

PORK QUALITY

Title: Identification and Traceability for the Pork Industry - A Proposal for a Feasibility Study
NPB #01-158

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Abstract:

A study of methods of animal identification and traceability in use in the European Union (EU) has been made. An investigation of the potential for adaptation of this method for deployment in the U.S. pork meat chain has been conducted. Relationships between traceability, food safety, economics, and country of origin labeling have been considered.

It has been observed that although many consumers in EU perceive individual animal traceability in their food chain from producer to retail, in reality only a small percentage of the meat marketed in the EU actually provides this traceability. From a technological viewpoint, an industry-wide adaptation of the individual animal traceability methods used in the EU into existing pork processing facilities in the U.S. will likely not be practical due to the high costs associated with their implementations, due to the limited focus and resources associated with optimizing their systems, and due to the much higher line speeds and efficiencies needed for processors to be competitive in the U.S. Some features of their systems such as the use of conventional ear tags, the passport concept, the use of electronic implantable tags to keep track of animal identity through the production process, and the use of electronic identification chips, tattoos, and “luggage tags” to keep track of carcasses, primals and subprimals to trace meat from the break-up floor to the retail counter could be adapted in the U.S. pork chain if individual animal identification and traceability is ever implemented through either market or regulatory pressures. It was, however, observed that the EU does maintain a reasonable level of batch traceability.

From an economic viewpoint, there seems to be little incentive at this time to establish industry-wide individual animal traceability even to the producer in the U.S. and correspondingly little interest from the producer, packer, distributor, retailer or consumer at this time in establishing this level of traceability. From both food safety and liability viewpoints, some form of traceability from retail to the producer and packer may be important in the U.S. pork chain but with the increasing role the large producers play in providing the pork consumed in the U.S., this can be achieved more practically with a batch traceability system in which breaks in the boning floor are used to separate batches from different producers. It can be argued that the batch processing systems are effectively in use today in some (if not many) existing U.S. packing facilities with daily or more frequent breaks in the boning floor although the packers may still be commingling carcasses from several large producers along with a small percentage of animals from larger numbers of small producers in a daily batch or they may be storing selected primals from slaughter over several days for subsequent boning or cutting.

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It is believed that the incremental cost of actually maintaining batch traceability from retail to large producers will be modest but the cost of maintaining traceability to the individual small producer could be high. The high costs associated with establishing traceability to the small producer would likely result in a significant discounting of their animals and could limit their options for packing facilities that would even be willing to accommodate small batches if batch traceability is either established voluntarily or mandated.

Contrary to our prior view that the EU was much farther ahead in the traceability area than the U.S., it can be argued that some U.S. plants are already involved in batch traceability though with very large batches. This suggests that the issue has more to do with semantics and marketing than with process flow, engineering, or economics.

Finally, the issue of Country of Origin Labeling (COOL) has been considered. Although there may be a perception that COOL provides some form of traceability, our study shows that compliance with COOL requirements can be achieved without the use of traceability and without any substantial impact on improving food safety.

III. Introduction:

Agriculture is unique in that product from many producers is routinely co-mingled prior to sale. In this environment there is little incentive to innovate, or to differentiate, and often a counter-incentive to improve quality. Farmers cannot individually benefit from product improvements because they compete on price, and packers and processors who co-mingle products from many producers cannot create credible branded images.

Agriculture is also unique in that it is a textbook case of a perfectly competitive market. Almost all other sectors of the U.S. economy have developed some sort of branding and have some product differentiation. In a perfectly competitive industry the producer is a price taker and prices will not exceed production costs for long periods. In branded sectors new entry is limited and the brand owner has some control over price. As long as agricultural production chains rely on co-mingled products, those who buy the products will constantly demand product improvements but because of the co-mingling, the system will not pay a premium to those who do place an emphasis on quality.

The problem described above is technical, spans essentially all sectors of U.S. agriculture, and is not caused by the lack of marketing expertise of producers. If the pork sector can practically solve the technical problem of tracking (tracing) meat cuts from slaughter through to the retail counter, then the pork chain will be revolutionized. With traceability, producers and producer groups will be able to capture the benefits associated with any improvements they make to the product and their ability to benefit from this opportunity will be limited only by their ability to find innovative ways to improve the product in a way that the consumer finds valuable. Most importantly, with traceability the average consumer will have access to higher quality and safer pork products and market pressures will prevail that reward those producers that provide higher quality and safer products and these same pressures will tend to purge those producers that compromise either the quality or the safety of the product that reaches the consumer.

Although it is questionable whether the maturity of computer, information and electronics technology of a few years ago was adequate to realistically create an industry-wide traceable pork chain, recent advances in these technical areas and recent initiatives abroad in establishing traceability in the beef chain strongly suggest that it is now possible to establish this traceability in the U.S. pork industry. With an industry-wide effort and with the scale of economy associated with electronics technology, it is anticipated that the incremental cost per slaughtered animal for the technology will be modest and that the timeframe needed for the development and deployment of the technology can be as aggressive as the industry chooses to make it.

At the outset on this project we took the rather narrow view that identification and traceability was an individual animal issue and that the full benefits of traceability would be realized only if trace back from retail to the parental genetics was possible. Although such a level of traceability may be needed to derive full benefits, it was found early on that the costs associated with this level of traceability would be very high and there was little interest on the part of the producer, packer, distributor or retailer in pursuing this level of traceability and probably even less interest in the consumer in such traceability. By expanding our view of traceability to include batch traceability, however, we believe that most benefits identified previously can be attained at a much lower cost and that economic forces alone may be sufficient to drive the U.S. pork industry

to a batch traceability approach to supplying the U.S. consumer with high quality pork products. More importantly, we believe that many U.S. packers already have process flows that can provide batch traceability without major changes in their operations.

