



Canadian Food
Inspection Agency

Agence canadienne
d'inspection des aliments

Livestock identification and traceability regulatory proposal

**Reference document for second round of
consultations**

Final draft

2015-05-13

Canada



This document provides background information for livestock identification and traceability regulatory proposal communicated through a second round of consultations. The consultation document is available upon request at the following address:
trace@inspection.gc.ca

Table of Contents

Glossary.....	3
1. Purpose	6
2. Context.....	6
3. Directions adopted in the development of traceability systems	8
4. Desired outputs and outcomes.....	11
5. Performance measurement.....	14
6. Current state of livestock identification and traceability in Canada	16
7. Gap analysis.....	21
8. Regulatory and non-regulatory options considered.....	25
9. Discussion over program design	27
References.....	35
Annex. Literature review	43



Glossary

Animal (*animal*): a bison, bovine, caprine, cervid, ovine or pig.

Animal Traceability (*traçabilité animale*): the ability to follow an animal or group of animals during all stages of its life (OIE).

Bison (*bison*): an animal, other than an embryo or a fertilized egg, of the subspecies *Bison bison bison*, *Bison bison athabascae* or *Bison bison bonasus*.

Bovine (*bovin*): an animal, other than an embryo or a fertilized egg, of the species *Bos taurus* or *Bos indicus* [and any animal that is a cross with a *Bos taurus* or *Bos indicus* animal].

Caprine (*caprin*): an animal, other than an embryo or a fertilized egg, of the genus *Capra*.

Cervid (*cervidé*): an animal, other than an embryo or a fertilized egg, of the family Cervidae¹.

Conveyance (*véhicule*): means any aircraft, carriage, motor vehicle, trailer, railway car, vessel, cargo container or other contrivance used to move persons, animals or things. *Under the proposed regulations, the license plate of the trailer and not of the motorized vehicle needs to be reported.*

Event (*événement*): a significant occurrence or happening related to an object process, or person. *The receipt of an animal is an example of an Event.*

Farm (*ferme*): land and all buildings and other structures on that land, that is used under one management for breeding or raising animals but does not include an artificial insemination unit.

Farm of origin (*ferme d'origine*): the farm on which an animal is born or, if an animal is not born on a farm, the first farm to which it is moved after its birth.

Feedlot (*parc d'engraissement*): an operation that feeds animals and is operated in whole or in part for the purposes of growing or finishing animals by means other than grazing, but does not include (i) an overwintering site where cattle are fed and sheltered, or (ii) a site for breeding animals and their offspring².

¹ www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=180693

² Modification from definition under Alberta statute



Herd mark (*marque de troupeau*): the identification number of a site from which a large number of animals departs or is kept together.

Indicator (*identificateur*): means of identification for animals. *An ear tag is an example of an indicator. The word “indicator” is used hereunder to reflect that means of identification other than ear tags could be approved under the TRACE program.*

Indicator, activation (*activation d'un identificateur*): reporting that an approved indicator has been applied to an animal and its identification number.

Indicator, approved (*identificateur approuvé*): means of identification approved by the Minister [of Agriculture and Agri-Food Canada] under subsection 173(1) of the *Health of Animals Regulations* and listed on the [Canadian Food Inspection] Agency's web site as an approved indicator.

Indicator, secondary (*identificateur secondaire*): indicator applied jointly with an approved indicator and bearing the same identification number.

Ovine (*ovin*): an animal, other than an embryo or a fertilized egg, of the genus *Ovis*.

Party (*partie*): an individual, a group, or a body having a role in a business function. Party has a legal connotation in a business transaction.

Performance criteria (*critère de performance*): specifications for performance of a programme and are usually expressed in quantitative terms, such as “all animals can be traced to the establishment of birth within 48 hours of an enquiry” (OIE).

Pig (*porc*): an animal, other than an embryo or a fertilized egg, of the genus *Sus*.

Responsible administrator (*administrateur responsable*): a person who is authorized by the Minister [of Agriculture and Food Canada] to receive information in relation to animals or things to which the [Health of Animals] Act or these Regulations apply, is listed on the [Canadian Food Inspection] Agency's web site as an administrator and administers a national identification program in relation to certain animals of all or part of one or more genera, species or subspecies that are located in one or more provinces.

Site (*installation*): a place where animals or dead stock are kept or collected but does not include a conveyance. *“Site” is a synonym of “premises”. The term “site” is preferred hereunder as it currently used under the Regulations. “Establishment” is another synonym; it is used under the OIE Terrestrial Animal Health Code.*



Site, intermediate (*installation intermédiaire*): means auctions, assembly yards, buying stations, community pastures, competitive events, fairs, feedlots and backgrounders, training and education facilities, rest stations, feed and watering stations, exhibits, reproduction centres, quarantine stations, rodeos, test stations, veterinary clinics and sites managed by dealers and order buyers. *This definition does not include farms.*

Site, terminal (*installation terminale*): means a location where animals are slaughtered or dead stock is being disposed off-site such as abattoirs (inspection by federal or provincial governments, mobile abattoirs), rendering facilities, dead stock collection centres.



1. Purpose

The main purpose of this reference document is to provide background information on a regulatory proposal for livestock identification and traceability which will be the subject of a national consultation in May and June 2015.

The following documents will also be provided to support the consultation:

- Overview of federal livestock identification and traceability regulatory proposal – second round consultation document. Consultation paper;
- Evaluation of Three Livestock Movement Reporting Options to Support Tracing Investigations Following a Sanitary Issue in Canada.

The following guiding principles were considered when drafting the regulatory proposal:

- Building on efforts that have already been made;
- Building on existing positions and perspectives from national industry groups and provincial, territorial governments;
- Meeting the national performance criteria for livestock traceability systems (developed by the federal, provincial and territorial governments);
- Considering resources available to verify regulatory compliance;
- Addressing gaps in the current regulatory framework; and
- Harmonizing, where possible, regulatory requirements among species to support compliance and facilitate compliance verification.

2. Context

- 2.1. Animal traceability means the ability to follow an animal or group of animals during all stages of its life³.
- 2.2. There are three main pillars to livestock identification and traceability systems: the identification of livestock; the identification of sites where livestock have been kept, assembled or disposed; and events related to livestock, e.g., receipt of animals from another site.
- 2.3. The development of livestock identification and traceability systems is a priority for Canada's agriculture ministers (see chapter 3).

³ Article 4.1.1 of the OIE Terrestrial Animal Health Code:
www.oie.int/index.php?id=169&L=0&htmfile=chapitre_1.4.1.htm



- 2.4. The objective of the national livestock identification and traceability system is to provide timely, accurate, and relevant information to mitigate the impact of a sanitary issue or a natural disaster; and to support market access, competitiveness and consumer confidence.
- 2.5. Enhancements in the effectiveness of livestock traceability system, e.g. data quality, could be addressed through non-regulatory measures. This document describes gaps against national performance criteria which could be dealt with through a regulatory amendment, such as the following:
 1. livestock species that share diseases are not all subject to traceability requirements;
 2. the time period provided to report an event to a responsible administrator is too long to support an efficient response to disease outbreaks or natural disasters;
 3. the geographical precision of the traceability information is poor, and;
 4. information on the domestic movements of livestock is not known or readily available.
- 2.6. An amendment to the *Health of Animals Regulations* administered by the Canadian Food Inspection Agency (CFIA) is being proposed as a policy instrument to address the above-mentioned gaps.
- 2.7. The first version of this document served as the basis of discussion for a first round of national consultations held between November 2013 and April 2014.
- 2.8. This reference document has been revised based on comments received from the first round of consultations, from results of a Livestock Movement Study (Serecon, 2015) and from further revisions to the epidemiological evaluation of program design options (Canadian Food Inspection Agency, 2015). The document now serves as the basis for discussion for a second round of consultations on a regulatory proposal to address gaps and other miscellaneous issues.
- 2.9. A summary of comments received in the course of this second consultation will be provided.
- 2.10. Following publication in Part I of the Canada Gazette, citizens will have the opportunity to comment the draft regulations.
- 2.11. The coming into force date of the proposed regulations is expected in 2016.



3. Directions adopted in the development of traceability systems

This section describes national and international directions adopted in the development of livestock identification and traceability systems.

In Canada

- 3.1. Amendments to the federal *Health of Animals Regulations* came into force on 20 December 2000, introducing cattle and bison identification requirements. Sheep identification requirements were introduced on 11 December 2003, whereas pig identification and movement reporting requirements came into force on 1 July 2014 (the same requirements will apply to farmed wild boars on 1 July 2015).
- 3.2. Under the Federal, Provincial and Territorial Agricultural Policy Framework (2003-08), the following traceability targets were identified:
 - (a) the development by industry of traceability systems which would allow for 80% of domestic products available at the retail level to be traceable through the agri-food continuum;
 - (b) the development by industry of traceability components for all products/commodities within the food quality and food safety control systems, and;
 - (c) the sharing among governments and, where appropriate, with industry and other partners, of relevant data and information to support public health, and the ready availability of such data and information.
- 3.3. In 2006, federal, provincial and territorial ministers of agriculture announced the need for a National Agriculture and Food Traceability System (NAFTS) starting with livestock and poultry. Four sectors were prioritized in the development of a traceability system: bovine (including bison), ovine, pigs and poultry.
- 3.4. Under the federal, provincial and territorial *Growing Forward Agricultural Policy Framework* (2008-13), the following targets were identified for traceability:
 - (a) a National Agriculture and Food Traceability System in place;
 - (b) an enabling regulatory and legislative framework;
 - (c) a national information sharing solution available continuously;



- (d) an operable National Agriculture and Food Traceability System for Canada, and;
 - (e) premises identification across all regions and sectors.
- 3.5. In 2009, the federal, provincial and territorial ministers of agriculture indicated that livestock traceability systems should be mandatory by the end of 2011.
- 3.6. In an effort to enhance the traceability system in Canada, the Canadian Cattle Identification Agency (CCIA), Dairy Farmers of Canada, the Canadian Bison Association, the Canadian Sheep Federation, the Canadian National Goat Federation, and the Canadian Cervid Alliance have all agreed in principle with new or enhanced traceability requirements for their respective sector, under Part XV of the *Health of Animals Regulations*.
- 3.7. In April 2012, the CCIA completed its Cattle Implementation Plan (CIP) to identify the targets, steps and issues with regards to implementing traceability in the bovine industry⁴. The CIP has been endorsed by 17 bovine organizations.
- 3.8. Dairy Farmers of Canada (2013) drafted specific recommendations for dairy bovine traceability. Other industry groups have provided their input concerning acceptable traceability regulatory amendments: the Canadian Cervid Alliance (2011), the Canadian National Goat Federation (2011) and the Canadian Sheep Federation (2011).
- 3.9. The Federal *Safe Food for Canadians Act* received Royal Assent in 2012. The Act provides regulatory-making authorities to require persons in keeping records on the inter-provincial movements of food and food commodity.

