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An Economic and Environmental Assessment of Eliminating Specified Risk Materials and Cattle Mortalities from Existing Markets

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Prepared for:

The National Renderers Association

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Foreword

The Food and Drug Administration, the Department of Agriculture and several other government agencies are faced with the challenging task of maintaining safety and consumer confidence in the US food supply. Consumer confidence in US beef was tested in December 2003 when a single case of BSE was discovered in a herd of cattle in Washington State. By all accounts, consumers responded rationally, by recognizing that the US beef supply remains among the safest in the world, with virtually no risk of human exposure to BSE. Consumer demand for beef—and the prices they paid—remained high in the months that followed despite media attention that tended to focus heavily on the most sensational outcomes and implications of this discovery.

Nevertheless, various government agencies, including the FDA, remain under pressure to further strengthen BSE controls in the US, including possibly restricting certain byproducts of cattle production and slaughter—and the rendered products derived from these materials—from their traditional use in livestock feed. Although the list of potential restrictions under consideration is long, attention appears particularly focused on "specified risk material" from slaughtered livestock, and cattle and calves that die on the farm.

Informa Economics (formerly Sparks Companies, Inc) has agreed to examine the economic and environmental consequences of potential SRM and livestock mortality restrictions. We find that these restrictions would generate significant revenue loss to the rendering industry, with cost implications across all segments of the livestock sector. And, at least as important as the economic consequences, we find that these restrictions would generate significant risk to the environment and human health, very likely offsetting any perceived improvement in food safety intended in the first place. We urge FDA to use caution in their rulemaking procedure, and to fully consider the economic, environmental, and human and livestock health consequences of their actions.

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An Economic and Environmental Assessment of Eliminating Specified Risk Materials and Cattle Mortalities from Use in Existing Markets

Background: Following detection of bovine spongiform encephalopathy (BSE) in December 2003, the Secretaries of the U.S. Departments of Agriculture and Health and Human Services announced a series of regulatory actions and policy changes to strengthen protections against the spread of BSE in U.S. cattle. The Secretary of Agriculture also convened an international panel of experts on BSE to review the U.S. response to the December, 2003 case and make recommendations that could provide meaningful additional public or animal health benefits.

One area that has received particular attention among government officials and the media is the potential for BSE to spread or infectivity to be amplified through the feeding of animal proteins to ruminants, particularly resulting from cross-contamination of ruminant feed with protein material derived from ruminant species. It has also been suggested that certain ruminant tissues are particularly vulnerable to carrying the agent believed responsible for BSE, especially tissue from cattle that die or are non-ambulatory prior to slaughter, and certain anatomical tissue designated as Specific Risk Material (SRM).

Accordingly, FDA has tentatively proposed removing these SRMs from all animal feed to minimize the risk of cross contamination throughout the feed manufacturing and distribution process, and to prevent intentional or unintentional misfeeding on farms. FDA is currently working on a proposal to accomplish this goal. FDA is also suggesting that protein derived from dead and non-ambulatory cattle be prohibited from the animal feed supply, and it is considering various other extensions of the existing feed regulations.

Recognizing that FDA is under severe pressure from various public interest groups, legislators, and industry participants to rapidly develop and implement new livestock feeding regulations to further reduce the already extremely low risk of BSE spreading in the United States, we nevertheless urge the agency to use caution by fully considering the potential unintended consequences—both economic and environmental—of stringent new restrictions on livestock feed. Many of the proposed feed regulations will have a direct adverse impact on the value of products produced by the livestock and rendering industries, and would almost certainly create serious new risks to the environment and to livestock and human health.

Materials Potentially Affected

In their interim final rules concerning regulation of SRMs for human food use, USDA and FDA define SMRs from slaughtered cattle as follows:

(1) The brain, skull, eyes, trigeminal ganglia, spinal cord, vertebral column (excluding the vertebrae of the tail, the transverse processes of the thoracic and

lumbar vertebrae, and the wings of the sacrum), and dorsal root ganglia of cattle 30 months of age and older
(2) The tonsils of all cattle
(3) The distal ileum of all cattle.

Under any proposed restrictions on the use of SRMs in animal feed, slaughterers would presumably be asked to separate SRMs and arrange for their disposal. USDA has already banned the use of SRMs in food for human consumption. Slaughterers would be expected to modify their animal killing operations to arrange for the separation of SRMs and delivery of the materials to an approved site or facility to dispose of this material. Currently, this SRM material goes almost entirely to rendering, where it contributes to the production of meat and bone meal (MBM) and tallow for use in feed and industrial applications.

The FDA is also considering restricting the use of dead and non-ambulatory (i.e., "downer") cattle in the production of livestock feed. From a practical standpoint, this restriction would prohibit the use of rendering as a disposal option for this material. While rendering is not the only method currently employed to dispose of livestock mortalities, it is one of the primary means of disposing of cattle and calves that die prior to slaughter.[1] Other feed restrictions under consideration include prohibitions on bovine blood and blood products, plate waste, and poultry litter.

Expected Impact of New Feed Restrictions

Since 1997, FDA has prohibited the use of all mammalian protein products, with the exception of pure pork and pure equine protein from single species processing plants, in animal feeds given to cattle and other ruminants (21 CFR 589.2000). This restriction, along with other measures in place including import restrictions of ruminants and ruminant products from countries infected with BSE, is widely viewed as providing effective protection against the spread of BSE in the United States. Importantly, the current feed restrictions operate by *diverting* ruminant-based feed ingredients away from ruminant feed and to feed used for other species. Hence, although this rule has undoubtedly affected the market price of certain ruminant-based feed ingredients, it maintains existing channels for disposing of slaughter by-products and livestock mortalities through the rendering sector, minimizing the need for alternative disposal options.

The feed restrictions now under consideration by FDA would not maintain existing channels for disposing of the material restricted from livestock feed. By eliminating SRMs and cattle and calf mortalities from use in *any* livestock feed, these restrictions would necessitate disposal of this material by methods other than rendering. The following are key points to consider:

[1] Historically, some material from dead cattle was diverted directly to use in the production of pet food, but we believe that this practice no longer exists in any significant quantity.

- The rendering industry will process material only if the cost of doing so is less than the revenue expected from the end product. Currently, the markets for rendered material focus mainly on feed ingredients, along with some industrial uses. If SRMs and/or cattle and calf mortalities cannot be used to produce livestock feed, the economic value to the rendering industry will be reduced below the cost of processing this material, so economics dictates this material will not be rendered.

