TAB 43

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October 30, 2001

Statement of

Michael J Langenhorst, Immediate Past Chairman

National Renderers Association

Before the

Food and Drug Administration

Kansas, City, Missouri

The National Renderers Association (NRA) is the international trade association for the industry that safely and efficiently recycles animal and poultry by-products into valuable ingredients for livestock, pet food and chemical and cosmetic industries. The NRA represents 43 member companies operating more than 160 rendering plants.

The NRA is very familiar with the issues we are discussing here today. Since the first case of BSE was reported in 1986, and through all of the stages of this situation, we have been proactive and worked closely with the FDA and other government departments as well as affiliated industries to promote and produce safe feed and food. In fact, I believe that the support of the NRA and North American Rendering Industry (NARI) was instrumental in the success of the surveillance program as well as the original rule itself.

There are 17 questions we have been asked to respond to, but I would just like to comment publicly on a few of them. Written comments from the North American Rendering Industry will be submitted before November 21, 2001.

The main question is, what additional enforcement activities, if any, regarding the present rule are needed to provide adequate public health controls? Are there any suggestions for ways to improve compliance with the rule?

The NRA believes that the current rule provides adequate protection of public health and has accomplished its intended goals as laid out in 1997. We realize that there have been concerns expressed with certain aspects of the rule, but feel that these concerns can be addressed by providing proper resources for inspections and data management.

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There have been very few operational non-compliance events since the rule has been implemented. The majority of non-compliance issues have come from incorrect inspection interpretation or incorrect data entry compilation. In fact, the recent APPI third party certification program has shown a 98% compliance with the rule in the rendering industry. The other 2% have not been determined non-compliant, but rather have not undergone third party certification.

The NRA strongly supports and would participate in any effort to attain 100% compliance of the rendering industry. We would not be opposed to licensing of rendering facilities as it relates to compliance with the rule if this would help with enforcement, so long as this does not become a bureaucratic nightmare. If anyone is not complying with the rule, appropriate action needs to be taken by the agency.

Much time and effort went into development of the final rule in 1997. It was felt very strongly at that time that appropriate controls had been implemented to protect public health in the U.S. The rule was based on scientific risk assessment and was deemed to satisfy the risk at that time.

It must also be remembered that the rule at that time was touted as a firewall for the meat industry. We all know that the U.S. really has many firewalls in place relative to BSE: the ban on imports since 1989, the surveillance program which exceeds OIE recommendations, the mammalian feed ban of 1997 and third party certification.

We are at the lowest level of risk that we have ever been as a country. There is no need to reopen the rule, but rather we must strive for 100% inspection and compliance with the current rule.

The NRA strongly supports appropriate restrictions on the importation of feed and animal products. These restrictions should be based on risk analysis and on a country's BSE incidence. The U.S. could accomplish this by establishing a category classification as practiced in other parts of the world. The resulting import restrictions and policies would be based on this systematic classification category.

Coordination of programs and appropriate financial resources must be put in place to accomplish this initiative.

The NRA thanks you for the opportunity to address these issues. We are committed to protecting public health and continue to be available to work with the FDA. As stated earlier, our common goal is to attain 100% compliance.

Thank you.

SPARKS COMPANIES INC.

The Rendering Industry: Economic Impact of Future Feeding Regulations

Prepared for
The National Renderers Association

June 2001

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The Rendering Industry: Current Situation and Economic Impact of Future Feeding Regulations

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The Rendering Industry: Current Situation and Economic Impact of Future Feeding Regulations

Foreword

The rendering industry performs functions vitally important to the livestock and poultry sectors: it provides an outlet for over 47 billion pounds of byproducts from meat packers, poultry processors, restaurants, retail meat stores, and other entities. Visualize a 4-lane truck convoy, placed bumper to bumper from Los Angeles, California to New York City, New York, and that's the amount of raw material processed by the rendering industry each year. From this waste, the rendering industry produces nearly 10 billion pounds of protein ingredients, highly valued by the feed industry. Also produced is a wide range of other lipid materials used in various feed and industrial applications, which amounts to over 9 billion pounds.

In recent years, fears over the spread of BSE in the United States have led to regulations regarding the use of animal-based proteins in livestock feed. This directly and negatively impacted the value of these products in the market. However, concerns over the threat of BSE have not abated, and it has been suggested that additional regulation over livestock feeding practices could surface. This could have tremendous cost implications for the rendering industry in particular, and the livestock complex generally. Ultimately, consumers will bare many of these costs through higher prices for meat and meat products

Sparks Companies has agreed to examine the potential economic impacts of three regulatory scenarios concerning the use of animal protein in livestock feeds. This research builds and expands on a similar study conducted by Sparks ahead of the current FDA feeding rule. This report is organized into sections examining: (1) the current size and scope of the rendering industry, (2) a retrospective on the impact of the 1997 feeding regulations, (3) cost estimates under three additional feeding regulations, and (4) a discussion of the economics of the disposal of raw animal byproducts.

It is our hope that this report will provide valuable insight into any future discussions regarding feed regulation, and will also help the industry to prepare should regulatory change be imminent.

June 2001

The Rendering Industry: Current Situation and Economic Impact of Future Feeding Regulations

Executive Summary

The rendering industry collects and processes over 47 billion pounds of byproducts from the slaughter and meatpacking industries and transforms them into useful and valuable feed and industrial materials. Rendering adds nearly $1 billion in value to the livestock production sector in the form of protein materials and also removes the need to dispose of byproducts in landfills or by other methods that might pose potential health risks or strain existing landfill space. The 47 billion pounds of raw material processed by the rendering industry each year would make a truck convoy 4 lanes wide from Los Angeles, CA to New York City, NY.

Today the industry is under severe threat of new regulations that could greatly decrease the value of its output. The spread of "mad cow" disease in Europe has attracted intense media attention and has led US regulators to become increasingly conscious of livestock feeding practices here, even though the disease has never been detected in the United States. The concern is that feeding certain animal-based protein substances to livestock might spread mad cow disease, but many of the proposed restrictions go far beyond science-driven requirements. Currently, the use of most ruminant-based proteins in ruminant feed is prohibited, and this appears to have abated any real risk of the disease in the United States. But several proposals have surfaced threatening to impose further restrictions on feeding practices, such as extending the current regulation to include all farm animals, or removing current exceptions concerning ruminant blood and other substances commonly used in ruminant feed.

Rendered animal proteins are especially valuable to the livestock and feed industry because of their high protein content, digestible amino acid levels (especially lysine), mineral availability (especially calcium and phosphorous), and relatively low cost in relation to their nutrient value. They have few close substitutes in most rations, although specific feeding characteristics of animal products can be reproduced to some degree using vegetable protein sources (e.g. soybean meal) supplemented with minerals and synthetic amino acids where necessary, but often at significantly higher cost. For most feeding applications animal proteins currently provide the lowest cost nutrient balance compared to plant-based or synthetic alternatives. For other applications, the natural forms of amino acids (e.g. lysine in blood meal) are the only effective source. In these instances, a significant loss in feeding values must be anticipated, which will reduce production efficiency and raise production costs.

Additional regulation of livestock feeding practices in regard to the use of animal proteins will create economic dislocations by reducing the demand for rendered material, increasing costs of feed, and incurring disposal costs for material which no longer can be fed. These shocks would resonate throughout the livestock production sector, in the form of higher production costs for certain livestock, lower values for slaughtered animals, reduced profitability for renderers, packers, and especially livestock producers, and perhaps higher prices for meat in retail stores.

The size of these market shocks and their distribution across the livestock sector depend upon the nature and extent of proposed future regulations.

This study examines the economic impact of several possible future feed regulation scenarios. The analyses are based on the current market value of rendered animal proteins to the feed industry, and potential disposal costs of these substances if they can no longer be fed. The regulatory proposals examined here are as follows:

Scenario I. Total animal protein feed ban to all ruminant animals.

Scenario II. Total ban on the feeding of ruminant protein to all farmed animals, including:

a. Ruminant meat and bone meal to swine and poultry
b. Ruminant blood meal and plasma to dairy, beef, swine, and poultry.

Scenario III. Total animal protein ban to all farmed animals.

Economic Impact of Scenario One
(banning animal proteins to ruminants)

The bulk of the impact from this scenario results from the elimination of all porcine (and equine) MBM and blood meal from ruminant diets. Unlike in Europe, the total amount of MBM used in ruminant rations has always been fairly low. However, blood meal is an extremely important component to ruminant feed rations, especially dairy cattle.

- The ban would immediately result in a sharp reduction (or complete elimination) of the price premium for non-ruminant (e.g. porcine) MBM. The market price for MBM would also fall as the total quantity demanded is reduced by at least 10% from current levels.

- Impacts on the market for blood meal would be larger since ruminants currently consume the major proportion of all mammalian blood meal. Up to 100 million pounds could require disposal in landfills at an expected cost of $60/ton in tipping fees plus additional transportation costs.

The total reduction in revenue to the rendering industry plus costs of disposal resulting from scenario one is estimated to be $100.14 million per year

Economic Impact of Scenario Two
(banning ruminant proteins to farmed animals)

Scenario II has several components that add to its cost: removal of ruminant-based MBM from the feed rations for swine and poultry, and removal of ruminant blood meal and plasma from the diets of ruminants, swine, and poultry.

- The scenario would result in significant reductions in the value and sales of all ruminant-based and mixed species animal proteins, and cause tremendous costs of disposal of the restricted materials.

- The price for non-ruminant MBM (and non-ruminant blood meal) might increase somewhat as more feed manufactures compete for a smaller supply of approved material, but the amount of this price increase will be constrained by the price of substitute products, particularly the lowest-cost ration of equivalent quality that can be developed without using animal proteins.

- Significant amounts of material would require disposal in landfills as important markets for many rendered products are eliminated.

- Cattle producers are especially impacted under this scenario, with a possible reduction in the value of their livestock of up to $15.50 per head.

Total net reduction in revenue to the rendering industry, plus costs of disposal under scenario two, is estimated at $636.4 million per year

Economic Impact of Scenario Three
(complete ban of animal proteins to all farmed animals)

A total animal protein ban to all farmed animals is the worst case in terms of cost to the livestock production sector from additional regulation of animal proteins. All use of animal proteins in commercial livestock feeds would be ended, necessitating the disposal of nearly all mammalian and poultry by-product feed ingredients in landfills or by some other method. Pet food and export markets are highly likely to follow suit and eliminate their use of animal proteins as well.

- As much as 47 billion pounds of slaughter by-products could accumulate each year—64 thousand tons per day—straining the capacity of existing landfills and incinerators and risking the spread of disease as it decays.

- The material likely would be rendered prior to disposal to reduce the volume of waste and to reduce environmental impacts. The value of animal byproducts at the slaughter facility would become negative, requiring packers to pay renderers to accept the product and cover the costs of rendering, handling, and disposal.

- All livestock sectors are expected to share in the costs imposed under this scenario. Estimates on the price of livestock range from $3.22 per hog, $15.50 per head of cattle, 7 cents per broiler, and 33 cents for each turkey sold for slaughter.

Total costs incurred by the rendering industry under scenario three are estimated at $1.519 billion per year

Distribution of Economic Impacts

Although the rendering industry will be the initial recipient of cost shocks resulting from future regulation of livestock feeding practices, these impacts will quickly be distributed across the marketing chain for livestock and derived products—affecting cattle producers, meat packers, meat processors, renderers, and even consumers in the form of higher meat prices.

This study concludes that additional regulation of animal protein feed ingredients will cause real and significant economic shocks and dislocations throughout the livestock complex. Many of these would have initial catastrophic effects on individual rendering firms, since their current revenue structure depends directly on the value of rendered products for feed. Ultimately, as markets adjust, costs will be distributed over the entire production and marketing chain. Even though these costs will be distributed widely, their impacts will not disappear; they are more likely to be amplified in the forms of reduced meat supplies to consumers and reduced profitability to firms in the livestock sector.

I. Introduction

The rendering industry refers to itself as "the original recyclers", which is an apt description of the role it plays in the livestock marketing chain. Renderers take the byproducts of slaughter and meat packing facilities and turn them into useful and valuable products for the livestock feed industry and other industrial sectors. They collect over 47 billion pounds of material annually that otherwise has little value and would need to be disposed of as waste. From this they produce nearly 10 billion pounds of ingredients for the feed industry valued at almost $1 billion, along with a wide range of products used in other industries such as tallow, fat, and greases.

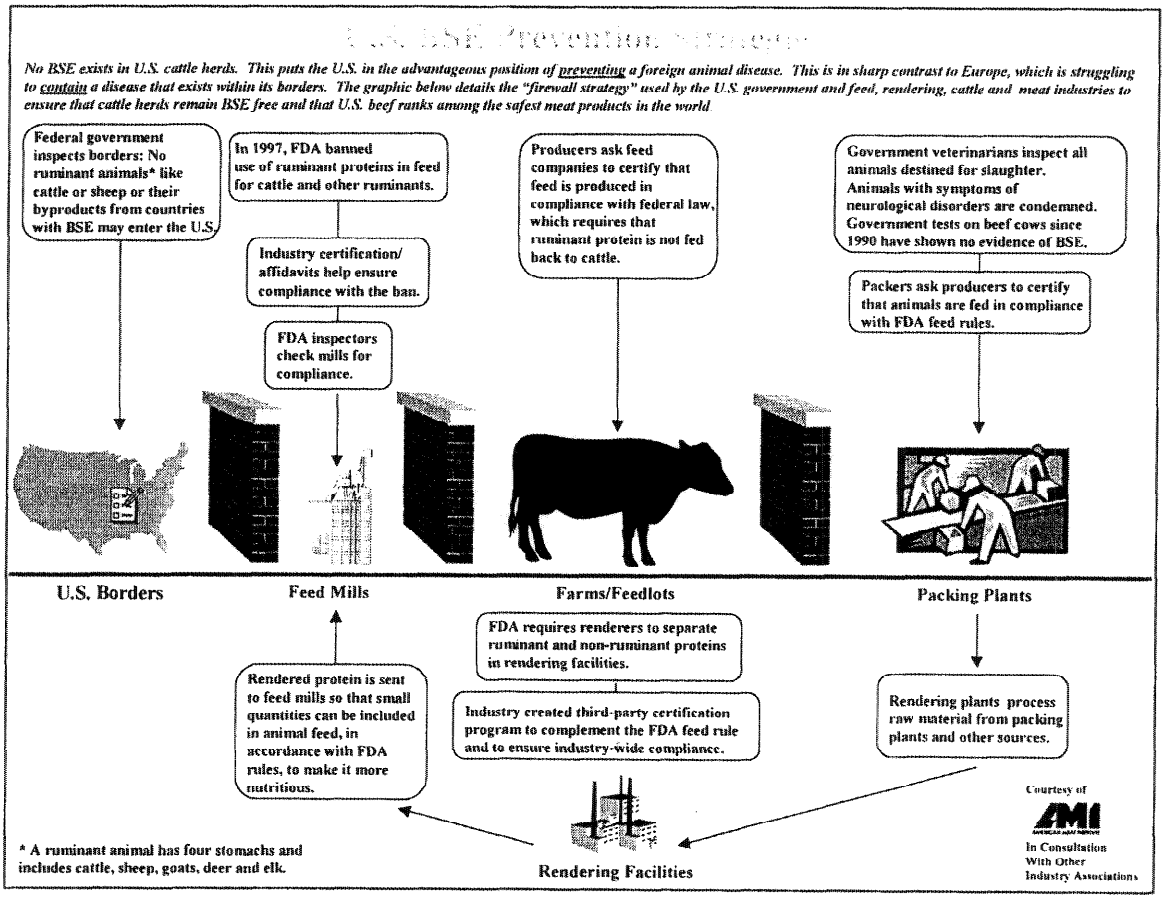
The industry today is under severe threat due to public health concerns spawned by the outbreak of "mad cow" disease in Europe. Bovine spongiform encephalopathy (BSE, commonly referred to as "mad cow disease") was first diagnosed in Great Britain in 1986, and has since been reported in several European countries including France, Switzerland, Netherlands, Belgium, Portugal, Luxemburg and Ireland. In March 1996, British scientists reported a possible link between consumption of meat from BSE infected cattle and a variant of the Creutzfeldt-Jakob disease (nvCJD) in humans. The effect on the livestock industry throughout much of Europe has been severe, with an estimated 20-30% decline in domestic beef sales due to negative long-term effects on consumer confidence, and substantial losses in international trade of beef, cattle, and livestock feed (Congressional Research Service).