Abroad and at the international level

For further information, see Literature Review in the Annex

- 3.10. The World Animal Health Organization (OIE) adopted “General principles on identification and traceability of live animals” and “Design and implementation of identification systems to achieve animal traceability” under its Terrestrial Animal Health Code. Canada’s livestock identification and traceability proposed systems are compatible with these OIE guidelines.

⁴ www.canadaid.com/documents/Cattle-Implementation-2012-04-02%20Dist%2004-09.pdf



- 3.11. In 2007, the International Dairy Federation adopted guiding principles for traceability and product tracing. "The dairy sector has taken the viewpoint that traceability and product tracing as a tool is not only relevant in the context of food inspection and certification systems, but may also be applied for industry-driven business reasons and is mainly concerned with food safety aspects".
- 3.12. The implementation of livestock traceability systems is used by some countries as a condition for import (e.g., European Union's requirements for the importation of horse meat, Korea's requirement for the importation of live bovine and beef).
- 3.13. In January 2013, the Department of Agriculture of the United States of America published inter-state livestock traceability requirements (referred to Animal Disease Traceability⁵). Livestock movements between states are identified and accompanied by an interstate certificate of veterinary inspection or other documentation. These rules came into force on 11 March 2013. The regulations apply to bison, bovine, ovine, caprine, cervids, equine and poultry.
- 3.14. The requirements for bovine identification, registration and tracing are governed by several pieces of European Union legislation, the most important being European Council (EC) Regulation 1760/00 which established a system for the identification and registration of bovine. It also pertains to the labelling of beef and beef products. EC Regulations 21/2004 and 504/2008 are the principal legislation covering the identification and registration for ovine, caprine and equine, respectively.
- 3.15. In Australia, bovine, ovine and caprine traceability is mandatory. The National Livestock Identification System (NLIS) is Australia's system for the identification and traceability of livestock. It was introduced in 1999 to meet European Union requirements for bovine exports. Since then it has expanded to enable bovine, ovine and caprine to be traced from the property of birth through to slaughter⁶.
- 3.16. In September 2006, Uruguay launched a mandatory program, overseen by the country's Ministry of Livestock, Agriculture and Fisheries, to require that all of its 12 million bovine be tracked with electronic tags as the animals pass from "cradle to fork."
- 3.17. In 2002, the Brazilian government created Sisbov⁷, a traceability system for bovines, in order to guarantee entrance into the international market, particularly Europe, a

⁵ www.aphis.usda.gov/traceability

⁶ www.mla.com.au/Meat-safety-and-traceability/National-Livestock-Identification-System

⁷ <http://www.agricultura.gov.br/animal/rastreabilidade/sisbov>



destination of nearly a third of the country's meat exports, and to meet the demand for more reliable and safer products⁸.

4. Desired outputs and outcomes

The following vision statement was developed by Canada's Industry-Government Advisory Committee (IGAC) for livestock traceability:

"To create an industry and government partnership resulting in secure data, networked into a value driven and sustainable traceability information system that meets Canada's private and public sector needs in our diverse agriculture and food industry to:

- *Enhance our ability to protect animal health and to address food safety issues*
- *Enhance industry competitiveness, retain or capture market opportunities."*

An overall objective for livestock traceability was also agreed upon:

"To provide rapid access to accurate and up-to-date traceability information; this information may be used to assist in managing emergencies resulting from a food safety issue, a natural disaster or an infectious disease that may spread slowly and insidiously (e.g. BSE), or more rapidly (e.g. foot-and-mouth)."

The following outputs and outcomes are specific to the livestock identification and traceability program administered by the CFIA.

4.1. Outputs

Outputs are the products or services produced by regulatory activities. Outputs are deliverables wholly under the control of an organization. The results that occur beyond outputs are not within the full control of the regulatory organization.

4.1.1. Secure databases

Under Part XV of the *Health of Animals Regulations*, regulated parties must report livestock identification and movement information to a responsible administrator. Significant resources have been allocated for the creation of Trace-Canada, an information system which could be used by responsible administrators. The administrator responsible for bison, bovine and ovine is the Canadian Cattle Identification Agency and the administrator responsible for pigs and

⁸ http://socialsciences.scielo.org/scielo.php?pid=S1413-05802006000200003&script=sci_arttext

farmed wild boars is the Canadian Pork Council. The administrator responsible for cervid and caprine would need to be identified before the proposed regulations come into force.

Part XV data is dealt in accordance with the *Privacy Act* and the *Access to Information Act*. The Government of Canada requires that all information systems collecting personal information under its control, such as Part XV data, must undergo a threat risk assessment. Government officials accessing traceability information systems need to be authorised based on their work description and having the proper security clearance.

4.1.2. Inspection tools

The Manual of Procedures for the livestock identification and traceability (TRACE) program provides CFIA inspectors with a description of the program, roles and responsibilities and explains the Compliance Verification System and associated tasks. It includes policies, regulatory clarifications, instructions, and procedures. The Manual of Procedures would be updated to reflect the new requirements, and be reviewed with and communicated to inspectors and industry associations before the regulations would come into force. The program's training course would also be updated based on new regulatory requirements.

4.1.3. Communications products

Industry, responsible administrators and governments would inform regulated parties on the new regulatory requirements. In particular, the CFIA would hold webinar sessions for national, regional and provincial agriculture and agri-food organizations representing the interests of the parties subject to the proposed regulations. Communications products, such as brochures and web pages, would be developed by industry and governments to inform the regulated parties of the new requirements before and after the regulations would come into force.

4.1.4. Available Information, Data Sharing Agreements

The CFIA and the responsible administrators are responsible for data integrity and quality. Data quality audits and evaluations are conducted based on the national data integrity framework.

The management of sanitary issues is a responsibility shared between the federal, provincial and territorial governments. Traceability data sharing agreements are signed between federal, provincial and territorial governments for the purpose of managing sanitary issues (e.g. disease control and surveillance activities) and verifying compliance.

4.2. Outcomes

Outcomes are not the direct result of a single regulatory activity; rather, they are affected by what the organization does. Outcomes are further qualified as immediate (also known as direct), intermediate, or ultimate.

4.2.1. Immediate outcomes

The immediate outcomes of the proposed regulations would be:

- Regulated parties and inspectors are aware of the regulatory requirements;
- International markets are aware of the program;
- Database and data management meet Government of Canada requirements (e.g. privacy), and;
- Authorized users have access to accurate and timely livestock traceability information.

4.2.2. Intermediate outcomes

The intermediate outcomes of the proposed regulations would be:

- Canadian livestock sector is compliant with the regulations;
- Informed decisions to manage and mitigate risks are made by federal, provincial and territorial veterinarians, scientists and decision makers, and;
- Traceability data is complete, accurate and up-to-date.

4.2.3. Ultimate outcomes

The regulatory proposal would contribute to the following strategic outcomes of the CFIA:

- Risks to Canadians from the transmission of animal diseases to humans are minimized;
- Risks to the Canadian animal resource base are mitigated;
- Risks to the Canadian public associated with the food supply system are mitigated;
- Domestic and imported animals and animal products are compliant with Canadian regulations and international agreements, and;
- International markets are accessible to Canadian food, animal, plant and their products.

4.2.4. Strategic outcomes

The regulatory proposal would contribute to the following Government of Canada's strategic outcomes:

- A fair and secure marketplace



- A traceability system will support the collection of enhanced traceability information for livestock in Canada. This information will assist in further protecting consumers as well as market access for the export of Canadian animal products.
- Healthy Canadians
 - A traceability system for Canadian livestock will equip stakeholders with information required to effectively manage disease outbreaks impacting food safety or human health due to spread of a zoonotic disease.
- A prosperous Canada through global commerce
 - A traceability system supports access to global markets and enhances confidence in the Canadian food system.
- A transparent, accountable and responsive federal government
 - A traceability system contributes to the ability of the federal government to report and respond to any livestock disease outbreaks in a timely and effective manner.

The regulatory proposal would also contribute to CFIA's strategic outcomes:

- A safe and accessible food supply and plant and animal resource base.

5. Performance measurement

Performance measurement of the program

The purpose of a performance measurement strategy is to ensure that program activities continue to meet their initial policy objectives and are accordingly renewed on an ongoing basis.

- 5.1. A performance measurement strategy for the TRACE program managed by the CFIA has been developed. Its purpose is to: (a) continuously monitor and assess the results of the program as well as the economy and efficiency of its management; (b) make informed decisions and take appropriate, timely action with respect to the program; (c) provide effective and relevant departmental reporting on the program; and (d) ensure that credible and reliable performance data are being collected to effectively support evaluation.
- 5.2. A program performance report is released annually.
- 5.3. An overall evaluation of the TRACE for ultimate outcomes and performance criteria is expected to be conducted during the 2016-17 fiscal year.



Performance criteria

- 5.4. The Federal, Provincial and Territorial Traceability Task Team (TTT) on traceability was charged with identifying livestock traceability information needs to efficiently manage a sanitary issue or a natural disaster.
- 5.5. The TTT developed performance criteria for the livestock identification and traceability program. Performance criteria are usually described in quantitative terms according to the epidemiology of the disease.
- 5.6. Livestock traceability performance criteria have also been developed by Australia⁹. The overall performance of the program is regularly assessed against those targets.
- 5.7. The regulatory proposal aims to meet the following performance criteria which have been approved by Federal, Provincial and Territorial Policy and Regulatory Assistant Deputy Ministers of agriculture:

“Within 48 hours of the relevant Chief Veterinary Officer or Competent Authority being notified of a sanitary issue or natural disaster or in the prevention or preparedness of such issue, it must be possible to...

- 1) *Establish the location(s) where a specified animal has been kept during its life.*
- 2) *Establish the location(s) from where animals at a given site were received.*
- 3) *Establish a listing of all animals that have been kept on the same location as the specified animal at any stage during those animals' lives.*
- 4) *Determine the current location of all animals that have been kept on the same site as the specified animal at any time during those animals' lives.*
- 5) *Determine the identification number and movement history of all conveyances used to transport animals to and from a given location.*
- 6) *Establish the location of a specified animal immediately prior to importation into Canada or the location of a specified animal immediately subsequent to exportation from Canada.*
- 7) *Establish the location and date at which deceased animals were sent, transported, received and disposed of (both on- and off-site), and a listing of those animals if identified individually”.*

⁹ www.animalhealthaustralia.com.au

Performance measurement and evaluation plan of the proposed regulations

Activities such as those listed below would need to be completed before the proposed regulations come into force in order to support compliance with the new requirements:

- Outreach
 - Communication products, information sessions provided to regulated parties on new requirements;
- Information Management
 - Information system ready to receive information;
 - Traceability data sharing agreements signed between CFIA and provincial, territorial governments;
 - Technological products provided to support data transmission;
- Administration
 - A responsible administrator identified for all species subject to Regulations;
 - Identity of responsible administrators communicated to regulated parties;
 - Agreements signed between the CFIA and responsible administrators;
 - Agreements signed between responsible administrators and database service providers;
- Technology
 - Indicators tested against performance and conformance criteria;
 - Pre-approved list of indicators communicated to regulated parties;
- Compliance Verification and Enforcement
 - Training course for inspectors amended to reflect new requirements;
 - Delivery of revised training course;
 - Manual of procedures amended to reflect new requirements, and communicated to regulated parties.