- Facing unfavorable market conditions for rendered feed ingredients, some renderers charge collection fees for processing livestock mortalities and/or slaughter byproducts. It has been suggested that renderers could therefore continue to collect and dispose of restricted slaughter byproducts and livestock mortalities by simply charging a fee sufficient to cover the revenue lost from the sales of rendered product. Under the proposed restrictions this is unlikely for the following reasons:

    - The restricted material would require careful segregation from non-restricted material, including processing on separate dedicated lines or facilities. However, the rendering industry is not uniformly equipped for such dedicated processing, and constructing the necessary infrastructure would take considerable time and expense.
    - The collection fee that renderers would be required to charge to make the collection of restricted material economically viable given lost product markets and the need to retool facilities would far exceed any fees currently being levied. Absent specific regulation of disposal methods, producers of restricted material will search for alternative means of disposal—including perhaps less costly but much more environmentally damaging methods such as burial and landfilling—that will directly compete with rendering.
    - While rendering restricted material would reduce the volume that requires disposal, it remains unclear how even this rendered material would be disposed of in the US. Unlike in Europe, the US does not have significant capacity to incinerate this material, and landfilling could require significant transportation or other costs.

- Removing SRMs from cattle and calves that die prior to slaughter would greatly increase renderers' cost of collecting this material (assuming such a practice is even operationally feasible), requiring an increase in collection fees of a magnitude that would likely force producers to employ alternative mortality disposal methods. Therefore, we believe that SRM removal from dead livestock is not a viable option.

- The proposed restrictions on feed ingredients would cause the immediate loss of the current market revenue renderers generate from the sales of meat and bonemeal (MBM), tallow, and all other products currently derived from the restricted material. These losses will be felt not only by the rendering industry, but will also be reflected in higher livestock feed costs (from a reduction in feed ingredient supply) and higher costs of slaughtering cattle (from the need for meatpackers to incur additional costs of SRM segregation and disposal).

- The environmental impact of alternative disposal methods for slaughter byproducts and cattle/calf mortalities must be carefully considered, especially in the absence of strict regulatory oversight of disposal methods such as on-farm burial and composting of livestock mortalities.

Economic Impacts Quantified

As noted above, restrictions on the use of SRMs and cattle/calf mortalities in the production of feed ingredients will result in the complete loss of the market revenue currently generated from processing these items. Estimating this lost market revenue is straightforward, based on the quantity of material affected by the restrictions. Hence, the first task in determining the economic impact is estimating the quantity of SRMs and cattle/calf mortalities currently rendered in the United States.

SRMs. Under the proposed definition of SRM, older cattle generate considerably more SRM per head than do younger cattle. In its *Environmental Assessment for the IFR on Use of Materials Derived from Cattle in Human Food and Cosmetics,* dated July 9, 2004, (the FDA report, hereafter) FDA quantified the volume of SRM generated by the US livestock industry based on the size and age distribution of the US cattle slaughter industry, and the estimated weight per head of SRM generated under the proposed definition.

Industry estimates indicate these materials constitute approximately 88.5 lbs in each head of cattle over 30 months of age, and 28.3 lbs in each head under 30 months. Although estimates vary widely based on factors such as the weight of the cattle and the ability of the packer to extract the SRM with minimal additional tissue, we believe these numbers provide a reasonable benchmark. As noted in the FDA report, based on a 2003 cattle slaughter of 35.3 million animals, the result is 1.423 billion pounds of SRM material generated annually. Given very limited (and now heavily restricted) food use of these items, it is assumed that renderers process all of this material, where it is converted primarily to MBM and tallow for use in non-ruminant livestock feed (primary use) and industrial markets.

Dead and Downer Cattle. Although the proportion of cattle and calves that die prior to slaughter is very modest, the sheer size of the US livestock sector results in the generation of *billions* of pounds of livestock mortalities annually, creating a disposal challenge for farmers, ranchers, and meatpackers. Disposing of these mortalities is complicated because of the need to minimize adverse environmental consequences, such as the spread of human and animal disease or the pollution of ground or surface water. Renderers play an important role in this process by providing an environmentally benign disposal option and transforming this potentially harmful material into various useful and valuable compounds.

The FDA report offers estimates of the volume of dead and downer cattle produced in the United States and the proportion currently processed by renderers (presented in Appendix A, Table 2), suggesting that only 17% of cattle and calves that die prior to slaughter are currently rendered and that over 4.6 billion pounds of material from dead cattle is disposed of by alternative, legal methods. On the surface, these numbers appear to suggest that the economic and environmental impact of restricting all dead and downer cattle from rendering would be minimal; but it is our view that not only are these numbers not accurate, their interpretation overlooks important economic and environmental consequences of eliminating this disposal channel.

USDA estimates 1.7103 million cattle and 2.3656 million calves died prior to slaughter in 2002[2], for a total species count of just under 4.1 million deaths. In 2001, USDA reported just over 4.2 million species deaths. The next step is to determine the number of nonambulatory cattle in the United States. No one knows the exact number; however, USDA estimates approximately 200,000 per year based on a survey conducted of American Association of Bovine Practitioners members[3], bringing the estimated total number of dead and downer cattle and calves to about 4.3 – 4.4 million per year, roughly consistent with FDA's estimate of 4.6 million.

USDA does not regularly report cattle deaths by type, i.e. beef or diary, but it periodically conducts an industry survey to provide a detailed breakdown of the cattle and calf death losses by class, state and size group. From their most recent survey[4] it is estimated that 69.4% of cattle deaths and 68.7% of calf deaths are from beef animals, with dairy animals accounting for the remaining 30.6% and 31.3% of cattle and calf deaths, respectively. Given the absence of updated data and little reason to expect these proportions have changed meaningfully over time, we apply these factors to the USDA total cattle and calf death loss estimates reported above to estimate current cattle and calf death loss in the beef and dairy industries (Table 1).

