OVERVIEW REPORT OF THE BENEFIT-COST ANALYSIS OF THE NATIONAL ANIMAL IDENTIFICATION SYSTEM

Animal and Plant Health Inspection Service
U.S. Department of Agriculture

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Table of Contents

Tables

Introduction

On April 29, 2009, the U.S. Department of Agriculture's (USDA) Animal and Plant Health Inspection Service (APHIS) publicly released the "Benefit-Cost Analysis of the National Animal Identification System," a 442-page study that provides a comprehensive assessment of the economic benefits and costs of adopting USDA's National Animal Identification System (NAIS). APHIS also published this overview report of the document to provide stakeholders with a summary of the analysis' key points. This report describes the background and limitations of the study and summarizes the analysis' benefit and cost estimates. The benefit-cost analysis is available in its entirety on the NAIS Web site at http://animalid.aphis.usda.gov/nais/naislibrary/documents/plans_reports/Benefit_Cost_Analysis_NAIS.pdf. For ease of review, specific sections of the report may also be downloaded, including the chapters covering species-specific information.

Background

In March 2007, APHIS announced a funding opportunity to conduct a benefit-cost analysis of NAIS. The announcement defined the scope and focus of the research that was needed. The purpose of the project was to analyze the economic benefits and costs of adopting NAIS in the United States, including premises registration; animal identification systems; and animal movement reporting for major species of cattle, hogs, sheep, poultry, and horses and, to a limited extent, minor species of bison, goats, cervids, and camelids.

In July 2007, APHIS entered into a cooperative agreement with Kansas State University (KSU) to conduct the research. A multi-institutional team of researchers from KSU, Colorado State University, Michigan State University, and Montana State University worked for more than a year to complete the study. The report of their findings comprises more than 400 pages of detailed analysis that offers the researchers' best estimates of what they anticipate would result from the adoption of NAIS across multiple species and at varying participation rates. The team also studied the overall distribution of the benefits and costs of NAIS for industry sectors, consumers, and State and Federal agencies.

Brief Synopsis of Findings

The "Benefit-Cost Analysis of the National Animal Identification System" provides a thorough explanation of the methodologies used for the analysis and projections that resulted in the probable cost and potential benefit estimates of NAIS. This document provides a condensed, high-level summary of the detailed report and focuses more on the results than the technical methodologies used by the research team. Several of the noteworthy findings include:

- As a result of NAIS, the Federal and State governments'savings in connection with the administration of animal disease control and eradication programs are significant, but they are only part of the overall benefits.
- Economic benefits in both the domestic and international marketplace resulting from enhanced traceability may be greater than the cost savings realized during animal disease control and eradication efforts.
- For industry, the effect of not implementing some aspects of NAIS (maintaining the status quo) may result in significant losses—as great as $1.32 billion on average per year over a 10-year period due mostly to reduced export market access.
- Implementation of NAIS becomes more cost effective as participation levels increase and actually may not be economically viable at lower participation levels.
- The cattle industry cost represents 91.5 percent of the total cost of NAIS for the primary food animal species (cattle, sheep, swine, and poultry).
- Identification tags and tagging cattle represent 75 percent of the cattle sector's annual adoption cost.
- Tags and tagging costs vary among cattle producers with 50 head from $3.30 to $5.22 per cow, depending on current identification practices.
- The total cost for implementing NAIS in the cattle sector as described in the study is $175.9 million annually (at a 90 percent participation level). Although significant, the cost is less than one-half of a percent of the retail value of U.S. beef products[1].
- The swine and poultry industries each have a lower cost because animal tracing requirements for these species require less infrastructure and often no individual identification devices.
- Traceability is becoming a global standard that will likely affect the ability of the United States to compete globally.

Focus and Principles Used in the Analysis

Objectives of the study included estimating the benefits and costs of adopting NAIS by the livestock and poultry industries as well as determining how net benefits are likely to be allocated among industry sectors, consumers, and government. The benefit-cost analysis focuses on the impacts of NAIS adoption in the cattle (beef and dairy), swine, sheep, poultry, and horse industries. The bison, camelid, cervid, and goat sectors are designated a lower priority in USDA's 2008 publication "A Business Plan to Advance Animal Disease Traceability." Therefore, the researchers did not focus on these industries, but did provide basic information about each sector. For the discussion on these minor species, see pages 337 to 344 of the full report.

[1] Source for retail value: USDA's National Agricultural Statistics Service, Agricultural Statistics Board: *Livestock Slaughter 2007 Summary*, March 2008.

Costs were estimated at the producer level for all four food animal species. Total costs to the respective industries were estimated under three scenarios: 1) premises registration only; 2) a bookend animal identification system in which animals are identified at their birth premises, and their termination is recorded and reported at slaughter without intermittent movement recording; and 3) animal identification with tracing of animal movements. Industry costs of each of these scenarios were estimated at NAIS adoption levels ranging from 10 to 100 percent in 10 percent increments. Cost at the packer level was estimated for the beef, dairy, swine, and sheep industries. Because a high percentage of cattle are sold through auction markets, costs were also estimated for auction markets for beef and dairy cattle.

The analysis provides a detailed estimate of the actual costs of NAIS adoption. Items such as costs for tags, labor, and equipment could easily be estimated. Data also were available to calculate factors such as shrink (weight lost when working cattle for tagging), tag loss rate, and the number of tags placed per year. Additionally, population estimates are well-defined for the food animal species, allowing the researchers to project the cost for these industry sectors. Costs projections made in the analysis are, therefore, considered probable costs. While the cost of tags—and possibly tagging—will decline over time, cost estimates were considered static. When ranges in cost were provided, the high-end figures were used. As a result, the researchers note that the cost estimates are most likely on the high end.

On the benefit side, however, it is more difficult to make similar probable projections. For example, the number of highly contagious animal disease outbreaks that will affect the United States, or even their probability, is unknown. The types of diseases, how they are contracted and spread, the location of the outbreak, and domestic and global market conditions at the time of the outbreak are dynamic and thus impossible to predict. Extrapolating all potential variables is not practical; therefore, the study presents comprehensive "what-if" scenarios to reflect potential benefits of adopting NAIS.

The researchers note that market disruption must be considered when evaluating potential benefits. The cost savings to animal disease control and eradication programs from increased traceability through NAIS are only part of the benefits picture. Quickly reestablishing markets is a major benefit—possibly the most significant benefit that NAIS offers.

