure application is the requirement of wide setbacks of 100 to 150 feet from "water bodies". These "water bodies" may be defined as areas as small as a township road ditch. On some properties this could result in half or more of the land that was previously applied with manure becoming ineligible.

I think it is important that we take a more common sense approach to setback requirements, as runoff near a stream or water body can be greatly affected by the management practices used on that land. I know on my own farm that I have seen much less runoff from cropland after it was converted to "no-till" management and where cover crops have been used. I think it would be sensible to allow narrower setbacks where runoff controlling practices such as these are used.

Another issue is the requirement that when developing a nutrient balance to consider the removal of nutrients for only one crop year. We have traditionally applied manure to our fields once every three to four years, but put an amount on adequate to supply crop needs of phosphorous over that time. This is an excellent system since the first year's corn crop can use all of the available nitrogen, but allows phosphorous for the soybean and wheat crops to follow. This is also necessary since when using poultry manure for instance, it may not be possible to apply a rate as low as one ton per acre, as needed by some crops during a one year period.

I also would like to ask why several of the proposed regulations are addressed specifically at CAO's or CAFO's? Our farm is not in either category at this time, but I do not understand why you have chosen to specifically target these larger operations with more stringent regulations. The manure produced by a large operation is comparable in nutrient content with that produced by myself or any smaller operation. There are both poor and excellent operators in any size of farming enterprise, and I think this needs to be remembered.

In conclusion, I hope the commission remembers the financial cost they may be imposing on our state's producers. We need to have adequate time to change and implement any new regulations that may be enacted. Please remember that agriculture is Pennsylvania's #1 industry and supplies the state with many jobs beyond the farm gate. Farming is a tough business to start with, and unnecessarily difficult regulations could push more farms over the edge to extinction at a time when good jobs are something our nation desperately needs.

Thank you for your consideration,

Michael Platt
125 Platt Ln.
New Columbia, PA 17856

99

119

Original: 2412
2413



November 2, 2004

PENNSYLVANIA
ASSOCIATION
OF
CONSERVATION
DISTRICTS, INC.

25 North Front Street
Harrisburg, PA 17101

(717) 238-PA02 (717-238-7202)
(717) 238-7204 FAX

Website: www.pacd.org
e-mail: PA02@BIZ.DOR.GOV

*Your Link
To Local
Conservation
Efforts*

PACD is a non-profit
organization that
supports, enhances,
and promotes
Pennsylvania's
Conservation Districts
and their programs.



Printed on Recycled Paper

Environmental Quality Board
PO Box 8477
Harrisburg, PA 17105-8477

Dear Sir or Madam:

Enclosed are the Pennsylvania Association of Conservation District's comments on the proposed revisions to the CAFO and Act 6 regulations. Please feel free to contact me with any questions at (717) 238-7223 or susan-marquart@pacd.org.

Sincerely,

Susan Marquart
Executive Director

RECEIVED
NOV 10 2004 PM 3:44
Pennsylvania Department of
Environmental Protection
Review Commission