Table 1. Cattle and Calf Death Loss, 2002

	Cattle[1]		Calves		Total Species
	Percent	*1,000*	*Percent*	*1,000*	*1,000*
Beef	69.4%	1,325.75	68.7%	1,625.17	2,950.92
Dairy	30.6%	584.55	31.3%	740.43	1,324.98
Total	100.0%	1,910.30	100.0%	2,365.60	4,275.90

1/. Includes 200,000 downer cattle
Source: Derived from USDA/NASS and USDA/APHIS estimates

Recent industry estimates suggest that renderers currently process roughly 50% of all livestock mortalities (i.e. mortalities from all species, including bovine, poultry, pork,

[2] USDA/NASS, *Meat Animals Production, Disposition, and Income 2003 Summary*, April 2004
[3] Hansen, Don and Bridges, Victoria. *A survey description of down-cows and cows with progressive or non-progressive neurological signs compatible with a TSE from veterinary-client herd in 38 states*. The Bovine Practitioner; 33(2); 179-187, 1999.
[4] USDA/APHIS and USDA/NASS, *Cattle and Calves Death Loss 1995*, March 1997

etc), and about 45% of all cattle mortalities.[5] Similar estimates can be derived using information readily available from various USDA agencies. Table 2 presents information collected by the USDA/APHIS National Animal Health Monitoring System, estimating mortality disposal methods at beef and dairy livestock operations. The USDA initiated the National Animal Health Monitoring System in 1983 to disseminate data on animal health, management, and productivity across the United States based on periodic, nationally representative industry surveys. This information suggests that rendering is one of the most widely used methods of mortality disposal for most types cattle and dairy operations (Table 2).

Table 2. USDA Estimates of Mortality Disposal Methods

	Dairy[1, 2]		Beef[3]	
	Calves	Cows	Feedlots[4]	Cow/Calf[5]
Buried	35.3	22.7	5.3	33.5
Burned/incinerated	2.8	2.2	--	34.6
Rendered	43.8	62.4	94.1	20.0
Composted	10.1	6.9	--	--
Landfill	2.4	1.9	0.5	4.9
Other	5.6	3.9	0.1	7.0
Total	100	100	100	100

1/. Source: USDA/APHIS, National Animal Health Monitoring System, Dairy 2002
2/. Percent of operations using each disposal method (only data available)
3/. Percent of mortalities disposed on by each method
4/. Source: USDA/APHIS, National Animal Health Monitoring System, Feedlot 1999
5/. Source: USDA/APHIS, National Animal Health Monitoring System, Beef 1997

The data in Tables 1 and 2 can be easily combined to derive estimates of the total volume of cattle and calf mortalities disposed of by rendering versus alternative means. First, beef feedlot mortalities are estimated at about 300,000 per year, based on a death rate of just over 1% (industry estimate) of the 25 to 30 million cattle placed in large feedlots each year. This is consistent with FDA's feedlot death estimate provided in the *Environmental Assessment* (FDA report) cited above. However, it should also be noted that in periods of severe weather, particularly hot summer conditions or unusually severe winters, the cattle death rate on feedlots sometimes increases significantly. The heavy dependence on renderers to dispose of feedlot mortalities reflects the high concentration of cattle within feedlots, and the limited land available to dispose of these mortalities by alternative means, such as burial or other land-intensive methods.

The remaining (non-feedlot) cattle mortalities are easily identified as originating from either beef cow-calf operations or dairy operations, and calf mortalities are likewise identified directly by type in Table 1. Estimates of quantities (number of head and weight) of dead and downer cattle processed by renderers are presented in Table 3.

[5] See for example, Sparks Companies, Inc, *Livestock Mortalities and Their Potential Costs*, March 2002.

Table 3. Estimated Quantities of Dead and Downer Cattle Rendered, 2002

	Mortalities and Downers			Volume		
	Head	Rendered	Head Rendered	Produced[1]	Rendered	Percent Rendered
Cattle	*1,000*	*Percent*	*1,000*	*1,000 lbs*	*1,000 lbs*	
Dairy Cow/Bull	584.55	62.0	364.76	818,370	510,663	
Feedlot	300.00	94.4	283.20	270,000	254,880	
Beef Cow	1,025.75	20.0	205.15	1,025,750	205,150	
Total	1,910.30	44.7	853.11	2,114,120	970,693	45.9
Calves						
Dairy calves	740.43	43.8	324.31	185,107	81,077	
Beef calves	1,625.17	20.0	325.03	406,293	81,259	
Total	2,365.60	27.4	649.34	591,400	162,336	27.4
Total Cattle and Calves	4,275.90	35.1	1,502.45	2,705,520	1,133,028	41.9

1/. Assumes following weights per mortality: Dairy cow, 1400 lbs; Feedlot, 900 lbs; Beef cow, 1000 lbs; calves, 250 lbs

The estimates in Table 3 indicate that roughly 2.7 billion pounds of dead and downer cattle and calves are generated annually in the United States, of which nearly 42% are processed by the rendering industry (nearly 46% of cattle and 27% of calves). This far exceeds FDA estimates that suggest only 17% of cattle and calf mortalities are rendered. Clearly, the rendering industry continues to play a key role in disposing of this otherwise worthless and environmentally menacing material. As the value of this material to renderers has decreased in recent years, the use of rendering as a mortality disposal method has likely declined somewhat, perhaps below the use implied by the National Animal Health Monitoring System estimates presented in Table 2. However, structural change in the dairy and beef industries that continues to favor larger, more concentrated livestock operations also decreases the viability of alternative disposal methods, such as burial on the farm, due to the high concentration of mortalities on a relatively limited land base. Hence, rendering continues to play an important role in mortality disposal despite the fact that renderers increasingly charge a fee for this service in order to cover revenue lost due to weak animal protein feed ingredient markets.

Other evidence also supports the implication that the volume of rendered cattle and calf mortalities far exceeds FDA estimates, including:

- The October 2003 revised "Harvard Risk Analysis Study" assumes that 85% of the cattle and calves that die prior to slaughter are rendered (Section 3.1.1.2).[6]

- Proprietary company-specific data provided by 4 firms in the rendering industry indicate that these firms alone process roughly 11.2 million pounds of deadstock per week (582 million pounds per year), which would account for over 84% of the total rendered deadstock estimate suggested in the FDA report. But the estimates from

[6] Harvard Center for Risk Analysis, *Evaluation of the Potential for Bovine Spongiform Encephalopathy in the United States,* Revised October 2003.

these four firms do not include the significant volume of deadstock rendered in the key dairy producing states of Minnesota and Wisconsin, and also do not include the more than half-dozen other major firms also engaged in deadstock rendering.

- As noted above, the estimates in table 3 are also consistent with estimates presented in an earlier (2002) study by Sparks Companies, Inc (now Informa Economics), which were based largely on an update to an industry survey conducted in 1995.

Therefore, we have significant confidence in the Table 3 estimates.

Lost Market Revenue

The direct economic impact of the proposed feed restrictions results primarily from the loss of the restricted material (SRMs and cattle/calf mortalities) as a feedstock into the rendering process, which translates directly into lost sales of the MBM and tallow that this material would otherwise have been used to produce. This lost market revenue is estimated below.