The benefit-cost analysis was completed using the best data available and the most accurate modeling that exists. However, there were limitations to the study, including cases where available data were insufficient for precise estimates. In addition, many of the benefits of NAIS adoption listed in the study have not been fully explored or quantified. This is an area where additional work would allow for actual numbers and estimates to be attached to the benefits.

The study is careful to provide as accurate an estimate of producer costs as possible by breaking down the numbers by size and operation type. Some species numbers were broken down even further. The costs provided within these subgroups are averages. For

an idea of the potential range of NAIS-related costs, producers should review the cost estimates in the report that correspond with their type and size of operation. However, because these costs are averages, there are many operation-specific variables that can result in costs that are higher or lower than those listed in the report.

Potential Benefits of Adopting NAIS

The study identifies a significant number of potential benefits of NAIS. Premises registration, animal identification, and animal movement tracking offer numerous potential benefits to industry stakeholders, government animal health professionals, and consumers. The types of benefits that accrue range from enhanced animal health surveillance to increased consumer demand resulting from higher levels of confidence in food products with food and animal traceability. This section of the overview groups the potential benefits identified in the study into three areas: administration of animal health programs, trade and markets, and societal benefits outside of agriculture.

1. Benefits to the Administration of Animal Health Programs.

Enhancement to Animal Health Surveillance and Disease Eradication.

One of the most important direct benefits of premises registration, animal identification, and animal movement tracing is their impact on animal health. Conducting appropriate and statistically sound animal health surveillance requires knowing where animals are located as well as their population densities and movements. In addition, animal health officials must know the location of animals before they can develop animal sampling procedures that can determine statistically valid measures of the extent of diseases in populations.

Animal disease management and eradication programs receive an immediate benefit from integration with NAIS, which provides standardization of premises identification systems; uniformity in a nationally recognized animal, lot, or flock identification numbering system; and standardized methods and devices for livestock identification use. In the event of an animal disease outbreak, these elements would help animal health officials to rapidly identify premises, trace animals, and respond with appropriate actions at the national level. This degree of preparedness before an outbreak is essential in reducing the economic impact.

Reduction of Economic Impact of Disease Outbreaks.

The type of animal identification and traceability system in place in an industry can significantly impact the duration, spread, and economic consequences of a foreign animal disease. A study conducted in 2001[2] analyzed the economic impacts of improved animal identification systems for cattle and swine using a hypothetical foot-and-mouth disease

[2] Disney W.T., J.W. Green, K.W. Forsythe, J.F. Wiemers, and S. Weber. (2001). "Benefit-Cost Analysis of Animal Identification for Disease Prevention and Control." *Scientific and Technical Review* 20(2):385-405.

(FMD) outbreak in the United States. Improved animal identification systems in cattle could provide economic benefits with average benefit-cost ratios for cattle ranging from 1.24 to 3.15, depending upon the time-planning horizon and the traceability situation. A 2006[3] study investigates the economic consequences of an FMD outbreak in the United States with increased levels of animal traceability and surveillance. It concludes that total consumer and producer combined losses from an FMD outbreak would decline from $266.3 billion to $50.3 billion with a depopulation rate that rose from 30 percent to 60 percent of latent infectious herds, which the authors attributed to increased animal traceability.

Reduction of Cattle Producers' Animal Disease Testing Costs.

Animal disease testing is part of ongoing animal disease surveillance and eradication programs. Having individual animal identification can significantly reduce the costs to both the producer and the State veterinarians of testing a herd for a particular animal disease. In Michigan, for example, between January 1, 2000, and June 1, 2006, more than 18,000 cattle herds and approximately 1.19 million animals were tested for bovine tuberculosis (TB). The tested herd size averaged 66 head of cattle. Michigan, currently the only State with a mandatory individual animal identification program for cattle, provides a specific example of the producer cost savings that may be realized by having individual animal identification and associated electronic technologies available to increase testing efficiency.

Discussions between the researchers and experienced veterinarians in Michigan suggest that the use of mobile information management (MIM) software that leverages electronic identification (eID) in animal disease testing leads to quicker bovine TB testing of cattle herds. One veterinarian suggests that the creation of herd testing charts for 25-, 50-, and 100-head herds may be conducted 0, 1, and 2.5 hours quicker, respectively, by using MIM software on animals with radio frequency identification (RFID) devices. These reduced testing times for herds of more than 25 head correspond to reduced periods of on-farm production interruption and, as a result, reduced lost production value for participating farmers.

2. Benefits to Trade and Markets.

Beef Export Markets Scenarios.

The researchers created two sets of scenarios that are based on an analysis of how the adoption—or lack of adoption—of NAIS by producers would affect market supply and demand in terms of price and quantity. They created a detailed economic model to study supply and demand influences and used it to evaluate the scenarios. These scenarios focus on the beef sector, which would incur the largest cost of adopting NAIS practices relative to the pork, lamb, and poultry sectors because cattle are the only species requiring individual identification. Costs are lower for the swine and sheep sectors,

[3] Zhao, Z., T.I. Wahl, and T.L. Marsh. (2006). "Invasive Species Management: Foot-and-Mouth Disease in the U.S. Beef Industry." *Agricultural and Resource Economics Review* 35(1, April):98-115.

which mostly use group/lot identification (with the exception of culled breeding animals), and for the poultry sector, which uses group/lot identification exclusively.

The first set of scenarios compares maintaining the status quo of animal identification in the United States to the adoption of full animal tracing. The researchers note that the international marketplace increasingly expects animal identification and tracing systems to be the norm for exporting countries and that the United States currently lags behind its major competitors and its major markets in providing traceability. The study concludes that countries failing to conform to this expectation will lose export market access. The researchers expect that this loss would likely occur over time even in the absence of a major market or animal disease event. They estimate that a loss of 25 percent of market share would result in producer revenue dropping by $18.25 per head sold. Such a loss would be similar to the loss of the South Korean market prior to the 2003 bovine spongiform encephalopathy (BSE) discovery, which was worth approximately $754 million[4].

The second set of scenarios examines the consequences of the beef industry adopting full animal tracing, thereby avoiding lost export market access. The model determined that if the adoption rate were 70 percent and this rate resulted in saving 25 percent of the export market, the net benefit of full tracing adoption to beef producers would be $9.26 per head.

The researchers also note that it is possible that demand for U.S. beef exports could increase as a result of adopting some type of animal identification system. They found that a 23 percent increase in beef export demand would completely pay for 70 percent adoption of full animal identification and tracing in the U.S. beef herd over a 10-year period. The study concludes that no other benefits beyond these would be necessary to make the investment in NAIS economically viable.