IV. Stated Objectives from Original Proposal

The objective of this proposal is to create a partnership between the National Pork Board and Iowa State University to investigate and propose an identification and traceability system designed specifically for the U.S. pork chain

This overall project objective will be addressed with a four-phase initiative. The current NPB project is for the support of Phase 1. The tasks in all 4 phases are:

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|---------|---|-------|
| Phase 1 | Initial technical and economic feasibility study to determine whether the systems now being created in Europe can be adapted for use in U.S. plants | |
| Phase 2 | Description of a prototype traceability system | |
| Phase 3 | Development and implementation of pilot traceability system in the ISU Laboratory and in facilities of selected packers in Iowa | Meats |
| Phase 4 | Industry-wide deployments | |

V. Materials and Methods

This project focused on obtaining first-hand information about best practices in use around the world in establishing traceability in meat supplies and on obtaining input from domestic producers, packers and retailers about their role in establishing traceability in the U.S. pork chain. With the considerable worldwide attention to meat supply problems in some countries in the EU, it appeared that the European community was the worldwide leader in establishing traceability procedures although there was evidence of considerable interest and activity in both Canada and Australia as well. After studying what was reported in the EU, Canada, and Australia, it was determined that an EU visit would provide a good view of what is going on outside of the U.S. in the area. As such, visits to several packing and processing facilities in the EU were made to obtain more detailed information about how they have implemented their systems and about the challenges they have faced in bringing these systems into being. Specifically, visits were made to meat processing plants and retailers in Denmark (pork), Holland (veal), and the UK (beef).

Input from producers, packers, retailers and distributors has been obtained through a series of three meetings organized by the Industry-Wide Cooperative Meat Identification Standards Committee (ICMISC). Included in these meetings were discussions about identification, traceability, food safety, distribution and retailing, consumer demand, and development of new standards for barcode space allocations for associating relevant information with individual meat products.

Contacts were also established directly with Iowa Beef Processors (IBP), Cargill and Hormel. IBP provided a tour of a high/flow packing facility along with some preliminary input about issues they see facing a U.S. traceability initiative on a visit by three team members to the IBP facility. Hormel also provided a tour of a high/flow packing facility and individuals involved with the management, operation, processing and engineering discussed some of the issues they see surrounding the traceability challenge.

VI. Results

This section will be broken into three parts. The first and major part focuses on costs and benefits associated with traceability in the U.S. pork industry and is based, in part, on information obtained with the visit to meat-chain suppliers in the EU and on information obtained through discussions with domestic packers. The second focuses on proposed standards in the expansion of the bar code system as it impacts traceability in the pork chain. The third is an ancillary observation about one practical issue associated with maintaining identity either through the breakup process or through the packaging that may take place in retail outlets.

VI.I Costs and Benefits of Traceability in the U.S. Pork Industry: Lessons from the EU

The European Union has implemented a series of steps to ensure consumers that beef and pork can be traced from farm to the retail customer. A driving force behind these changes was the outbreak of BSE in the UK. As a result of these regulations almost all retail meat that is sold in the EU contains a code that in theory allows the consumer to find the farm of origin. The U.S. pork industry may eventually decide to consider developing a similar traceable system. This might occur because of competitive pressures on export markets or consumer demand in the U.S., or to satisfy a federal regulation designed to improve food safety. The purpose of this research is to describe the costs and benefits of the programs that have been implemented in the EU with an eye towards possible replication in the U.S. To achieve this objective we visited meat processing plants and retailers in Denmark, Holland and the UK. What follows is a description of what we learned about costs and benefits of the dominant types of traceability in the EU.

Defining Traceability

We encountered three types of traceability in the EU. The first method that we encountered involved full traceability. This system maintains the identity of all cuts from the farm through the cutting and distribution system. It is extremely expensive and essentially requires new construction. It is therefore very rare in the EU. Nevertheless many consumers seem to think that this system is used on all beef and pork. We will call this system **farm to retail traceability**.

The most common method of traceability in the EU involves traceability from farm to carcass. This system can be used to provide full life history of each carcass or primal, but it cannot be used to trace through the cutting floor. Instead the meat is cut and processed in batches and the ultimate consumer can trace the product back to a particular batch. This system is relatively inexpensive especially if batch sizes are large. Processors who wish to provide additional information or impose additional criteria on the meat they sell can simply purchase only those carcasses or primals that meet their criteria and then cut the meat in a different location. This feature means that the additional costs of farm to retail traceability are added only when dictated by market forces. We will call this method **batch traceability**.

A third method of traceability involves the collection of DNA swabs from each animal. Whenever problems arise with a particular piece of meat the DNA from this meat can be compared with the DNA of each swab. The vast majority of swabs collected under this system are never analyzed, but the sheer fact that they can be provides producers with an incentive to adjust their behavior. We call this system **hypothetical traceability**.

The fourth section of this report discusses the interaction of traceability and Country of Origin Labeling (COOL). COOL is scheduled to become mandatory in the U.S. in the near future and has become confused with traceability. This section shows how the U.S. meat industry can meet the requirements of COOL without adopting any of the three traceability methods described above. We call this solution **segregation**.

The remainder of this paper describes each of the three types of traceability and provides estimates of the costs and benefits of the system in the EU. We make some general comments about the feasibility of each method in the U.S., and ask whether the U.S. pork producer would benefit or lose should such a system be adopted. We also include a discussion of how segregation can be used to achieve COOL and attempt to clarify the difference between traceability and segregation.