6. Current state of livestock identification and traceability in Canada

This section outlines the current state of federal and provincial livestock identification and movement reporting requirements; the level of movement information collected on a voluntary basis; the level at which agriculture and food premises have been identified; the compliance levels, and; activities conducted to support compliance.

Federal government requirements related to livestock identification and movement reporting

- 6.1. Amendments to the federal *Health of Animals Act* came into force on 22 November 2012. The new regulatory-making authorities provided under the Act enable full livestock traceability in Canada.



- 6.2. Livestock identification and traceability requirements under Part XV of the *Health of Animals Regulations* currently include the following: identifying bison, bovine, ovine and pigs; reporting the slaughter, disposal, import and export of bison, bovine and pigs; reporting the disposal and import of ovine; recording the domestic movements of ovine over 18 months that are not going directly to an abattoir and ovine that are bought or sold for reproductive reasons; recording and reporting the domestic movement of pigs; reporting the replacement of lost or damaged approved indicators; and reporting the sale of approved indicators.
- 6.3. Pig traceability became mandatory under Part XV of the *Health of Animals Regulations* on 1 July 2014. All the domestic movements of pigs are required to be reported within seven days by both the operators of the departure and the destination site. The same requirements will apply to farmed wild boars on 1 July 2015. After eight months of pig traceability regulations coming into force, approximately 160,000 pig departure events and 190,000 pig receipt events have already been reported to PigTrace.
- 6.4. Under Part IX of the *Health of Animals Regulations*, no person shall, without a permit issued by the Federal Minister, move or cause the removal of a cervid from one place in Canada to another place in Canada.
- 6.5. Under Part X of the *Health of Animals Regulations*, “every person conducting a public sale, auction or market of livestock, *Camelidae*, *Cervidae*, chickens, turkeys or game birds shall keep and make available for inspection by an inspector a record showing, with respect to each animal sold or received at the sale, auction or market, the complete, legal names and addresses of the consignor of every animal received and the purchaser of every animal sold at the sale, auction or market”.
- 6.6. Under Part XII of the *Health of Animals Regulations*, every railway company and motor carrier engaged in the extra-provincial or international transportation of livestock for hire shall keep a record of information on the conveyance in which animals are transported extra-provincially or internationally.

Information which must be recorded include the following: (a) the name and address of the shipper; (b) the name and address of the consignee; (c) the number, description and gross weight of the livestock or other animals; (d) the identifying number of the railway car or registration number of the motor vehicle; (e) the time when, date on which and place where the livestock or other animals came into the carrier's custody; and (f) the time when, date on which and place where the livestock or other animals were unloaded at destination.



Provincial and territorial government requirements related to livestock identification and movement reporting

- 6.7. Provincial and territorial governments are responsible for the identification and characterization¹⁰ of sites where animals transit. The identification of sites is currently mandatory through regulations in Quebec, Alberta, Manitoba and Prince Edward Island; and voluntary in the other provinces and territories.
- 6.8. Identifying and reporting the movement¹¹ of bovine, ovine and cervids is mandatory under Quebec regulations.
- 6.9. Regulations in Alberta require the following events to be reported: receipt of bovine at feedlots with more than 1,000 bovine heads; bovine birth dates; and the movement of pigs to abattoirs. In 2013, approximately 2.7 million livestock receipt events were reported to the information system managed by the Canadian Cattle Identification Agency (Canadian Cattle Identification Agency, 2013). Most of this information would have been reported from the Alberta feedlot move-in requirement; the rest of the information would have been reported voluntarily.
- 6.10. The four Western provinces have legislated the usage of documents (manifests) accompanying livestock when transported. These provinces require general animal information to be recorded on this manifest such as type and location of brand, or colour and type of livestock. Quebec is the only province to require the recording of individual animal identification numbers. The animal species for which a manifest is required is not consistent among those provinces.
- 6.11. Indicators are approved for cervids under provincial regulations for the Yukon, British Columbia, Alberta, Saskatchewan, Manitoba and Quebec. The application of two ear tags (i.e., double-tagging) to cervids is required in Alberta, Manitoba and Quebec.
- 6.12. The Government of Alberta requires the reporting of birth, movement, sale and death records (including animal identification numbers) of all farmed cervids.
- 6.13. The Government of Alberta has delegated responsibility for the administration and enforcement of the *Livestock Identification and Commerce Act* and the *Stray Animals*

¹⁰ Four data fields are collected through the characterization of premises: its location, a contact person for the premises, the types of operations on the premises, and the livestock species kept, assembled or disposed on the premises.

¹¹ With the exception of bovine and ovine movements within an operation and for a distance less than 10 km.



Act to Livestock Identification Services Ltd. (LIS). As such, LIS collects a broad range of livestock group movement data.

Identification and movement information collected from non-regulatory means

- 6.14. From 50,000 and 70,000 livestock departure events are reported voluntarily each year to the information system managed by the Canadian Cattle Identification Agency (Canadian Cattle Identification Agency, 2013).
- 6.15. The movements of livestock between the Western provinces and Ontario (and/or to other provinces further East) were monitored at West Hawk Lake (Manitoba) from 2006 to 2009.

Site (premises) information

- 6.16. As of February 2015, approximately 45,000 sites (premises) where beef cattle are kept were identified. Those figures were approximately 8,500 for pigs, 5,500 for ovine, 500 for bison, 1,800 for caprine, 300 for elk, 220 for deer and 8,000 for equine (Agriculture and Agri-Food Canada, 2015).

Compliance levels

- 6.17. The compliance level of tag distributors and dealers in reporting the issuance of approved tags has been relatively low. As a result, millions of data errors have been generated in information systems managed by responsible administrators. Significant resources have been allocated to resolve the issue. The gradual reduction in the number of dealers selling approved tags may reduce the importance of this issue.
- 6.18. There are few mechanisms to validate livestock import and export data reported to the responsible administrators. Export certificates only contain information on which animals were eligible to be exported. Such document, as it stands, may not be used to confirm which animals have been exported.
- 6.19. According to custom information, approximately 47,800 bovines were imported into Canada in 2013 for purposes other than slaughter¹². However, there were only 3,440 bovines reported as imported for the same year to the database of the responsible administrator (Canadian Cattle Identification Agency, 2013).

¹² <http://www.agr.gc.ca/eng/industry-markets-and-trade/statistics-and-market-information/by-product-sector/red-meat-and-livestock/red-meat-market-information-canadian-industry/imports-and-exports/livestock-imported-from-the-united-states/2013/?id=141586000008#cattle>



- 6.20. According to custom information, 1,056,805 bovines were exported from Canada to the United States of America¹³ in 2013. However, only 722,720 and 57,710 bovines were reported as exported for the same year to the CCIA (Canadian Cattle Identification Agency, 2013) and ATQ (Agri-Traçabilité Québec, 2015), respectively. The difference is 276,375 bovines being exported but not reported as such.
- 6.21. In 2013, approximately 2.77 million bovines¹⁴ and bison¹⁵ were slaughtered in federally- and provincially inspected abattoirs located outside of Quebec. This is relatively close to the 2.70 million tags reported as “retired” to the CCIA database (Canadian Cattle Identification Agency, 2013).
- 6.22. Based on the number of bovines slaughtered per year, an assumption could be made that approximately 2,7 million bovines are identified each year with an approved tag. Yet, there were only 921 tags reported as “Replaced” and 3,220 “Cross-Referenced” events to the CCIA in 2013. Those numbers are relatively low (0.04% of approved tags applied to bovines would be replaced) even when considering that that approved tags do not need to be replaced at abattoirs, rendering facilities or dead stock collection centres.

Compliance support: communications

- 6.23. The lists of indicators approved under the TRACE program are made available to regulated parties under the website of the CFIA and of responsible administrators.
- 6.24. Communications products (brochures, web pages) have been developed by governments and responsible administrators to inform regulated parties of their obligations under the Regulations.

Compliance support: research and development

¹³ http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?report_format_type_code=21&action=gR&signature=2E99B5FF75CBCB92D67D411DC44D29F8&pdctc=&r=191&pTpl=1&btnDownload=View

¹⁴ http://aimis-simia.agr.gc.ca/rp/index-eng.cfm?report_format_type_code=21&action=gR&signature=29A098E858DEF690386EC99AEE2FE0E7&pdctc=&r=105&pTpl=1&btnDownload=View

¹⁵ <http://www.agr.gc.ca/eng/industry-markets-and-trade/statistics-and-market-information/by-product-sector/red-meat-and-livestock/red-meat-market-information-canadian-industry/by-sector-reports/alternative-livestock/annual-game-report/?id=141586000117>



- 6.25. Numerous research and development (R&D) studies have been conducted in Canada over the last years to enhance the ability to rapidly and efficiently complete a livestock traceability investigation.
- 6.26. The first set of studies deal with the performance of indicators (retention, readability). Conformance and performance standards for the approval of indicators were raised in 2012 [Canadian Food Inspection Agency, 2014(b)] to support compliance with tag reading and application requirements. Studies are also being conducted to assess readability of Ultra-High Frequency (UHF) indicators.
- 6.27. The feasibility in reading and reporting the identification number of indicators applied to animals transiting through intermediate sites has been studied at auctions (Canadian Cattle Identification Agency, 2011(a), 2011(b), 2010; Integrated Traceability Solutions, 2010) and community pastures (Agriculture and Agri-Food Canada, 2010).
- 6.28. The transmission of traceability data to responsible administrators may be facilitated through data automation. Efforts have been made on the development of electronic manifests and forms.
- 6.29. A livestock traceability research and development conference was held in 2009 with the objectives to share information on the latest research projects and technologies, and to discuss research priorities. A research and development strategy presented at the conference in co-operation with the National Science and Engineering Research Council (NSERC) was not approved.

7. Gap analysis

A list of gaps between performance criteria and the current state assessment is captured in this chapter. This preliminary list helps identifying what could be addressed through the proposed regulations.

- 7.1. The scope of the traceability system is currently limited to bison, bovine, ovine and pigs and therefore does not support the principle that “no single species group (or sector) shall jeopardize the health status of another species”, as set by the Canadian Livestock Identification Agency.
- 7.2. Distributors of approved indicators are not currently subject to record-keeping requirements. This situation limits CFIA’s ability to verify compliance in reporting who purchased approved tags.