In addition, current research indicates that domestic beef demand is likely to be greater for products having animal identification and traceability. The study found that small increases in domestic beef demand, with all other factors constant, would completely pay for full animal identification and tracing in the beef industry. A 0.67 percent increase in domestic beef demand would be enough to fully pay for 70 percent adoption of cattle identification and tracing even if no other benefits, such as increased export demand, occurred over a 10-year period. This is a relatively modest increase in beef demand relative to changes that have occurred for a variety of reasons over the past decade. The researchers conclude that NAIS adoption would result in large positive net returns to producers and consumers with even a very small increase in domestic beef demand resulting from NAIS adoption.

[4] South Korean market value based on USDA Economic Research Service data at http://www.ers.usda.gov/news/BSECoverage.htm.

Reopening Export Markets: Foot-and-Mouth Disease Simulations.

The researchers also conducted simulations to evaluate the potential impacts of closures in the export markets resulting from an FMD outbreak. The scenarios illustrate potential gains in the event of an FMD or similar highly contagious disease outbreak with different adoption levels—30, 50, 70, and 90 percent—of animal identification tracing already present. Producer monetary losses for an animal identification and tracing program with a 90 percent participation rate would be $4.5 billion less than a program with a 30 percent participation rate. In addition, consumers would lose $807.7 million more if adoption rates were only 30 percent versus 90 percent. The combined societal gain for producers and consumers from a 90-percent versus a 30-percent adoption rate in the event of an FMD outbreak would be $3.7 billion over a 10-year period.

Regionalization and Compartmentalization to Reestablish Market Access.

A critical issue regarding the economic impact of any animal disease outbreak is the ability to contain the disease and restore market access for at least part of the industry as soon as possible. This can be accomplished through a process known as regionalization (or zoning) in which an animal subpopulation, based on geographic region, can be demonstrated to be an isolated area free of disease incidence. The defined region could then regain international market access. A 2007[5] study examines the economic impact of regionalization in the United States in the event of a highly pathogenic avian influenza outbreak. It concludes that with no regionalization over a 4-year period, such an outbreak would have substantial economic impacts with about a $718 million reduction in returns to capital and management in the poultry meat production sector. With regionalization, however, poultry meat producer losses would be reduced to about $500 million because regionalization dampens export market losses.

The concept of compartmentalization isolates one or more establishments with common biosecurity management measures that, according to a 2006[6] study, "provide distinct disease risk separation from animals or birds at higher risk for the disease(s) in question." The World Organization for Animal Health officially recognizes regionalization and compartmentalization animal disease management procedures as conditions that may, following a disease discovery, enable resumed international market access in unaffected areas. Animal identification, movement tracking, and inflow and outflow documentation are essential in demonstrating whether an auditable biosecurity management system is present.

[5] Paarlberg, P.L., A.H. Seitzinger, and J.G. Lee. 2007. "Economic Impacts of Regionalization of a Highly Pathogenic Avian Influenza Outbreak in the United States." *Journal of Agricultural and Applied Economics* 39(2, August):325-333.

[6] Scott. A., C. Zepeda, L. Garber, J. Smith, D. Swayne, A. Rhorer, J. Kellar, A. Shimshony, H. Batho, V. Caporale, and A. Giovannini. (2006). "The Concept of Compartmentalisation." *Scientific and Technical Review* 25(3):873-879.

Enhancement of Global Competitiveness.

Case studies[7] of poultry, beef, pork, lamb, and fish firms employing traceability located in France, Holland, Germany, Norway, and Scotland indicate that the company officials adopted traceability because they believed that consumers want to know the origin of their food and the processing methods used in preparing it. Following the BSE events in the United States in December 2003, the vast majority of the beef export market was completely closed. Five years later, only about 75 percent of beef export market volume movement prior to the BSE event has been regained. A 2008[8] study that reviewed animal identification systems in North America argues that animal identification systems are becoming "prerequisites to international trade."

A number of studies that the benefit-cost analysis cites describe how the United States lags behind a number of major world meat producers in animal traceability. According to these studies, the pork industries in the United Kingdom, Denmark, Japan, New Zealand, Australia, and the European Union (EU) all lead the U.S. pork industry in animal traceability. In addition, Australia and the EU have advanced mandatory sheep traceability systems beyond the voluntary system present in the United States. Australia, the EU, Japan, Brazil, Argentina, and Canada also lead the United States in beef traceability systems. Meat and Livestock Australia, a company that provides a variety of services to Australia's red meat industry, considers cattle identification in Australia to be an insurance policy in the event of a trade disruption.

Increased Transparency in the Supply Chain.

An important implication of animal traceability is that it can reduce information asymmetry (one party having access to more information than another in the vertical supply chain), leading to greater transparency. Animal identification is a direct link to an animal's origin. Along with movement tracking, it provides an efficient way to identify sources of—and to quickly solve—animal production problems that affect the overall value of animals throughout production and processing. For example, a 2008[9] study demonstrated that, even with low levels of animal traceability (39 percent), a beef packer can induce a cattle feeder to adopt quality control practices to reduce the incidence of injection-site lesions in fed cattle. Animal tracing would provide similar incentives to reduce information asymmetry related to up-to-date vaccination programs, feeding regimens that might lead to meat residues, or the tracking of other animal treatments such as growth-promoting implant programs.

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[7] Buhr, B.L. (2003). "Traceability and Information Technology in the Meat Supply Chain: Implications for Firm Organization and Market Structure." *Journal of Food Distribution Research* 34(3):13-26.

[8] Murphy, R.G.L, D.L. Pendell, D.L. Morris, J.A. Scanga, K.E. Belk, and G.C. Smith. 2008. "Review: Animal Identification Systems in North America." *Professional Animal Scientist* 24(4, August):277-286.

[9] Resende-Filho, M.A. and B.L. Buhr. 2008. "A Principal-Agent Model for Evaluating the Economic Value of a Traceability System: A Case Study with Injection-Site Lesion Control in Fed Cattle." *American Journal of Agricultural Economics* in press.

Improvement of Value-Added and Certified Program Efficiency.

USDA's Agricultural Marketing Service (AMS) has several voluntary marketing programs such as USDA's Process Verified Program, Quality Systems Assessment Program, and Non-Hormone Treated Cattle Program that require animal identification and traceability. AMS has integrated its auditing of these certification programs to enable NAIS to meet the animal identification requirements.

NAIS can also be used to help verify requirements for USDA Export Verification programs, which allow eligible products to be exported to specific countries such as Japan or EU member nations. Global certification programs such as International Organization for Standardization guidelines are another growing source of food safety and hygiene systems entailing traceability.