SRMs. Based on the assumption (used in the FDA report) that cattle SRM material is composed of 25% protein, 25% fat and 50% moisture, the 1.423 billion pounds of SRMs potentially subject to new regulatory controls now is used to produce 355.8 million pounds of MBM and 355.8 million pounds (177,800 tons) of tallow at rendering facilities. As noted above, with livestock feed accounting for the largest proportion of MBM use (and human use already restricted), all rendered products produced from SRMs will become effectively worthless, resulting the need to dispose of it by alternative means.

The economic loss to renderers can be calculated as a direct loss in market revenue. Since January 2002, MBM prices have averaged $182/ton[7] and rendered tallow prices have averaged $333/ton.[8] Lost sales potential of 177,000 tons of both MBM and tallow annually translates directly to revenue losses by renderers of $32.4 million from lost MBM sales and $59.2 million in lost sales of tallow, for a total **economic loss of $91.6 million** in lost annual revenues from product sales.

Dead Stock. Given that all rendered material from these cattle and calf mortalities would be restricted from livestock feed, there would clearly be no economic incentive for renderers to continue to collect this material absent exorbitantly high collection fees to cover all costs of collection, processing and disposal. The economic impact to the rendering industry from losing cattle and calf deadstock as a raw input would be large. Based on the estimated volumes in Table 3, the rendering industry would immediately lose access to over 1.1 billion pounds of raw material. Assuming (as above) that these cattle mortalities are roughly 25% fat and 25% protein (with the balance moisture), the result would be a loss in meat and bone meal (MBM) production of 283.3 million pounds per year (141,628 tons), with similar quantities of tallow removed from the market.

[7] USDA/ERS Feedgrains Database, http://www.ers.usda.gov/db/feedgrains/
[8] Informa Economics estimate

Based on the estimated MBM and tallow prices used above, lost renderer sales from this material equate to roughly $25.8 million in reduced annual MBM sales, and $47.2 million in reduced annual tallow sales, for a **loss to the rendering industry of $73.0 million.**

Given current weakness especially in the price of ruminant MBM, many renderers have begun changing fees to collect dead cattle and calves, and industry experts suggest these fees average about $25/head for mature cattle, and $10/head for calves. Based on the Table 3 estimates of the number of cattle and calves currently rendered, the lost revenue from collection of this material is $21.3 million for dead mature cattle, and $6.5 million for dead calves, annually. Hence, the total lost revenue to the rendering industry from omitting this material from livestock feed includes not only the loss in product revenue identified above, but also the estimated $27.8 million in deadstock collection fees, for a total economic loss to the rendering industry of about **$100.8 million per year**.

In addition to the lost revenue identified above, additional market impacts can be expected that could produce both economic and environmental consequences. For instance:

- If renderers no longer collect dead cattle and calves, the economics of livestock mortality disposal for *all livestock species* could be undermined. Renderers undoubtedly experience economies of scale in deadstock collection, minimizing the transportation costs of collecting this material per mortality by collecting mortalities of other livestock species (e.g. swine, equine, poultry etc.) along with cattle and calves. Eliminating the collection of cattle and calves would almost certainly cause the unit cost of collecting other mortalities to rise, perhaps above levels that producers are willing to pay. The result could be higher costs of mortality disposal across the entire livestock (i.e. all species) sector, a direct reduction in revenue from all deadstock material that is currently rendered, and adverse environmental consequences from employing alternative disposal methods for other livestock species.

- A loss of more than 2.5 billion pounds of raw material available to the rendering industry would increase the unit cost of processing for the remaining material that would presumably still be rendered. The excess rendering capacity that would result has no economic value, but would still generate costs to the firm associated with the original capital expenditures, maintenance and security, and other expenses. The loss of economies of scale in processing that would normally allow these expenses to be spread over the larger quantities of material (perhaps though additional shifts) will vary by firm, but are expected in every case to result in higher production costs per unit. Some industry participants suggest an impact of more than 12% per unit of material processed, or up to 23¢/cwt in increased costs. Older, smaller, or less efficient plants, as well as those that currently rely heavily on deadstock as a raw input, would experience disproportionate cost increases and financial burden.

- Rendering is the only livestock mortality and SRM disposal option that directly lends itself to regulatory control and oversight, and therefore the only option that could be

consistent with efforts to enact a national animal identification and traceability system for all livestock. Eliminating rendering as a disposal option for livestock mortalities would allow regulators to lose all ability to monitor, test or track livestock that die on the farm.

The estimated revenue losses from restrictions on the use of SRM material and cattle/calf mortalities in the livestock feed are summarized in table 4.

Table 4. Estimated Revenue Impact from Additional Feed Restrictions

	Raw Material Affected	Finished Product MBM	Finished Product tallow	Annual Value of Lost Sales
	1,000	*tons*		*$ million*
SRM Ban	1,423,044	177,000	177,000	91.6
Dead and Downer Ban[1,2]	1,133,028	141,628	141,628	100.8
			Total	**$ 192.4**

1/. Amount currently rendered

2/. Includes $27.8 million in lost collection fees

Cost of Alternative Disposal Options

As a general rule, the cost of disposing of SRMs and/or livestock mortalities rises in inverse proportion to the environmental impact of the disposal option chosen. For instance, significant volumes of mortalities or SRM material *could* be disposed of at relatively little cost by simply burying the material in a large, unlined pit excavated near the slaughter facility or on a farm. However, significant risks to human, livestock and environmental health offset the savings in disposal costs from this or similar methods. Unfortunately, the United States does not uniformly regulate the disposal of slaughter waste or livestock mortalities, so there is little assurance that restricted material would routinely be disposed of in a manner that minimizes environmental and human health externalities.

A recent report by Sparks Companies, Inc. (now Informa Economics) estimated the fixed and variable costs of disposal options for livestock mortalities.[9] Assuming rendering is no longer an option, the cost to the livestock industry of the three most likely other disposal options for dead cattle and calves are presented in Table 5. The detailed assumptions used in developing these costs estimates can be found in the above-cited report.

Importantly, the estimates in the table below assume that **all appropriate environmental controls are adopted**, which is an assumption that is likely to be violated frequently given the unregulated and geographically dispersed nature of deadstock production.