- 7.3. The names of persons who purchase approved indicators are reported to the information system of the responsible administrators. In the course of a traceability investigation, the assumption is made that an animal bearing an approved indicator was borne on the properties belonging to the person who purchased the approved indicator. Such assumption is sometimes false as there are illegal transactions of indicators occurring and not reported to the responsible administrators.
- 7.4. There is evidence that approved indicators issued to a site (and associated with a given person) are sold or given to other persons without the transaction being reported to the responsible administrator. Tag price discrepancy due to different levies from provincial industry associations taken from those tags is one reason for this situation. In the event of a disease outbreak, the situation may lead to a wrong herd being subject to a disease control investigation or even destruction.
- 7.5. There is no confirmation that approved indicators have actually been applied to animals. This has been a major hurdle in completing a trace-out investigation of feed and birth cohorts. This lack of information does not support performance criterion #4.
- 7.6. In the course of a disease surveillance and control activity, a Health of Animals (H of A) tag may be applied by a CFIA inspector to an animal or dead stock (H of A tags are not approved under the TRACE program). The identification number of a H of A tag is cross-referenced to the identification number of an animal tissue or blood sample sent to a laboratory for testing; and consequently to the test result. If this animal or dead stock leaves the farm of origin, it will be also identified with an approved indicator. Animal custodianship, location and movement information associated with the identification number of an approved tag is not linked with the animal health information linked with the identification number of an H of A tag.
- 7.7. There is no federal regulatory requirement to report the movement of animals to, within and from farms, with the exception of pigs.
- 7.8. Intermediate sites usually receive animals from a high number of sources (in-degree), and animals transiting through these sites are often further dispatched to multiple destinations (out-degree). Due to the high level of co-mingling, the movement of livestock through these sites poses greater sanitary risks. As the movement of livestock through these sites is not reported at the national level, a gap in the traceability program exists.



- 7.9. Currently, location information for departure or destination sites usually corresponds to the mailing address of the parties subject to traceability requirements. This information provides poor geographical information on the location of animals and does not support the performance criteria.
- 7.10. The site where the animals or dead stock were loaded into the conveyance before arriving at a terminal site is usually an information that is only recorded; and therefore not readily available. Reporting such information to the responsible administrator instead of recording it would greatly enhance the ability to trace-in and to meet performance criteria.
- 7.11. Due to a lack of data sharing agreement, the history of an animal borne outside Quebec and transported to Quebec for slaughter may not be completed. The reverse situation is also true. Each year, approximately 100,000 bovines are “imported” in Quebec from another province, and 50,000 bovines are “exported” from Quebec to another province (Statistics Canada, 2012).
- 7.12. Currently, the transportation of animals not bearing an approved indicator is prohibited. However, the carriers may not always be in a position to verify that animals loaded into a conveyance are identified with an approved indicator (e.g., darkness, speed of loading). This situation leads to compliance issues.
- 7.13. The history is conveyance usage for the transportation of livestock is not readily available. This lack of information does not support performance criterion #5.
- 7.14. It is currently prohibited to receive animals not bearing an approved indicator. In many cases, this is unavoidable for the consignee as they are not in a position to verify that animals loaded into a conveyance, destined for their operation are identified with an approved indicator.
- 7.15. The type of operation eligible to be a tagging site (e.g. intermediate site) and the purpose for which tagging sites may be used should be clarified.
- 7.16. Currently, the requirement is for the approved indicator to be applied to bison or bovine immediately after they are received at the tagging site. The word “immediately” has led to different interpretations by the CFIA’s inspection staff and needs to be clarified.
- 7.17. The disposal of dead stock not identified with an approved indicator is not required to be reported to the responsible administrator. This lack of information does not support performance criterion #7.



- 7.18. Information on the disposal of dead stock disposed at the farm and bearing approved indicators must only be recorded. The lack of readily available on-site disposal of dead stock does not support performance criterion #7.
- 7.19. The off-site disposal of dead stock bearing approved indicators must be reported to the responsible administrator within 30 days of disposal. The 30-day time period in reporting the information does not support performance criterion #7 which is based on the ability to complete a trace-in within 48 hours.
- 7.20. When animals are exported, only the identification number on the approved indicators applied to them must be reported to the responsible administrator. The lack of information about the location of the departure and destination sites of these animals significantly impedes the ability to trace their movements.
- 7.21. Every person who imports an animal shall apply or cause the application of an approved indicator to the animal either before its importation or as soon as the animal reaches its initial destination. There is a risk that animals located in foreign countries and identified with Canadian approved indicators are perceived as being born in Canada, which could be misleading in the event these animals are not actually imported into Canada. In cases where these animals are diseased, this could lead to a non-justified trade embargo against Canada.
- 7.22. Every person who imports an animal is required to report to the responsible administrator enough information about the origin of the animal to allow the origin to be traced. The information requested is not specific and does not support performance criterion #6.
- 7.23. The person who imports an animal shall report import information to the responsible administrator within 60 days and 30 days, for bison and bovine, respectively. The 30- or 60-day time period in reporting the information does not support performance criterion #6.
- 7.24. Currently, the operator of an abattoir is not required to report the retirement of an indicator applied to an animal imported for immediate slaughter, or to report enough information about the animal to allow the origin to be traced. This does not support performance criterion #6.



Case study: traceability information in support of BSE investigations

Since 2003, Canada has had 19 cases of Bovine Spongiform Encephalopathy (BSE). The epidemiological investigation for a BSE case include the following elements: (a) identifying the birth farm and other farms where the infected animal may have lived; (b) examining feeds the animal may have consumed during its first year of life (considered the susceptible period); (c) tracing all cattle born 12 months before and after the birth of the BSE infected animal on the birth farm; and (d) locating all cattle that may have consumed the same feed as the BSE-infected animal during its first year of life (tracing out). BSE epidemiological investigations follow the recommended BSE guidelines (Terrestrial Animal Health Code 2008) of the World Organization for Animal Health.

The first 18 BSE Cases

In three (3) of the eighteen BSE cases, the farm of origin of the infected animal was never determined. This would probably be due to the loss of approved tags and noncompliance with the regulatory requirement for replacing the tag and linking the former and new tag ID number in the central database. For BSE cases where the farm of origin was established, after weeks and even months of investigations, 27% of the cattle needed to be traced-out were “traced and presumed to have died or been slaughtered” and 9% were “untraceable because of records limitations”.

8. Regulatory and non-regulatory options considered

This section describes the range of regulatory and non-regulatory options considered to address the issue or risk identified, including the proposed regulatory action and the key differences between the options. Four options have been considered.

1. *Status Quo* (national identification requirements for bison, bovine and ovine; some provincial movement requirements for bovine, ovine and cervid, and; some provincial and territorial identification requirements for cervid)

A voluntary system does not ensure participation by all custodians of livestock in the development of a traceability system. Following the introduction of bison and bovine identification requirements in January 2001, the compliance rate for the program was approximately 40%. From the time violations of identification requirements were subject to monetary penalties (July 2002), the compliance rate increased above 90%. With potentially incomplete livestock identification and movement information being reported, the efficacy of



the traceability system would not be guaranteed, while additional animal identification and movement reporting costs would be borne by the industry.

2. An amendment to the *Health of Animals Regulations* that would meet information needs to manage a sanitary issue according to the first recommendation made under the epidemiological evaluation of program design options (Canadian Food Inspection Agency, 2015).

Federal, provincial and territorial governments identified the livestock traceability information which would be needed to properly manage a sanitary issue and natural disasters, as well as the time period at which such information should be reported and accessed.

Through this option, operators of all sites (with the exception of cervid farms) would be required to report the individual receipt of animals at their site (i.e. reading, recording and reporting the identification number of approved tags applied to the animals) and the identification number of the departure site of those animals. Farmers raising cervids would be subject to the same requirements with the exception that they would report the departure of cervids from their farms instead of their receipt.

The program design would be market-neutral as all sites would be subject to the same requirements.

3. An amendment to the *Health of Animals Regulations* that would meet information needs to manage a sanitary issue according to the second recommendation made under the Epidemiological evaluation of program design options (Canadian Food Inspection Agency, 2015).

The epidemiological evaluation demonstrates that following requirements would lead to the same level of traceability efficacy as for the first recommendation (described above under option 2):

- farmers would report both the individual departure and receipt of animals (reading and reporting the identification number of indicators) and the location of both the sites of departure and of destination;
- operators of terminal sites would be subject to the same requirements as stated under option 2, i.e. to report the individual receipt (reading and reporting the identification number of indicators) and the location of the departure site, and;
- operators of intermediate sites would report the movement of animals as a group (i.e. not required to read, record or report the identification number of approved tags) and the location of the departure site.



Under this option, farmers would be subject to significantly more regulatory burden than the rest of the value chain stakeholders. Moreover, farmers already cover most of the traceability costs with the purchase of indicators.

4. Amend the *Health of Animals Regulations* to solely reflect industry positions.

The vast majority of program design elements recommended by industry groups support addressing gaps identified hereunder and would be included under the proposed regulations. However, according to the epidemiological evaluation (Canadian Food Inspection Agency, 2015), there are elements of industry recommendations that would not enhance Canada's ability to manage the outbreak of a disease that spreads slowly or rapidly.

The approach recommended by the CFIA is option 2 which is reflected under the consultation document.

9. Discussion over program design

The requirements and activities conducted to support the objectives of a program are referred to as the program design. There are six program design elements being discussed in this consultation document:

- Scope of the program;
- Animal identification requirements;
- Maintaining animal's history;
- Application and activation of indicators;
- Setting the geographical precision of trace investigations, and;
- Movement reporting requirements.

The overall objective is for the design to meet program's objectives.

9.1. Scope of the program

In 2006, when the need for a national agriculture and food traceability system was announced, federal, provincial and territorial ministers prioritized four sectors: bovine (including bison), ovine, pigs and poultry. The proposed regulations outlined in this document address three of those sectors: bovine, bison and ovine. Separate regulations focussing on pig traceability came into force on 1 July 2014; the same requirements will apply to farmed wild boars on 1 July 2015.

In 2011, industry-government advisory committee members recommended not moving forward with federal traceability requirements for live birds. The feather industry groups already capture enough information to support effective and rapid trace-ins and trace-outs, with the exception of information from non-commercial operations where birds are kept. This gap could be addressed through the identification of premises, an initiative led by provincial and territorial governments.

All of the sectors prioritized in the development of a traceability system participate in the industry-government advisory committee. The caprine, cervid and horse sectors were not prioritized in 2006 but have shown interest developing traceability systems. Three different scenarios were examined for the scope of the consultations and proposed regulations:

1. *Status quo*, i.e., enhanced traceability for bison, bovine and ovine, which are already subject to Part XV requirements – base level
2. Base level + caprine and cervid
3. Base level + caprine, cervid and horse.