VI.I.A Farm to Retail Traceability

Method of Implementation

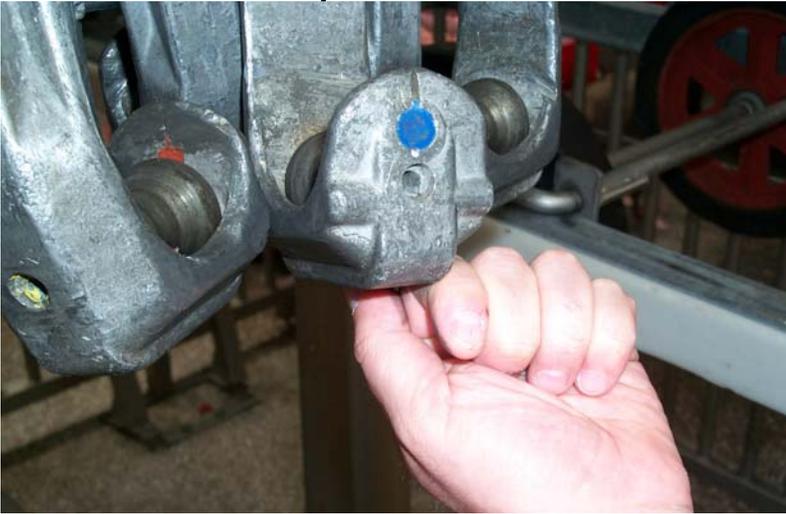
Almost all meat animals slaughtered in the EU arrive at plants with individual animal identification. For cattle and sheep this form of identification involves a passport that contains a scanner code as well as a double ear tag with the passport number. This number is assigned by the EU at birth, and is used as a basis for animal subsidies. This form of identification was originally introduced to avoid subsidy fraud and was introduced prior to traceability. Hogs are tattooed to provide producers with feedback on prices and yield and not for purposes of traceability. Therefore the individuals we spoke with did not associate this individual animal ID with traceability. Pictures 1 below show examples of a passport.

Picture 1. An animal passport



When animals arrive at the slaughterhouse the animal id number is scanned into an electronic system. This system keeps track of the location of the carcass via an IRD chip in the gambrel. (See Picture 2) The meat in turn is cut into a container that also has an embedded chip, (See Pictures 3 and 4). Each container contains only meat from the same animal. The system then remembers the location of each container and the carcass that contributed meat to that container. When the meat reaches the individual who makes the final cut and who places the meat into a vacuum bag, a scanner tag is printed automatically and placed face down in the bag before the meat. See Picture 5.

Picture 2. Gambrel Chip



Picture 3. Cutting into a container



Picture 4. The Systems remembers the location of each container



Picture 5. The finished product



Costs of farm to retail traceability

The company we visited shared their cost information with us. The company had priced a new slaughter floor with and without the traceable system and so these cost estimates are probably quite accurate for this facility. For this small veal plant the additional marginal cost was approximately 20%. This pays for the

additional labor associated with cutting and labeling. The additional capital cost of this building was 50%. The most expensive parts of this were the electronic system itself and the equipment for moving the containers around in an organized fashion.

It is very difficult to translate these costs into a U.S. system. Our best guess is that the use of twin ear tags, or tattoos and the associated recording system would cost \$2.00 per animal. Packers would need to adapt slaughter floors to maintain individual animal identification to the cutting floor and this would add an estimated \$0.25 cents per animal or less.

The most expensive component of the system involves the cutting floor. Parts of a particular animal would be kept together until labeled and this would require a re-configuration of the cutting floor. In addition workers would be used to maintain the system and to physically place the labels in the packs. As mentioned above costs for converting an EU plants to such a system involved a 50% increase in fixed costs per animal and a 20% increase in variable costs per animal. If we apply these to charges to typical large scale U.S. pork plant with \$3.00 per head fixed costs and \$23 per head variable cost, the additional cost is \$1.50 per animal for the additional capital and \$4.60 for additional labor¹. Additional costs at the retail level are estimated at one tenth of a cent per pound (or \$1.87 per animal) for labels, additional record keeping, audit compliance and labor. The total additional costs of the trace back system are therefore estimated at \$10.22 per animal or \$4.00 per hundred pounds. This is equivalent to a 10% increase in on farm production costs or about \$0.08 per pound for retail meat.

Benefits of farm to retail traceability

As mentioned earlier this kind of traceability appears to be very rare in the EU. The plant we visited produced a premium veal product and had faced consumer concerns about illegal use of hormones. The system had been installed to alleviate these concerns and not to obtain a price premium. In all of the interviews we conducted we did not encounter a single individual who said that the average consumer was willing to pay a premium for the additional information contained in farm to retail traceability when compared to batch traceability. This probably explains why this type of traceability is so rare in the EU despite the ready availability of animal identification systems and government mandates to encourage traceability.

VI.I.B Batch Traceability

Method of Implementation

This system essentially separates the packing system into two production processes. In the first process the identity of the animal is maintained through to the carcass. The majority of these carcasses are then cut and processed without any further attempt to maintain traceability to the carcass. However the company uses the same batch number on all output for that day and can recall meat from a particular carcass by recalling the entire batch. This is essentially the system that is in operation in modern U.S. plants, with the obvious exception that batches in the EU are much smaller than batches in the U.S.. Furthermore the EU plants can subdivide a days slaughter into very small batches by allowing for short breaks on the cutting line. For example in the Danish plant that we visited, the shift typically began with hogs destined for a niche market such as the U.K., and ended with a second niche market such as the organic sector. Thus in this one day three different batches were slaughtered and processed with only a very small disruption of the line.

The elegance of the batch system is that market forces determine the optimal size of the batch. If recalls are too expensive because the batch is large then it makes sense to reduce the batch size. Also if a customer wishes to purchase only carcasses with specific attributes they can do so and cut and process these carcasses elsewhere. In one example we saw all of the carcasses grown under animal friendly production practices pulled out of the cooler and shipped from Denmark to the U.K. We also visited a beef packer that sold primals and sub-primals to individual British retailers for further processing. Each of these retailers could then claim that all of the beef sold in that chain had met some very strict production criteria.