[9] Sparks Companies, Inc, *Livestock Mortalities and Their Potential Costs*, March 2002. Available on the web at http://www.renderers.org/economic_impact/index.htm

Table 5. Estimated Livestock Sector Cost of Alternative Livestock Mortality Disposal Options

Cost Category	Burial	Incineration	Composting
		$1,000	
Annual Operating Costs	43,902	38,561	125,352
Fixed Investment Costs			
Beef Cattle	N.A.	797,985	1,241,310
Dairy Cattle	N.A.	333,630	518,980
Total Fixed	N.A.	$1,379,646	$2,146,116
Cost of Adoption	$109,898	$1,437,525	$2,337,759

While it was estimated above that renderers currently charge approximately $27.8 million annually in collection fees for the cattle and calf mortalities that are rendered, table 5 emphasizes that while producers would no longer face these collection fees if this material were restricted from feed production, they would nevertheless face very significant costs of alternative disposal methods that far exceed current disposal costs where rendering is an option. Hence, disposal expenses of the magnitude illustrated in table 5 would be borne entirely by livestock producers, and are almost certainly to exceed the current costs of mortality disposal where rendering is a viable option.

For the 1.423 billion pounds of SRM material that would be generated annually by livestock slaughter facilities, disposal options would be even more limited than those available for livestock mortalities. Given that enormous volumes of this material are generated at a relatively small number of packing plants, burial or composting are not likely to be viable options at or near the packing facility.

USDA provides estimates of the number of cattle slaughtered in federally inspected facilities, by size of facility (Table 6). As illustrated below, the 13 plants that each slaughter between 1 and 1.5 million head of cattle per year are responsible for processing nearly half (46.8%) of all cattle annually slaughtered in the United States. Using these plants as an example and assuming they are all of equivalent size, with cattle over 30 months of age accounting for about 20% of the annual slaughter, each plant would annually generate 291.9 million pounds of SRM material from cattle over 30 months of age and 373.4 million pounds of SRM material from cattle under 30 months, for a total of nearly 1 million pounds of SRM material *per week* from *each* plant. Larger plants would generate even greater quantities. Clearly, composting or burial of this enormous volume of material on site would be impractical, so specialized disposal facilities or dedicated transportation systems would be required.

Table 6. Number of Federally Inspected Cattle Slaughter Facilities and Head Slaughtered by Size Group, 2003

Size Group	Plants *Number*	Head *1,000*	Size Group	Plants *Number*	Head *1,000*
1 - 999	508	163.7	300,000 - 499,999	11	4,409.60
1,000 - 9,999	89	299	500,000 - 999,999	9	5,344.20
10,000 - 49,999	26	624.4	1,000,000 – 1,499,999	13	16,492.20
50,000 - 99,999	11	790.1	1,500,000 +	2	3,338.70
100,000 - 199,999	12	1,792.70	Total	689	35,271.30
200,000 - 299,999	8	2,016.60			

Source: USDA/NASS Livestock Slaughter 2003 Summary, March 2004

In terms of disposal costs, landfilling this material results in staggering expenses that would be incurred by all slaughter facilities. Normal tipping fees at US landfills vary widely, but are estimated to average $60/ton. However, for raw offal consider that landfills would charge higher than normal tipping fees in order to:

- Cover the costs of nearly 0.4 billion pounds of sawdust (or equivalent absorbent material) at about $20 per ton (based on a recent quote from Georgia Pacific) to blend with the raw material;

- Handle this material that in some cases might be considered environmentally hazardous therefore requiring significant "tipping fees" charged at landfills.

The unit cost in tipping fees for the raw material is estimated at $105 per ton, exclusive of transportation costs, for a total cost of $74.7 million per year to dispose of the 1.423 billion pounds of SRM byproducts currently produced in the United States. Of course, this assumes that landfills would be willing to even collect this material, and that adequate space would be available. From a practical standpoint, it is far from obvious that landfills would be willing to accept this material, especially given the implication of the FDA rule that the material is potentially hazardous.

Environmental Impact

Without the rendering industry, it would be necessary to discard or dispose of animal byproducts and mortalities in community landfills, compost piles, burial sites, incinerators or, worse, left in illegal dumping places, causing a potential public health hazard. Each of these alternative methods has several limitations with respect to animal byproduct and mortality disposal, with limited space being the most obvious. Typically, these alternative disposal methods are only loosely regulated at the state and/or local levels, occasionally including restrictions on their use in certain jurisdictions or where groundwater pollution is a concern. However, enforcement could be lax especially on farms and fields that are geographically remote. We are aware of no scientific study that assesses the environmental impact of alternative methods of disposing of such significant volumes of potentially infectious (with various animal diseases) and highly unstable

material. However, logic dictates that environmental consequences could be severe, and these need to be carefully considered when imposing regulations that could lead to such significant disposal challenges.

When unprocessed animal byproducts derived from ruminant animals are disposed of by methods other than rendering, not only is their disposition not uniformly regulated, but the potential exists for cattle and other ruminant animals to be exposed to materials prohibited by the current FDA feed ban. Domestic and wild ruminant animals may have direct exposure to unprocessed raw materials that have been improperly buried, composted or placed in landfills. As a result, these non-rendering practices could contribute to the amplification of BSE should it ever occur in the United States. For example, spreading composted animal byproducts, of ruminant animal origin, on land used for grazing and/or hay production is permissible under the current regulations.

Landfills. While rendering reduces volume, amendments (such as sawdust) must be added (1 part amendment to 3 parts byproduct) to compensate for the high moisture content of animal byproducts and mortalities when preparing these raw materials for disposal in a landfill. As a result, the total volume would be increased by approximately 25%. Decomposition proceeds slowly and at relatively low temperatures (130 to 150° F) in landfills, which limits pathogen destruction. Landfilling animal byproducts also contributes to methane gas production and odors, attracts vectors by which disease can be spread to the livestock and human population (such as rats, cats, dogs, birds, flies, etc.) and creates contact and/or inhalation exposures to humans. Furthermore, the potential for increased disease among landfill workers and the transfer of pathogens to off-site locations may be increased when landfills are used for large animal disposal.[10]

Composting is an approved method of disposal in most states, although local and state regulations often guide construction of the composting structure and the type, size, and amount of livestock that can be composted at a single location. However, contrary to popular belief and practice, simply covering mortalities in manure is not considered composting[11]. The proper use of composting is a labor and management intensive activity, which if done improperly will generate significant risk to the environment as well as human and livestock health. Although many aspects of composting are not exact, there are several factors that affect the success of the composting process including:

- The carbon and nitrogen ratios (C:N ratio)
- The moisture content
- Particle size
- Oxygen concentrations
- Temperature.