3. Societal Benefits Outside of Agriculture.

Enhancement of Animal Welfare in Response to Natural Disasters.

During natural disasters, there are times when having premises registration and/or animal identification information can greatly assist officials in identifying and assisting animals in distress or finding owners of displaced animals. A recent example of premises registration improving animal health surveillance occurred in southeast Colorado during the December 2006 blizzards. The Colorado Department of Agriculture used premises registration information to check on the welfare of ranchers and their livestock, which substantially accelerated and expanded the scope of issue assessment and the determination of assistance needs. In 2005, after Hurricane Katrina struck New Orleans, 163 horses and mules were returned to their owners; most of the animals were identified with microchips or lip tattoos.

Reduction of Risk of Unfounded Liability Claims.

A 2008[10] study asserts that traceability enables parties in the vertical supply chain to more easily document that they are not responsible for harm associated with a food safety event. In addition, because traceability systems increase the possibility of legal action upon responsible parties, such systems create incentives for firms to take actions that increase food safety.

Social Benefits: Minimizing Damage to Individual Producers and Industry as a Whole.

The social value of traceability in general is very well presented by a 2004[11] study that identifies potential social benefits that may include avoided costs to firms that produce safe products but lose sales because of safety problems in the industry:

> A firm's traceability system not only helps minimize potential damages for the individual firm, it also helps minimize damages to the whole industry and to upstream and downstream industries as well. For example, a series of widespread ground meat recalls has the potential to hurt the reputation and sales of the entire meat industry, including downstream industries such as fast food restaurants and upstream suppliers such as ranchers. The benefits to the industry of a traceability system pinpointing the source of the bad meat and minimizing recall—and bad publicity—could therefore be much larger than the benefits to the individual firm.

Although the study's example refers specifically to a meat traceability issue, similar arguments certainly apply to animal traceability.

Note: Benefits to the equine industry are included in the Summary of the Equine Industry section on page 27. Because the analysis of the equine industry was hampered by a lack of available data and because this industry varies from the other livestock industries in a number of significant ways, the researchers used a slightly different approach to estimate costs and benefits. Therefore, the benefits to the equine industry in the context of this different approach are outlined in the equine section.

[10] Pouliot, S. and D.A. Sumner. 2008. "Traceability, Liability, and Incentives for Food Safety and Quality." *American Journal of Agricultural Economics* 90 (1, February):15-27.
[11] Golan, E., B. Krissoff, F. Kuchler, L. Calvin, K. Nelson, and G. Price. 2004. *Traceability in the U.S. Food Supply: Economic Theory and Industry Studies.* United States Department of Agriculture, Economic Research Service, Agricultural Economic Report Number 830, Washington, DC, March.

Cost Summary by Major Food Animal Species

The study estimated the total costs to the cattle, swine, sheep, poultry, and horse industries under three scenarios: 1) premises registration only; 2) a bookend animal identification system in which animals are identified at their birth premises, and their termination is recorded at slaughter without intermittent movement recording; and 3) an animal identification system with reporting of animal movements when commingling occurs with animals from other premises. Industry costs of each of these scenarios were estimated at NAIS adoption levels ranging from 10 to 100 percent in 10 percent increments. Table 1 summarizes the cost of 90 percent and 100 percent participation in each scenario. To aid the process of reporting direct costs in these three scenarios, specific costs (when applicable) were categorized as tags and tagging costs, reading costs, and premises registration costs. The specific costs contained in these categories and how the costs in general were determined are explained below.

Tags and Tagging Costs.

Tags and tagging costs reflect the cost of the official identification devices and the application of the devices to the animals when individual animal identification is applicable. The researchers needed to make assumptions as to the type of identification system used to estimate direct costs associated with an animal identification system. In the cattle (bovine) industry, it was assumed that the technology used for animal identification would be eID using RFID eartags, and identification would be on an individual animal basis. For the swine (porcine) industry, it was assumed that market hogs would be identified with a group/lot identification number, and cull breeding stock would be identified with a unique visual premises eartag. Sheep (ovine) industry cost estimates were based on a scrapie program tag for breeding animals and group/lot identification for lambs. For the poultry industry, it was assumed that group/lot identification would be used for all poultry; thus, there are no cost estimates for identification devices. For the equine industry, the use of injectable transponders was assumed to estimate the costs of devices and implantation of the microchip transponders.

Reading Costs.

The term “reading costs” refers to the costs associated with collecting the animal identification number (AIN) or other official identification number from each animal (or group of animals) as it is received into a premises. Thus, reading costs reflect the additional costs to progress from the bookend system to the full-traceability scenario. This data collection cost includes expenses associated with recording the AINs of RFID tags, purchasing and operating the RFID technology (e.g., panel and wand electronic readers), and purchasing computers and software, as well as charges for the use of animal tracking databases.

Premises Registration Costs.

Although premises registration is currently a free service, potential costs could be incurred when registering a premises related to management time, mileage, and paperwork requirements. To capture this cost, the researchers assumed that a producer would incur a $20 cost associated with time, travel, and supplies to register his or her premises. Theoretically, once a premises is registered, the registration lasts for the life of the operation as well. However, many producers will need to renew or modify their premises registration information regularly as their operations change. Thus, it was assumed that the lifespan of premises registration would be 3 years. The cost of renewing premises registration every 3 years was assumed to be 50 percent of the initial cost, or $10 per operation. When accounting for the time value of money, the initial premises registration cost of $20 and the renewal every 3 years of $10 equates to a cost of $4.64 per operation annually in current dollars. This approach in determining the cost incurred for premises registration was used for all species. The cost for identification (tags and tagging) and reading the tags varies by species. The full report explains these costs in each species section.

The researchers estimate the total annual cost for 90 percent and 100 percent participation in a full-traceability NAIS system for the cattle, swine, sheep, and poultry industries are $192.22 million and $228.27 million, respectively.