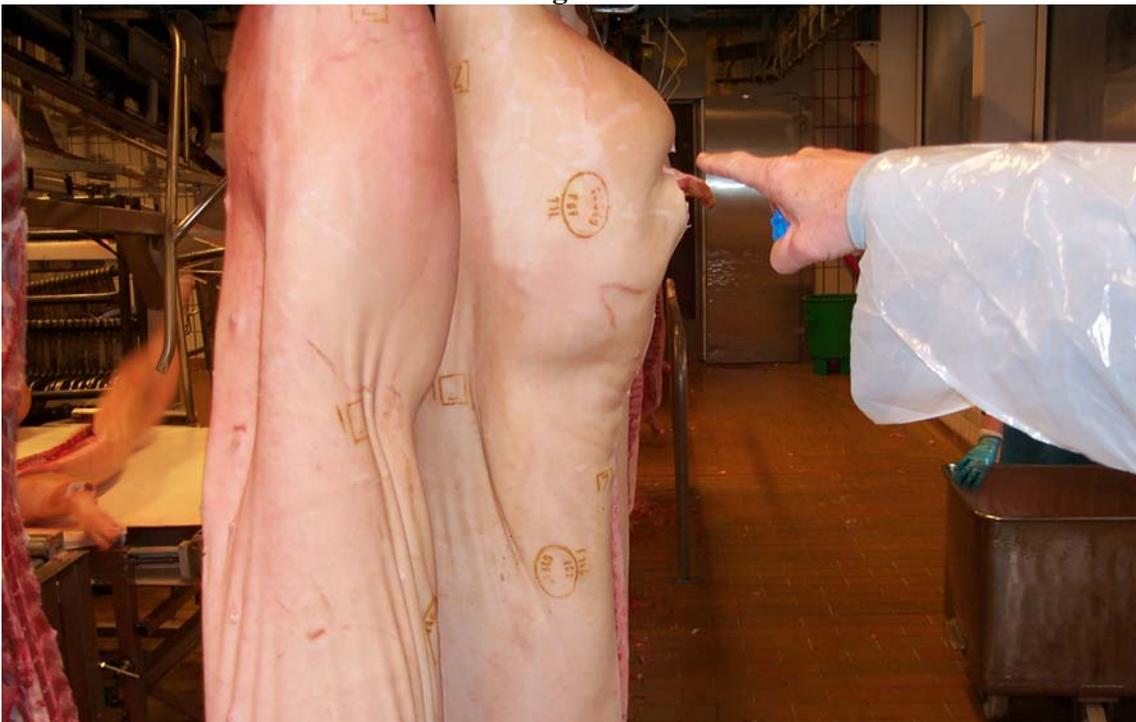
¹ Because of the enormous amount of specialized equipment few U.S. plants would be able to install such a system on existing floors. This would therefore require the construction of a new boning hall.

Picture 6 shows a batch of “organic” pigs ready for slaughter at the end of a shift. Picture 7 shows a tattoo used to maintain animal identity through the kill line. Picture 8 shows batch numbers on boxes in a cooler. Pictures 9 and 10 show bar-coded “luggage tags” attached to carcasses and primals used to maintain traceability to that level. Picture 11 shows sub-primal information about the breed of an animal.

Picture 6: A Batch of “Organic Pigs” being slaughtered at the end of a shift



Picture 7 Animal ID is maintained through the kill line



Picture 8 Batch Numbers on Boxes



Picture 9 Luggage tags used on carcass



Picture10 Luggage tags used to maintain identity through to primal



Picture 11 Sub-primals contain information about the breed of animal



Costs of a batch traceability system

The costs of batch traceability include; the cost of animal identification, the cost of tracing the animal through the slaughter line and the costs involved in maintaining animal specific records. In the beef plan we visited these costs were about \$20 per animal. Most of this involved the additional labor involved in placing the luggage tags in to the primal and subprimal. However the owner told us that the additional information made the system worthwhile because it increases production efficiencies. For example one producer had a problem with a sharp piece of metal at a feeding trough and the hides from these animals were discounted. The beef packer was able to tell the producer that he had this problem and it was immediately resolved.

We visited a Hormel plant in Austin Minnesota that had a similar system to the one described above. This system was used to pay producers based on carcass quality. The Hormel staff we visited believed that the system made sense because it enhanced production efficiency, even in the absence of any marketing advantage that may have been offered.

A second set of costs associated with batch traceability involves inefficiencies associated with breaks in the cutting line. These costs were small in the Danish pork plant because they had only two breaks per day. Costs would increase dramatically if many small batches were processed. The line break had to be at least 10 minutes long to ensure that batches were not mixed.

If we expand the definition of batch to include one full days kill then many U.S. plants can claim this type of traceability with minimal changes from their current process flow. As mentioned above the optimal size of a batch can be found by comparing recall costs associated with very large batches against marginal costs associated with stopping the cutting line for smaller batches. It seems clear that U.S. packers will adopt smaller batch sizes only if it would make economic sense.

Benefits of batch traceability

As mentioned above batch traceability provides production efficiencies and can reduce recall costs. These advantages appear to be large enough to justify the relatively small costs associated with the system. The process also appears to offer some advantage in the market place.