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[10] Gerba,C. P., 2002. Potential health implications from the disposal of large animals in landfills. Presentation to the Arizona Department of Agriculture. June 11

[11] For a detailed description of proper composting techniques for large cattle, see *Whole Animal Composting of Dairy Cattle,* New Mexico State University Cooperative Extension Service, Guide D-108, by Michael Looper..

Given the complicated nature of managing a compost facility, the potential for improper management of on-farm composting facilities and resulting environmental risk is high. Failure to properly manage the composting process can result in excessive odors and a high possibly for the spread of disease, and runoff from composting facilities can endanger ground and surface water. Large animals such as mature cattle will often need to be cut into smaller pieces to facilitate the composting process, and the thick hides of mature cattle can be difficult to compost, often requiring additional cycles to completely decompose. And, even under the best of circumstances, composting facilities are vulnerable to rodent and predator activity, as well as insects and other pests, which can easily spread disease to other livestock or to humans. Given the potential for adverse environmental consequences, composting often requires additional time and equipment compared to the other disposal methods.

Furthermore, composting typically generates internal temperatures of only between 110-150 degrees F, which could be sufficient to kill most pathogens, but if compost piles are not properly turned, pathogen destruction can not be guaranteed, especially for heat resistant and spore forming bacteria, such as *Bacillus anthracis.* And, there is no evidence that the composting process is capable of inactivating the prion believed responsible for BSE. This has very important implications since composted material is often disposed of by spreading it on fields where cattle might graze or where livestock feed is produced, which could potentially expose cattle to the very compound that current and proposed FDA feed regulations are intended to prevent.

Burial of livestock is, along with rendering, one of the most widely used methods of carcass disposal (table 2). However, it is also the method that creates the largest risks to human health and the environment because of the potential for ground and surface water pollution if proper techniques are not rigorously followed. Livestock carcasses ideally must be buried at least 4 feet below the ground within 36 hours, and ideally not within 200 feet of a waterbody, well or spring. The burial pit should also be at least 100 feet away from production facilities to lessen risk of disease transmission by rodents. Regulations concerning on-farm burial vary considerably by state, sometimes requiring detailed knowledge of the local geology to determine the maximum number of burials on a given area of land, or to ensure that the mortality is buried some specified distance above the water table. Despite these regulatory guidelines, there is little assurance that "proper" burial techniques are routinely or uniformly applied.

There are also practical challenges to this disposal technique. Burial is not a viable option in many states because of population density and/or the potential for ground and surface water contamination. Where it is permitted, a common practice is to dig a trench and then, starting at one end, fill the trench in over time with carcasses and soil. However, maintaining an open trench poses a serious occupational hazard as a well as hazard to people and livestock simply walking through the area. During winter months in some areas, despite the use of earth-moving equipment, it can be difficult, if not impossible, to bury the carcasses in frozen soil. And, especially if proper techniques are not followed, rodent and predator activity is a concern that can lead to significant health risks to livestock and humans.

Incineration can be a biologically safe method of carcass disposal, but only if done properly in an approved mortality incinerator. Incinerators usually operate on diesel, natural gas, or propane. A diesel-fueled incinerator will require from 1 to 3 gallons of fuel per 100 pounds of carcass. However, large carcasses are more difficult to burn in most farm-operated incinerators; most tend to work best for carcasses smaller than 500 pounds. Therefore, carcasses from mature cattle typically need to be cut into smaller pieces prior to incineration, increasing the labor requirement and the potential for worker injury. The significant capital costs associated with purchasing or constructing an environmentally benign on-farm incineration facility can be a barrier to adoption, and incineration by other means can generate significant environmental damage to the air and water. For instance, burning carcasses in open pits typically does not comply with Department of Environmental Quality (DEQ) air quality standards and is not recognized as an approved method. Furthermore, incineration capacity in the United States is currently inadequate to dispose of all of the animal byproducts and mortalities produced annually.

Table 7 summarizes the relative human health impact of several alternative mortality disposal methods, as identified by the United Kingdom Department of Health[12]

[12] United Kingdom Department of Health. *A Rapid Qualitative Assessment of Possible Risks to Public Health from Current Foot and Mouth Disposal Options - Main Report.* June 2001.

Table 7. Summary of Potential Health Risks of Potential Methods of Byproduct/Mortality Disposal [1,2]

Disease/Hazardous Agent	Potential human health hazard from each option				
	Rendering	Incineration	Landfill	Pyre	Burial
Campylobacter, E. Coli, Listeria, Salmonella, Bacillus anthacis, C. botulinum, Leptospira, Mycobacterium tuberculosis var bovis, Yersinia	Very small	Very small	Moderate	Very small	High
Cryptosporidium, Giardia	Very small	Very small	Moderate	Very Small	High
Clostridium tetani	Very Small	Very Small	Moderate	Very Small	High
Prions for BSE, Scrapie[3]	Moderate	Very Small	Moderate	Moderate	High
Methane, CO_2	Very Small	Very Small	Moderate	Very Small	High
Fuel-specific chemicals, Metal salts	Very Small	Very Small	Very Small	High	Very Small
Particulates, SO_2, NO_2, nitrous particles	Very Small	Moderate	Very Small	High	Very Small
PAHs, dioxins	Very Small	Moderate	Very Small	High	Very Small
Disinfectants, detergents	Very Small	Very Small	Moderate	Moderate	High
Hydrogen sulfide	Very Small	Very Small	Moderate	Very Small	High
Radiation	Very Small	Moderate	Very small	Moderate	Moderate

1/. Adapted from a United Kingdom Department of Health Report cited below
2/. Legend: Very Small – least exposure of humans to hazards
Moderate – intermediate exposure of humans to hazards
High - greatest exposure of humans to hazards
3/. Risk of human exposure to TSEs was rated as very small when solid products of rendering were incinerated.

The Costs Versus Benefits of Enhanced Livestock Feed Regulations

The revised and updated Harvard Risk Study finds that BSE is extremely unlikely to become established in the US, and that potential human exposure to BSE, even if it exists in the US cattle herd, is extremely remote. For example, in a hypothetical scenario (the "base case") in which ten cattle infected with BSE were imported into the US, on average only four new cases of BSE would occur over a 20-year period. Moreover, given the current feed ban and other controls already in place, the disease is virtually certain to be eliminated from the country within 20 years after its introduction, with the new cases resulting primarily from lack of compliance with existing livestock feed regulations. The import of one infected animal yields on average less than one new BSE case in 20 years, and the disease is likely to be quickly eliminated from the US following its introduction.

If the disease can occur spontaneously in cattle, as some have suggested, it would result in only one to two cases per year with little spread.