BSE has not been found in the United States. Other Transmissible Spongiform Encephalpathies (TSE's), such as Scapie of sheep, and Chronic Wasting Disease (CWD) of deer and elk, have been reported to occur here on a small scale and in isolated geographic areas. The rare human TSE, Classic Creutzfeldt-Jakob Disease, known as CJD, has been recognized as a disease found worldwide, at a rate of about one case per million persons across the globe, in all races, in all climates, from the artic to the tropics. But this naturally occurring TSE is not related to nvCJD, a new form of the disease in Europe suspected of being linked to BSE. Like BSE, nvCJD is not present in the United States.

Intensive efforts are in place to confirm the continued absence of BSE and reduce the likelihood of it entering the United States. Strict controls (or total prohibitions) over the importation of live ruminants and meat and meat products from Europe are in place, imports of all rendered animal protein products from Europe have been banned, and, in August 1997, the FDA banned the feeding of virtually all mammalian proteins to ruminants in the United States. By all accounts, the measures in place have succeeded in their goal of eliminating the possibility of an outbreak, but the baffling nature of the disease, including the continued uncertainty over how it can be transmitted, has led many to call for even more stringent regulation over US livestock feeding practices.

The safeguards currently in place are intense, comprehensive and well managed. Since no BSE exists in the United States, the focus is on *prevention.* Therefore, all critical points of the livestock production chain where the disease *could* enter the United States have been identified, with safeguards and "firewalls" erected to guard against the introduction of BSE to US herds. Inspections, certifications, and detailed record keeping are important components of regulations aimed at eliminating the risk of an accidental outbreak in the United States (Figure 1).

Figure 1. BSE Prevention Strategies in the United States



Further restrictions on livestock feeding practices here would cause market adjustments and increased costs throughout the meat production and marketing chain, distributed among livestock producers, meat packers, feed manufactures, consumers, and the rendering industry. In 1997, Sparks Companies evaluated the cost impact of then-proposed FDA feed-use regulations.[1] This study is a follow-up and expansion of that research, examining three scenarios of tighter restrictions on the use of animal proteins in livestock feed[2].

Current FDA Regulation of Animal Feeds

The Center for Veterinary Medicine (CVM), a division of the Food and Drug Administration (FDA), regulates the manufacture and distribution of feed additives and drugs used for livestock.

In August 1997, FDA regulation 21 CFR 589.2000 "Animal Proteins Prohibited from Ruminant Feed" took effect. This regulation prohibits, with some exceptions, the use of protein derived from mammalian tissue in feed for ruminant animals. The exceptions to this ban are:

[1] Sparks Companies, 1997. "The Economic Impact of Proposed Regulations Concerning Ruminant-Based Protein Products"

[2] While it does not repeat the industry survey that was conducted as part of the 1997 study, it does build on the findings in that report

- Proteins derived solely from swine and/or equine tissue
- Blood and blood products
- Milk and milk products
- Gelatin
- Plate waste (meat products which have been prepared for human consumption).

The scientific basis for banning only mammalian protein feed sources is that no TSE of plant or non-mammalian animals has ever been detected. Similarly, no naturally occurring TSE has ever been detected in swine or equine species, and neither blood nor milk from any species has been shown scientifically to play a role in transmitting BSE through oral infusion (FDA Veterinarian).

Rendering establishments are the first point of control for this regulation, since they are responsible for processing slaughter byproducts, animals unfit for human consumption, and meat scraps into material that can be used for feed and industrial uses. They are now compelled to monitor the type of raw material processed in their operations, particularly whether it contains any tissue from ruminants. Any rendered protein substances produced from raw material that is either exclusively from ruminants or that may contain some ruminant tissue is considered "prohibited" and must be labeled and tracked throughout the marketing chain. All prohibited material must be labeled, "Do not feed to cattle or other ruminants".

In order to avoid commingling of prohibited and non-prohibited end-products, renders that receive raw material from various species could separate ruminant materials and process them on a separate line, but this appears to be cost-prohibitive to most independent renderers. Instead, all material from mixed-species renderers tends to be considered prohibited and labeled accordingly. Discussions with renderers suggest that less than 2% of the independent renderers currently have the capability of rendering "prohibited" material on separate lines.

All businesses that handle mammalian proteins (renderers, animal feeders, protein blenders, feed manufacturers, transporters, etc.) are required to track the flow of prohibited material through their facilities and establish safeguards to prevent commingling of prohibited and non-prohibited material. Records sufficient to track prohibited materials must be made available to the FDA and maintained for at least one year.

BSE Regulations in the EU

The BSE epidemic that originated in Europe has been underway there for over 16 years now, since being first discovered in Great Britain in 1986. In response the cattle and meat industries throughout Europe have undergone a significant increase in regulation. Major steps have been taken to change long-standing feeding practices, limit trade of potentially infected cattle, and destroy any animals that could be harboring the disease. A major initiative in the UK, enacted following the 1996 EU ban of beef and cattle imports from the Britain, is the "Over Thirty Month Slaughter" (OTMS) program. Under this plan, which bans the sale of meat and meat products from cattle over 30 months old, the British government has purchased and destroyed over 4.9 million head of cattle at a direct cost in excess of $4.0 billion.

The controls on the use of animal protein as a feed additive in the EU are much more stringent than in the United States, restricting nearly all sources of animal protein in all animal feeds. Although a complete ban on meat and bone meal in animal feed was originally intended to remain in effect for only six months beginning January 2001, the belief is that it will not be repealed any time in the near future. Already, France and Germany have publicly expressed interest in making the ban permanent. Last year (December 7, 2000) the United States announced a prohibition on the importation of all rendered mammalian protein and feed from Europe and several other countries suspected to be at risk for BSE. One consequence of the OTMS and the severe feeding restrictions has been an accumulation of over 431,000 metric tons of MBM and 215,000 metric tons of tallow awaiting disposal by incineration or in landfills. The primary method of disposal of culled animal is incineration, with most first being rendered into MBM and tallow. Tallow is subsequently used as a fuel in many rendering facilities in place of petroleum based products.

Calls for Tighter BSE Controls in the US

The current feed rule, in place since 1997, has been criticized by some as inadequate to remove the risk of BSE entering the US livestock complex. Much of the criticism can be traced to widely publicized and confusing media reports documenting failures by many licensed feed mills and rendering facilities to fully comply with the current regulations. A recent case in which a Texas feed mill quarantined 1,222 head of cattle suspected of consuming restricted animal proteins added to the public perception that further feed control measures are necessary. The Texas incident, however, is a vivid example that the multi-layered safeguard system in the United States is working to protect the food supply. The mill in question behaved responsibly by quickly reporting the problem and cooperating closely with State and Federal authorities to satisfactorily resolve the matter in compliance with all laws and regulations.

FDA's enforcement plan for the feed rule includes education as well as inspections of firms that handle prohibited material. As part of the enforcement plan, in 1998 all FDA District Offices were assigned to conduct inspections of 100% of all renderers and feed mills and some ruminant feeders to determine compliance with the feed rule. Initial reports released by the FDA's Center for Veterinary Medicine (CVM) suggested that nearly half of all feed manufactures were not in full compliance, particularly regarding the proper separation and labeling of prohibited materials. However, follow-up inspections showed dramatic improvement.

To supplement the enforcement activities of the Federal and State agencies, and provide an additional level of quality control and safety, both the rendering and the feed industries have adopted voluntary self-certification programs that include third-party audits. Although it is clear throughout the scientific community that these measures have successfully prevented the spread of BSE, some consumer advocate groups continue to call for more stringent regulations.

Senate hearings held April 4, 2001 by the subcommittee on Commerce, Science, and Transportation ("Mad Cow Disease: Are Our Precautions Adequate?") examined the measures currently in place to prevent BSE. Included was testimony from Federal agencies (USDA and FDA) as well as from industry groups representing cattle producers, the meat industry, veterinarians, and consumer groups. Most of the government and industry testimony stressed

that BSE is not currently found in the United States and that current measures are adequate, especially if enforcement activities can be bolstered.

However, consumer groups, including the Center for Science in the Public Interest (CSPI), were less sanguine about current regulatory protections, and called for expanding enforcement activities and the removal of various exceptions from the current feeding ban.

Suggestions that the current feeding regulations could become more stringent in the near future have come from several sources, including testimony by Illinois' Senator Durbin, who may introduce a bill entitled "The National Food Security and Safety Act". Though details of the bill were not disclosed, he suggested that at the very least it would remove many or all of the exemptions from the current feeding ban, and could extend prohibitions to include all use of animal proteins in livestock feed.

Several feed companies have implemented proactive strategies to reduce the likelihood of possible inadvertent inclusion of ruminant-based feed ingredients in ruminant feed. Purina Mills, the third largest feed company in the US with a more than 7.5 million ton annual capacity, announced in January that it would no longer purchase any meat and bone meal containing ruminant materials, at least until it can develop better methods of segregation. While Purina Mills is on record as approving the use of ruminant-based feed ingredients for non-ruminants, it stated that in its large feed mills it could not guarantee segregation of ruminant as required by US law.

Other livestock feed makers that no longer purchase ruminant-based feed ingredients include Consolidated Nutrition (the 6th largest producer with 2.6 million tons of capacity) and Kent Feeds (the 8th largest producer with a capacity of 2.0 million tons). Of course, the few feed mills that adopted this strategy are the exception and are overshadowed by the many, many mills across the country that continue to legally use these valuable ingredients in the diets of poultry, swine, pets and aquaculture.

Potential Scenarios for Additional US Regulation

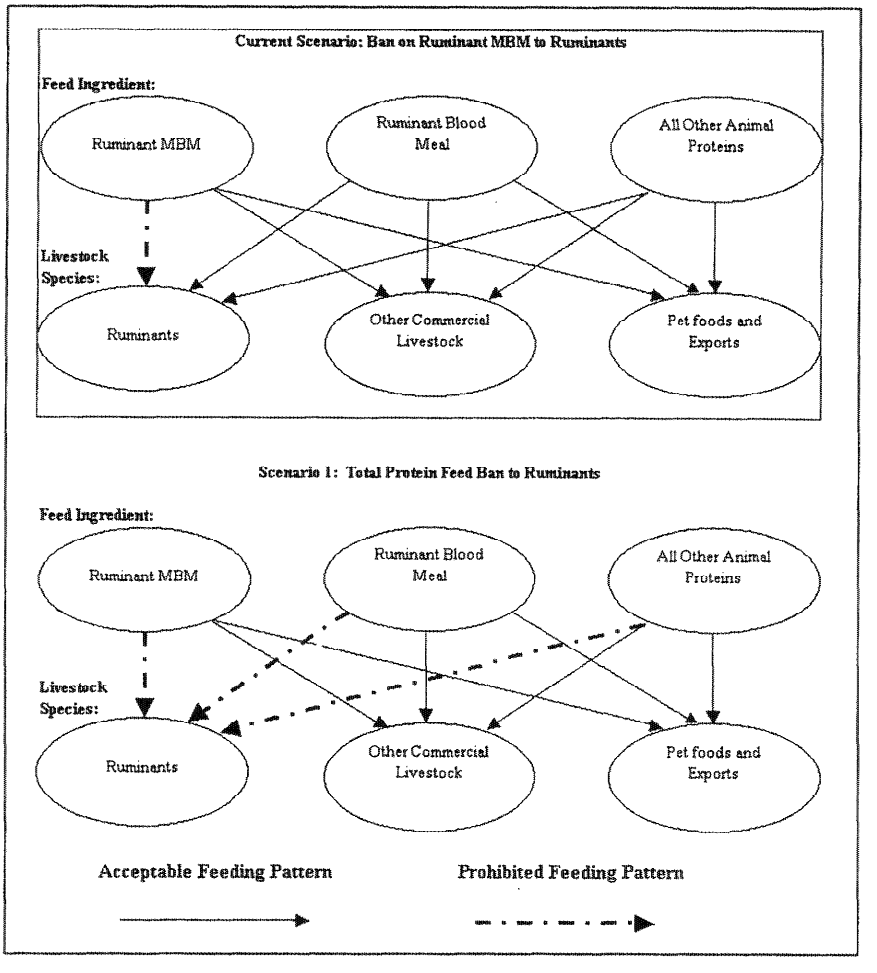
Even before the recent hearings in the Senate, negative attention from the media over the threat of BSE in the United States and public concern over livestock feeding practices persuaded the National Renderers Association (NRA) to investigate the economic impacts to the livestock complex should tighter feeding regulations become a reality. This study draws heavily upon a comprehensive industry survey and impact analysis conducted by Sparks in 1996, just prior to the implementation of the existing FDA. Economic costs of potential future regulations are estimated in this study based on the value of rendered animal products in current markets, and expected disposal costs should this material no longer be included in livestock feed.

This study examines three possible scenarios:

1. A total animal protein feed ban to all ruminant animals (Figure 2).

   The scenario extends the current regulations by removing exceptions made for the feeding of non-ruminant or poultry byproducts to cattle, sheep, or other ruminants. While animal proteins represent a small proportion of the total feed ration for ruminants, the current feed ban has resulted largely in a switch from ruminant-based feed ingredients to porcine meat and bone meal. Under this scenario, porcine meat and bone meal would no longer be a feeding option. Furthermore, ruminants, especially dairy cattle, are the largest consumers of blood meal, which is currently exempt from all feeding regulation. This scenario would remove blood meal from dairy cattle rations, and thereby dramatically reduce the domestic use and value of this product. Plus, it is likely to result in the need to dispose of some blood meal in landfills or by some other means since the largest share of the market for this product will no longer be available.

Figure 2. Feeding Restrictions Under Scenario One

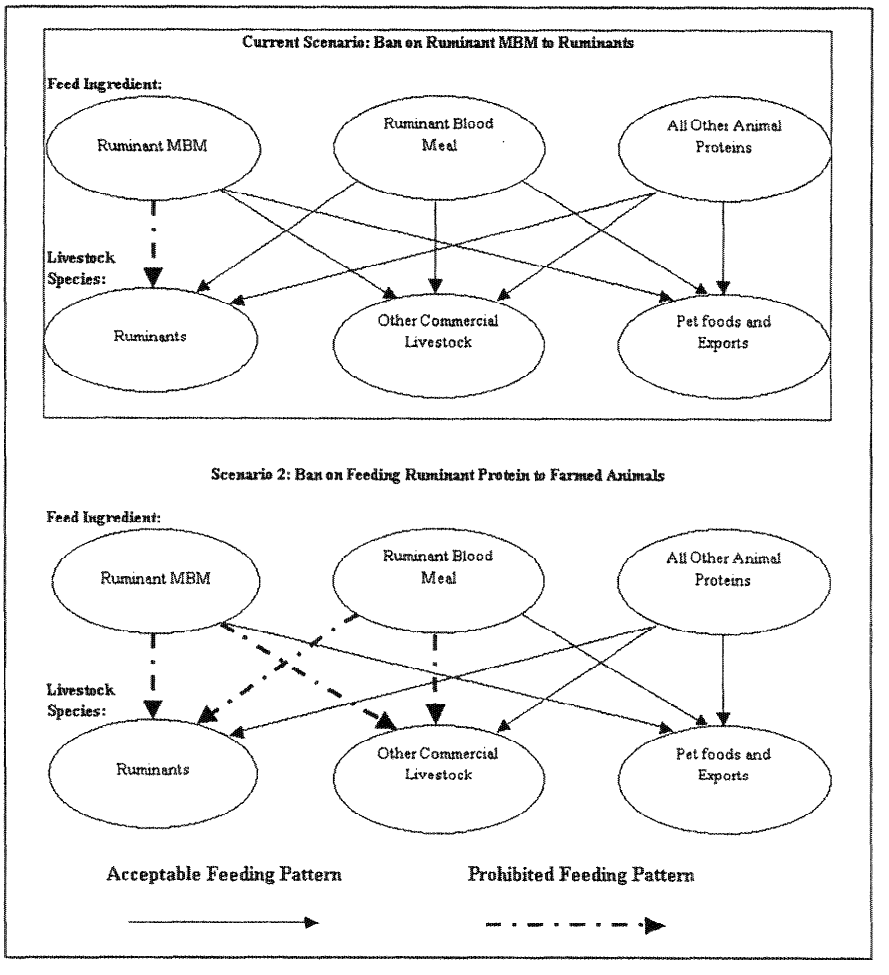


2. A total ban on the feeding ruminant protein to all farmed animals, including (Figure 3):
   a. Ruminant meat and bone meal to swine and poultry
   b. Ruminant blood meal and plasma to dairy, beef, swine, and poultry.