The retailers that we visited said that customers liked the idea of batch numbers on meats because it gave them the sense that they could trace the meat back to the producer in the event of a problem (even though this is not technically true). We also learned that consumers and their retail representatives had learned to use the information that was provided. For example consumers soon learned to avoid meat from Holstein cattle because this meat had poor eating ability. These calves are no longer fattened and are simply killed at birth. We were also told of a Scottish beef producer who had excellent genetics. An Italian butcher noticed enormous customer satisfaction when he sold meat from this farmer and had agreed to pay a premium for this meat in the future. However this deal was nullified by the Italian ban on British Beef. A third example of a market based premium was a nationwide promotion for “Scotch Beef”. Beef selected for this program had to satisfy several criteria that ensured good eating quality and this beef sold at a premium.

This system would seem to have much to offer the U.S. pork industry because it offers production efficiencies and possible marketing advantages. It does not require any major restructuring of plants and will evolve without outside research or legal mandates resources if it is economically justified.

VI.I.C Hypothetical Traceability

The British and Irish lamb industry have adopted a traceable system based on DNA sampling. The lamb is swabbed at slaughter with a specially designed Waterman swab and this swab is then filed with the animal ID. In the vast majority of cases no further action is taken. However, in the event of a problem with the meat the retailer can request the swabs for all animals that contributed to the problem batch. Each test costs about \$14. When the retailer finds the animal DNA that matches the DNA of the problem meat, the producer can be identified and appropriate action can be taken.

Costs of the hypothetical system

The only ongoing costs associated with this system involve the swabs and the maintenance of a filing system. We were told that these costs were very small but we did not get accurate values.

A second cost associated with this system is that producers can be sued when meat from their animals creates a problem. This cost might be high for pork producers who leave needles in pigs.

Benefits of a hypothetical system

Producers who sell meat into this system are aware that any problems can eventually be traced to them and they realize that one problem could drive them from business. They are therefore far less likely to engage in production practices that might cause such problems. Consumers who realize that this set of incentives is in

place should feel more comfortable with the final product. The incentive created by this system will eventually drive poor producers from business and in the process should enhance the industry as a whole.

VI.I.C Segregation

The 2002 farm bill contains a set of provisions (Mandatory Country of Origin Labeling, or COOL) requiring that beginning on September 4th 2004², all retail meat sold in the United States shall contain information on the country of origin of the product. The act (relevant sections of which are excerpted below) specifies that the label “U.S.” meat be applied only to meat from animals that were born, raised and slaughtered in the U.S. It also indicates that meat of “Canadian” or “Mexican” origin must also be born, raised and slaughtered in those countries.

Two methods can be used to meet the requirements of the act. The first involves the use of Farm to Retail Traceability or batch traceability as described above. The second involves the segregation of all animals that were born or raised abroad. See Smyth and Phillips in *AgBioforum* 5(2):30-42 for working definitions of segregation and Farm to Retail Traceability.

Many of the strongest proponents of COOL argue that it will increase food safety and they implicitly assume that it will lead to traceability, however as we will explain below, the most likely response to the act does not improve food safety or require traceability in any form.

Provisions of the Farm Security and Rural Investment Act of 2002

Full details of the act are available at <http://www.ams.usda.gov/cool/>. The provisions of relevance to the U.S. pork industry are that all pork sold in supermarkets or large butcher shops must have information specifying where the animal was born raised and slaughtered. Ground pork from multiple animals would require an associated specification of the source country in order of importance.

Discussion of the Act

The act requires that after September 30, 2004, all retail cuts of meat including ground product shall have country of origin labels. The act is clear in defining U.S. meat as that which originates in animals born, raised, and slaughtered in the U.S, and it clearly puts the responsibility for the accuracy of this label on the retailer.

The act, as it pertains to the Secretary of Agriculture, contains a contradiction in that “*The Secretary may require that any person that prepares, stores, handles, or distributes a covered commodity for retail sale maintain a verifiable recordkeeping audit trail that will permit the secretary to verify compliance with this subtitle*” while it prohibits the Secretary from using a “*mandatory identification system to verify the country of origin of a covered commodity.*” There is nothing in the Act that prohibits “any person that prepares, stores, handles, or distributes a covered commodity for retail sale” from requiring an animal identification system in order to facilitate a “verifiable record-keeping audit trail.”

Therefore, mandatory animal identification is not prohibited by this legislation; only the Secretary of Agriculture is prohibited from requiring animal identification.

The contradiction is important because segregation, the Secretary’s only real alternative to a mandatory animal identification system, is not traceability. To see why this is true consider a retailer who buys a load of pigs of unknown and possibly mixed origin from a packer. A segregation program would require that the packer simply prove that all of the hogs were born and raised in the U.S. A traceable system would require some evidence that this was the case, and would require this information for each animal in the load. The packer and retailer can achieve segregation by purchasing live animals or meat from suppliers that only feed or process U.S. animals. However in order to achieve traceability, the retailer and packer would need to follow each piece of meat through their system. These terms are extremely important because some of the proponents of COOL

² Recent media reports now suggest that the USDA may not have sufficient funding to implement the provisions of MCOOL until September 2005.

have assumed benefits that can only be achieved with a traceable system and assumed costs associated with a segregated system (See Vansickle et al 2003).

Two Mechanisms for Implementing the Act

There are two possible solutions to the contradiction described above. The first is based on a strict interpretation of the word “audit” and requires that the retailer be able to trace a piece of meat back to the original animal. It is obvious from the discussion above that USDA cannot require this but that retailers can require it of their suppliers who, in turn, can require it of their suppliers. Farm to Retail traceability meets this criteria.

The second solution is to require that certificates be backed up by some proof that meat came only from animals born raised and slaughtered in the U.S. This one is feasible under current marketing practices. The easiest way of meeting it would be to segregate all non-U.S. animals into a separate processing and slaughter system. This course of action would cause these animals to be heavily discounted due to increased costs of this alternative system and would impose economic strain on producers in Canada and Mexico. This economic pressure would create strong incentives for producers in Canada and Mexico to feed and slaughter their own animals and export meat, and not feeder animals.