Table 1. Costs Summary of NAIS Implementation by Species at 90 Percent and 100 Percent Levels of Participation

	Premises Registration		**Bookend Animal ID System**		**Full Traceability**	
	Level of Participation					
Species/Sector	90%	100%	90%	100%	90%	100%
Cattle (Beef & Dairy)	$2,915,856	$4,493,910	$140,285,046	$165,262,586	$175,868,526	$209,070,173
Swine	$226,447	$305,259	$1,609,870	$1,889,457	$5,668,691	$6,422,323
Sheep	$318,168	$359,450	$1,617,275	$2,450,398	$2,709,481	$3,663,961
Poultry	$531,137	$643,638	n/a	n/a	$7,976,271	$9,112,856
Total	**$3,991,608**	**$5,802,257**	**$143,512,191**	**$169,602,441**	**$192,222,969**	**$228,269,313**

Cattle

The costs for beef and dairy cattle are the highest in the study largely due to production practice differences and the traceability tactics that need to be implemented. Costs were estimated by segmenting the cattle industry into six main groups, referred to as "operation types" in the report: 1) beef cow/calf, 2) dairy, 3) backgrounder (also referred to as stocker), 4) feedlot, 5) auction yard, and 6) packing plant. Table 5, located at the end of the cattle section, lists the distribution of cost for each of these operation types. This section summarizes the approach used to calculate some of the major costs to the beef and dairy industries. Because the beef cow/calf and dairy operations account for the majority of the cost in the cattle industry, this overview also specifically comments on them.

Tags and Tagging Costs.

It was assumed that RFID tags (eartags) would be used for the identification of all cattle[12]. Tags and tagging costs account for 75 percent of the projected cost of implementation in the cattle industry. Additionally, the number of animals that would be individually tagged in the cattle industry is far greater than any other species; thus, this cost contributes significantly to the overall cost of adopting NAIS across all species. RFID tag cost estimates from $2.00 to $2.60 per tag were used with the lower per-unit cost applied to cost projections for larger herds with more than 500 head.

Tagging costs included the tag applicator, labor, and chute (for working animals), as well as the economic impact of cattle shrink and potential injury to both cattle and people during tagging. These costs are broken out and listed in Table 4. Additionally, a tag loss rate of 2.5 percent was used to adjust the estimated costs to account for replacement tagging.

For producers who do not currently identify calves individually, it was assumed that the producers would have their animals tagged at an auction yard when selling their animals and that the auction would charge these producers for such tagging service. Based on survey results published in 2007[13] on tagging costs from auction yards, as well as Livestock Marketing Association data regarding the distribution of auction market sizes in the United States, it was estimated that the average chute and labor cost would be $2.54 per head. Although this estimate did not include the cost of an RFID tag, it did include added liability insurance premiums and human injury costs to the extent that auction markets incorporate these costs into their charges. As noted in Tables 2 and 3, the costs to producers that do not currently tag are significantly greater than those currently tagging. While many producers not currently tagging may tag their own

[12] Group/lot identification according to NAIS may be applicable when animals move through the entire production system as one group. This option was not analyzed in the study.

[13] Bolte, K. 2007. *Electronic Animal Identification Systems at Livestock Auction Markets: Perceptions, Costs, and Benefits.* M.S. Thesis, Department of Agricultural Economics, Kansas State University.

animals in the future, cost estimates were based on having all cattle from these current non-tagging premises tagged at the auction yard.

Tag Reading Costs.

As noted earlier, reading costs are the costs associated with recording and reporting the AIN (or other official identification number) of each animal when it is moved into a premises, including markets. Collecting, reporting, and storing information reflect additional costs to achieve the full-traceability system from the bookend system.

It was assumed that tags would not have to be read when they were initially applied because this information would be obtained when AIN tag managers distribute tags to premises. Therefore, operations that tag calves at their birth premises will not need to read these tags; they will only need to read the tags of calves brought onto their premises from outside sources. To estimate the cost of reading RFID tags, the average number of animals brought onto buying premises was determined by using information from the National Animal Health Monitoring System's "Beef '97" study, which reported the average percentage of animals brought onto buying premises for the study year. Using this information, the average number of animals bought per buying premises was determined by multiplying the total number of operations by size with their corresponding percentages.

When considering reading costs, three types of reading were used: hiring a third party to read the tags, purchasing a wand reader, and purchasing a panel reader. The size of the operation and its number of reads determined what type of reader was used in the estimation; generally, larger operations employ the more expensive panel readers. Costs include the need for a computer with the correct software. Data from "Beef '97" determined the breakdown of operations that already have the needed equipment and operations that would need to purchase it. Also included were the costs of reporting animal data to a database. Cost estimates took into account the extra time in the chute needed to read the tags and associated potential for injury to humans and animals this could cause.

Table 2 summarizes the cost for the beef cow/calf sector associated with an individual animal identification system that has full traceability. Cost by size of operation for operations that currently tag and those that do not are estimated separately. The cost per animal sold ranges from a low of $2.48 per head for the largest operation currently tagging to a high of $7.17 per head for the smallest operation not currently tagging. Two things are readily apparent from these figures. First, economies of size exist as larger operations have more than a $2 per head lower cost compared to the smallest operations. Second, operations that currently tag their cattle have lower costs. This is because the incremental cost of using their labor and facilities (e.g., chute) are lower than hiring a third-party tagging service, which also results in higher shrink cost. Operations that tag calves at birth, or at a young age, were assumed to have considerably lower costs associated with shrink compared to operations that tag their calves at sale time.

Table 2. Summary of RFID Costs for Beef Cow/Calf Operations by Size of Operation

	Size of Operation, Number of Head						
	1–49	50–99	100–499	500–999	1,000–1,999	2,000–4,999	5,000+
Operations Currently Tagging Cattle							
Total annual cost, $/cow	$5.12	$3.30	$3.01	$2.61	$2.55	$2.53	$2.48
Total annual cost, $/head sold	$5.95	$3.83	$3.50	$3.04	$2.97	$2.94	$2.88
Operations Currently Not Tagging Cattle							
Total annual cost, $/cow	$6.16	$5.22	$5.02	$4.77	$4.72	$4.69	$4.68
Total annual cost, $/head sold	$7.17	$6.07	$5.83	$5.55	$5.49	$5.46	$5.44

Table 3, in a similar approach, summarizes the costs associated with an individual animal identification system with full traceability for dairy operations that currently tag and those that do not, respectively. The cost per cow ranges from a low of $2.53 per head for the largest operation currently tagging, to a high of $5.84 per head for the smallest operation not currently tagging. As with the beef cow/calf operations, the economies of size exist such that larger operations have considerably lower costs; larger operations have more than a $2 per head lower cost compared to the smallest operations. Operations that currently tag their cattle also have slightly lower costs relative to those that do not tag. However, the difference between these two groups is not nearly as large as it was for beef cow/calf operations because a higher portion of the costs for dairy operations is associated with reading tags as opposed to tagging cattle. Further, the cost for the smallest operations that currently tag is actually slightly higher than the cost for the same-sized operations that do not currently tag.