The criteria considered when determining the scope of the consultations and proposed regulations were:

- Level of risks mitigated;
- Industry's readiness and willingness to adopt new regulatory requirements; and
- Availability of sufficient inspection and program resources.

Level of risks mitigated

As diseases may be spread across species, broadening the scope of the program would mitigate the impact of certain disease outbreaks. The Canadian Food Inspection Agency (2013) developed a matrix (Table 2) showing the number of reportable diseases species share. Each of the 22 reportable diseases was researched in order to find the list of susceptible species. The distribution of the number of diseases shared by each pair of species was obtained and the following categories were used to develop the qualitative classification:

Category	Percentile range	Number of diseases shared
Very Low (VL)	Up to 5 th percentile	6
Low (L)	From 5 th to 25 th percentile	6
Moderate (M)	From 25 th to 50 th percentile	7
High (H)	From 50 th to 75 th percentile	8-9
Very high (VH)	From 75 th percentile to max	>9



Table 2. Level of sharing of disease (qualitative) amongst species to be impacted by proposed regulatory changes to traceability.

	Bovine	Ovine	Caprine	Bison	Horse	Cervid
Bovine		H	H	H	VL-L	H
Ovine			VH	M	VL-L	H
Caprine				M	VL-L	H
Bison					VL-L	M
Horse						VL-L

The matrix show that equine share the least number of diseases with other species which are already subject or are planned to be subject to Part XV of the Regulations. It is however recognized that by excluding equine from the proposed regulations, the impact of disease outbreaks affecting equine would not be mitigated.

Industry’s readiness and willingness to adopt new regulatory requirements

As indicated hereunder, significant actions have been taken and are planned by the private and public sectors to facilitate the implementation of traceability systems. With respect to willingness, national industry groups representing the bison, bovine, ovine, caprine, cervid and horse sectors agreed that federal regulations would be the favoured policy instrument. However, consensus among horse owners with regards to regulations has not been reached.

9.2. Animal identification requirements

Bison, bovine and ovine and dead stock of those species shall be identified with an approved indicator before leaving their farm of origin. A unique identification number made of 15 digits following the ISO 11784 standard (which includes a code specific to a country) is printed on each approved indicator.

Operators of terminal sites are already required under the Regulations to read, collect and report a 15-digit animal identification number. Conducting these activities with non-electronic indicators is labour-intensive and prone to data entry errors. In preparation for the proposed regulations, non-electronic indicators approved under the national program are gradually being phased-out and replaced with electronic indicators (e.g., currently, all tags approved for bison and bovine are electronic).



However, identification approaches for species that are planned to be introduced to Part XV of the Regulations (i.e., caprine, cervids) need to be developed. Considerations in the development of these identification approaches include:

- the cost of the indicator versus the value of the animal;
- the animal's morphology and the agricultural practices it is subject to; and
- the cost-effectiveness of reading and reporting the identification number of animals through different means (e.g. group of animals bearing non-electronic and electronic indicators).

Cost of indicators versus the value of animals

For the animals already included under Part XV, i.e., bison and bovine, and mature ovine, the cost of electronic indicators is relatively small compared to the value the animal.

For cervids, each animal would be identified with an approved indicator bearing an identification number unique to the animal. This approach would build on current provincial requirements. Moreover, based on industry's recommendation, cervids would also be identified with a secondary non-electronic indicator.

The unique identification of each ovine and caprine slaughtered at a young age is perceived by industry as cost-prohibitive. Other countries require a relatively cheap option: a non-electronic indicator bearing a site identification number (also referred to a "herd mark") applied to ovine and caprine aged 12 months or less and transported directly from the farm of origin to an abattoir^{16, 17}.

Currently, dead bovine, bison and ovine shall be identified with an approved indicator bearing a unique identification number when disposed off-site. Concerns have been raised regarding the cost-effectiveness of this regulatory requirement. On the other hand, requiring employees of rendering plants and dead stock collection centres to manually read, record and report the identification number of a non-electronic indicator applied to dead stock could become an occupational health hazard.

Animal's morphology and agricultural practices

Because of the morphological traits of some caprine breeds (e.g., small ears) and the handling practices of dairy caprine (e.g., individual station), indicator locations other than ear tags (e.g., leg bands) would need to be considered.

¹⁶ www.scotland.gov.uk/Publications/2010/02/08120157/7

¹⁷ <https://www.gov.uk/sheep-and-goats-identification-registration-and-movement>



Reporting the movement of animals identified through different means

If animals or dead stock received at a site are identified in different manners, the operator of the destination site may be required to purchase multiple readers to read and report the identification number of those indicators. These additional costs to read and handle animals may eventually be paid by the producers.

Recognition of foreign indicators

Under the regulations that came into force on 1 July 2014, imported animals bearing a foreign indicator do not need to be re-identified with a Canadian approved indicator “if the Minister determines that the foreign indicator meets the criteria set out in the regulations and that the identification number on the indicator can be entered and tracked in the responsible administrator’s database”. The policy is that foreign indicators would need to be of the same technology and bear the same level of information as Canadian-approved indicators in order to be recognized as equivalent. Currently, U.S. ear tags bearing a unique identification number following the ISO 11784 standard (including a country code) applied to imported dairy bovine and pig are considered equivalent. A slap tattoo with an identification number unique to a herd or location that is unique in Canada and the U.S. and applied to pigs imported from the U.S. for immediate slaughter is also considered as an equivalent mean of identification.

Application of secondary indicators in addition to primary, approved indicators

The Government of Quebec requires the application of a secondary tag to bovine, ovine and cervids. Moreover, the identification number of the primary and secondary indicators must match. Additionally, the Government of Alberta also requires that cervids be identified with two tags bearing the same identification number.

The dairy bovine sector currently encourages its members to apply a secondary indicator throughout the country. However, as this is a voluntary measure, there is no compliance verification or enforcement measures being taken. A request was made by the Dairy Farmers of Canada to require, at the federal level, the application of both primary and secondary identifiers to all dairy bovine before they leave their farm of origin. However, making a distinction between dairy and beef bovine in the regulations may be challenging.

Building on current requirements in Quebec, the Canadian Cervid Alliance has also requested that all cervids be identified with primary and secondary identifiers before they leave their farm of origin or before they reach one year of age.

9.3. Application and activation of indicators

The activation of an indicator is an event whereby a person reports to the responsible administrator the date and the location that an approved indicator was applied to an animal, along with the identification number of that indicator. There are three main benefits in reporting this event:

1. To confirm the location of an animal at a given time;
2. To narrow down traceability investigations by excluding indicators sold to regulated parties but not yet applied to animals; and
3. To enable the identification of birth cohorts and herd inventories at different points in time.

Quebec regulations require the application of tags to bovine and ovine within seven days of the animal's birth at a farm, within five months after birth on pasture, or before its departure from its farm of origin or pasture, whichever comes first. Under the same regulations, cervids must be identified before the end of the calendar year in which they were born or before their departure from their farm of origin, whichever comes first. In Quebec, tags must be activated within seven days of the animal's identification or before its departure from its farm of origin, whichever event comes first.

Dairy Farmers of Canada and the Canadian Cervid Alliance have requested that the identification of their animals be required within a certain time period after birth.

9.4. Maintaining animal's history

Maintaining the history of an animal, i.e., having access to information on an animal (e.g., date of birth, its departure from a site, etc.) is a key consideration with livestock traceability. All events related to an animal and reported to the responsible administrator are cross-referenced to the unique identification number of that animal. The history of an animal may therefore not be maintained in the event its indicator is lost or has been removed. Actions have already been taken through regulatory and non-regulatory means to reduce the probability of an animal's history being lost:

- requiring the application of a new approved indicator in the event the previously applied indicator has fallen off and, to cross-reference in the administrator's database the identification number of the former (if known) and of the new approved indicators applied to the animal;
- increasing the performance requirements for the approval of indicators under the program;
- setting a data retention period standard for information systems that collect traceability information; and
- prohibiting the removal of foreign indicators applied to imported animals; and



- considering foreign indicators as equivalent to domestically-approved indicators, so that imported animals do not need to be re-identified when they enter Canada.

Additional measures that are explored under the proposed regulations are:

- removing the option of having Canadian approved indicators sent to other countries and applied to animals that may not end up coming to Canada, and;
- requiring the application of a secondary animal indicator in addition to the primary, approved indicator.

9.5. Setting the geographical precision of traceability investigations

Each person or organization subject to Part XV requirements has an account under the responsible administrator's database. Tombstone information such as name, contact information, type of operation and mailing address is associated with each database account. The regulated party's account number under the responsible administrator's database is currently being reported as the departure and destination points of animals and animal indicators. Therefore, under the current program, the geographical points of trace-ins and trace-outs do not correspond to past or current locations of animals, but to the mailing address of their custodians. This issue has been discussed since 2002 and has led to the site (premises) identification initiative. In 2006, provinces and territories were tasked to identify and characterize agricultural and food sites based on the national standards agreed through the livestock traceability industry-government advisory committee. Different instruments have been used by provinces and territories to meet this policy (e.g., regulations, cross-compliance, voluntary measures).

As provinces and territories have control over land titles and legal land description information, they are best positioned to validate site location information that has been provided through the identification process. In addition to location information, contact information, type(s) of agriculture and agri-food operation(s) and livestock species kept on the site are captured through the site identification and characterization process.

9.6. Domestic movement reporting requirements

Events that are reported to the responsible administrator under the federal TRACE program only relate to the start (e.g., issuance of tags, import) and end (e.g., slaughter, export) of the animals' presence in Canada, but exclude movement events taking place between the farm of origin and a terminal site. Information on the movement of animals through intermediate sites (e.g., auctions, feedlots) is currently provided voluntarily by custodians of livestock (e.g., from declaring the presence of an animal at a given location, also known as a "sighting") or through provincial requirements (e.g., declaring the movement of bovine to feedlots in Alberta that



have more than 1,000 bovines). The lack of information on the movement of animals through these sites undermines the efficiency of the TRACE program.

In order to support the discussion on which livestock movement information is critical in managing risks, and as a consequence which type of livestock movements should be required to be reported, the CFIA mandated the realization of a Domestic Livestock Movement Demographic Study (Serecon, 2015).

In addition, an epidemiological evaluation of program design options was realized in 2013. It was revised in spring 2014 to further review how program design recommended by industry could address risks. The final version of the evaluation has been provided under this second round of consultations (Canadian Food Inspection Agency, 2015). It has been revised based on the findings of the above-mentioned livestock movement study. The analysis of which domestic livestock movements should be reported is captured under the revised epidemiological evaluation.