This scenario eliminates all ruminant protein from all domestic commercial livestock feed. It would still allow the feeding of porcine and poultry-based feed ingredients to any farmed animal, so the largest direct effect would be on the disposal of feed ingredients containing any trace of ruminant-based materials—or the disposal of slaughter by-products from ruminants if these were no longer rendered.

Ruminant based feed ingredients, along with those from mixed-species that may contain ruminant material, account for over 75% of all mammalian by-product feed ingredients produced in the US. The only domestic market that would remain for these products would be the pet food industry. While pet food companies are the second largest users of meat and bone meal in (accounting for 23% of all purchases) this change would sharply reduce byproduct markets. This ban would also remove much of the domestic demand for blood meal.

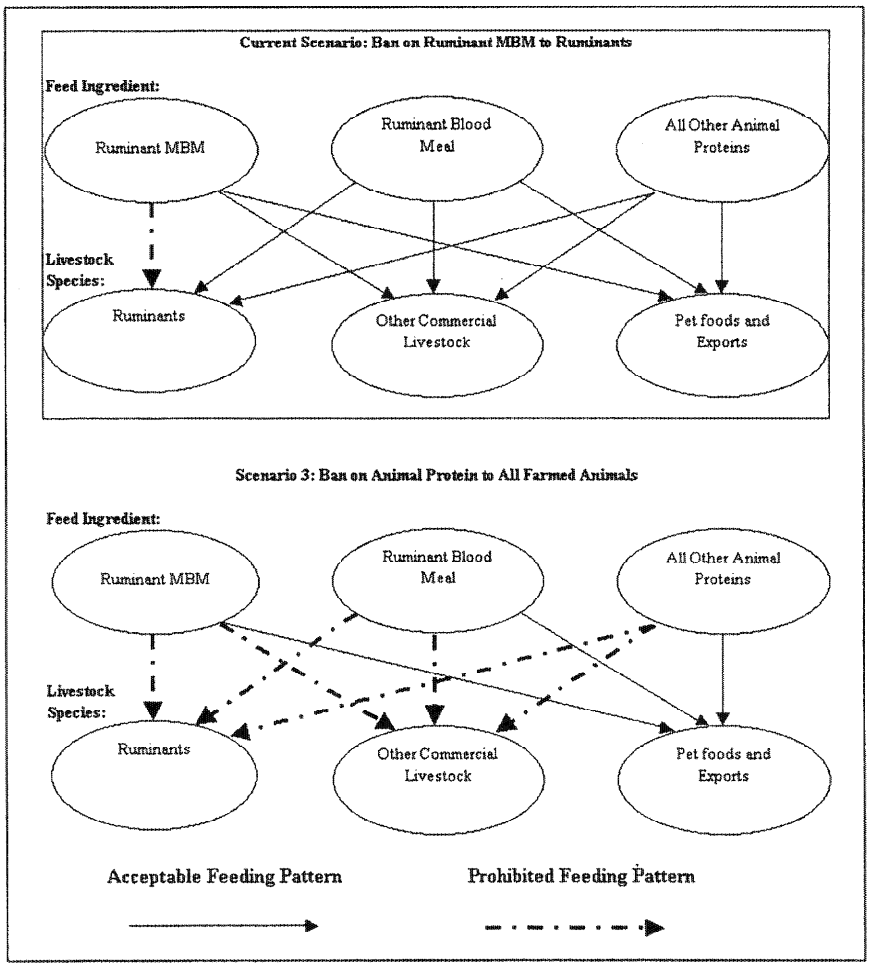
Figure 3. Feed Restrictions Under Scenario Two



3. A total animal protein ban to all US farmed animals (Figure 4).

This scenario effectively eliminates most all markets for value-added rendered products. Under this alternative, all use of animal proteins in commercial livestock feed would cease, leaving the pet food market as the sole domestic outlet for these products (and it is likely that public pressure would soon to curtail their use of rendered animal products as well). Furthermore, it is likely that exports would be considerably reduced or eliminated as foreign countries react to the message implied by this US action that animal proteins are not safe for use in livestock feed. An immediate impact would be a sharp reduction in the value of all rendered animal protein feed ingredients and dramatic increase in disposal costs. It is unclear whether rendering of animal byproducts would continue, depending upon the costs or feasibility of disposing of the more than 47 billion pounds of slaughter byproducts produced each year in the United States.

Figure 4. Feeding Restrictions Under Scenario Three



Guide to the remainder of the report

This report examines these scenarios in detail. The sections following this introduction are organized as follows:

II. Rendering Industry Profile (pgs. 11-18)

This section documents the current size and structure of the rendering industry. It estimates the total amount of slaughter byproducts produced and used as input to the rendering industries and the amount of animal protein feed ingredients currently produced. Estimates are also developed of the amount of animal proteins produced by type of renderers (mixed-species or single, non-ruminant species). The information in this chapter is used to form "baseline" estimates of what is at stake under each of the potential regulatory scenarios described above.

III. Market Response to the 1997 Feeding Rule (pgs. 19-24)

The market responded sharply to the 1997 rule, and those responses provide a useful guide to expected future responses to even tighter regulations. This section documents the current market situation for protein feed ingredients, including both plant and animal-based materials. It estimates the long-term effect that the 1997 rule had on the price for animal proteins, thereby providing a "benchmark" for estimating the effect that future regulation might have on the industry.

IV. Economic Impacts of Additional Feed Regulation Scenarios (pgs. 25-44)

This section describes and evaluates the direct economic impact of each feed ban scenario described above. It explores both direct market impacts on the prices for animal-based feed ingredients, and estimates disposal costs should large quantities of rendered material or slaughter by-products be removed from the feed markets. Implications for the distribution of these costs across the livestock production and marketing chains are also discussed. Subsections are organized as follows:

Economic Impact of Scenario 1: pgs. 28-31
Economic Impact of Scenario 2: pgs. 32-36
Economic Impact of Scenario 3: pgs. 37-38
Distribution of Economic Impacts: pgs. 39-40

V. The Economics of Disposal Costs (pgs. 41-44)

The economics of disposing of raw byproducts directly in landfills is estimated and compared to the costs associated with rendering this material prior to disposal in landfills.

VI. Summary and Conclusions (pgs 43-46)

This section summarizes the key results from this analysis.

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II. Rendering Industry Profile

The US livestock sector slaughters 139 million head of cattle, calves, sheep, hogs, and horses and nearly 36 billion pounds of poultry annually. In addition to protein for human consumption, the system produces an enormous amount of byproducts that are in turn transformed into nearly 10 billion pounds of highly valuable feed and industrial products. The task of transforming byproducts from slaughterhouses and packing plants into safe and valuable products lies with the renderers. Animal offal (including viscera, heads, bone, blood, and other waste) is the primary raw material for rendering operations, along with waste generated from restaurants, grocery stores, and butcher shops. From this raw material renderers manufacture meat and bone meal (MBM) for use in livestock feed, as well as tallow, greases, and various other products of value to the feed, industrial, and food processing industries.

Raw Material for Processing

The amount of material available for rendering corresponds directly to the number of animals slaughtered. The nation's appetite for red meat and poultry continues to rise, up nearly 12 pounds per person between 1994 and 2000, to almost 275 lbs (Table 1). Reflecting this trend, the number of animals slaughtered, especially cattle, hogs, and poultry, rose steadily over the period (Table 2).

Table 1. Per Capita Meat Consumption

	Beef	Pork	Poultry	Total
		Pounds		
1994	96.1	68.3	98.1	262.5
1995	96.7	67.4	98.1	262.2
1996	96.9	63.2	100.8	260.9
1997	95.3	62.7	102.1	260.1
1998	96.8	67.6	103.4	267.8
1999	98.3	69.3	108.8	276.4
2000	99.0	67.5	107.8	274.3

Table 2. US Livestock Slaughter

Year	Cattle	Calves	Hogs	Sheep	Equine	Poultry Meat
			1,000 Head			*Mill. Lbs*
1994	34,196	1,268	95,697	4,938	107.0	29,768
1995	35,639	1,430	96,326	4,560	109.2	30,741
1996	36,584	1,768	92,394	4,184	105.0	32,378
1997	36,318	1,575	91,960	3,907	87.2	32,714
1998	35,465	1,458	101,029	3,804	72.1	33,105
1999	36,150	1,282	101,544	3,698	62.8	34,999
2000	36,248	1,131	97,955	3,429	47.1	35,693

The weight of the animals slaughtered determines the amount of offal and other by-products available for rendering. For example, 36.2 million head of cattle were slaughtered in 2000 each with an average liveweight of just over 1,200 lbs, meaning that nearly 43.9 billion pounds of cattle was processed by the beef packing industry. With hides and skins accounting for 5% of the liveweight (2.2 billion pounds), and commercial beef production at 26.8 billion pounds, this implies the remaining 14.9 billion pounds of byproducts (offal, bone, and other material) were available to the rendering industry to be processed into fat and protein products for feed and industrial uses. The byproduct yield for cattle is estimated at 34.1%, resulting in nearly 15 billion pounds of byproducts processed by renderers. Following similar logic, the total amount of mammalian slaughter by-products available for use by the rendering industry was over 20 billion lbs in 2000, up over 500 million pounds from 1995 (Table 3).

Table 3. Estimated By-product Volume Based on Slaughter and Implied Yield

	BP Yield	Avg. Liveweight		Total Pounds of By-product	
		1995	2000	1995	2000
	Percent	*lbs*		*Million lbs*	
Cattle	34.1	1187	1213	14,425.5	14,993.3
Calves	29.0	372	288	154.3	94.5
Hogs	20.4	257	259	5,050.2	5,175.6
Sheep/lamb	44.5	126	134	255.7	204.5
Horse	35.0	1200	1200	45.9	19.8
			Total	19,931.5	20,487.6

Since these coefficients are based on the relationship between total slaughter weight and edible meat production, they implicitly account for by-products used by industries other than renderers, including pet food manufactures and products used for human consumption including sausage, organ meats, and other specialty items. Thus, the estimates in Table 3 can be viewed as reasonable approximations of the amount of mammalian by-products rendered.

In the Sparks survey based on data for 1995, the total amount of material processed by renderers was estimated at 43.9 billion pounds, including condemned (4-D) animals, poultry by-products, and sludge, tankage, and waste from other sources (Table 4). The subtotal for raw mammalian by-products was 23.9 billion pounds (including dead stock), reasonably close to the estimate in Table 3 after accounting for dead stock and other minor species.[3] Using the 1995 survey estimates and their relation to the US commercial slaughter, total raw material volume rendered in 2000 was an estimated 47.1 billion pounds, up 7.5% from 1995 (Table 4).

The largest contributors to the increase in material rendered are swine and poultry, reflecting trends in meat consumption and production. Cattle slaughter has grown only modestly, resulting in a decrease in its share of rendering inputs from 38.3% in 1995 to 35.8% in 2000. Slaughter of

[3] The slight discrepancy is likely accounted for by material from other species, including goats, bison, deer, etc. that is not included in table 3 calculations, along with 4-D animals. The fact that the estimates from the 1995 survey are so close in value to those based on the 1995 livestock slaughter provides a high degree of confidence that the actual amount of material processed by renderers in 1995 was within the range of the estimates presented in that study.

horses has decreased dramatically over the 1990's in response to public pressure, and the sheep/lamb slaughter is down as well.[4]

Table 4. Raw Material Processed by Renderers

	Slaughter By-Products[1]		Blood		Total Material	
	1995*	2000**	1995*	2000**	1995*	2000**
Source	*Million lbs.*					
Cattle	15,349.1	15,407.9	1,457.5	1,482.5	16,806.6	16,890.4
Swine	6,021.0	6,283.9	987.8	1,004.5	7,008.8	7,288.4
Sheep	86.4	64.9	--	--	86.4	64.9
Equine	30.7	13.2	--	--	30.7	13.2
Subtotal	21,487.2	21,770.0	2,445.3	2,486.9	23,932.5	24,257.0
Poultry	16,932.1	19,659.5	460.4	534.5	17,392.5	20,194.1
Other	2,498.6	2,693.9	29.5	30.2	2,528.1	2,724.2
Total	40,917.9	44,123.5	2,935.2	3,051.7	43,853.1	47,175.2

1. Includes estimates of dead stock
* From Sparks 1996 Survey
** Based on 1996 estimates and slaughter numbers in 2000

Industry Structure

Rendering facilities are either operated as independent entities or are integrated with livestock packing operations that process by-products produced on the premises. Historically, most rendering operations were independent, but the continuing trend is toward increasing volumes processed by packer/renderers. General independent renderers often process a wide range of raw materials (i.e. from various species), but since most major packinghouses process only a single species at each plant, the rendering facilities associated with these plants typically produce output from only a single species (e.g. MBM only from cattle or hogs). The result is that the volume of "mixed species" MBM and other rendered products is declining as general independent renderers continue to lose market share to packer/renderers.

In 1995, production of MBM was roughly evenly split between livestock packer/renderers and independents. Today, experts interviewed report that packer/renderers produce *at least* 60% of all MBM, with independents accounting for the remaining 40% or less.

This observation is consistent with trends in the number and size of slaughter facilities. Between 1995 and 2000, the total number of facilities slaughtering hogs and cattle declined by 81 (10%) and 98 (12%) respectively, while in each case the numbers of the largest-volume facilities increased (Table 5). These high-volume slaughter facilities produce enormous amounts of by-

[4] Renderers also process dead animals and condemned animals, although this contribution is modest. As rendering fees increase from depressed markets, composting and on farm burial have become more popular. However, unapproved methods of disposal are oftentimes used as well, often at the expense of the environment and public health.

products that they often process on the premises. In some cases their volume would overwhelm the capacity of nearby independent renderers, but independents still perform an important function by picking up much of the slack from these large facilities as well as providing an outlet for the byproducts from smaller facilities that do not render on the premises. Furthermore, many of the largest meat packers (especially in poultry) are integrated all the way back to livestock production and feed manufacturing, so the animal proteins produced in their own rendering facilities are sometimes used in their own feed rations.

Table 5. Livestock Slaughter Facilities

Hog Slaughter Facilities:				
		Head per year		
Year	**Number**	**250,000 +**	**2 mil +**	**3.5 mil +**
1995	802	46	19	4
1997	770	42	16	6
2000	721	42	20	6
Cattle Slaughter Facilities:				
		Head per year		
Year	**Number**	**200,000 +**	**500,000 +**	**1 mil +**
1995	836	43	24	14
1997	822	41	23	14
2000	738	25	25	16

Source: USDA/NASS

Since the primary source of material for independent renderers is smaller slaughterhouses, continuing structural change in the livestock packing industry has certainly reduced the amount of material processed by independents, and thus the proportion of mixed-species animal protein sold in the feed markets.

The structure of the industry has undergone few dramatic changes within the last five years, with the exception of the on-going trend towards greater volume processed through packer/renderers. While some recent consolidation has occurred, the number of facilities that ceased operation remains a small share of the total that were operating in 1995. Rapid consolidation occurred in the late 1970's and the 1980's when the total number of facilities declined from more than 800 to the fewer than 300 that exist today.

Animal Protein Production

More than 6 billion pounds of mammalian MBM (i.e., excluding poultry products) were produced in 1995.[5] Based on the by-product volume derived above and an implied yield of

[5] Sparks' estimate of 6.2 billion pounds is nearly identical to the US Census Bureau's independent estimate of 6.1 billion lbs for 1995 (including MBM, dry rendered tankage, and MBM not elsewhere classified).

27.8% for MBM and 9% for bloodmeal, the total amount of mammalian MBM and blood meal produced in 2000 approached 6.7 billion lbs and 226.6 million lbs respectively (Table 6).