Table 3. Summary of RFID Costs for Dairy Operations by Size of Operation

	Size of Operation, Number of Head						
	1–49	50–99	100–199	200–499	500–999	1,000–1,999	2,000+
Operations Currently Tagging Cattle							
Total annual cost, $/head sold	$10.01	$7.44	$7.23	$6.76	$5.85	$5.16	$4.70
Total annual cost, $/cow	$5.84	$4.34	$3.99	$3.72	$3.16	$2.78	$2.53
Operations Currently Not Tagging Cattle							
Total annual cost, $/head sold	$9.05	$7.80	$7.55	$7.36	$6.68	$5.93	$5.52
Total annual cost, $/cow	$5.28	$4.55	$4.16	$4.06	$3.60	$3.20	$2.97

Summary of Cost by Type (Labor, Products, Services, etc.).

Table 4 reports the total costs of all sectors with a partial breakdown by cost type. On a percentage basis, just under half (46.7 percent) of the total costs to the industry are the costs of RFID tags. The researchers note that, as technology increases, this cost is expected to decline. The next largest cost is chute charges, which basically represent

working cattle. However, chute costs were not particularly high for operations that currently tag. This indicates that current management practices of a producer can have a sizable impact on his or her cost of adopting an animal identification system. Collectively, about 17 percent of the costs were associated with reading tags (e.g., readers, labor, injuries, and data storage). However, this percentage was lower for producers who already tag their cattle and higher for those who currently do not tag.

Table 4. Breakdown of Cattle Industry Costs for Full Traceability

	Total	Percent of Full Traceability Total
Tags and Tagging Costs		
RFID Tag	$97,627,025	46.7
Applicator	$8,918,038	4.3
Labor	$5,329,689	2.5
Chute	$32,991,443	15.8
Shrink	$9,631,394	4.6
Injury	$2,828,195	1.4
Subtotal	**$157,325,784**	**75.3**
Reading Costs		
RFID Capital	$23,396,457	11.2
Labor/Chute	$8,475,520	4.1
Shrink/Injury	$3,165,973	1.5
Other (Feedlot/Packers)	$12,232,477	5.8
Subtotal	**$ 47,270,427**	**22.6**
Premises Registration Costs	**$4,473,962**	**2.1**
TOTAL	**$209,070,173**	**100.0**

Note: See pages 71 to 73 (Tables 4.9, 4.10, and 4.11) in the full report for cost by cattle industry sector and various levels of participation.

Overall Costs of NAIS Adoption: Cattle Industry.

Table 5 summarizes the total cost to the cattle industry by sector under the full-traceability scenario. Based on assumptions used in this analysis, a full-traceability animal identification program in the cattle industry would add about $5.97 per head to the cost of cattle marketed.

Table 5. Summary of Cattle Industry Cost for Full Traceability

Operation Type/Sector	Total Annual Cost	Average Cost per Animal Marketed
Beef Cow/Calf	$139,764,146	$4.91
Dairy	$31,437,688	$6.21

Backgrounder	$12,072,978	$0.71
Feedlot	$13,562,885	$0.51
Auction Yard	$8,765,395	$0.23
Packing Plant	$3,467,081	$0.10
Total	**$209,070,173**	**$5.97**

Note: See Table 4.9 on page 71 of the full report for complete statistics.

Swine

The costs for the swine industry are significantly lower than those for the cattle industry due to the swine industry's vertical integration; swine are mostly raised under contract for a packer. The researchers prepared cost estimates based on the six main operation types: 1) farrow-to-wean, 2) farrow-to-feeder, 3) farrow-to-finish, 4) wean-to-feeder (nursery), 5) feeder-to-finish (grow/finish), and 6) packers. The vast majority of hogs are marketed directly to a packer; thus, the auction market sector is not included for the swine industry. Estimating costs separately for different types of operations makes it possible to see how different sectors of the swine industry would be impacted by the adoption of an animal identification system.

Tags and Tagging Costs.

Most swine, with the exception of cull breeding animals, move through the production chain as a group and are identified using group/lot identification. This decreases the costs associated with tags and tagging in the swine industry. The type of tag used also affects the cost. In this study, costs were based on visual tags bearing an animal's birth premises number. The average cost for these tags is $0.75. A lower per-unit cost was used for cost projections for larger operations with more than 200 breeding animals. Tagging costs for swine included the tag applicator, labor, and the potential injury to people during tagging. Due to costs related to the tagging process, operations that do not house breeding stock have a lower cost per animal sold.

Tag Reading Costs.

Because visual tags are used, electronic reading is not required. However, costs associated with recording, reporting, and storing data still exist. These costs include the printing of barcode labels to accompany group/lot shipments. Most of the NAIS adoption costs for swine are associated with reading and recording data. Table 6 displays a summary of identification costs at a 100 percent participation rate for five operation types. The costs to swine packers are examined in the full report on page 95. Costs are based on the costs of recording and reporting data pertaining to group/lot identification; however, for very small operations "groups" might actually represent individual hogs.

Table 6. Summary of ID Costs for Swine Operations by Type and Size

Cost per Pig Sold	Size of Operation, Number of Head			
	<500	500–1,999	2,000–4,999	5,000+
Farrow-to-Wean	$0.31	$0.07	$0.02	$0.01
Farrow-to-Feeder	$0.32	$0.07	$0.02	$0.01
Farrow-to-Finish	$0.63	$0.18	$0.09	$0.09
Wean-to-Feeder	$0.07	$0.02	$0.01	$0.01
Feeder-to-Finish	$0.28	$0.04	$0.01	$0.01

Note: See Table 5.7 on page 93 in the full report for additional cost breakdown information.

The total costs for the 168 U.S. swine packing plants are estimated at under $150,000, or less than $1,000 per plant, based on recording and reporting group/lot identification.

Overall Costs of NAIS Adoption: Swine Industry.

The swine industry costs for a full-traceability system are outlined in Table 7. The bulk of the overall costs are associated with reading and recording data in a full-traceability system.

Table 7. Summary of Swine Industry Cost at 100 Percent Participation

	Total	Percent of Full Traceability Total
Tags and Tagging Costs	$1,437,491	22.4
Reading Costs	$4,680,355	72.9
Premises Registration Costs	$304,477	4.7
Total	**$6,422,323**	**100.0**

Sheep

The costs for the sheep industry are lower than those for the cattle sector but higher than those for the swine sector. The researchers prepared cost estimates after dividing the industry into two operation types: producers and packers. The cattle industry included an auction market sector; however, because the vast majority of sheep are marketed directly, this sector is not included for the sheep industry. The researchers did attempt to break the producer group into subgroups of breeding flocks and lamb feedlots; however, data to support this breakdown was largely unavailable, resulting in the general producer group being included in the study.