Since the primary concern with BSE in the cattle population is the potential for human exposure through the food supply, it is important (and comforting) to note that under practically all scenarios examined the amount of potential BSE infectivity that would ever reach the human food supply is almost immeasurably small. The amount of infectivity is expressed in terms of "cattle oral ID_{50s}" for the purpose of quantifying both animal and human exposure to this agent. A cattle oral ID_{50} is the amount of infectious tissue that would, on average, cause 50% of exposed cattle to develop BSE. The relationship between human exposure quantified in terms of cattle oral ID_{50s} and the likelihood of human disease is unknown, but European authorities suggest that the cattle disease may be 10 to 100,000 times less virulent in humans[13]. In the entire 20 year period following the import of ten BSE-infected cattle (the base case), the mean estimate for the amount of infectivity potentially available for human exposure is 39 cattle oral ID_{50s}, among the more than 56 billion pounds of cattle and calves annually slaughtered in the United States for human consumption. Clearly, the BSE risk to human health is already, essentially, infinitesimal. Furthermore, the greatest sources of exposure to humans include consumption of cattle brain (24% of the total risk), spinal cord (10%), and meat derived from advanced meat recovery systems (51%)—items that USDA has recently enacted strict controls over to eliminate SRM material from human food (Docket No. 03-025IF and 03-038IF). Simply accounting for the fact that SRMs have been removed from human food, the amount of infectivity potentially available to humans has been reduced by over 87% from the already low risk, from 39 potential ID_{50s} to 4.922. These most recent actions by USDA appear to have eliminated essentially all risk of human exposure to BSE in the United States.

Several important findings implied by the Harvard Risk Study should be noted:

- The study unambiguously concludes that the measures currently in place are highly effective against the spread of BSE in the US cattle population, the risk of human exposure to BSE is extremely remote, and it is highly unlikely that BSE could become established in the United States.

- In all of the simulations conducted (see Appendix 3A), even when BSE infectious material is assumed to present the cattle population, the vast majority of this material (89% in the base case) is eliminated by the rendering process, with practically all of the remaining material directed to prohibited feed uses or non-feed uses.

- Practically no infectious material is distributed through bloodmeal (only 0.39 infectious agents out of over 41,000 assumed present in the base case), suggesting essentially zero likelihood of the disease spreading through this route and little measurable benefit to imposing further restrictions on the use of blood meal in feed.

[13] Executive Summary, page vii, op. cit.

- The largest risk (though still extremely modest) for potentially infectious material to re-enter the cattle population is through the accidental or intentional mislabeling or contamination of non-prohibited livestock feed or MBM. This suggests that FDA's goal of achieving full and complete compliance with existing regulations would potentially obviate the need for any additional feeding or rendering regulations.

- Under all reasonable scenarios examined, if BSE is present in the cattle population, existing controls work to reduce the quantity of infectious material present over time, where it rapidly approaches zero typically well ahead of a 20-year time frame. Hence, the potential for the disease to be "amplified" over time is mitigated by the existing controls.

However, perhaps as a result of media sensationalization of this disease and its symptoms, and under pressure from various consumer groups and other advocates, regulatory agencies including the FDA are under pressure to enact even tighter controls to reduce potential human exposure to BSE. As noted earlier, proposed regulatory efforts include restrictions on rendering cattle that die prior to slaughter and rendering material designated as SRMs. Since the Harvard Risk Study is widely cited as providing the basis for enacting these new controls, it should likewise be used to place the magnitude of the reduced risk to human exposure from these actions in the context of the potential consequences that might result, including the impact on the environment and the costs imposed on various industry segments.

In Appendix 3A, the Harvard Risk Study provides detailed analysis of the potential human exposure to BSE given the base case assumption (i.e. importation of 10 infected cattle) and various alternative assumptions and proposed regulations. Regarding a ban on rendering cattle that die prior to slaughter, the study suggests that compared to the base case, this new restriction could decrease the mean number of new BSE infected cattle over a 20 year period by more than 80%, from 4.3 to 0.77.[14] However, since the real concern is the impact on human health, the appropriate metric to examine is the change in the potential disposition of infection material (ID_{50s}) to humans. Here the study suggests a reduction of only 23%, from 39 potential ID_{50s} to 30 under a complete ban on rendering cattle mortalities. And, as with the base case, the consumption of brain, spinal cord and meat derived from AMR systems account for the majority of the potential human exposure (93%), all of which are already restricted for use as human food.

Accounting for the fact that material designated as SRM is restricted from human diets, the potential human exposure to BSE resulting from a ban on rendering dead cattle is effectively reduced from only 4.922 to 1.997 over a 20-year period. Given the enormous volume of beef produced in the United States, this decrease in potential human exposure is, essentially, too small to be considered meaningfully significant.

Similarly, a proposed ban on rendering SRMs is credited in the Harvard Study with potentially reducing the mean number of new cattle infected by nearly 90%, from 4.3 to

[14] Section 4.4.5, page 111, and Appendix 3A section 4.5

0.53.[15] However, comparing the potential for human exposure given no human consumption of SRMs (including from AMR systems) shows a reduction from only 4.922 ID_{50s} to 1.8 over a 20-year period. Again, this decrease in potential human exposure is, in our view, extremely small and should be viewed in the larger context of the costs and environmental harm that is likely to result from these types of feeding restrictions. Indeed, simply eliminating SRMs from the human diet appears to have reduced the risk of human exposure to BSE very nearly as much as would be expected from a complete ban on rendering this material, and certainly to levels that are far below risks to human health associated with any number of daily activities.

Furthermore, as noted in the Harvard Risk Study, estimates of the potential for human exposure to BSE are likely to be overstated even by this analysis, since they represent the amount of infectivity *presented* for human exposure, but do not take into account waste or actual consumption rates[16]. For example, the reported quantity for potential exposure of ID_{50s} in beef on bone potential reflects the presence of spinal cord and dorsal root ganglia in a fraction of cuts like T-bone steaks. The spinal cord may never be consumed but is still available for potential human exposure. Likewise, some materials are not purchased at the retail level and some is not consumed even when purchased. These issues are also relevant to the other tissue categories. For these reasons, the study authors note that their estimates of potential human exposure are likely to overestimate true human exposure to infected BSE tissues. In addition, as noted above, the dose of infectious material required to infect cattle is likely much less than the dose required to infect humans, perhaps on the order of 10 to 100,000 times. Therefore, in the base case and in practically all cases examined, the potential for human infectivity is very likely already at, or essentially, zero.