Table 6. Production of Rendered Mammalian Protein

	Yield[1]	1995	2000
		Million lbs.	
Meat and Bone Meal	27.8	6202.5	6652.4
Blood Meal	9.0	222.8	226.5
Total MBM and Blood Meal		6425.3	6878.9
Inedible Meat Products	0.31	136.2	146.2

1. Based on raw material volume and production from 1996 survey

Table 7. Production of Rendered Feed Ingredients

	Total[1]
Meat and Bone Meal	*Million lbs.*
Ruminant only	2734.1
Single, non Ruminant	1640.5
Mixed, containing ruminant	2263.1
Mixed, not containing ruminant	14.6
Total MBM	6652.4
Blood Meal	
Ruminant	121.9
Single, non Ruminant	54.8
Mixed	49.8
Total Blood Products	226.5
Poultry Based Feed Ingredients	
Poultry MBM	3073.5
Feather Meal	1200.0
Total Poultry Products	4273.5

1. Includes production by both independents and packer/renderers

Adjusting for changes in the production share processed by packer/renderers since 1996, over 2.7 billion pounds of ruminant meat and bone meal and 122 million pounds of ruminant blood meal were produced in 2000 (Table 7). In addition, 2.26 billion pounds of meat and bone meal and 50 million pounds of blood meal from mixed species origin (primarily produced by independent renderers) likely contained some ruminant protein. The majority of blood meal is produced by packer/renderers (estimated at 80%) so most of this is identifiable by species. Poultry based feed ingredients are processed almost exclusively by poultry packers or independent firms that

process only poultry by-products. The total amount of poultry based feed ingredients produced in 2000 was just over 4.2 billion pounds.

Markets for Rendered Protein

Most of the protein-based ingredients produced by renderers are sold to livestock and poultry operations and pet food manufactures to be incorporated into feed rations. Commercial feed manufacturers and protein blenders also purchase a significant portion of these products for the production of compound feed which is in turn purchased by livestock operations of all type.

In 1996, the beef and dairy industry used approximately 15% of all mammalian meat and bone meal sold in the United States, with swine operations accounting for 11%, poultry operations 42%, pet food manufacturers 22%, and 10% going toward other uses (Table 8). Changes since 1996 likely are small, except for some loss in sales to beef and dairy operations. The share going to beef and dairy producers following the 1997 FDA feed rule is now expected to account for 10% of all meat and bone meal (exclusively from non-ruminant sources) sold in the United States, with the excess distributed evenly across the other categories (Table 8).[6]

Table 8. US Sales of MBM*

	1995	2000
	Percent of Domestic Sales	
Beef Cattle	7	4
Dairy Cattle	8	6
Swine	11	13
Poultry	42	43
Pet Food	22	23
Other	10	11
	100	100

* Includes both ruminant and non-ruminant MBM

Rendered products are especially valuable to the livestock and feed industry because of their high protein content, digestible amino acid levels (especially lysine), mineral availability (especially calcium and phosphorous), and relatively low cost in relation to their nutrient value. There are few close substitutes for animal proteins in most rations, but specific feeding characteristics of animal products can be reproduced to some degree using vegetable protein sources (e.g. soybean meal) supplemented with minerals and synthetic amino acids where necessary. For most feeding applications animal proteins currently provide the lowest cost nutrient balance compared to plant-based or synthetic alternatives.

In some specialty applications, animal proteins offer clear advantages that are very difficult to reproduce. For instance, blood meal is highly valued for its content of "by-pass" protein, and its

[6] Note that table 8 refers only to distributions across *domestic* markets, but does not consider the fact that total domestic consumption has declined somewhat as exports have grown over this time (see Table 10).

ability to deliver essential amino acids that are not broken down in the rumen. Hence it is used heavily by the dairy industry both in milk-replacers for calves and as a feed supplement for lactating cows. It is also used in various animal starter rations to promote growth. Table 9 provides some comparative statistics of the nutrient content of animal proteins and some oft-used plant protein sources.

Table 9. Comparative Analysis of Animal and Plant Feed Protein Sources

	Dry Matter	Crude Protein	Bypass Protein	Met. Energy[1]	TDN[2]	Available Calcium	Available Phos.
	%	%	%	*Kcal/lb*	%	%	%
Meat and Bone Meal	93	50.0	39.5	1150	68	9.20	4.70
Blood Meal	89	80.0	63.1	1465	60	0.28	0.22
Poultry Meal	94	58.0	45.9	1380	74	4.00	2.40
Feather Meal	93	85.0	70.1	1310	63	0.20	0.70
Soybean Meal[3]	88	48.0	46.6	1125	79	0.20	0.21
Corn Gluten Meal	90	60.0	47.4	1700	86	0.02	0.18

1. Metabolizable Energy for Poultry
2. TDN = Total Daily Nutrients for Ruminants
3. High Protein Soybean Meal

Source: Feedstuffs 2000 Reference Issue, July 13, 2000

In addition to domestic sales for feed use, nearly 500 thousand tons of meat and bone meal were exported in 2000, valued at about $116 million. The largest and fastest growing foreign markets for meat and bone meal are in Asia, accounting for over 55% of all exports. North American markets (Canada and Mexico) account for the majority of the remaining exports (Table 10).

Table 10. US Exports of MBM

Destination	Unit	1991	1996	1997	1998	1999	2000
North America	Short tons	71,921.3	115,019.3	116,883.8	160,649.5	148,701.3	137,452.7
	$ millions	17.6	32.1	35.2	36.5	31.0	32.6
EU	Short tons	1.1	1,277.1	1,366.2	2,594.9	2,077.9	1,248.5
	$ millions	0	1.5	0.5	0.7	0.9	0.6
North Africa	Short tons	0	844.8	573.1	3,411.1	16,857.5	41,990.3
	$ millions	0	0.1	0.2	1.3	4.6	12.1
Asia	Short tons	35,231.9	219,294.9	199,254.0	166,372.8	240,594.2	272,708.7
	$ millions	8.9	67.6	64.6	45.8	56.6	65.7
Other	Short tons	1,287.0	1,975.6	1,127.5	10,855.9	11,411.4	35,995.3
	$ millions	0.5	0.9	1.2	3.5	3.6	5.0
Total	Short tons	108,441.3	338,411.7	319,204.6	343,884.2	419,642.3	489,395.5
	$ millions	27.0	102.2	101.7	87.8	96.7	116.0

Source: Foreign Agricultural Service

Growth in export sales have been strong over the past decade, and likely blunted some of the impact of the 1997 feeding rule. Excluding exports, total domestic consumption of MBM in 2000 was 5.67 billion pounds. Since the United States currently produces slightly more animal protein feed ingredients than necessary to fulfill domestic demand, growth in exports will be critical to minimize market impacts of any future feed regulations that reduce domestic demand. However, US regulations often affect regulatory decisions around the globe, so adoption of stringent new feed rules in the United States could constrain future exports.

Key Characteristics of the Rendering Industry

- The amount of material processed reflects the weight of animals slaughtered. Based on current estimates of total slaughter volume and the last comprehensive survey of the rendering industry, over 47 billion pounds of livestock byproducts are rendered into highly valuable feed and industrial products annually.

- The amount of mammalian meat and bone meal produced annually exceeds 6.6 billion pounds. Poultry byproducts add another 4 billion pounds, and blood meal of all types accounts for 226 million pounds.

- Poultry operations and pet food manufacturers purchase most US meat and bone meal, accounting for 66% of all domestic sales. Swine operations and producers of ruminants (primarily beef and dairy cattle operations) purchase 13% and 10% of all domestic sales, respectively.

- The majority of the material processed by independent renderers is "mixed species", containing proteins from ruminants as well as non-ruminants.

- Most porcine MBM produced is from integrated pork packing facilities that render their own byproducts.

The characteristics of the industry are important in determining the cost of existing and proposed feeding regulations. Based on the industry statistics developed in this chapter, the following analyses determine the market impact of the 1997 feeding rule and the expected impacts of future regulation. The distribution of these impacts across independent renderers and integrated slaughter facilities is described in following sections.

III. Response to the 1997 Rule

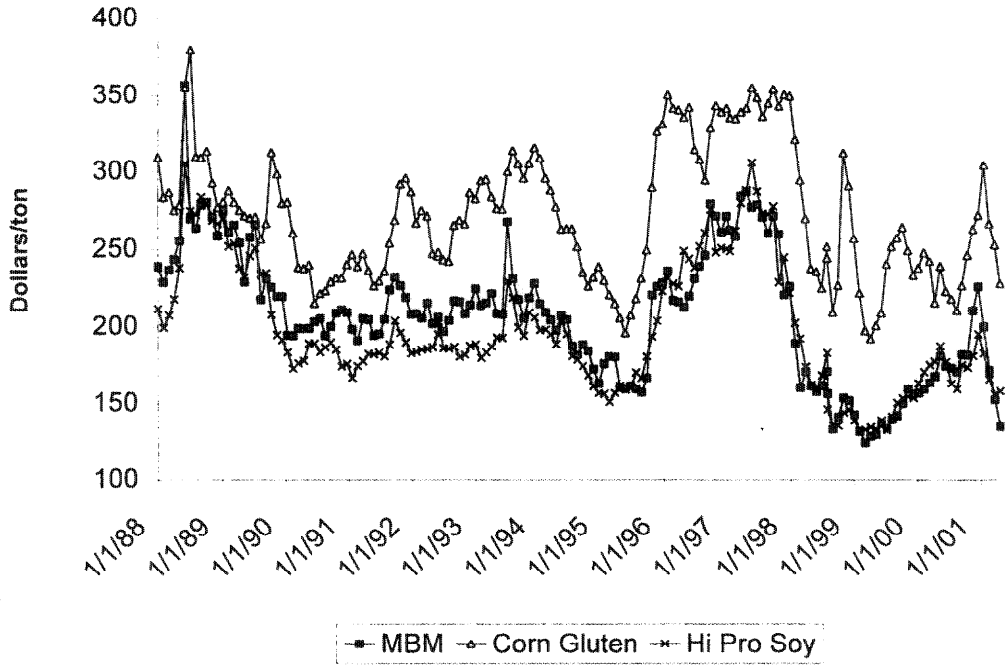
Demand/Prices

The demand structure for animal protein feed additives is determined by the needs of the feed industry and competition among feed supplements for this market. Commercial feed producers are highly sophisticated and operate with very low margins. Complex mathematical tools are used continually to develop least-cost rations built to well known specifications reflecting feed needs by specie, purpose, age and feeding objectives.

While MBM has a number of potential uses based on its protein and energy components, its highest use is as a supplement for animal feeds. It is especially valuable because of its unique protein structure and low cost. However, its price is defined not only by its availability, but also by prices of competing protein sources, primarily soybean meal and corn gluten meal. This relationship over time can be seen to be both close and highly dynamic (Chart 1).

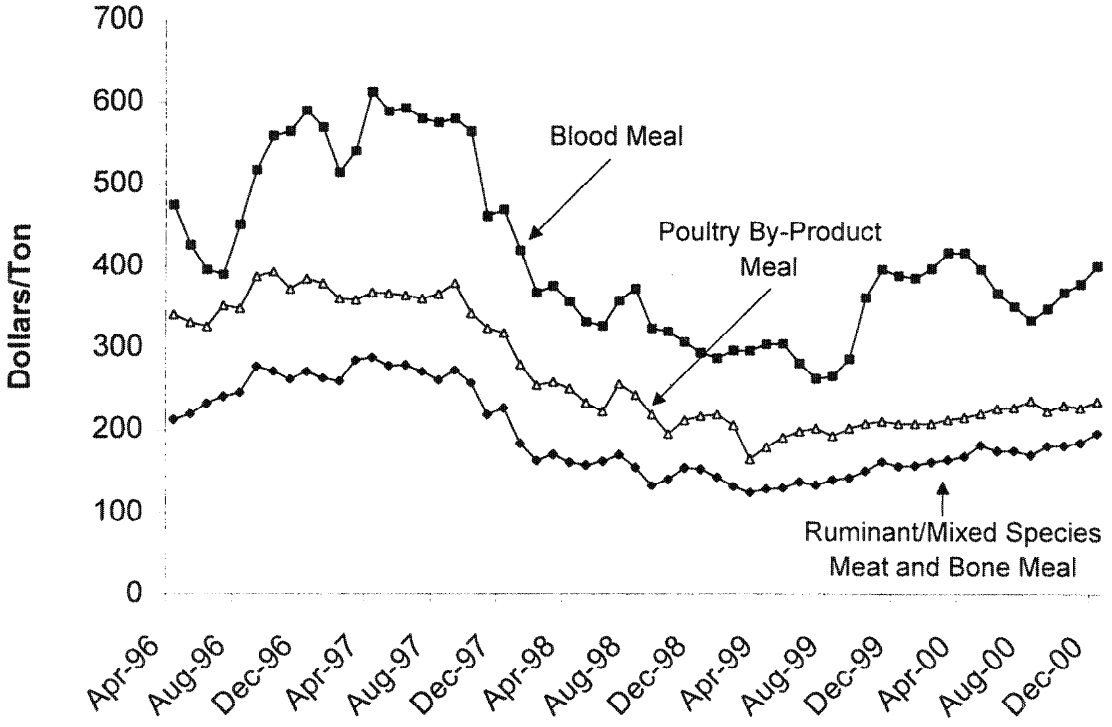
Over the past decade prices for ruminant/mixed species MBM (Central US) have been quite volatile. Its price peaked in May 1997 at just over $305/ton but has fallen steadily to a low of $132/ton in February 1999 before staging a moderate recovery to over $200/ton in late 2000. However, since January prices have again fallen, dipping to $135/ton in April perhaps in anticipation of increased feeding regulations. Another key factor behind these trends is the rapid growth in production of corn and soybeans, resulting in large supplies of soybean meal and corn gluten (with steadily lower prices). Greater industrial use of corn also leads to greater stocks and availability of corn gluten.

Chart 1. Prices for Animal and Vegetable Proteins



The prices for animal protein feed supplements tend to move together, but their relative values are determined by their protein content, the specialized nature of their uses, the degree of substitutability with plant-based protein sources, and market supply.[7] For example, blood meal tends to have the highest value of all animal-based protein sources, followed by poultry by-product meal, and mixed-species meat and bone meal (Chart 2). Blood meal is highly valued for its high concentration of by-pass protein (and protein content of nearly 90%), especially important to the dairy industry; poultry by-product meal is used widely in the pet food industries; while meat and bone meal is produced in the greatest quantities among these products and is somewhat more directly competitive with plant-based products in many types of animal feeds.

Chart 2. Relative Prices for Animal By-products



Impacts of the 1997 Feeding Rule

August 1997, FDA prohibited the use of most mammalian protein in feeds for ruminant animals.[8] The rule was in response to concerns over the potential spread of BSE in the United States, and particularly by reports in scientific journals in March 1996 suggesting a link between BSE in cattle and a variant of Creutzfeldt-Jakob disease (nvCJD) in humans.

[7] For example, meat and bone meal has an average protein content of over 50%; high-protein soybean meal is 48%; and corn gluten is 60% protein.

[8] (Title 21 Part 589.2000 CFR). The only exceptions were blood and blood products; gelatin; inspected, processed, and cooked meat products for human consumption (such as plate waste); milk products; and products only containing pork and/or equine products.

MBM markets responded quickly to the scientific report, declining from an average of $237/ton in January to $212/ton in April (a 10.5% decrease) while at the same time the price for high-protein soymeal climbed from $232/ton to nearly $250 (an increase of 7.7%).[9] The MBM decline reflected market uncertainty over public perception of its use in animal feeds and expectations of future regulation of animal-based feed ingredients. In anticipation of an official FDA ruling, the feed industry voluntarily banned sheep and other animal parts from ruminant feed shortly after the March 1996 report. The official FDA rule strengthened this existing ban and expanded it to include all ruminant products.