References

AGRICULTURE AND AGRI-FOOD CANADA, 2015: PID Max matrices – Multi-Species. RDIMS #6554078.

AGRICULTURE AND AGRI-FOOD CANADA, 2010: Federal Community Pasture Traceability Project Summary. RDIMS #4407790.

AGRI-TRAÇABILITÉ QUÉBEC, 2015: number of bovines reported to the ATQ database as “exported” in 2013. Request made by email.

ALABAMA DEPARTMENT OF AGRICULTURE AND INDUSTRIES, 2013:
http://www.agi.alabama.gov/infectious_disease/scrapie-detail-info

BIGRAS-POULIN, M., K. Barfod, S. Mortensen, and M. Greiner, 2007: Relationship of trade patterns of the Danish swine industry animal movements network to potential disease spread. *Prev. Vet. Med.* 80, 143-165.

BIGRAS-POULIN, R.A. Thompson, M. Chriel, S. Mortensen, and M. Greiner, 2006: Network analysis of Danish cattle industry trade patterns as an evaluation of risk potential for disease spread. *Prev. Vet. Med.* 76, 11-39.

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE, 2013a:
www.cdfa.ca.gov/ahfss/Animal_Health/Domestic_Goats.html

CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE, 2013b:
www.cdfa.ca.gov/ahfss/Animal_Health/Sheep.html

CANADIAN CATTLE IDENTIFICATION AGENCY, 2013: Annual Report.
http://www.canadaid.com/documents/Annual_Report_Master_online.pdf

CANADIAN CATTLE IDENTIFICATION AGENCY, 2012: Summary of the cattle industry traceability plan. As recommended by the Cattle Industry and Requested by the Industry Government Advisory Committee (IGAC). Revised April 2, 2012.

CANADIAN CATTLE IDENTIFICATION AGENCY, 2011(a): Study of radio frequency identification systems at livestock auction markets and buying stations in Canada. Phase Two: National Applied Research Project. 20 p.

CANADIAN CATTLE IDENTIFICATION AGENCY, 2011(b): Study of by-pass software for use with RFID systems at auction markets and buying stations in Canada. Phase Two-B: National Applied Research Project. 24 p.

CANADIAN CATTLE IDENTIFICATION AGENCY, 2010: Study of radio frequency identification systems at livestock auction markets across Canada. National Applied Research Project. 97 p.

CANADIAN CERVID ALLIANCE, 2011: Policy points for regulatory amendments to Part XV HOA regarding farmed cervid traceability. September 2011. 3 p.

CANADIAN FOOD INSPECTION AGENCY, 2015: Evaluation of Three Livestock Movement Reporting Options Applied at Intermediate Sites to support tracing investigations following a Sanitary Issue in Canada. V46. Animal Health Risk Assessment, Canadian Food Inspection Agency. Non-published report.

CANADIAN FOOD INSPECTION AGENCY, 2014(a): Evaluation of Three Livestock Movement Reporting Options Applied at Intermediate Sites to support tracing investigations following a Sanitary Issue in Canada. V46. Animal Health Risk Assessment, Canadian Food Inspection Agency. Non-published report.

CANADIAN FOOD INSPECTION AGENCY, 2014(b): Animal Indicator Approval and Revocation Framework. Livestock Identification and Traceability Program. Document developed by the industry-government National Identification and Methodology Advisory Committee. 40 p.

CANADIAN FOOD INSPECTION AGENCY, 2013: Comparative table of diseases shared among ruminants (domestic and wild) and horses. Animal Health and Welfare Management, Canadian Food Inspection Agency. Non-published report.

CANADIAN FOOD INSPECTION AGENCY, 2011(a): Livestock traceability in Canada – an epidemiological perspective. Animal Health and Welfare Management, Canadian Food Inspection Agency. Non-published report.

CANADIAN FOOD INSPECTION AGENCY, 2011(b): Livestock Traceability Movement Information Requirements For Cattle. Animal Health Risk Assessment, Canadian Food Inspection Agency. Non-published report.

CANADIAN NATIONAL GOAT FEDERATION, 2011: Policy decision points: goat identification. 4 p.

CANADIAN SHEEP FEDERATION, 2011: Livestock traceability system regulatory requirements description; sector: Canadian sheep industry. 10 p.

CHRISTLEY, R.M., S.E. Robinson, R. Lysons, and N.P.French, 2005: *In Proc. Soc. Vet. Epidemiol. Prev. Med.*, 234-244.

DAIRY FARMERS OF CANADA, 2013: Next steps in cattle traceability in selected provinces. Project report. Project reference (AAFC): TRAC-028-DFC. 121 pages (185 pages with appendices).

DUBE, C., C. Ribble, D. Kelton, and B. McNab, 2011: Estimating potential epidemic size following introduction of a long-incubation disease in scale-free connected networks of milking cow movements in Ontario, Canada. *Prev. Vet. Med.* 99, 102-111.

DUBE, C., C. Ribble, D. Kelton, and B. McNab, 2010: An analysis of the movement of dairy cattle through 2 large livestock markets in Ontario, Canada. *Can. Vet. J.* 51, 1254-1260.

DUBE, C., C. Ribble, D. Kelton, and B. McNab, 2008: Comparing network analysis measures to determine potential epidemic size of highly contagious exotic diseases in fragmented monthly networks of dairy cattle movements in Ontario, Canada. *Transbound. Emerg. Dis.* 55, 382-392.

GOVERNMENT OF SOUTH AUSTRALIA, 2013a:

www.pir.sa.gov.au/biosecuritysa/animalhealth/other_animals/deer/deer_identification_movement_and_trading_requirements/property_registration

GOVERNMENT OF SOUTH AUSTRALIA, 2013b:

www.pir.sa.gov.au/biosecuritysa/animalhealth/other_animals/deer/deer_identification_movement_and_trading_requirements

GOVERNMENT OF THE UNITED KINGDOM, 1989: The Tuberculosis (Deer) Order, accessed 12 July 2013: www.legislation.gov.uk/uksi/1989/878/article/13/made

GOVERNMENT OF WESTERN AUSTRALIA, 2013:

www.agric.wa.gov.au/objtwr/imported_assets/content/aap/si/nlis/lstockidmvt_deer_camelids_bam.pdf

GOVERNMENT OF WESTERN AUSTRALIA, accessed 4 July 2013:

www.agric.wa.gov.au/PC_95188.html?s=1001

ILLINOIS ANIMAL IDENTIFICATION, 2013 :

www.agr.state.il.us/premiseid/illinoisanimalidentification.pdf

INTEGRATED TRACEABILITY SOLUTIONS. 2010. Traceability Systems & Technologies Pilot in Alberta Auction Markets: Scanning Metrics. October 1, 2009 through June 30, 2010. 63 p.



NATIONAL INSTITUTE FOR ANIMAL AGRICULTURE, 2013: Joint Strategy Forum on Animal Disease Traceability, Denver CO, August 6-7 2013, White paper: Bringing Industry and Regulatory Leaders Together to Create Sensible Solutions, http://animalagriculture.org/2013-joint-strategy-forum-on-adt/documents/ADTWhitePaperandAddendums_000.pdf

IRELAND DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE, accessed 4 July 2013a: www.agriculture.gov.ie/animalhealthwelfare/animalidentificationmovement/nationalsheepidentificationsystem/

IRELAND DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE, 2012: www.agriculture.gov.ie/media/migration/animalhealthwelfare/animalidentificationandmovement/nationalsheepidentificationsystem/NSISInformationBooklet230512.pdf

IRELAND DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE, accessed 4 July 2013b: www.agriculture.gov.ie/animalhealthwelfare/animalidentificationmovement/nationalsheepidentificationsystem/sheepidentificationandtagging/#d.en.43130

IRELAND DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE, accessed 4 July 2013c: www.agriculture.gov.ie/animalhealthwelfare/animalidentificationmovement/nationalgoatidentificationsystem/

IRELAND DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE, accessed 4 July 2013d: www.agriculture.gov.ie/animalhealthwelfare/animalidentificationmovement/nationalgoatidentificationsystem/dispatchdocuments/

KENTUCKY DEPARTMENT OF AGRICULTURE, 2013: www.kyagr.com/statevet/livestock-and-poultry.html#cervids

KISS, I.Z., D.M. Green, and R.R. Kao, 2006a: The effect of contact heterogeneity and multiple routes of transmission on final epidemic size. *Math. Biosci.* 203, 124-136.

KISS, I.Z., D.M. Green, and R.R. Kao, 2006b: The network of sheep movements within Great Britain: network properties and their implications for infectious disease spread. *J. R. Soc. Interface* 3, 669-677.

KISS, I.Z., D.M. Green, and R.R. Kao, 2006c: Infectious disease control using contact tracing in random and scale-free networks. *J.R. Soc. Interface* 3, 55-62.

MAY, R.M., and A.L. Lloyd, 2001: Infection dynamics on scale-free networks. *Phys. Rev. E* 64, 066112.1- 066112.4.

MCLAWS, M., Ribble, C., 2007: Description of recent foot and mouth disease outbreaks in nonendemic areas: Exploring the relationship between early detection and epidemic size. Can. Vet. J. 48, 1051-1062.

MEAT & LIVESTOCK AUSTRALIA, 2012a: www.mla.com.au/Meat-safety-and-traceability/National-Livestock-Identification-System/NLIS-contacts

MEAT & LIVESTOCK AUSTRALIA, 2012b: www.mla.com.au/Meat-safety-and-traceability/National-Livestock-Identification-System/NLIS-sheep-and-goats

MEAT & LIVESTOCK AUSTRALIA, 2012c: www.mla.com.au/Meat-safety-and-traceability/Livestock-Production-Assurance/Vendor-declarations

MEAT & LIVESTOCK AUSTRALIA, 2012d: www.mla.com.au/Meat-safety-and-traceability/National-Livestock-Identification-System

MINNESOTA BOARD OF ANIMAL HEALTH, accessed 12 July 2013:
<http://mn.gov/bah/animals/deer-elk/cervid-faq.html#30>

MONTANA OFFICIAL STATE WEBSITE, accessed 12 July 2013:
http://liv.mt.gov/content/ah/orders/Notice_230

NAIT Ltd., 2013a: www.nait.co.nz/nait-scheme/

NAIT Ltd., 2013b: www.nait.co.nz/farmers/

NAIT Ltd., 2013c: www.nait.co.nz/news-and-publications/nait-act-becomes-law/

NAIT Ltd., 2013d: www.nait.co.nz/farmers/deer-farmers/

NEW SOUTH WALES LIVESTOCK HEALTH AND PEST AUTHORITIES, accessed 11 July 2013a:
www.lhpa.org.au/identifying-and-tracing-livestock/property-identification-codes

NEW SOUTH WALES LIVESTOCK HEALTH AND PEST AUTHORITIES, accessed 11 July 2013b:
www.lhpa.org.au/identifying-and-tracing-livestock/brands-and-earmarks

NEW SOUTH WALES LIVESTOCK HEALTH AND PEST AUTHORITIES, accessed 11 July 2013c:
www.lhpa.org.au/moving-stock

NORTHERN TERRITORY GOVERNMENT, 2013:

www.nt.gov.au/d/Primary_Industry/index.cfm?header=Importing%20Deer

OKLAHOMA AGRICULTURE FOOD AND FORESTRY, accessed 12 July 2013:

www.oda.state.ok.us/ais/farmedcervidae.htm

ORTIZ-PELAEZ, A., D.U. Pfeiffer, R.J. Soares-Magalhães, F.J. Guitian, 2006: Use of social network analysis to characterize the pattern of animal movements in the initial phases of the 2001 foot and mouth disease (FMD) epidemic in the UK, *Prev. Vet. Med.* 76, 40-55.