A logical alternative to the costs associated with traceability would be to allow each participant in the marketing channel to certify that the product comes only from U.S. sourced animals. When audited under this system the farmer or packer would simply have to prove that all of the animals or products in a particular batch were U.S. sourced and they would not need to maintain identity. Under this system the majority of U.S. pork and beef that originates in animals born and raised in the U.S. would not be impacted. However the meat that originates from animals that are born, raised or slaughtered in Canada or Mexico would be severely impacted.

To see why this is the case, consider a U.S. retailer who agreed to handle this hybrid product. The retailer would have to maintain a handling and labeling system for U.S. meat and for hybrid meat. The retailer would bear the costs of such a system only if the hybrid meat was less expensive or if the customer was willing to pay a higher price for this product. If we assume for the moment that the customer is not willing to pay a higher price for this product, then the retailer would handle the hybrid product only if it is discounted.

Now consider the meat packer who would also have to strictly segregate animals that were *not* certified to have been born and raised in the U.S. First, these animals would need to be transported and penned separately. Second, these animals would all need to be slaughtered and processed in a batch. If the batch size was less than one day’s kill (as it most likely would be) then, the line would need to come to a halt until all U.S. product had been cleared from the system. All carcasses not designated as being from the U.S. would require different labels and would need to be kept separated while being chilled overnight. The de-boning and cutting of this meat would also require a separate batch size, and again the line would have to be stopped while changing from one type of product to the other.

If the batch size was for one full day’s slaughter, additional pen space would be needed to collect these non-U.S animals and additional coordination costs would be incurred to ensure that no U.S. animals were included in that batch. One U.S. packer interviewed for this report stated that if the act were implemented in this fashion, they would refuse to slaughter any non-U.S. hogs so as to avoid the burdens associated with maintaining two separate production and distribution systems.

Boxes and retail packs from this product would need special labels and handling and a system would be required to handle possible audits. This meat would likely have to be sold at a discount to retailers as well. This suggests that packers would agree to handle the hybrid product only if they could purchase it at a discount that was large enough to cover their additional costs as well as those of the retailer.

Whether additive or compounded, the effect of these multiple discounts would be most severe on farms that import feeder animals, and these farms would pass this discount plus their certification costs back to the producer in Mexico or Canada. The initial impact of this certification system would therefore be to create a large price wedge between U.S. sourced feeder animals and imported feeder animals.

Note that unlike the traceability system, there is no incentive for participants in a segregated system to enhance the safety of the product. Segregation simply allows the consumer to know in which country the animal

was born and raised, and unless the safety of meat is determined by the country of origin of a feeder animal, there is no possible reason the expect COOL to increase food safety

Will the Consumer Pay a Premium for a COOL Label?

From the discussion presented above it is clear that COOL will lead to a segregation of U.S. and imported product and that the costs associated with this segregation can only be justified if consumers will pay a premium that exceeds these costs. This result can also be shown more formally by means of a multi sector equilibrium displacement model of the farm wholesale and retail sectors of the U.S. beef pork and poultry industries See Lusk, J.L. and J.D. Anderson, "Modeling the Effects of Country of Origin Labeling on Meat Producers and Consumers." Staff Paper #03-07. Dept. of Agricultural Economics, Purdue University. June 2003.

There is some recent evidence of a willingness to pay for a COOL label. "Country-of-Origin Labeling of Beef Products: U.S. Consumers' Perceptions" Wendy J. Umberger, Dillon M. Feuz, Chris R. Calkins and Bethany M. Sitz. This paper was presented at the 2003 FAMPS Conference: *Emerging Roles for Food Labels: Inform, Protect, Persuade* Washington D.C. March 20-21, 2003. These authors provide survey results and results from an experimental auction and conclude that consumers were willing to pay a 19% premium for steak labeled "Guaranteed USA: Born and Raised in the US." The authors further conclude that "Food safety concerns, preferences for labeling source and origin information, a strong desire to support U.S. producers, and beliefs that U.S. beef was of higher quality, were reasons consumers preferred COOL."

The authors use a well-respected experimental method as a basis for this conclusion and the experiment appears to have been performed correctly and in a representative fashion. However there is some reason to be somewhat skeptical of these experimental results. First, participants were paid \$50 to participate and showed that they were willing to return \$0.40 to \$0.50 of this to purchase the U.S. product. One common-sense explanation for the result is that participants were being nice to the organizers by returning a very small fraction of their \$50 payment. A second reason for skepticism is that participants mentioned food safety as a primary reason for the premium. However, as described above, food safety can be enhanced with a traceable system but not with a segregated system. In other words it may be true that the authors were measuring benefits of a traceable system and not a segregated system.

A final and more important reason to be skeptical of these experimental results is to ask why the market has not already begun to provide COOL labels in a voluntary fashion given the relatively large price premiums that were reported. One U.S. based pork processor (Premium Standard Farms of Princeton Missouri) has been in a position to provide a U.S. label on all of the pork it sells because the company domestically slaughters only pork grown in its own facilities. The fact that it has chosen not to provide a COOL label despite the zero cost of doing so may ultimately provide a better understanding of the market than the experimental results described above.

VI.I.D Assessment of Cost and Benefits of Traceability in the U.S.Pork Chain

The purpose of this report has been to describe the different types of traceability we discovered in a fact-finding trip to the EU and to lay out some of the advantages and disadvantages of each. We had expected to find farm to retail traceability in many slaughter lines and were surprised to discover that this was not the case. The most common type of traceability we discovered was batch traceability. This system allows the packer to trace the animal through the slaughter line but it does not allow them to trace the meat through the boning hall.