Tags and Tagging Costs.

For the sheep industry, it was assumed that lambs (feeder and market) would be identified with a unique group/lot identification number, and breeding stock would be individually identified with visual identification tags (e.g., scrapie program tags). To be consistent with the other species for the purpose of the study, it was assumed that producers would bear the cost of purchasing the tags, but they could do so in a similar fashion to the current scrapie program because it is considered compliant with NAIS. An average cost of $0.27 per tag was used, which was adjusted for volume.

Reading Costs.

While RFID and its associated costs were not considered for the sheep industry, cost associated with recording, reporting, and storing data still exist. These costs include the printing of barcode labels to accompany group/lot shipments. A relatively large portion of the NAIS adoption costs for sheep are associated with reading and recording data. Table 8 displays a summary of identification costs for sheep producers. The costs to sheep packers are examined in the full report. Costs were based on recording and reporting data pertaining to group/lot identification; however, for very small operations, "groups" might actually represent individual sheep.

Table 8. Summary of Producer ID Costs for Sheep Operations by Size

Cost per Animal Sold	Size of Operation, Number of Head			
	<100	100–499	500–4,999	5,000+
Cost per Animal Sold	$2.19	$0.79	$0.51	$0.44

Note: See pages 114 to 115 (Tables 6.3 to 6.5) in the full report for additional cost breakdown information.

The total costs for the 58 U.S. sheep packing plants are estimated at $32,000, or about $550 per plant, based on recording and reporting group/lot identification. These costs are exclusively for reading and recording tag information.

Overall Costs of NAIS Adoption: Sheep Industry.

Table 9 outlines the sheep industry costs for a full-traceability system.

Table 9. Summary of Annualized Cost to Sheep Industry at 100 Percent Participation

	All Operations	Packers	Total	Percent Total
Tags and Tagging Costs	$2,090,948		$2,090,948	57.1
Reading Costs	$1,213,562	$32,012	$1,245,574	34.0
Premises Registration Costs	$327,438		$327,438	8.9
Total	**$3,631,949**	**$32,012**	**$3,663,961**	**100.0**
Cost per Sheep Sold, $ per Head*	**$1.06**	**$0.01**	**$1.39**	

* Includes lambs, cull ewes, and rams; total for industry is based on total head slaughtered.

Poultry

The costs for the poultry industry are the lowest in the study, due to the industry's extremely high level of vertical integration in which birds are raised under contract for a packer. Researchers prepared cost estimates based on the three main operation types: 1) layers, 2) broilers, and 3) turkeys. The vast majority of poultry are marketed directly, so an auction market sector is not included in the poultry industry cost estimate. Estimating costs separately for different types of operations makes it possible to see how different sectors of the poultry industry would be impacted with the adoption of an animal identification system.

Tags and Tagging Costs.

The poultry industry uses the group/lot identification numbering system exclusively. No tags are needed, and no costs are associated with tags or tagging.

Tag Reading Costs.

The use of only group/lot identification means that tag reading is not required. However, costs associated with recording, reporting, and storing data still exist. These costs include the printing of barcode labels to accompany group/lot shipments.

Costs were not estimated separately for packers. The vertical integration of the industry is such that the cost of recording and reporting group/lots at the packer level is already accounted for at the production level. Table 10 outlines the costs for layers, broilers, and turkey operations.

Table 10. Summary of ID Costs for Poultry Operations by Type and Size

	Layers (average inventory of layers aged 20 weeks and older)								
Number of Layers	1–49	50–99	100–399	400–3,199	3,200–9,999	10,000–19,999	20,000–49,999	50,000–99,999	100,000+
$ per Layer	1.90	0.53	0.21	0.09	0.02	0.0082	0.0078	0.0071	00.0011

	Broilers (annual broilers sold)									
Number of Broilers	1–1,999	2,000–15,999	16,000–29,999	30,000–59,999	60,000–99,999	100,000–199,999	200,000–299,999	300,000–499,999	500,000–749,000	750,000+
$ per Broiler	0.50	0.0075	0.0025	0.0012	0.0007	0.0004	0.0004	0.0004	0.0003	0.0002

	Turkeys (annual turkeys sold)						
Number of Turkeys	1–1,999	2,000–7,999	8,000–15,999	16,000–29,999	30,000–59,999	60,000–99,999	100,000+
$ per Turkey	0.56	0.0047	0.0018	0.0010	0.0008	0.0008	0.0006

Note: See pages 134 to 140 (Tables 7.2 to 7.8) in the full report for additional cost breakdown information.

Overall Costs of NAIS Adoption: Poultry Industry.

Due to the industry's high level of integration, the bookend system was not considered for poultry. Table 11 outlines the costs for a full-traceability system.

Table 11. Summary of Poultry Industry Cost at 100 Percent Participation

	Total	Percent of Full–Traceability Total
Tags and Tagging Costs	N/A	0.0
Reading Costs	$8,469,218	92.9
Premises Registration Costs	$643,638	7.1
Total	**$9,112,856**	**100.0**

Summary of the Equine Industry

The researchers examined the equine industry at great length. However, the lack of reliable, quality data hampered their efforts. For example, data as simple as the number of horses in the United States is unknown. A number of different groups have issued reports estimating this count, and they vary widely. Other missing data include the number of equine events per year and the number of premises that house equines. Therefore, estimates are not as accurate as the ones used for the four food livestock species.

This industry also has very different considerations than the other livestock industries. Horses generally have longer lifespans, higher values, and more frequent movements than any of the other species in the analysis. They are also considered companion animals rather than livestock by many owners.

Equine Industry Benefits.

The benefits of a national animal identification system to the equine industry exceed but are much harder to quantify than NAIS adoption costs. The researchers indicate that NAIS' major benefit would likely be the ability to maintain export markets. Live equine exports are valued at approximately $460 million per year (as estimated in 2005). Any disease detection that would disrupt this movement could have a severe financial effect on the industry. The full report discusses 15 categories of benefits to the equine industry on pages 287 to 298. The most notable benefits are summarized below.

Equine Diseases of Concern: Numerous diseases of equine are of concern to the horse industry and to other livestock industries. In USDA's "2006 United States Animal Health Report," eight "animal health events" were reported, five of which involved horses but affected multiple species of animals; the other three were equine-specific disease outbreaks. These reports demonstrate that horses and other equine species play an important role in the health status of the livestock sector, and attention to this segment of the industry could help alleviate economic losses and eradicate zoonotic diseases affecting multiple species.