Impacts of the Ban Quantified

The long-term effect of this new regulation on the demand and price for MBM is highly complex. However, to estimate the ban's importance it is possible to examine MBM price behavior before and after the ban relative to prices of substitutes. This analysis includes several components:

- The degree to which prices of different protein ingredients move together over time suggests the extent to which they compete with each other for use in feed rations. Nearly 93% of the variation in MBM prices is associated with changes in soybean prices, and 73% of corn gluten price variation is associated with changes in MBM prices (Table 11). The high correlation between MBM and soybean meal is not surprising given their highly similar protein content (MBM has a protein content of 50%, high-protein soybean meal has 48% protein). Corn gluten meal has a somewhat higher protein content (60%) and thus is not as close a substitute, which explains its slightly lower correlation with the price of MBM.

Table 11. Estimated Price Correlations

	MBM	High Protein Soybean Meal	Corn Gluten Meal
MBM	1.000	0.926	0.735
High Protein Soybean Meal	0.926	1.000	0.772
Corn Gluten Meal	0.735	0.772	1.000

- Given the strong relationship between the prices of MBM and soybean and corn gluten meal, it is possible to measure directly the price impact of a fundament change in the demand structure for MBM that resulted from a change in the allowable uses for ruminant MBM. A linear regression model was constructed that includes monthly prices of MBM, soymeal, corn gluten meal and a "demand shifter" reflecting the MBM feed ban for ruminants. Thus, the model estimated the mathematical relationship between the price of MBM, prices of MBM substitutes and the presence

[9] Throughout this analysis, MBM refers to meat and bone meal that may contain ruminant proteins. Porcine MBM, or "non-ruminant" MBM, is referred to directly as such.

of an adverse long-term effect on the price of MBM following news in March 1996 of the link between BSE and nvCJD, and the FDA feeding rule that followed. [10]

- The linear regression model explains more than 91% of the monthly variation in MBM prices over the last ten years (reflected by the R-squared statistic, Table 12). It identifies an extremely strong link between soymeal and MBM prices, and implies that each $1 change in soymeal prices is associated with a $0.88 change in MBM prices. It also identifies a very significant, negative shift in MBM demand beginning in March 1996. Since then, MBM has experience an average discount of $18.13/ton below what it would have been had no link between BSE and nvCJD been reported. The likelihood that this shift occurred by chance is less than one in ten thousand.

Table 12. Linear Regression Estimates Predicting MBM Price

Regression Statistics	
R-Squared	0.914
Std. Error	12.760
Observations	159
F-Value	109.42

Variable	Parameter Estimate	Standard Error	t-value	Prob. > t
Intercept	26.786	8.134	3.29*	0.0012
Soybean Meal	0.884	0.045	19.44*	< 0.0001
Corn Gluten	0.065	0.045	1.44	0.1507
Feeding Rule	-18.127	2.172	-8.35*	< 0.0001

* Indicates statistical significance at the 0.01 level

The results of the regression analysis follow closely the logical economic relationships observed. Key observations include:

- The price of soybean meal has a highly significant role in determining the price of MBM. This reflects its degree of substitutability with MBM.

- The relationship between the price of MBM and corn gluten is not as strong.

- The demand shifter (i.e., the variable controlling for the net price effect on MBM following March 1996) is negative and highly significant, implying that since March of 1996, MBM has experienced an average price discount of $18.13/ton below what it would have been had no link between BSE and nvCJD been reported. The greatest price discount for MBM occurred immediately following the 1996 announcement,

[10] Using monthly price data from January of 1988 to March of 2001, (159 observations) a linear regression equation was estimated relating the price of MBM to prices of high-protein soybean meal and corn gluten meal, adjusting for seasonal price effects. A "demand shifter" variable was included in the specification to estimate the significance of any sustained effect on the price of MBM after March 1996.

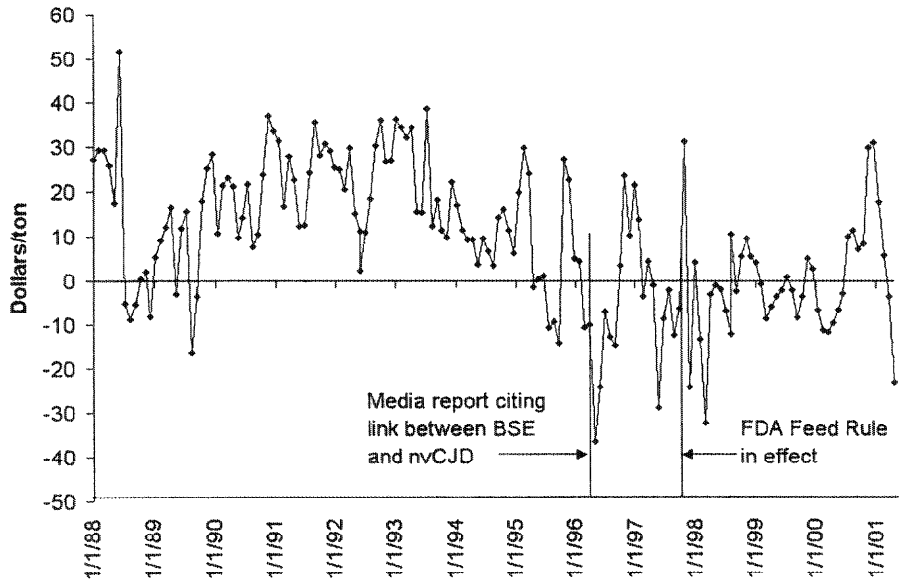
reflecting the degree of uncertainty surrounding future action by the FDA. By the time FDA's final rule was implemented, the market had adjusted and the MBM price relative to its substitutes had become more stable.

Other Evidence of Impacts

Other observable evidence supports the regression model's estimate of the magnitude of the price discount attributable to the current feed ban, including:

- **Historic price patterns.** MBM containing ruminant proteins traditionally sells at a moderate premium to plant-based materials of similar protein content (e.g. high-protein soymeal), reflecting its superior amino-acid structure, mineral content, and other qualities. This has been especially true when the markets for feed protein were soft, since the marginal benefit to using a somewhat higher-quality product is even more pronounced when its price is low. It is evident in chart 1 when viewed over the period prior to 1996. However, since 1996 the price premium historically held by ruminant MBM has disappeared on average (Chart 3). From January 1988 to February of 1996, ruminant MBM sold for an average $16.05/ton above the price of high-protein soymeal, while since March of 1996 it sold at an average discount of $1.20/ton. This total discount of $17.25/ton ($16.05 + $1.20) below average levels prior to 1996, in line with the regression estimates.

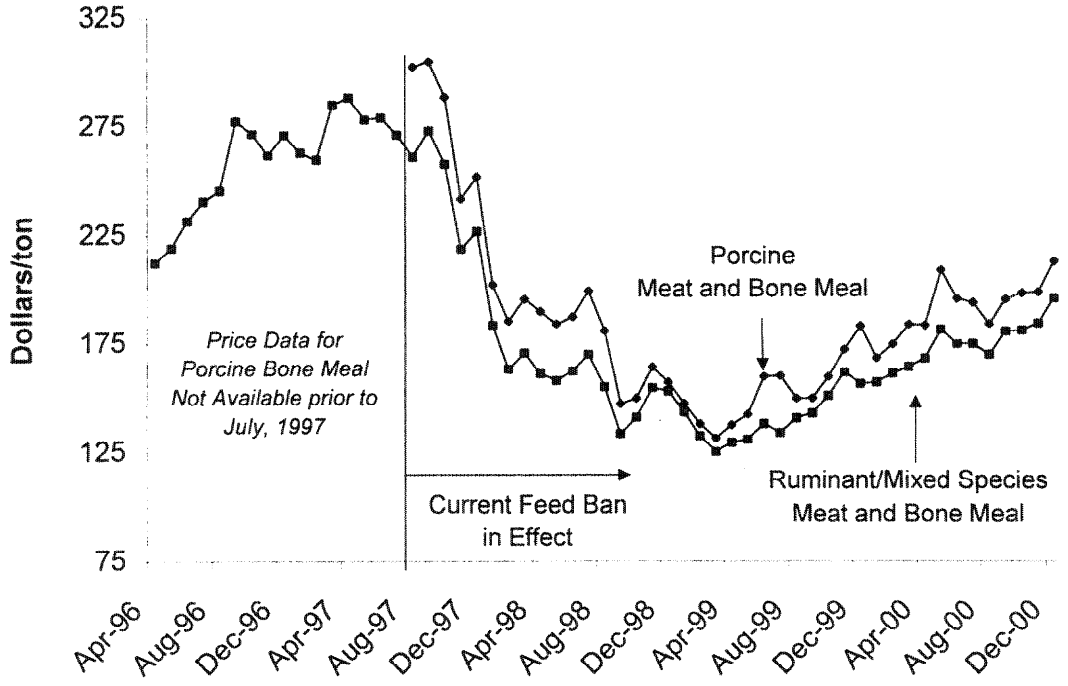
Chart 3. Ruminant MBM Premium Over High-Protein Soymeal



- **Relationships among MBM types.** Historically, MBM tended not to be separated by species origin, since it could be included generally without restriction into any livestock feed and there was no benefit from such segregation. And, there was little in any price differential

between MBM produced from different mammalian species. However, the restrictions on ruminant MBM since 1996 have changed that structure. MBM containing ruminant tissue began to sell at a discount to non-ruminant based MBM, particularly porcine MBM immediately following the ban (Chart 4). From August 1997 to December 2000 (the period for which data are available), porcine MBM sold for an average premium of $17.98/ton above MBM containing ruminant-based materials. Again, this MBM discount is in line with our regression results estimated above. The premium for porcine MBM reached more than $42/ton immediately prior to the feeding rule, but has since moderated somewhat since that time.

Chart 4. Price Premium for Porcine MBM



Total Impact Estimate

The average MBM discount of $18 per ton observed since the current ruminant MBM feeding restriction was imposed translates into revenue losses to the rendering industry totaling $288 million between 1996 and 2000, assuming approximately 32 billion lbs of MBM was produced and sold over this period. However, these market losses would have been highly concentrated among renderers that either produce ruminant MBM exclusively or mixed species product and are therefore forced to sell into the discounted ruminant MBM market.

The foregoing sections present estimates of the economic relationships between MBM prices and prices of vegetable oil meals, and the impact of the 1996 ban of MBM in ruminant feeds. The following section extends this analysis to examine economic impacts from three possible scenarios for future feed regulation.

IV. Economic Impacts of Feed Regulation Scenarios

Any additional regulation of livestock feeding practices in regard to the use of animal proteins will create economic shocks by reducing the demand for rendered material, increasing costs of feed, and incurring disposal costs for material which no longer can be fed. These shocks would resonate throughout the livestock production sector, potentially in the form of higher production costs for certain livestock, lower values for slaughtered animals, reduced profitability for renderers, packers, and livestock producers, and perhaps higher prices for meat in retail stores. The size of these market shocks and their distribution across the livestock sector depend upon the nature and extent of proposed future regulations.

The scenarios described earlier are considered in this section. Impact estimates are based on estimates of the impact of the 1997 feeding rule, the current structure of the industry, and the particular material(s) targeted for new regulation.

The scenarios are as follows:

1. A total animal protein feed ban to all ruminant animals.
2. A total ban on the feeding of ruminant protein to all farmed animals, including:
    b. Ruminant meat and bone meal to swine and poultry
    c. Ruminant blood meal and plasma to dairy, beef, swine, and poultry.
3. A total animal protein ban to all farmed animals.

These scenarios are ranked relative to the magnitude of their expected cost impact on the livestock complex, with scenario 3 expected to produce the largest strain on the system.

Basic Assumptions

The following assumptions are used throughout the analyses. They are based on discussions with animal nutritionists, renderers, and waste management professionals, as well as observation of the current situation in the European Union.

- Domestic demand for animal proteins is constrained by amounts of each that can be included in feed rations without supplying excess nutrients or reducing palatability.

- Quantities of animal proteins produced beyond domestic needs will be either exported or disposed of in landfills, however, export markets might also decline substantially in response to actions taken by US regulators.

- Exports of MBM from the United States will be constrained by excessive world supplies of animal proteins and the likelihood that other nations will restrict animal protein use in reaction to additional regulation in the United States. The world market price for MBM is assumed to equal to the US domestic price following any additional regulatory action.

- Costs of disposal for rendered animal products will be $60 per ton in tipping fees plus an additional average transportation cost of $15 per ton to ship the material to landfills rather

than to current market outlets (based on discussions with waste management professionals and renderers).

- Incineration of rendered material is more expensive than disposal in landfills (estimated at over $100/ton), and is constrained at low levels by the current capacity of waste-incinerators, which is too small to handle large increases in supply. Furthermore, the current technology cannot support incineration of large quantities of rendered proteins.

- If disposal is necessary, renderers will continue to process animal by-products in order to reduce the volume of material entering landfills and to reduce environmental impacts of raw slaughter by-products in landfills—as has been the case in Europe. Much of the cost of this process would be passed back to livestock packers as collection fees (see Section 5 for a discussion of the economic rationale behind this assumption). Renderers will still be able to produce fats, tallows, and greases for sale to industrial markets.

- Revenue impacts are based on price changes from average price levels after August 1997. These average prices are: ruminant/mixed species MBM $169/ton; porcine MBM $187/ton; blood meal $368/ton; poultry byproduct meal $235/ton; feather meal $202/ton.

The Industry Today

Based on average market prices over the past 3 years, the value of all mammalian-based protein feed ingredients sold by the rendering industry surpasses $618 million per year. Poultry byproduct account for another $361 million in sales of poultry meal plus $121.2 million in feather meal sales (Table 13).

Table 13. The Animal Protein Feed Market Today

	Average Price *$/ton*	Total Volume *Mill. lbs*	Sales *$ million*
Ruminant/mixed Species MBM	169	4,997.2	422.3
Porcine/non Ruminant MBM	187	1,655.1	154.8
Total MBM		6,652.3	577.0
Ruminant/mixed species Blood Meal	368	171.7	31.6
Porcine/non Ruminant Blood Meal	368	54.8	10.1
Total Blood Meal		226.5	41.7
Rendered Mammalian Protein		6,878.8	618.7
Rendered Poultry Meal	235	3,073.5	361.1
Feather Meal	202	1,200.0	121.2
Total Poultry by-Product Meal		4,273.5	482.3
Total Sales of Animal Proteins		11,152.3	1101.0
Export Sales (From Table 10)		978.8	116.0
Total Domestic Sales		**10,173.5**	**985.0**

The majority of the MBM produced is sold for use by non-ruminants, however, ruminants consume up to 70% of all blood meal sold (Table 14). Poultry producers are the largest consumers of MBM, followed by pet food manufacturers. In most feed rations, mammalian MBM comprises a relatively small proportion of the total quantity fed, often due to limitations of palatability. Poultry feed tends to have the highest concentrations of animal proteins, consisting on average of more than 2% mammalian MBM (Table 15). The majority of poultry byproduct feeds are also used by the poultry sector, with the total proportion of animal proteins in poultry feed often exceeding 5%.