One important reason for the dominance of batch traceability involves the costs associated with each system. Farm to retail traceability is expensive and there is no evidence that consumers are willing to pay an associated premium for this product. Batch traceability is inexpensive and was reported to have paid for itself in terms of production efficiency in the plants that we visited. We also discovered some evidence that premium producers were beginning to receive some small benefit from batch traceability.

It can be argued that some U.S. plants are already involved in batch traceability, though with very large batches. This is contrary to our prior view that the EU was much further ahead in this area than is the U.S. This suggests that the issue is has more to do with semantics and marketing that with engineering or economics.

A third type of traceability that we discovered involved the use of DNA that allowed the legal and food safety systems to trace a piece of problem meat back to the source animal. This type of traceability is inexpensive because DNA tests are done only when a problem is encountered. The obvious advantage of this system is that it gives producers an incentive to keep problem animals out of the system. However it does little in the way of product identification and it will potentially lead to adverse legal settlements against some producers.

We also discuss the new Country of Origin labeling requirement that has been mandated in the U.S. and have shown that it can be achieved without the use of traceability. This section is important because this issue is currently topical, and also because some of the proponents of COOL are claiming advantages that can only be ensured with some form of traceability which can not be guaranteed with COOL.

We have determined that the U.S. consumer is not yet ready to pay for Farm to Retail traceability and do not know whether impending forces are likely to change consumer position on this issue. We also realize that there is no real impediment to the widespread adoption of batch traceability or to small batch traceability in the U.S. beyond the economics associated with loss of productivity associated with creating and managing small batches. This type of traceability will expand when dictated by the market, and this will be driven by a desire to reduce the size of recalls or to satisfy consumers that the meat is from animals that meet certain criteria.

Our proposal called for an initial economic feasibility of farm to retail traceability followed by a technical feasibility study should this be merited. Our results from the economic study suggest that there is little economic incentive for establishing individual animal traceability and that the producers, packers, and retailers are collectively reluctant to pursue the issue of their own accord. As such, a detailed technical study of how the European system can be adapted for use in the U.S. will be of minimal use to the U.S. pork industry at this time. We have therefore returned the funds set-aside for this purpose.

VI.II Bar code implications and limitations

Preliminary observations about the allocation of space on the proposed new 72-digit bar code deserve mention. It is widely recognized that the existing and widely-used 14-digit U.P.C. bar codes adopted by the U.C.C. does not have sufficient space to accommodate traceability. Proposals under discussion for the 72-digit RSS bar-code have some space allocated for "lot" traceability but insufficient space allocated for individual animal or small lot traceability. With the 72-digit limit established in the proposed code, there is insufficient space remaining after other allocations have been made to support the individual animal traceability concept. There seems to be a sense of urgency at establishing a fixed space allocation standard that parallels what the U.C.C. has done with the current 14-digit codes. Within the 72-digit code, there is sufficient space to include all data in all fields that have been proposed for the new standard as well as sufficient space for establishing individual animal traceability should the need arise. The distinction between what is proposed in a 72-digit code and a code assignment strategy that can accommodate individual animal traceability is how efficiently code space is utilized. Some of the data fields in the proposed code, including those relating to date and purchase price, do not efficiently code data. A more efficient coding strategy can provide for the inclusion of a large amount of data in the same physical 72-digit code space. A bar code with a fixed number of digits can be viewed much like an electronics communications channel used for transmitting data over wires or through the atmosphere. In these electronic communication channels, it was recognized many years ago that the number of users that a given channel could support was severely restricted if each user was permanently allocated a fixed frequency spectrum in that channel. Dramatic improvements in the number of users that a given channel can support have been obtained by various types of dynamic spectrum assignment. The amount of data that can be stored in a fixed-length bar code can correspondingly be dramatically increased through more efficient assignment of code space. If the urgency for establishing the 72-digit fixed-space assignment standard were changed to an urgency for establishing a 72-digit dynamic space assignment standard with efficient coding of data, the resultant code and the corresponding standard would likely have a long useful life, could be tailored to accommodate varying types of business practices, could accommodate establishment of multiple levels of traceability as determined by individual producers, packers, distributors, and retailers, and would provide those that take the initiative to become leaders in establishing an effective traceability system the opportunity to do so

without the bureaucratic overhead and likely large costs needed to change what would likely become a deeply entrenched and rigid bar code space assignment standard.

VI.III Tagging or association of meats or meat cuts

The issue of maintaining identity of a primal or sub-primal with the original carcass or maintaining identity when larger portions of the carcass are distributed to third party cutters or to retailers deserves attention. The carcass or primals or even sub-primals are not an ideal medium to associate with identity information. Tattoos, electronic tags, bar code tags, tagged containers or wraps, and possibly more exotic mechanisms can be used to help make this information association. Cost, potential contamination of the product, ease in applying the associator, ease and reliability in reading information from the associator, durability of the associator, and ease of removing the associator, are all factors that must be considered when determining how to make an identity association with a meat product. It was apparent from the study in the EU that bar codes printed on plastic and/or paper have received considerable use as associators. There are concerns, however, about possible intermingling of the tag itself with the meat product should the tag enter a grinder or be missed by a worker or a consumer when a cut of meat is distributed to the consumer. We believe the concept of using edible tags so the presence of a missed-tag in a product will reduce the risk to the consumer deserves study. Soybean products can be used to make edible plastics that could carry bar code information but a very small percentage of the population may have allergic reactions to such products. Collagen products may also be useful for this purpose and may be less likely to affect consumers with allergies.