Placing the Risk Benefits in Proper Context

Given the negligible reduction in risk of human exposure to BSE that is expected from restrictions on either deadstock or SRM rendering, the benefits of these actions must be carefully weighed against the environmental and economic consequences likely to result. While estimating economic impacts is reasonably straightforward based on lost market value for newly restricted material (as is discussed earlier in this report), the environmental consequences are much harder to analyze but as noted above are potentially severe. Without appropriate alternative disposal channels already in place, even the short-term accumulation of millions of pounds of rancid and potentially virulent dead cattle and calves and similar quantities of slaughter by-products would create environmental challenges that the industry and government regulators are unlikely prepared to address.

We know of no scientific study that attempts to quantify the environmental impact of such a situation. Certainly, at the very least such a study would be warranted prior to enacting regulations capable of creating vast quantities of decaying or improperly

[15] Section 4.4.4, page 111, and Appendix 3A section 4.4
[16] Section 4.1, page 99.

disposed of organic material that could threaten human and livestock health and the purity of the air and water.

While it is our view that the results of the Harvard Risk Study suggest no measurable human (or livestock) health benefit from further restrictions on animal feed and rendering, if such regulations remain in the offing they should at least be designed to minimize the quantity of tissue that will require alternative disposal methods. For instance, the Harvard Risk Study considers only the impact of a complete ban of all materials designated as SRM. However, the study notes that the level of potential infectivity varies considerably across these materials, with nearly 90% of total infectivity limited to the brain and spinal cord (Table 8).

Table 8. Relative Infectivity of Specific Tissues from an Infected Bovine, 32 Months Post-Inoculation

Tissue	Fraction of Total Infectivity
Brain	64.1
Spinal Cord	25.6
Dorsal Root Ganglia	3.8
Trigeminal Ganglia	2.6
Distal Ileum	3.3
Tonsil	<0.1
Eyes	<0.1

Source: Harvard Risk Study

Limiting restrictions only to the materials most likely to contain significant quantities of infectious material (such as the brain) would presumably still generate significant reductions in the risk of human and cattle exposure from the already low levels, but would likewise dramatically reduce the quantity of material requiring alternative disposal methods. The Harvard Risk Study does not provide detail about the relative risk reduction expected from a more limited SRM ban, but a simple deduction based on the relative infectivity of the tissues identified above suggests that an SRM ban that focuses only on brain tissue from older (over 30 month) cattle could achieve almost 65% of the benefits predicted from a complete SRM ban, while removing "only" 7 million pounds of material from existing disposal channels (assuming each brain weighs approximately 1 pound and an annual slaughter of 35 million head, 20% of which are over 30 months of age) as opposed to more than 1.4 billion pounds from a complete SRM ban. Similarly, "targeted" restrictions based on the age of cattle could likewise reduce the disposal burden while still providing reduced BSE infectivity risk. The true expected gains achieved from these or other alternative actions can only be assessed through a scientific process such as used in the Harvard Risk Study.

Conclusions and Final Thoughts

FDA and other government agencies maintain an important role in ensuring the continued health and economic viability of the livestock industry, as well as protecting consumers against food related disease. Recent discussions and proposed efforts to strengthen

controls over materials permitted in livestock feed are laudable on the surface, but must be considered in the full context of the economic, environmental and human health consequences that could result. Estimates presented in this report suggest a ban on the use of cattle and calf mortalities and SMRs in livestock feed would directly result in lost revenue to the rendering industry in excess of $190 million annually. This accounts only for lost revenue from the reduced sales of rendered products and foregone fees for collecting cattle and calf mortalities, and does not explicitly consider the potential increased costs of disposing of restricted material by means other than rendering, the potential impact on livestock feed costs, and other costs such as transportation of restricted material, costs of maintaining segregation at slaughter facilities, and lost economies of scale in byproduct rendering.

In addition to the economic impacts of these restrictions (which are relatively easy to quantify), environmental impacts are likely to be severe. Unlike the feed ban currently in place that diverts the material most likely to transmit BSE from ruminant use to other species not susceptible to BSE, the restrictions currently under consideration propose to *remove* significant quantities of slaughter byproducts and livestock mortalities from ever entering any livestock feed. The result will be the need to dispose of enormous quantities of unpleasant material by methods other than rendering. Given the absence of direct regulatory control of alternative disposal methods, the potential for adverse environmental and human health consequences is extremely high. These need to be carefully examined and fully considered prior to enacting such severe feed restrictions.

The following points deserve particular emphasis:

- The US livestock, rendering and waste disposal sectors evolved over decades and within existing regulatory controls to effectively manage disposal challenges in ways that are most cost effective and create minimal risk to human and livestock health. This system is currently unprepared to manage the waste disposal challenges certain to arise if significant quantities of livestock mortalities and slaughter byproducts require disposal by means other than rendering.

- The disposal and environmental challenges resulting from a ban on rendering SRMs and/or livestock mortalities would be faced immediately, but the solutions to these challenges would arise only after significant time and financial investment across the livestock sector. Therefore, imposing stringent new regulations capable of producing such disposal challenges should only be conducted (if at all) in the context of a meaningful transition period and adequate financial assistance and incentives to create the necessary alternative disposal infrastructure capable of meeting these challenges.

- The cost estimates presented here do not account for the disproportionate financial burden than could be faced by small, local meatpackers and other businesses. The thousands of small, non-federally inspected slaughter facilities operating in the United States, as well as small and medium-sized facilities that are federally inspected, could be especially burdened by high disposal costs for the modest

amounts of SRM material they generate, reflecting few economies of scale and the potential for much more limited disposal options in geographically remote areas. These regulations could put hundreds of small businesses in jeopardy of failure.

- While an individual farm improperly disposing of livestock mortalities might have only a modest environmental impact, the temptation (or necessity) for many to engage in similar practices can create an environmental catastrophe. Absent regulatory oversight of livestock mortality (or SRM) disposal, the extremely high potential for environmental externalities must be fully considered as a cost of these proposed regulations.

- Eliminating rendering as a disposal method would not only expand the potential for new environmental risks, but would also eliminate an important mechanism by which potentially "high risk" cattle can be monitored and tracked throughout the livestock production system. This runs counter to current efforts to enact a national animal identification system for tracking and monitoring all livestock.

- The Harvard Risk Study suggests that one of the greatest risks of BSE exposure in the cattle population is through mishandling, mislabeling, or contamination of non-prohibited livestock feed. This suggests that more rigorous and complete enforcement of the current feed rules to achieve full compliance would generate perhaps the greatest and most cost effective protection against the spread of BSE.