Table 14. Volume Sales (Pounds) of Mammalian MBM to Major Markets

	Meat and Bone Meal		Blood Meal	
Consumption	**Percent**	**million lbs**	**Percent**	**million lbs**
Ruminants*	10	567.4	70	158.55
Swine	13	737.6	20	45.30
Poultry	43	2439.6	10	22.65
Pet Food	23	1304.9		
Other	11	624.1		
Domestic Use	100	5673.5		
Exports		978.8		
Total Production		6652.3		226.50

* All MBM consumed by ruminants is from non-ruminants

Table 15. Complete Feed Consumption (Tons)

	Total Feed Consumption*	MBM Consumption	MBM Ration
	000 tons		*%*
Ruminants	69,442	283.68	0.41
Swine	41,497	368.78	0.89
Poultry	54,994	1219.80	2.22
Pet Food	9,213	652.45	7.08

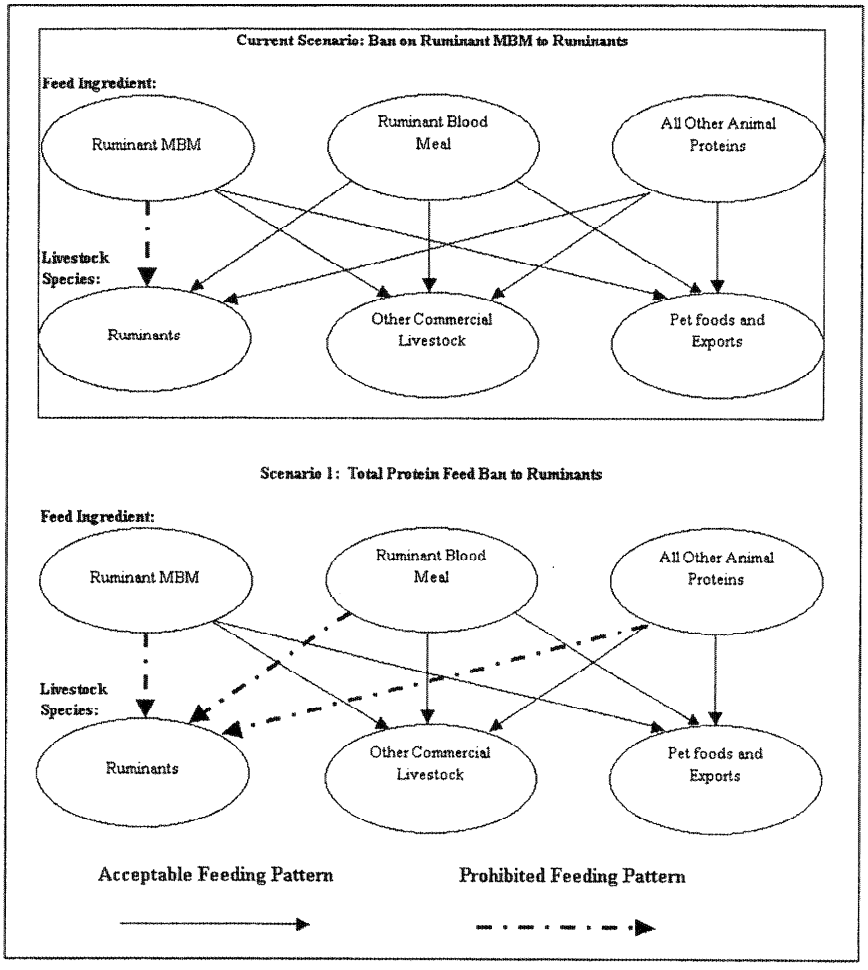
* Source: Feed Management Magazine

Each of the three scenarios examined will affect the livestock complex in different ways. To measure the economic impact, the change in revenues to the rendering industry from the situation outlined in Table 13 is calculated based on assumptions of price changes for animal proteins and potential losses in volume sales if feeding practices are altered. Disposal cost estimates for material that can longer be fed is added to these revenue losses to arrive at the total direct economic cost to the livestock industry under each scenario. Indirect costs could also accrue in the form of higher feed costs and depreciation on equipment that can longer be used. The total costs will be distributed across the livestock sector and borne to various degrees by livestock producers, slaughterhouses, renderers, and consumers.

ECONOMIC IMPACT OF SCENARIO ONE

A total ban on the use of animal proteins in feed for ruminant animals extends the current feed rule by eliminating all existing exceptions. The greatest impact would result from the elimination of all porcine (and equine) MBM and blood meal from ruminant diets (Figure 5).

Figure 5. Feeding Regulations Under Scenario One



Prior to the 1997 feed rule, approximately 15% of all MBM produced (regardless of protein source) was used in ruminant feed, sold either directly from renderers to dairy and cattle operations or through feed manufactures that incorporated the material into complete feed. After the 1997 rule, the majority of dairy and cattle operations switched from using ruminant-based MBM to porcine-based product. However, the total quantity of MBM fed to ruminants also decreased due to reduced availability of approved MBM (i.e. porcine MBM is not as widely available as ruminant MBM, especially in certain regions), higher costs of porcine MBM relative to substitutes (e.g. soybean meal), and the likelihood that some beef and dairy producers removed all MBM from their rations in response to public pressure or in anticipation of more stringent regulation. It is surmised that sales of MBM used for ruminant feed dropped from 15% five years ago to about 10% today, along with the switch to only non-ruminant sources.

Scenario 1:

Primary Materials Affected: Porcine/Equine MBM, Blood meal.

Types of Feed Affected: Ruminant Feed: i.e., Beef Cattle, Dairy Cattle, Sheep, Goats, Bison; including starter and milk replacement rations.

Quantity of Material Affected: MBM: 567 million pounds (10% of domestic sales of mammalian production)
Blood Meal: 159 million pounds (70% of mammalian production)

Requires Separation of Material by Species Origin: No

Unlike in Europe, the total amount of MBM used in ruminant rations has always been fairly low. Considering that 10% of mammalian MBM is currently consumed by ruminants (exclusively in the form porcine MBM), the total quantity fed in 2000 was about 567 million pounds (283,500 tons). Total annual feed consumption by ruminants (beef cattle, dairy cattle, and sheep) exceeds 69 million tons per year, so MBM accounts for less than ½ of 1% of the total ration in the United States (Table 15).

However, blood meal is an extremely important component to ruminant feed rations, especially dairy cattle. Current estimates suggest that ruminants consume as much as 70% of all blood meal produced, primarily in milk replacement rations for calves and in feed rations for lactating heifers. Although feed rations vary by many factors including region, season, feed manufacturer, and producer, nutritionists suggest a typical feed ration for a lactating cow may contain up to 5% blood meal, or nearly 1 pound of blood meal per day per cow, with milk replacement rations containing up to ¼ pound per day depending on the age of the calf.

The economic analysis for this scenario is based on the following assumptions:

- All MBM currently used in ruminant feed rations is from porcine or other non-ruminants.
- Prohibiting animal proteins in ruminant feeds would remove 10% of the existing market for mammalian-based MBM (the amount currently fed to ruminants).
- MBM and blood meal quantities used in feed rations for non-ruminants are constrained near current levels due primarily to issues of palatability, but a 10% increase in feed use by non-ruminants would be possible.
- Requirements to separate and label ruminant-based protein ingredients as "prohibited" and track them through the marketing chain would be eliminated, since under this scenario all animal-based feed products will be prohibited from feed rations (i.e. the primary point of control of this regulation will shift from renderers to feed companies).

Market Impacts

- The specialized demand for porcine MBM due to current feeding restrictions is one of the key factors behind its nearly $18.00 average price premium above MBM containing ruminant tissue. The immediate impact of a ban on its use in ruminant feeds would be a sharp reduction (or complete elimination) of this price premium. Thus, under Scenario 1 a single market price for MBM, regardless of species would result.[11] The market price for MBM would fall as the total quantity demanded is reduced by at least 567 million pounds (10%) from current levels.

- The amount by which the overall price for MBM would be reduced because of a feeding ban to ruminants will depend on several factors, but critical among these is the extent to which existing markets for MBM can absorb the excess supply that will result from removing 10% of the sales market for MBM. Most feeding rations are developed using highly sophisticated computer models that optimize nutrient content subject to choosing among all ingredients in such a way to minimize cost. Thus, a reduction in the price of any one ingredient relative to its substitutes will cause greater use of that ingredient in the ration, absorbing the excess supply with only a slight decrease in price. But, the maximum use of any ingredient (e.g. MBM) is constrained by many factors, including palatability of the feed and possible adverse effects of providing too much of certain nutrients. Therefore, at some level, the market will simply not be capable of absorbing an excess supply of MBM regardless of how low the price drops; it becomes "maxed out" in existing rations, and some quantity of the material would need to be disposed of in other markets or by other means (e.g. landfills, incineration, etc.) For scenario 1 it is assumed that the non-ruminant feed market could absorb the excess supply resulting from removing the ruminant market from the sales channels, but at a lower price.

- The existing feed ban resulted in a long-term reduction in the price of MBM by $18.13 per ton after shifting 15% of the market away from ruminant-based MBM. Scenario 1 is expected to result in an additional $12.00/ton decrease in the price of MBM due to a 10% reduction in total sales of MBM. Therefore, the complete price effect would be about $12.00 for the ruminant/mixed species MBM market, and $30.00 for the porcine MBM market (elimination of the existing $18.00 premium, plus the $12 reduction in the price of ruminant/mixed species MBM).

- Impacts on the market for blood meal would be larger. Since ruminants currently consume 70% of all mammalian blood meal, it is unlikely that the non-ruminant market for blood meal could absorb the excess supply, some of this would have to be disposed of in landfills, unless it is could be incorporated into MBM and sold in that market.

- A conservative assumption is that existing non-ruminant markets for blood meal would increase their usage by 85% above current levels given a dramatic reduction in price.

[11] This is considered the "worst case" impact on the price of porcine MBM, but there is a chance it might still demand a slight premium over ruminant MBM if some pork, poultry, or pet food manufactures adopt a voluntary policy of "no ruminant ingredients" in their feed rations in response to public pressure. Furthermore, porcine MBM is sometimes preferred over ruminant-MBM in pet foods and other feeds because of greater palatability.

This will bring the total amount of blood meal used for feeding under scenario one to 126 million pounds. Thus, 100 million pounds would remain to be disposed of in landfills at an expected cost of $60/ton in tipping fees plus $15/ton to transport the material to the landfill. Renderers will continue to produce blood meal in order to supply what little market remains for this product and to minimize the volume of material requiring disposal, but the market price will fall precipitously given the huge excess of supply over feeding industry demand. In fact, the price could be expected to fall to zero f.o.b. the rendering plant such that a renderer would be willing to give the material away simply to forgo the cost of hauling it to a landfill.

The total costs to the livestock complex of the feeding rule described in scenario one are:

Reduction in market revenues to renderers resulting from a decrease in the value of MBM:

- Producers of porcine MBM: Price discount of $30.00/ton × 1.655 billion lbs of non-ruminant MBM produced = $24.825 million per year.

- Producers of mixed species and ruminant MBM: Price discount of $12.00/ton × 4.997 billion lbs produced = $29.97 million per year.

Reduction in market revenues to renderers resulting from decreased sales and value of blood meal:

- Loss of sales revenue from 226.6 million lbs/year (including the 126 million lbs that are expected to be used by the feed industry but collected from the renderer free of charge) × average market price of $368/ton = $41.594 million per year.

Disposal costs for blood meal that will no longer be used for feed:

- 100 million lbs/year × $75/ton tipping fees and transportation costs to landfill = $3.75 million per year.

The total reduction in revenue to the rendering industry plus costs of disposal resulting from scenario one is $100.14 million per year (Table 16).

Table 16. Economic Costs of Scenario One

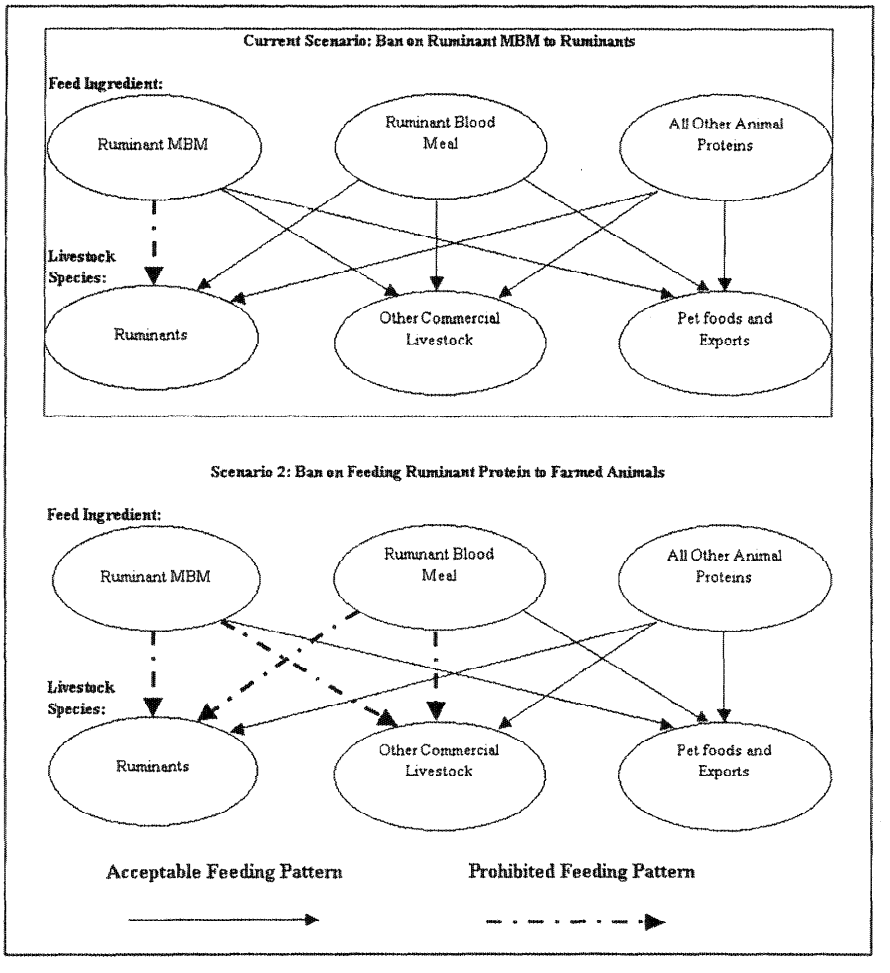
Source of Revenue Loss	Dollar loss (million)
Loss in revenue from porcine MBM	24.825
Loss in revenue from ruminant/mixed species MBM	29.970
Loss in revenue from blood meal sales	41.590
Total revenue losses	96.385
Disposal costs for excess blood meal	3.750
Total costs to the rendering industry	$100.135

Scenario one (and any scenario that removes the use of blood meal from feed rations) will have especially heavy impacts on feed costs and efficiency within particular livestock sectors. Because of its nutrient content, amino acid availability, and other feeding characteristics, blood meal is highly valued in starter rations for swine and other livestock, and in milk replacement rations for cattle. Few if any close substitutes are available for blood meal, meaning that attempts to replace it in specialized feed rations will be met with dramatically higher feed costs and the strong likelihood of reduced feed efficiency.

ECONOMIC IMPACT OF SCENARIO TWO

A total ban on feeding ruminant-based feed ingredients to farm animals extends the existing ban by removing a considerable amount of the current supply of MBM and blood meal from feed rations. This scenario has two components that add to its cost: removal of ruminant-based MBM from the feed rations for swine and poultry, and removal of ruminant blood meal and plasma from the diets of ruminants, swine, and poultry (Figure 6).

Figure 6. Feeding Regulations Under Scenario Two



Scenario 2:

Primary Materials Affected: Ruminant and mixed-species MBM, ruminant and mixed-species blood meal.

Types of Feed Affected: All commercial livestock feeds.

Quantity of Material Affected: MBM: 4.997 billion pounds (75% of mammalian production)
Blood Meal: 171.8 million pounds (76% of mammalian production)

Requires Separation of Material by Species Origin: Yes, ruminant material will be labeled and completely removed from the market

While scenario one reflects a reduction in the demand for animal protein feeds due to restrictions on the use of these materials in ruminant rations, scenario two is more a reduction in the supply of approved materials for all species. It also creates costs of disposal for material that must be removed from the market.

Nearly 5 billion pounds of MBM currently produced (75% of total annual production) are either solely from ruminants or of mixed-species form that that may contain ruminant tissue. Over 171 million pounds of blood meal (76% of total blood meal production) contains ruminant material (Table 13). Scenario 2 would result in a significant reduction—or complete elimination—in sales of all ruminant-based or mixed species animal proteins, and cause tremendous costs of disposal of the restricted materials.

The economic analysis for this scenario is based on the conditions described in the box above and the following assumptions:

- Ruminant feeds will still be able to include animal proteins, but can only be derived from non-ruminant (e.g. porcine) sources.
- About 80% of blood meal is produced by packer/renderers so is identifiable by species.
- Prohibiting ruminant proteins from animal feeds would remove up to 75% of the existing supply of mammalian proteins from the market.
- MBM and blood meal quantities used in feed rations for all animals are constrained near current levels due primarily to issues of palatability. Any dramatic increases in the costs of animal protein feed ingredients would cause ration formulators to switch to other protein sources (e.g. soybean meal, corn gluten, etc.).
- Requirements to label ruminant-based protein ingredients as "prohibited" and track them through the marketing chain would remain in place.

Market Impacts

Scenario Two extends the existing feed ban by extending the current regulations that apply to ruminants to include all commercial livestock, and it also eliminates much of the existing market for blood meal.