VII. Discussion

Our results suggest that at this time there is little interest on the part of the producer, the packer, the distributor, the retailer or the consumer in establishing individual animal traceability or identity in the U.S. pork chain from the farrowing house to the consumer or even from the packer to the consumer. The issue of animal identity can be readily addressed with several commercial ventures providing solutions to the problem. The costs associated with individual animal identity are, however, high and there is little evidence that high volume producers will be rewarded in the marketplace at this time if they provide individual animal identity at the time pigs leave the finishing barns. Individual animal identity can be practically maintained from the time the animals enter the slaughter facility to the time their carcasses leave the cooler and enter the cutup floor. Correspondingly, it appears that traceability of boxed meat products from the shipping dock of the packing facility to the retailer can be practically maintained. The challenge is on maintaining individual animal traceability across the cutup floor as the primals and sub-primals are removed from the carcass.

Although electronics and computer technology is now sufficiently mature to help support maintaining individual animal identity through the cutup process, the cost of modifying process flows in many existing facilities to support this level of traceability would be very high if not prohibitive thus suggesting that new construction would often be necessary to incorporate this technology. Even in new construction there are challenges since demand has not yet driven the development and production costs of the necessary electronic and computer components to the level of maturity needed to support the industry. If this technology were developed, it is difficult at this time to assess the increase in variable costs. The one facility in the EU that has adopted this technology suggests a 20% increase in variable costs but since this operation has low volume and since it is the only facility that we studied that even provides the capability, it likely does not provide a good model for what the increased variable costs would be in a modern high/volume U.S. facility.

The issue of batch traceability, however, does appear to be more attractive at this time. In contrast to individual animal traceability, batch traceability would allow traceability from the retail back to the batch that entered the packing facility. If the batches came from individual producers, batch traceability would provide traceability back to the producer. By including breaks in batches as they flow through the cutup floor, the challenges associated with maintaining traceability across the cutup floor would be reduced or eliminated. The issue of batch sizes would play a key role in the costs associated with batch traceability. Large batches that may correspond to a 1 day slaughter may require minimal modifications of process flows in existing facilities. The

cost associated with breaks in the cutup floor to accommodate smaller batches could become higher. Producer incentives and cooperation with packers could be used to match batch sizes to processing efficiencies in the slaughterhouse. From both food safety and meat quality viewpoints, it appears that batch traceability can provide most of the benefits of individual animal traceability. The incremental cost of batch traceability, in particular with large batches, would be small and existing market pressures will likely move the industry to batch traceability even in the absence of regulatory initiatives. Economic issues associated with the cost/benefit tradeoffs associated with reducing risk associated with smaller batch sizes when recalls are necessitated and the loss of productivity associated with breaks in the process will determine what batch sizes are most practical. Batch traceability could, however, disfavor the small producer who would likely be forced to sell small lots of pigs at a substantial discount or develop specialized markets for their products that could support the increased costs associated with small-batch traceability.

The issue of whether even batch traceability in the pork meat chain from retail back to the producer is viewed by U.S. producers, packers, or retailers as being important or economically viable is less apparent. Based upon comments from industry representatives at the two ICMISC meetings and contacts we have had with packers, it appears that some in the supply chain will be reluctant to support any traceability initiative, some have established a "wait and see" approach, and others believe some level of traceability beyond what we currently have may offer some economic benefits.

The need for establishing some form of traceability for the purpose of protecting the U.S. meat supply chain from natural disasters or acts of aggression (such as terrorism) is more difficult to predict. At the present time, it appears that the batch traceability approach can provide a reasonable level of protection but it is difficult to predict unforeseen technology developments, particularly in the presence of considerable ongoing activities around the world focusing on genetic alterations, that may require individual animal traceability to quickly respond to potential problems.

The perception that the EU has widespread individual animal traceability is just a perception and in reality the distinction between the traceability in the U.S. and that in the EU has more to do with semantics and marketing than with engineering or economics. Finally, the issue of Country of Origin Labeling (COOL) and its relationship between food safety and traceability has been considered. Although there may be a perception that COOL provides some form of traceability, our study shows that compliance with COOL requirements can be achieved without the use of traceability and without any substantial impact on food safety.

VIII. Lay Interpretation

Modern electronics and computer technology can be used to provide traceability in the U.S. pork chain from the retail counter back to the original animal in the farrowing house but the costs associated with identification tags in the live animals would be substantial and it would be difficult if not impossible to make the needed changes in many existing packing facilities to maintain this level of traceability. This would necessitate replacement of existing packing facilities with new construction. The resultant cost of meat with this level of traceability would, at least in the near term, be high and we believe the average U.S. consumer is not yet ready to pay for these increased costs. Most of the benefits from traceability, however, such as improved meat quality and improved food safety, could be derived with a batch traceability method in which retail products could be traced back to the producer by appropriately limiting the source of animals that constitute a batch. The incremental cost of batch traceability, in particular with large batches, would be small and existing market pressures will likely move the industry to batch traceability even in the absence of regulatory initiatives. Economic issues associated with the cost/benefit tradeoffs associated with reducing risk associated with smaller batch sizes when recalls are necessitated and the loss of productivity associated with breaks in the process will determine what batch sizes are most practical. Batch traceability, however, will disfavor small batches and thus disfavor small producers and if this type of traceability becomes a reality, the small producer will likely either face substantial discounts in what they are paid for their product or be forced to focus on more specialized markets. The perception that the EU has widespread individual animal traceability is just a perception and in reality the distinction between the traceability in the U.S. and that in the EU has more to do with semantics and marketing than with engineering or economics.

Finally, the issue of Country of Origin Labeling (COOL) and its relationship between food safety and traceability has been considered. Although there may be a perception that COOL provides some form of traceability, our study shows that compliance with COOL requirements can be achieved without the use of traceability and without any substantial impact on food safety.