QUEENSLAND GOVERNMENT, 2013a: www.daff.qld.gov.au/animal-industries/moving-selling-livestock/national-livestock-identification-system/property-registration

QUEENSLAND GOVERNMENT, 2013b: www.business.qld.gov.au/industry/agriculture/animal-management/land-management-for-livestock-farms/welfare-and-transport-of-livestock/branding-livestock

QUEENSLAND GOVERNMENT, 2013c: www.daff.qld.gov.au/animal-industries/moving-selling-livestock/regulations-for-transporting-and-selling-livestock/waybills

RIBBLE, C., Meek, A.H., Shewen, P.E., Guichon, P.T., Jim, G.K., 1995: Effect of pretransit mixing on fatal fibrinous pneumonia in calves. *J. Am. Vet. Assoc.* 207, 616-619.

ROBINSON, S.E., and R.M. Christley, 2007: Exploring the role of auction markets in cattle movements within Great Britain. *Prev. Vet. Med.* 14, 21-37.

ROBINSON, S.E., M.G. Everett, and R.M. Christley, 2007: Recent network evolution increases the potential for large epidemics in the British cattle population. *J. R. Soc. Int.* 4(15), 587-762.

SERECOM INC, 2015: Domestic Livestock Movement Demographic Study. Prepared in cooperation with the Canadian Animal Health Coalition. 72 p.

SERECOM MANAGEMENT CONSULTING LTD, 2011: West Hawk Lake zone: Producer participation and ease of access. Evaluation of the level of producer participation and ease of access of the West Hawk Lake zoning initiative system (2009-2013). Final report. 33 p.

SHIRLEY, M.D.F., and S.P. Rushton, 2005: Where diseases and networks collide: lessons to be learnt from a study of the 2001 foot-and-mouth epidemic. *Epidemiol. Infect.* 133, 1023-1032.



STATE OF VICTORIA DEPARTMENT OF ENVIRONMENT AND PRIMARY INDUSTRIES, 2013a: www.depi.vic.gov.au/agriculture-and-food/animal-health-and-welfare/interstate-livestock-movements/deer

STATE OF VICTORIA DEPARTMENT OF ENVIRONMENT AND PRIMARY INDUSTRIES, 2013b: www.depi.vic.gov.au/agriculture-and-food/animal-health-and-welfare/interstate-livestock-movements

STATISTICS CANADA. 2012. Cattle Statistics. Catalogue no. 23-012-X. 62 p.

THE SCOTTISH GOVERNMENT, 2010a: www.scotland.gov.uk/Publications/2010/02/08120157/3

THE SCOTTISH GOVERNMENT, 2010b: www.scotland.gov.uk/Publications/2010/02/08120157/5

THE SCOTTISH GOVERNMENT, 2010c, <http://www.scotland.gov.uk/Publications/2010/02/08120157/9>

THE SCOTTISH GOVERNMENT, 2010d: www.scotland.gov.uk/Publications/2010/02/08120157/10

THE SCOTTISH GOVERNMENT, 2010e: www.scotland.gov.uk/Publications/2010/02/08120157/11

THE SCOTTISH GOVERNMENT, 2010f: www.scotland.gov.uk/Topics/farmingrural/Agriculture/animal-welfare/Diseases/15721/2966

THE SCOTTISH GOVERNMENT, 2013: www.scotland.gov.uk/Topics/farmingrural/Agriculture/animal-welfare/Diseases/MovementRestrictions/GenLicence

U.K. ANIMAL HEALTH AND VETERINARY LABORATORIES AGENCY, 2012: www.defra.gov.uk/ahvla-en/keeping-animals/registering/other-species

U.K. ANIMAL HEALTH AND VETERINARY LABORATORIES AGENCY, 2013a: www.gov.uk/sheep-and-goats-identification-registration-and-movement

U.K. ANIMAL HEALTH AND VETERINARY LABORATORIES AGENCY, 2013b: www.gov.uk/sheep-and-goats-identification-registration-and-movement#reporting-your-sheep-and-goat-movements



U.K. DEPARTMENT OF ENVIRONMENT, FOOD AND RURAL AFFAIRS, 2009:

www.gov.uk/government/uploads/system/uploads/attachment_data/file/69413/pb13327-sheeps-goats-guidance-091209.pdf

U.K. DEPARTMENT OF ENVIRONMENT, FOOD AND RURAL AFFAIRS, 2013a:

www.defra.gov.uk/ahvla-en/disease-control/premises-licence/sheep-eid-cprcs/

U.K. DEPARTMENT FOR ENVIRONMENT, FOOD & RURAL AFFAIRS, 2013b: www.gov.uk/deer-health-welfare-and-movement#movement-identification-and-tracing-of-deer

U.S. ANIMAL AND PLANT HEALTH INSPECTION SERVICE, 2013:

www.aphis.usda.gov/traceability/downloads/ADT_summary_species.pdf

U.S. CODE OF FEDERAL REGULATIONS, accessed 12 July 2013: www.gpo.gov/fdsys/pkg/CFR-2013-title9-vol1/xml/CFR-2013-title9-vol1-part81.xml (Title 9, part 81)

U.S. DEPARTMENT OF AGRICULTURE, 2013:

www.aphis.usda.gov/newsroom/2012/12/pdf/traceability_final_rule.pdf

UTAH DEPARTMENT OF AGRICULTURE AND FOOD, accessed 12 July 2013:

<http://ag.utah.gov/divisions/animal/elk/documents/ElkFarmingRegs.pdf>

WELSH GOVERNMENT, 2013:

<http://wales.gov.uk/topics/environmentcountryside/ahw/faranimaltracing/sheepandgoatidentification/?lang=en>

WELSH GOVERNMENT, 2011:

<http://wales.gov.uk/topics/environmentcountryside/ahw/faranimaltracing/animalmovementlicences/aml24deer/?lang=en>

WELSH GOVERNMENT, 2010:

<http://wales.gov.uk/docs/drah/publications/120412rulesforidentifysheepgoatsen.pdf>

WELSH GOVERNMENT, 2009:

<http://wales.gov.uk/topics/environmentcountryside/ahw/faranimaltracing/generalmovementlicences/genlicmoveofdeer/?jsessionid=E70FE3385F4AAFA1FA50E012F1496294?lang=en>

WISCONSIN DEPARTMENT OF AGRICULTURE, TRADE AND CONSUMER PROTECTION, 2013:

http://datcp.wi.gov/animals/animal_movement/deer_elk/



Annex. Literature review

Bovine and bison

Excerpt from Canadian Food Inspection Agency (2011a)

As a result of the detection of Bovine Spongiform Encephalopathy (BSE) in Europe and the risk that it posed to human health, the council of the European Union introduced regulations concerning the identification and registration of bovine and the labelling of beef products (EU, 1996) which led to the regulations regarding the European bovine identification and registration system: the bovine passport system (EC Regulation No. 1760/2000, 2000). The key requirements of Regulation No. 1760/2000 are:

- Every bovine must be registered and individually identified using one ear indicator in each ear.
- Individual paper passports are required for all bovine animals and passports must accompany the animals when they move.
- The governments of the Member States must be informed of each animal movement.
- Member States must maintain a computerised bovine tracing database.
- Animal keepers must maintain up-to-date registers of on-farm bovines.

As a result, all European Union (EU) countries have implemented computerized livestock movement databases. For example, the United Kingdom (UK) has, since 1998, the Cattle Tracing System (CTS) which is managed by the Department for the Environment, Food and Rural Affairs (DEFRA) and the Netherlands has had an identification and registration system since 1992 which was significantly overhauled in 2006 and is maintained by the Ministry of Agriculture, Nature and Food Quality. In Switzerland, the Swiss Animal Movement Database (TVD renamed Identitas Ltd in 2006) was initiated in 1998 and is maintained by a private company, with the Swiss Government represented as a majority shareholder.

In the United Kingdom (UK), an analytical system, Rapid Analysis and Detection of Animal-related Risks extracts and shows the animal movement information in order to rapidly draw the restricted areas at the outset of an outbreak and also provides an initial estimate of the potential geographical extent of the dissemination associated with bovine movements.

This piece of information, if available at the first detection of a case of foot-and-mouth disease (FMD) in Canada would bring tremendous insight into determining the size of the Control Area in which movements would be restricted and in directing our surveillance efforts. Intelligent tracing (by having knowledge of animal movements and by targeting those livestock operations that pose a great risk for further dissemination) and testing for disease or clinical signs has been shown to be much more effective than simply randomly targeting farms for surveillance



(around detected-infected premises alone for example) (Kiss *et al.*, 2006c). Therefore the ideal early response to an incursion of a highly contagious disease would require prior knowledge of the level of risk posed by various livestock operations in the population through their animal movement activities, and the actual potential spread that could have taken place based on the amount and location of movements during the incubation period.

Having access to animal movement databases which document all movements in one animal's life can therefore be used in preparedness to learn about the patterns of animal movements and the role of different livestock operations in these networks. This information can then be used in simulation modelling and other preparedness efforts in order to inform and validate contingency plans.

As a result of the level of information now available in these complete livestock movement databases in countries such as the UK, social network analysis methods have been applied to study these movements. Rather than simply understand the frequency of movements by type of operation, it now becomes possible to understand the interactions among all operations in the population. By building networks in which livestock operations represent nodes and livestock movements link the nodes together, it becomes possible to identify the operations that control the flow of animals in the network, those operations that are at greater risk of becoming infected and of disseminating a disease agent to a large number of other operations. Targeting these highly important and highly connected operations for surveillance, education and disease control, would drastically improve our chances of quickly controlling the spread of a highly contagious disease agent. Below are the main findings from various network analysis studies of livestock movements.