- Under the existing regulation, a two-tiered market for MBM has developed. Ruminant feed manufacturers (accounting for 10% of MBM sales) can only purchase MBM from suppliers of porcine or equine-based MBM, while ruminant and mixed-species MBM supplies the remaining 90% of the market. Under scenario two the market would remain segmented, with all commercial livestock feed manufacturers vying for the 25% of all animal proteins that contain no ruminant materials, and the remaining 75% of the market left for either disposal, exports, and/or pet food manufacturers.

- The price for non-ruminant MBM (and non-ruminant blood meal) under this scenario would increase somewhat as more feed manufactures compete for a smaller supply of approved material, but the amount of this price increase will be constrained by the price of substitute products: particularly the least-cost ration of equivalent quality that can be developed without using animal proteins.

- The price for ruminant and mixed species MBM (and blood meal) will fall dramatically as the majority of the current demand for these products is eliminated. Renderers will continue to produce ruminant/mixed species MBM and blood meal in order to supply what little market remains and to minimize the volume of material requiring disposal, but the market price will fall precipitously given the huge excess of supply over feeding industry demand. In fact, given that most approved uses of this material will be eliminated requiring large amounts being sent to landfills, its price could be expected to fall to zero f.o.b. the rendering plant such that a renderer would be willing to give the material away simply to forgo the cost of hauling it to a landfill.

- MBM marketed for export and pet food currently accounts for about 2.5 billion pounds (978.8 million lbs of exports, and 1.53 billion lbs for pet food). Assuming that all MBM exports are currently ruminant/mixed species and at least 25% of total MBM sales to pet food manufactures are porcine-based (porcine MBM is reported to be preferred by many pet food manufacturers because of superior palatability) the total use of ruminant/mixed species MBM by pet food manufacturers and exporters is 2.1 billion lbs/year.

- Even if the price of ruminant-based MBM falls effectively to zero, the draconian nature of this regulation is likely to result in a complete elimination of ruminant-containing MBM from all uses, including pet foods and export markets. Pet food markets are highly sensitive to consumer perceptions, and are therefore likely to avoid this material simply to reduce the threat of consumer outrage. Furthermore, foreign countries are likely to view such action by the United States as indicative of serious health concerns over ruminant-based proteins, and would therefore follow suit with their own restrictions.

Price Responses:

- The price of non-ruminant MBM would increase, with the amount of the increase constrained by the relative value of substitute products for feed rations. Historically, the largest market premium recorded for porcine MBM over ruminant MBM occurred just prior to the implementation of the existing feeding rule, at $42/ton. At this time, the premium over the next closest substitute (high protein soybean meal) was $30/ton. This is the highest recorded premium for porcine MBM over its next closest substitute (either ruminant MBM or soybean meal). It is assumed that this represents the maximum price differential where feed formulators are indifferent to using MBM or a plant-based protein source. Under scenario two the price of porcine MBM is expected to increase by $12/ton over current levels, to an average premium over plant based protein of $30/ton.

- The price of non-ruminant blood meal will increase in response to removal of over 75% of existing blood meal from the market, but like MBM, the price increase will be constrained by the cost of the next least expensive substitute. The average expected premium above current levels is $50/ton.

The total cost to the livestock complex under scenario two is estimated as follows:

Complete loss in value of the 4.997 billion lb markets for ruminant and mixed species MBM resulting from a ban on feeding to ruminant, swine, and poultry (subcomponent a):

- Average market price for MBM of $169/ton × 4.997 billion lbs = $422.26 million per year.

- Disposal costs: 4.997 billion lbs × $75/ton = $187.395 million per year.

Complete loss of 171.8 million lb market for ruminant and mixed species blood meal (subcomponent b):

- Average market price for blood meal of $368.00/ton × 171.8 million lbs = $31.6 million per year.

- Disposal costs: 171.8 million lbs × $75/ton = $6.4 million per year.

Increased revenues from price premium for non-ruminant MBM:

- 1.655 billion lbs of non-ruminant MBM × $12/ton average premium over current levels = $9.93 million per year.

Increased revenues from price premium for non-ruminant blood meal:

- 54.8 million lbs of non-ruminant blood meal × $50/ton average premium over current levels = $1.37 million/year.

Total net reduction in revenue to the rendering industry, plus costs of disposal under scenario two, is $556.0 million per year (Table 17).

Table 17. Distribution of Costs Under Scenario Two

Source of Revenue Loss	Dollar loss (million)
Ruminant/mixed species MBM	422.263
Ruminant/mixed species Blood Meal	31.600
Total revenue losses	453.863
Disposal costs for excess MBM	187.395
Disposal costs for excess blood meal	6.400
Total Disposal costs	193.795
Sources of Increased Revenue	
Porcine MBM	-9.930
Porcine Blood meal	-1.370
Total Cost to Renderers	636.358

Scenario two has especially heavy impacts for independent renderers since nearly 80% of the animal proteins they currently produce contain some ruminant material. Independent renderers are likely to essentially become waste disposal companies for smaller livestock packers and those that do not render their own product, being forced to charge a disposal fee to packers high enough to cover their rendering and disposal costs.

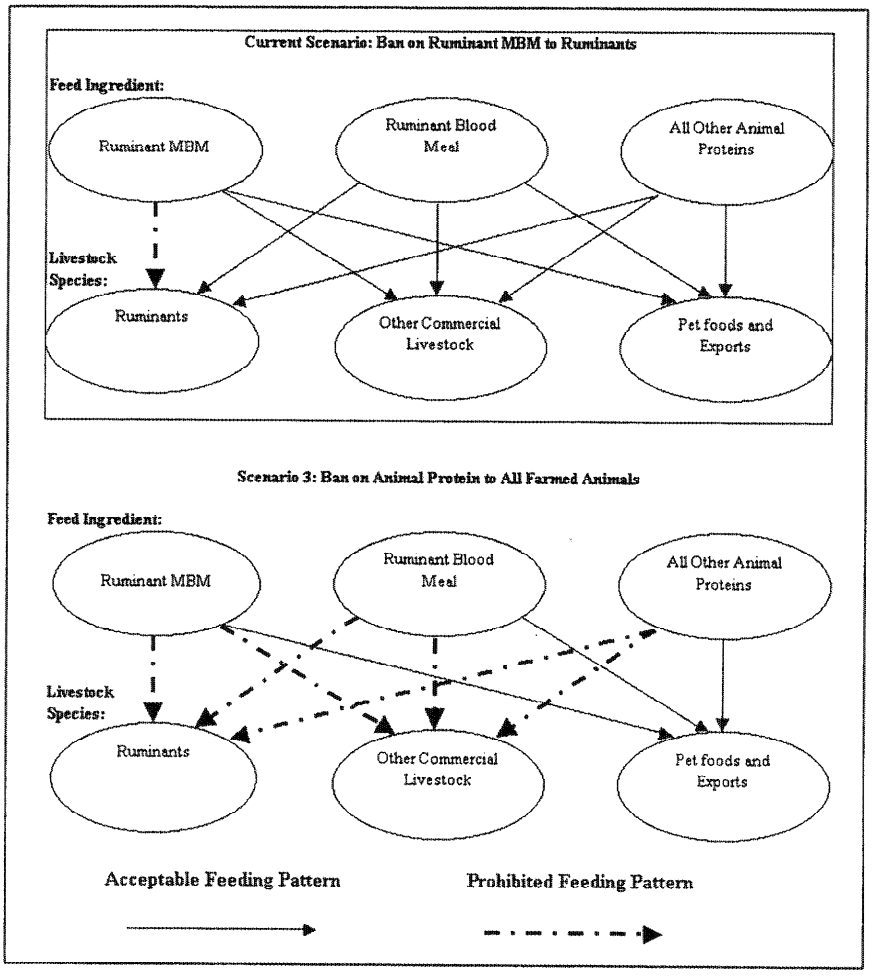
Since this scenario would require strict segregation of ruminant material from all other sources of raw inputs, some renderers might instead find it economically advantageous to build another plant or install separate lines for ruminant material and all other raw products. This would allow a renderer that currently processes several species including ruminant material to sell the non-ruminant output in the commercial feed market. However, the costs of building another plant or installing separate lines within a plant are likely to be prohibitive for most renderers compared to the revenues they might receive from non-ruminant MBM sales.

ECONOMIC IMPACT OF SCENARIO THREE

A total animal protein ban to all farmed animals (scenario 3) is the worst case in terms of cost to the livestock production sector from additional regulation of animal proteins. All use of animal proteins in commercial livestock feeds would cease, necessitating the disposal of nearly all mammalian and poultry by-product feed ingredients in landfills or by some other method (Figure 8). The only remaining domestic animal-protein feed market would be pet foods, but it is likely that public pressure would force reduction or complete elimination of the use of rendered animal

proteins in these feeds as well. Furthermore, other countries would likely interpret such action by the United States as signaling real danger of the use of these substances in livestock feed, severely restricting or eliminating all export markets.

Figure 8. Feed Regulations Under Scenario Three



If rendering animal by-products were to cease, as much as 47 billion pounds of slaughter by-products would accumulate each year—64 thousand tons per day—straining the capacity of existing landfills and incinerators and risking the spread of disease as it decays. Therefore, it is likely that rendering of this material would continue with the protein-based finished products disposed of in landfills (see Section 5 for a discussion of the economics of disposal). This would clearly change the revenue structure for renderers: revenue from feed ingredient sales would disappear, replaced by disposal costs of at least $75/ton ($60 tipping fees plus $15 average transportation costs) plus the costs of processing this material. Therefore, the value of animal byproducts at the slaughter facility would become negative, requiring packers to pay renderers to accept the product and cover the costs of rendering, handling, and disposal.

Given the dramatic increase in stocks of rendered protein ingredients under this scenario, it is likely that if any market remained for these products, the price in the remaining markets would be zero. However, it is more likely that under such a draconian regulation, all use of rendered animal proteins would cease, resulting in all such material being disposed of in landfills.

Market Impact

The total cost to the livestock complex of scenario three is estimated as follows:

Lost revenue from the sale of animal protein feed ingredients:

- Ruminant/mixed MBM: 4.997 billion lbs × $169/ton = $422.26 million per year
- Porcine/non-ruminant MBM: 1.655 billion lbs × $187/ton = $154.75 million per year
- Blood meal: 226.6 million lbs × $368/ton = $41.683 million per year
- Poultry byproduct meal: 3.073 billion lbs × $235/ton = $361.08 million per year
- Feather meal: 1.2 billion pounds × $202 per ton = $121.2 million

Disposal costs of materials no longer sold:

- Mammalian MBM: 6.65 billion lbs × $75/ton = $249.458 million per year
- Blood meal: 226.6 million lbs × $75/ton = $8.459 million per year
- Poultry byproduct meal: 3.073 billion pounds × $75 per ton = $115.238 million per year
- Feather meal: 1.2 billion pounds × $75 per ton = $45.0 million per year

Total costs incurred by the rendering industry under scenario three are $2.961 billion per year (Table 18).

Table 18. Distribution of Costs Under Scenario Three

Revenue losses:	Dollar loss (million)
Ruminant/mixed Species MBM	422.263
Porcine/non Ruminant MBM	154.750
Blood Meal	41.683
Poultry Byproduct Meal	361.080
Feather Meal	121.200
Total Revenue Losses	1,100.976
Disposal Costs:	
Mammalian MBM	249.458
Blood Meal	8.459
Poultry Byproduct Meal	115.238
Feather Meal	45.000
Total Disposal Costs	418.155
Total cost to Renderers	1519.131

Distribution of Economic Impacts

Although the rendering industry will be on the front lines of any cost shock resulting from future regulation of livestock feeding practices, the economic impact will quickly be distributed among all individuals and companies that form the marketing chain for livestock and derived products—affecting cattle producers, meat packers, meat processors, renderers, and even consumers in the form of higher meat prices. The costs will not disappear; they will be shared unevenly throughout the marketing chain, and will be in addition to the costs that continue to be incurred under the 1997 rule. No sector of the marketing and production chain will be immune from sharing in these costs. Plus, they are not "one-time" charges; they are costs that remain with the system indefinitely.

Ultimately, each scenario examined here removes value from the livestock complex equal to the total costs estimated above (i.e., $100.14 million under scenario one; $636.36 million under scenario two; and $1.52 billion under scenario three). The initial shock is likely to be borne entirely by renderers, particularly independent renderers, in the form of lost revenues and value for their products. Much of these costs will be quickly passed back to livestock packers in the form of reduced prices for slaughter byproducts. Increased rendering fees for dead-stock in light of currently depressed markets for animal proteins has already resulted in greater use of on-farm burial and composting to dispose of this material, and almost certainly has led to some use of non-approved disposal methods that threaten to harm the environment.

However, the volume of slaughter byproducts generated today is tremendous relative to the volume of dead animals requiring disposal, so it is unlikely that an alternative method of disposing of this material will develop. Furthermore, disposing of slaughter byproducts in landfills is likely to be cause for serious environmental concerns, perhaps leading to legislation requiring this material to be in some way processed to sterilize it and remove most of the moisture.

Effects on the value chain

Renderers will not operate at a loss; they will instead reduce the price they are willing to pay for their raw materials, even to the point where they charge fees for the collection of this material. Thus, the economic costs under each of these scenarios will be quickly passed back to the slaughter facilities, where they will be felt directly as a reduction in revenue (if the value of byproducts falls but remains positive) or in increase in costs (if the value of byproducts becomes negative, i.e., packers must pay to have the byproducts shipped away).

Significant costs will be passed to livestock producers. The value that a slaughter facility is willing to pay for livestock is directly related to the value of the individual components of livestock in the wholesale and retail markets, i.e., the value of the various cuts of meat, fat, hides, organ meats, offal, and other byproducts. In fact, in many livestock sectors packers have long paid livestock producers based on a "formula" that calculates the total value of the individual components comprising an animal (e.g. lean tissue, fat, byproducts). A reduction in the value of byproducts to packers directly reduces the value they are willing to pay for livestock, so a large

proportion of these costs will be reflected in a reduction in the value of livestock at the packing facility. This will directly reduce revenues and profitability to livestock producers.

The potential impact of these regulatory scenarios on the value of livestock will be directly related to the amount of byproduct material produced by each livestock sector. This depends on both the byproduct yield per animal and the total number of animals slaughtered. The direct costs to livestock producers can be estimated based on the following assumptions:

- All costs realized by the rendering industry under each of these scenarios are passed in their entirety to livestock producers in the form of reduced prices.

- The distribution of these costs across livestock sectors is based on specific constraints and their impacts under each scenario, e.g. scenario 1 affects pork producers through the elimination of the porcine MBM premium and the sales of porcine blood meal, and it affects ruminant producers (cattle) through a reduction in the value of ruminant MBM, ruminant blood meal, and disposal costs for ruminant blood meal. The total annual slaughter is used to estimate costs per head (Table 2).

- In each scenario, where there is a reduction in the value of "mixed species" MBM, this impact is allocated between pork and cattle producers assuming that porcine byproducts account for 30% of the total quantity of mammalian byproducts rendered. The remaining 70% is allocated to cattle (ignoring the very minor contributions of equine, sheep, or other species). This distribution is based on Table 4.

Given these assumptions, the costs to individual livestock producers are likely to be severe. Under the most stringent of regulations (Scenario 3), cattle producers are likely to realize a price reduction of nearly $15.50 for each head of cattle sold, with hog producers experiencing a decline of $3.22 in the price of each hog marketed (Table 19).

Table 19. Distribution of Costs Under Each Regulatory Scenario

	Scenario 1	Scenario 2	Scenario 3
		$ million	
Lost Revenue from Reduced Sales	96.38	442.56	1,100.97
Disposal Costs for Material no Longer Fed	3.75	193.80	418.16
Total Cost to Livestock/Rendering Sector	100.13	636.36	1,519.13
Estimated Costs to Livestock Producers			
		$ per head	
Cattle Producers	$1.69	$15.49	$15.49
Hog Producers	$0.40	$0.76	$3.22
Broiler Producers	--	--	$0.07
Turkey Producers	--	--	$0.33

Additional indirect costs from tighter feed regulation

- Consumers will be impacted as the market adjusts to a sustained reduction in the value of livestock. If the value of livestock falls (as estimated above), production will inevitably decrease, reducing the total supply of meat in the retail market. Reduced supply always leads to higher prices, although the exact impact on price depends on many factors including consumer demand characteristics, the degree of competition in the livestock packing and retail sectors, and the amount of meat imports. In addition, meat prices are likely to increase directly as packers attempt to recoup lost revenue from reduced values for byproducts.