The benefit-cost analysis lists a number of equine diseases of concern, including both zoonotic and equine-specific diseases. Some are obvious problems. Others are less known or currently do not exist in the United States, but they could still have a drastic economic impact if they are not monitored or if an outbreak occurred that was not immediately detected and traced. The list includes the following diseases:

- Anthrax
- Contagious equine metritis
- Equine herpes virus
- Equine infectious anemia (EIA)
- Equine influenza
- Equine piroplasmosis

- Equine viral arteritis
- Encephalomyelidities
- Glanders
- Hendra virus disease
- Japanese encephalitis
- Leptospirosis
- Strangles
- Venezuelan equine encephalomyelitis
- Vesicular stomatitis

Premises Registration: Nationwide equine premises registration has already proven to be beneficial in certain circumstances. For example, Wisconsin animal health officials were able to use their premises registration database to send out mailings with West Nile virus information during the season when outbreaks commonly occur.

Official, Complete, Ideal Traceback System: During equine industry meetings, the most noted benefit of having an equine identification system was the availability of an official, complete, ideal traceback system. Simply having the ability to identify and trace horses provides many benefits, particularly with regard to disease containment, tracking, and possibly eradication.

Maintaining Equine Commerce and Movements: A proper traceback system that could identify where a sick animal had been and the horses it had commingled with could benefit the equine community by decreasing the size and number of quarantined areas during a disease outbreak. Such a system could also facilitate equine commerce by reducing the number and duration of trade interruptions.

Disaster Relief and Recovery: In recent years, Hurricanes Andrew, Katrina, and Ike demonstrated to the equine industry the value of having an animal identification system—or the problems caused by the lack of one in the case of Hurricane Andrew. In the wake of Hurricane Andrew, it took many weeks for owners to find their horses, if they ever did. On the other hand, Hurricane Katrina was evidence of how beneficial unique identification can be. Due to Louisiana's 1994 EIA testing law requiring unique identification, nearly all horses were identified. As a result, their owners were located and contacted in a timely manner during the relief efforts. Virtually all horses were returned to their owners following Hurricane Katrina, which was not the case with many other livestock species in this and other disasters.

Show Check-In and Management: Having individual animal identification at horse shows could aid in the check-in process, improving the speed of health checks and verifying that every animal entering the show grounds has a current Coggins test and health certificate. Using microchips—and possibly electronic certificates of veterinary inspection and Coggins tests—would reduce check-in time compared to the current paper-based process.

Racetrack Management and Racetrack Check-In: There are numerous benefits of microchips that are specific to the racehorse industry. In the current system, each racehorse is identified by an individual code tattooed inside its lip. Quite often, the lip tattoo is used to verify animal identity when horses are checked in and out of racetracks, checked in for races, or checked in for various other procedures such as veterinary examinations or breeding. Microchips would greatly simplify these processes. If microchips were implemented on a mandatory basis, this form of identification has the potential to replace lip tattoos in the check-in process, preventing possible disease spread caused by touching the lips of multiple horses to check tattoos; avoiding the need for gloves to guard against the spread of disease; speeding the process by using a quick wand scan instead of physically touching the horse; and avoiding the potential for the horse to object to its lip being flipped, which could result in injury to the horse or its handlers.

The EU and other Nations Requiring Microchips: The EU has adopted a program to give every equine a Unique Equine Life Number, which is a 15-character code. The first three digits represent the country, the second three represent the breed of the horse, and the final nine are random numbers to identify the individual horse. At least 12 European countries, as well as Australia, New Zealand, and many South American countries, already have microchipping regulations for the equine species. Many of these regulations are specific to the racehorse industry or to horse movement. However, some countries require all horses to be microchipped, and others require certain breeds to be microchipped with the data entered into registries or studbooks.

Equine Industry Cost.

Due to the data limitations, the researchers used a slightly different approach to the cost analysis for the equine species than for the other species. They typically used the median value from the data that they were able to collect through published reports, surveys, and other sources.

The costs of NAIS adoption in the equine industry are quantified for premises registration, animal identification, and animal tracking. In addition to premises registration, the costs considered include the RFID microchip, veterinary services to insert the microchip, universal readers, database costs, and training and labor costs for each step. Because of the lack of data for the equine species, some estimates used in the study are based on numbers obtained from studies on other livestock species. Other estimates come from producers.

Premises registration costs were based on the annualized cost of $4.64 per premises, which was used for the other species, and an estimate that 579,975 premises need to be registered. The resulting estimate for the annual cost of premises registration in the equine industry is $2.7 million dollars.

Total costs for animal identification include estimates for the microchip, veterinary charge for the chip insertion, and cost of veterinary travel. The costs are based on an estimate of 5.8 million equids in the United States, as listed in USDA's 2008 publication

"A Business Plan to Advance Animal Disease Traceability." Finally, a cost of $4.15 was charged for the time and materials the owner would spend recording the data on the horse and reporting this data to a government database. Table 12 summarizes these costs.

Table 12. Estimated Annual Costs to Identify Horses Individually with Microchips

	Per Horse	Total
Microchip	$14.60	$10,745,332
Vet Charge	$27.40	$20,165,897
Vet Travel	$29.36	$558,522
Recording/Reporting Data	$4.15	$3,054,324
TOTAL	**$75.51**	**$34,524,074**

The cost for animal tracking was by far the hardest to quantify for the equine species. The NAIS business plan suggests that events—such as shows, races, sales, or other exhibitions—where horses are commingled with equids from different premises should be a priority in a tracking system. As it is impossible at this time to obtain an actual number of equine events, number of equines per event, and number of equine movements, the research team chose a different route to quantify the tracking charges. The assumptions described on pages 326 to 328 of the full report were used to estimate the number of scans (reading the microchip with an RFID reader), and the annual cost per scan was estimated to arrive at an animal tracking cost to the equine industry. The estimates of 47.7 million scans and $0.81 per scan resulted in a component cost of $38.7 million.

The full report provides a detailed discussion of estimated costs to the equine industry on pages 323 to 332. Table 13 outlines the costs for a full-traceability system with a 100 percent participation rate.

Table 13. Total Annual Cost of NAIS Adoption to the Equine Industry

	Total
Premises Registration Costs	$2,690,269
Animal Identification Costs	$34,524,074
Reading Costs	$38,682,132
Total	**$75,896,475**