- Costs of waste disposal in landfills could increase. Any substantial increase in the amount of material entering landfills will quickly increase the value of landfill space. In the short run, landfills are a fixed resource and are constrained by their own capacity. Under the worst-case scenario (Scenario 3), landfills would be required to accept an additional 7.8 billion pounds of rendered protein material annually. This would compete for landfill space with all other materials currently entering landfills. Inevitably, the value of the landfill space would increase, reflected in higher tipping fees for waste from all sources, and creating the need to expedite construction of new landfills or incinerators. These are additional costs that will affect all users of landfill space, and will therefore have implications far beyond the livestock sector.

- Livestock producers will be impacted by higher feed prices. Current feed rations are based on delivering the maximum nutrition at the lowest cost among all alternative formulations. Total expenditures for commercial feed in the United States are $24.7 billion per year. Since the current amount of animal proteins included in rations reflects the lowest cost formulations available, this amount will certainly increase if animal proteins are no longer a feeding option.

Total feed usage by ruminants, swine, and poultry approaches 166 million tons per year (Table 15). Domestic use of animal protein feed ingredients (including poultry and feather meal) is about 10.174 billion pounds annually, with a value of $985 million (Table 13). If 20% of this is used in pet food (about 2 billion lbs), approximately 8.13 billion pounds of animal proteins are used by the commercial livestock sector, accounting for about 2.5% of the commercial livestock feed ration. The value of this material to livestock producers approaches $788 million.

The cost of formulating a feed ration that does not include animal protein will depend on many factors, most importantly the rate of substitution with plant-based or synthetic alternatives that will provide equivalent nutritional characteristics. This will vary greatly by species, region, season, and other factors. If formulating a non-animal based feed alternatives were to cost 25% more on average than using currently available animal proteins, the total increase in feed costs would approach $197 million in feed costs alone.

However, some livestock sectors, such as those that are heavy users of blood meal, will experience even greater feed costs and reduced feed efficiency because viable substitutes are simply not readily available. In many applications, plant-based or synthetic alternatives to

existing animal proteins cannot be formulated to provide similar nutritional characteristics. In these cases, costs to livestock producers resulting from reduced efficiency could far outweigh the direct costs of higher feed, resulting in reduced supplies of meat and dairy products and direct increases in costs to consumers.

Higher feed expenses would further erode the profitability of livestock production and lead to reduction in the amount of livestock produced over the long-term.

Situation 2: Byproducts are Rendered Prior to Disposal

An alternative to disposing of raw material in landfills would be to render the material first, then dispose of the protein ingredients in landfills. This situation offers three strong advantages: 1) the amount of animal protein needing disposal is reduced by about 75% (from 47.2 billion pounds of raw byproducts to 11.15 billion pounds of rendered protein), 2) the need to landfill an extra 15.7 billion pounds of sawdust is eliminated, and 2) the tipping fees for disposing of this material would be less since it presents less of a biological hazard and does not require the addition of an absorbent. However, since renderers would have to pay the costs of rendering and disposal under this situation—and they could not receive revenue from the sale of finished product—they would be forced to charge packers a fee to cover the costs of processing and disposal of slaughter byproducts.

It is possible to estimate the cost per ton of raw material that renderers would have to charge to dispose of slaughter byproducts in order to provide the same revenue that they currently receive, and cover disposal costs. Consider that renderers currently receive roughly the following revenues:

- Ruminant/mixed species MBM: 5.0 billion pounds × $169 per ton = $422.5 million
- Porcine/non-ruminant MBM: 1.6 billion pounds × $187 per ton = $150.0 million
- Blood meal: 226.5 million pounds × $368 per ton = $41.5 million
- Poultry byproduct meal: 3.0 billion pounds × $235 per ton = $352.5 million
- Feather meal: 1.2 billion pounds × $202 per ton = $121.2 million
- Total revenues from sale of animal proteins: $1.1 billion per year

This total sales revenue of over $1 billion would be lost under a scenario where animal protein feed ingredients could no longer be sold for feed use.

Annual production of protein feed ingredients by renderers exceeds 11 billion pounds. If this material could not be fed or exported, it would need to be disposed of at an average cost of $60 per ton in tipping fees. Thus, tipping fees would total about $330 million.

Therefore, renderers will incur annual costs of $330 million in landfill fees, and lose sales revenue of $1.1, for a total "cost" of $1.43 billion. Renderers cannot incur these costs even momentarily if they are to remain in business, they will instead be forced to immediately charge packers a hefty fee to accept this now worthless material. The fee renderers would need to charge to collect this raw material and cover their total economic loss of $1.43 billion would likely average: $60 per ton of byproduct ($1.43 billion / 23.6 million tons of raw material).

Cost Comparisons

Given the choice, livestock packers would be far more willing to pay a renderer $60 per ton to process and dispose of slaughter byproducts than to pay $105 per ton to dispose of it themselves. Therefore, given the current cost structure for landfill disposal, all material is likely to be rendered prior to disposal.

Note that the calculations above do not include transportation costs. This is because these will be incurred under either scenario: the raw product will either have to be transported directly to landfills, or be transported to rendering facilities and then to landfills. The costs estimated above under each situation could thus be viewed as costs for raw material f.o.b. the packinghouse. The actual transportation costs under each scenario would depend in large part on the geographic location of landfills relative to slaughterhouses and rendering facilities. However, it is worth noting that transportation costs under scenario 1 (disposing of raw byproducts directly in landfills) are in fact likely to be far greater for the following reasons:

- Raw byproduct material has over 4 times the mass of rendered proteins, and transportation costs are directly related to the weight of the material being transported.

- Rendering facilities tend to be located relatively close to slaughter facilities in order to minimize the costs of transporting the raw offal. But landfills tend to be located close to population centers, not necessarily in close proximity to slaughter facilities.

Therefore, the estimated cost of disposing of raw offal in landfills of $105/ton is a conservative estimate of the total cost; in practice transportation costs would likely add substantially to this total especially for packers that are not in close proximity to a landfill. This further decreases the likelihood that raw material would enter the landfill prior to being rendered

Other cost considerations also reduce the plausibility of disposing of raw slaughter byproducts directly in landfills. For example:

- The quantity of absorbent material available for mixing with the byproducts is limited. Even if the lumber industries currently produce enough sawdust to supply the 15.7 billion pounds that would be required for this purpose, the development of such a major new market for sawdust would certainly cause a dramatic rise in price as landfills compete with other users for the limited supply.

- Major modifications would be required at packinghouses and/or landfills to perform the task of mixing an absorbent material with the offal.

- Packinghouses would need to purchase large numbers of "water tight" offal trailers for transporting this material.

- Assuming markets for "lipids" are not affected by future feeding regulations, these fats, tallows and greases might still be produced and sold in industrial markets. Even if markets for these products are dramatically reduced, they still might retain some value as an alternative fuel source within the rendering plant. This potential value would be completely forfeited if raw offal were sent directly to landfills.

- Environmental groups would likely be highly opposed to disposing of offal in landfills due to concerns that it could harbor disease, create environmentally hazardous run-off, and use excessive space in landfills.

Covering the Costs of Offal Disposal

As noted in Section 4, the value that a slaughter facility is willing to pay for livestock is directly related to the value of the individual components of livestock in the wholesale and retail markets, i.e., the value of the various cuts of meat, fat, hides, organ meats, offal, and other byproducts. A reduction in the value of byproducts to packers directly reduces the value they are willing to pay for livestock, so it is expected that a large proportion of the costs associated with a complete loss of the rendered animal protein market will be reflected in a reduction in the value of livestock at the packing facility.

Meat packers would most likely cover these costs by passing them back to the livestock producer in the form of lower prices for live animals, and possibly to the consumer in the form of higher retail meat prices. Estimates of these costs for each livestock sector were presented in the previous section, and under a total animal-protein feeding ban were calculated to be as high as $15.50 per head of cattle and $3.20 per hog.

Conclusions

It is highly unlikely that raw slaughter byproducts would be sent directly to landfills even under the worst-case scenario of a complete ban on the feeding of animal proteins to all livestock. Given the current cost structure of landfill disposal fees, it is far more economical for packers to pay renderers to process and dispose of this material. Rendering both drastically reduces the volume of material needing disposal, and reduces the unit costs of disposal because the final product is less of an environmental hazard. Furthermore, other products such as fat and greases—assuming they can still be used in industrial markets—might still be produced and sold by renderers.

VI. Summary and Conclusions

The rendering industry collects and processes over 47 billion pounds of byproducts from the slaughter and meatpacking industries and transforms them into useful and valuable feed and industrial materials. Rendering adds nearly $1 billion in value to the livestock production sector and also removes the need to dispose of this material in landfills or by other methods that might pose potential health risks or strain existing landfill space.

Additional regulation of livestock feeding practices regarding the use of animal proteins will create economic dislocations by reducing the demand for rendered material, increasing costs of feed, and incurring disposal costs for material which no longer can be fed. These shocks would resonate throughout the livestock production sector, in the form of higher production costs for certain livestock, lower values for slaughtered animals, reduced profitability for renderers, packers, and livestock producers, and perhaps higher prices for meat in retail stores. The size of these market shocks and their distribution across the livestock sector depend upon the nature and extent of proposed future regulations.

The costs of three potential feed regulation scenarios were estimated. The analyses were based on the current market value of rendered animal proteins and potential disposal costs for substances that can no longer be fed. The regulatory proposals examined were as follows:

Scenario I. Total animal protein feed ban to all ruminant animals.

Scenario II. Total ban on the feeding of ruminant protein to all farmed animals, including:
   a. Ruminant meat and bone meal to swine and poultry
   b. Ruminant blood meal and plasma to dairy, beef, swine, and poultry.

Scenario III. Total animal protein ban to all farmed animals.

Economic Impact of Scenario One
(Banning animal proteins to ruminants)

The bulk of the impact from this scenario results from the elimination of all porcine (and equine) MBM and blood meal from ruminant diets. Unlike in Europe, the total amount of MBM used in ruminant rations has always been fairly low. However, blood meal is an extremely important component to ruminant feed rations, especially dairy cattle.

- The ban would immediately result in a sharp reduction (or complete elimination) of the price premium for non-ruminant (e.g. porcine) MBM. The market price for MBM would also fall as the total quantity demanded is reduced by at least 10% from current levels.

- Impacts on the market for blood meal would be larger since ruminants currently consume the major proportion of all mammalian blood meal. Up to 100 million pounds could require disposal in landfills at an expected cost of $60/ton in tipping fees plus additional transportation costs.

The total reduction in revenue to the rendering industry plus costs of disposal resulting from scenario one is estimated to be $100.14 million per year

Economic Impact of Scenario Two
(Banning ruminant proteins to farmed animals)

Scenario II has several components that add to its cost: removal of ruminant-based MBM from the feed rations for swine and poultry, and removal of ruminant blood meal and plasma from the diets of ruminants, swine, and poultry.

- The scenario would result in significant reductions in the value and sales of all ruminant-based and mixed species animal proteins, and cause tremendous costs of disposal of the restricted materials.

- The price for non-ruminant MBM (and non-ruminant blood meal) might increase somewhat as more feed manufactures compete for a smaller supply of approved material, but the amount of this price increase will be constrained by the price of substitute products, particularly the lowest-cost ration of equivalent quality that can be developed without using animal proteins.

- Significant amounts of material would require disposal in landfills as important markets for many rendered products are eliminated.

- Cattle producers are especially impacted under this scenario, with a possible reduction in the value of their livestock of up to $15.50 per head.

Total net reduction in revenue to the rendering industry, plus costs of disposal under scenario two, is estimated at $556.0 million per year

Economic Impact of Scenario Three
(Complete ban of animal proteins to all farmed animals)

A total animal protein ban to all farmed animals is the worst case in terms of cost to the livestock production sector from additional regulation of animal proteins. All use of animal proteins in commercial livestock feeds would be ended, necessitating the disposal of nearly all mammalian and poultry by-product feed ingredients in landfills or by some other method. Pet food and export markets are highly likely to follow suit and eliminate their use of animal proteins as well.

- As much as 47 billion pounds of slaughter by-products could accumulate each year—64 thousand tons per day—straining the capacity of existing landfills and incinerators and risking the spread of disease as it decays.

- The material likely would be rendered prior to disposal to reduce the volume of waste and to reduce environmental impacts. The value of animal byproducts at the slaughter facility would become negative, requiring packers to pay renderers to accept the product and cover the costs of rendering, handling, and disposal.

- All livestock sectors are expected to share in the costs imposed under this scenario. Estimates on the price of livestock range from $3.22 per hog, $15.50 per head of cattle, 7 cents per broiler, and 33 cents for each turkey sold for slaughter.

Total costs incurred by the rendering industry under scenario three are estimated at $2.961 billion per year

Distribution of Economic Impacts

Although the rendering industry will be the initial recipient of cost shocks resulting from future regulation of livestock feeding practices, these impacts will quickly be distributed across the marketing chain for livestock and derived products—affecting cattle producers, meat packers, meat processors, renderers, and even consumers in the form of higher meat prices.

- Many of the costs under each scenario will be quickly passed back to the slaughter facilities, where they will be felt directly as reductions in revenue (if the value of byproducts falls but remains positive) or increases in costs.

- Significant costs will be passed to livestock producers. A reduction in the value of byproducts directly reduces the price packers are willing to pay for livestock, directly reducing revenues and profitability of livestock operations.

- Consumers will bear some of these costs. If the value of livestock is reduced, production will inevitably decrease, reducing the total supply of meat in the retail market. Reduced supply always leads to higher prices.

- Feed prices will rise. Current feed rations are based on delivering the maximum nutrition at the lowest cost among all alternative formulations. Since the current amount of animal proteins included in rations reflects the lowest cost formulations available, this amount will certainly increase if animal proteins are no longer a feeding option. Higher feed expenses would further erode the profitability of livestock production and lead to reduction in the amount of livestock produced over the long-term.

- Costs of waste disposal in landfills could increase. Any substantial increase in the amount of material entering landfills will quickly boost the value of landfill space. This could be reflected in higher tipping fees for waste from all sources, and create the need to expedite construction of new landfills or incinerators.

The feeding regulations instituted in 1997 impacted the rendering industry by eliminating key markets and reducing the value for some animal protein feed ingredients. This has resulted in lost revenues and reduced prices and returns that remain today in many of the animal protein markets.

Additional regulations for US livestock feed will add to the costs already placed on the livestock production complex. The costs will reflect reduced prices in key markets for animal proteins and the need to pay for disposal of unusable material. The result will be reduced returns for the

rendering industry and higher costs of meat production. Most of these costs will eventually be borne by livestock producers and meat consumers. The total costs imposed on the meat production sector under each of the feeding regulation scenarios examined in this study are:

Total Costs to the Rendering Industry Under Each Regulatory Scenario

	Scenario 1	Scenario 2	Scenario 3
		$ million	
Lost Revenue from Reduced Sales	96.38	442.56	1,100.97
Disposal Costs for Material no Longer Fed	3.75	193.80	418.16
Total Costs	100.13	636.36	1,519.13

This study concludes that additional regulation of animal protein feed ingredients will cause real and significant economic shocks and dislocations throughout the livestock complex. Many of these would have initial catastrophic effects on individual rendering firms, since their current revenue structure depends directly on the value of rendered products for feed. Ultimately, as markets adjust, costs will be distributed over the entire production and marketing chain. Even though these costs will be distributed widely, their impacts will not disappear; they are more likely to be amplified in the forms of reduced meat supplies to consumers and reduced profitability to firms in the livestock sector.

References

Congressional Research Service, "Mad Cow Disease: Agricultural Issues" RS20839, March 12, 2001

US Food and Drug Administration, "FDA Veterinarian" Vol. XIII, No. IV, July/August 1998.

Food and Drug Administration, "Compliance Policy Guide" Chapter 6, Subchapter 675, Rendered Animal Feed Ingredients

Sparks Companies, "The Economic Impact of Proposed Regulations Concerning Ruminant-Based Protein Products" 1997.