The common findings of descriptive livestock movement studies has been the heterogeneity of contacts among livestock operations, or the high variance in the number of potential contacts, either incoming and /or outgoing, per operation, and the localized potential transmission of infection with the potential for long-distance jumps. In 2005, Christley *et al.* studied bovine movements in Great Britain. By looking at movements over 4-week long periods through farms, markets and dealers in year 2002, they were able to identify livestock operations of importance in the flow of animals in the network of animal movements. While most livestock operations had relatively few connections to source and recipient operations, a few which were most likely markets and dealers, had a vast number of incoming and outgoing connections. Also, markets and dealers were important in linking pairs of operations in the network by having a central place in the flow of animals.

Robinson and Christley (2007) compared the movements of bovine through auction markets to the number of bovine moving from farm to farm using weekly networks and yearly networks in 2002-2004. Forty-one percent of bovine shipments through markets were dispersed to 2-4 livestock operations. Extreme cases occurred where a shipment of bovine was dispersed to 62



holdings on a single day and similarly, one holding purchased bovine at the market which were brought in from 63 holdings. This clearly demonstrated the risk of livestock markets in spreading infections in the population. Furthermore, it was shown that movements through markets covered longer distances than movements from farm to farm directly, increasing the risk that markets pose in disseminating infections in distant areas. Although each farm in the network appeared to use two markets on average, there was a great deal of variation between markets with highly skewed distributions in terms of the number of farms selling bovine to and buying bovine from each market.

In addition to markets, some farms were also important in controlling the flow of animals from one part of the network to another part. The authors identified these holdings as cut-points which if removed from the network, fragmented the network (Robinson and Christley, 2007). The markets were also highly connected due to their high buying and selling activities, which makes them important for building communication pathways and for information dissemination within the livestock industry.

Bigras-Poulin *et al.*, (2007; 2006) described the networks of bovine movements over a 179-day period and swine movements over a 232-day period in Denmark in 2002-2003. A significant level of heterogeneity in animal movements was also observed in these studies. Also, the distance of movements of bovine and swine was skewed to the right indicating that a small proportion of movements were long distance movements.

The UK 2001 FMD outbreak has also provided a network of contacts among infected premises that has been studied using network analysis (Ortiz-Pelaez *et al.*, 2006; Shirley and Rushton, 2005a). In 2005, Shirley and Rushton studied what they called the FMD network, or the network of nine livestock markets and 239 premises infected from 20 February to 15 March 2001. They found that a few livestock dealers monopolized a large proportion of the total links between livestock operations in the network and were responsible for the early long-distance movement of ovine. Then, once the movement bans were in place and markets were closed, clustering or a pattern of contagious spread was attributed to the further spread.

In 2006, Ortiz-Pelaez *et al.* obtained movement records of bovine and ovine in the initial phase of the outbreak, prior to the implementation of the national movement ban and used network analysis measures to identify key players in the initial spread of infection. Among the findings, ten operations: three farms, four markets, and three dealers were identified as key players in the initial spread of infection. These farms, which appear to have a movement pattern similar to markets or dealers, are difficult to detect beforehand and pose a very high risk to the spread of an infectious disease agent within the network. The authors suggested a few key measures which should be obtained for all farms in the network beforehand and these farms should be targeted for disease control activities once primary actors like markets and dealers have been contained.



Robinson *et al.* (2007) studied successive weekly networks of bovine movements from 2002-2004 and showed that since the bovine movement regulations were put in place in 2001 in the UK, a reorganisation of the bovine industry has led to it becoming increasingly connected. These regulations were meant to reduce the potential for large epidemics by lowering the number of animal movements. By reducing each individual's contacts in the network, it was also anticipated that this rule would result in a less cohesive network (Robinson *et al.*, 2007). Instead, they have led to a self-organizing system that has potentially increased the size of infectious disease epidemics within the bovine industry. Hypotheses of increased communications between livestock producers resulting in a more connected network to allow maximum movement within the current movement restrictions and of an increased reliance on markets for animal trades were proposed (Robinson *et al.*, 2007). Although the movement regulations do not appear to have led to a decreased cohesion of the network, they can still be effective in reducing potential epidemic size as they allow a time period for clinical signs of FMD to develop. Should producers examine their animals on a daily basis in this situation, these measures could be effective at limiting the spread of the virus. However, if clinical signs of FMD are missed, the consequences could be as dramatic as in 2001.

The results of network analysis studies of livestock movements in the UK and in Denmark show the importance of understanding and characterizing these networks for the purposes of disease control. A significant finding is the level of heterogeneity in contacts among the various livestock holdings in the networks. Highly connected livestock operations are therefore very important to identify in advance of disease incursions so they can be targeted for education and also for rapid intervention during epidemics. Livestock markets are one of the potential highly connected operations, along with livestock dealers and even some individual farms.

Epidemics can spread faster on heterogeneous networks due to the existence of hubs, or highly connected nodes as compared to random networks of equivalent size (Kiss *et al.*, 2006c). However, once the hubs are infected and have infected their partners, infection then spreads more slowly than on random networks (Kiss *et al.*, 2006a; Kiss *et al.*, 2006b). Therefore, disease control strategies that target the most highly connected nodes (or hubs) in a network will be more effective than those that randomly target nodes (Kiss *et al.*, 2006c; May and Lloyd, 2001). These concepts provide support for efforts to be directed at the identification of infected farms during an epidemic, rather than randomly depopulating farms which for the most part, might not be infected. By having knowledge of animal movements early on in an outbreak, we improve our chances of quickly finding infected herds.



Caprine and ovine

The principle components of traceability programs for caprine and ovine in countries other than Canada are primarily focused on the tagging (identification) of animals, movement recording, premise identification and record keeping requirements. Although there is some variation between the different countries, there are also many similarities with regards to the traceability requirements for caprine and ovine in other jurisdictions.

United States of America

On 9 January 2013, the United States published the Final Rule on Traceability for Livestock Moving Interstate in order to establish general regulations for improving the traceability of livestock moving between US states. Caprine and ovine are subject to these regulatory requirements and must be officially identified and accompanied by an interstate certificate of veterinary inspection (ICVI) or other type of documentation when they are moved between states (National Institute For Animal Agriculture, 2013).

The new Federal rule requires that all caprine and ovine that are moved interstate must be officially identified prior to the interstate movement, unless they are exempt from the official requirements of the rule or they are officially identified after the movement, as provided for under the new rule. An authorized device or method must be used to identify caprine and ovine that are require official identification. Group or lot identification is also permitted for both caprine and ovine under the rule (US Federal Register, accessed 4 October 2013).

As the Federal rule establishes uniform minimum standards for the identification and movement of livestock in the US, each state is responsible for developing, owning and administering their own livestock traceability program. However, these state-specific systems must meet the federal rule and they must accept all official animal identification methods (National Institute for Animal Agriculture, 2013).

In Alabama, all caprine and ovine must bear USDA ear tags before change of ownership occurs by sale, trade, private treaty or auction and before they are transported to a livestock market, slaughter facility, show, fair, petting zoo or exhibition. Registered caprine that have a legible registry tattoo and that are accompanied by their registry certificate do not require tags. However, the tattoo must be registered as a unique entity with the breed registry and the appropriate US government offices (Alabama Department of Agriculture and Industries, 2013).

The state of California requires that caprine be officially identified (with either an ear tag indicating a unique identification number that is approved by the USDA and the state, a registration tattoo or electronic identification that is accompanied by registration papers including the tattoo or EID number as appropriate, a USDA issued premises ID tattoos beginning



with the two digit state code for non-registered caprine, voluntary Scrapie Flock Certification Program Identification (SFCP) ear tags, tattoos or electronic ID, or official USDA ear tags), with the exception of caprine less than 18 months of age in slaughter channels and that are not pregnant and have not kidded or aborted, low risk commercial caprine, castrated caprine less than 18 months of age that are not for exhibition and caprine that are being moved for grazing without change of ownership (California Department of Food and Agriculture, 2013a). Ovine in the state of California must be identified with either official USDA ear tags, electronic implants or RFID, an official registry tattoo (if recorded in a Purebred Registry Association Book with documentation attached to the CVI) or premises identification ear tags or tattoos. Ovine that are exempt from identification are those are less than 18 months of age that have not lambed, have not aborted, or are not pregnant, are moved directly to a state or federally approved slaughter facility, and castrated ovine less than 18 months of age, except those that are for exhibition (California Department of Food and Agriculture, 2013b).

In addition to the animal identification requirements outlined under the Federal rule, the state of Illinois requires that all caprine and ovine moved within the state be officially identified to their flock/herd of birth, with the exception of caprine and ovine moving directly from a farm to an auction or market, all caprine moving directly to slaughter and ovine under 18 months of age that being moved directly to slaughter and that have not lambed and are not pregnant (Illinois Animal Identification, 2013).

Australia

In Australia, the National Livestock Identification System (NLIS) database provides information on the movement of caprine and ovine. Although NLIS is a national database, each Australian state or territory has its own set of NLIS Regulations that may differ slightly from the national requirements (Meat & Livestock Australia, 2012a).

In terms of animal identification requirements, ovine and managed caprine in Australia must be identified with an NLIS visual or RFID ear tag before they leave the property on which they were born. Caprine and ovine that are identified with a visual tag can only have their movements tracked on a mob-basis (Meat & Livestock Australia, 2012b). Mob-based movement (MBM) recording involves the movement of "mobs" or groups of animals. Within NLIS, the database entry reference to 'individual' caprine or ovine only applies to animals which are electronically identified (Government of Western Australia, accessed 4 July 2013). Mob-based movement recording is mandatory in New South Wales, South Australia and Western Australia and is voluntary in Queensland and Victoria. Only animals that are uniquely identified can be traced on an individual basis (Meat & Livestock Australia, 2012b).

State or Territory authorities will issue a unique Property Identification Code (PIC) to identify individual parcels of land used for agricultural purposes. Every time an animal moves to a property with a different PIC, or to a site such as a feedlot, sale yard or abattoir, the PIC it



moved from and to is recorded in the NLIS database, therefore establishing a 'life history' of movements for that animal (Meat & Livestock Australia, 2012a). In terms of movement records, the Livestock Production Assurance (LPA) National Vendor Declaration (NVD) and Waybill (or LPA NVD/Waybill) is required for all livestock movements, whether it is to a sale yard, a processor or between properties that have different PICs (Meat & Livestock Australia, 2012c).

New Zealand

National Animal Identification and Tracing (NAIT) (NAIT Ltd., 2013a) is New Zealand's national livestock traceability database. Animal identification and tracing are mandatory for bovine and deer in New Zealand (NAIT Ltd., 2013b). Caprine and ovine are not subject to traceability requirements in this country. There is no indication if and/or when caprine and ovine will be subject to mandatory animal identification and tracing in New Zealand. However, given that the NAIT scheme only became mandatory for bovine on 1 July 2012 and on 1 March 2013 for deer (NAIT Ltd., 2013c), it is possible that caprine and ovine could become subject to the animal identification and tracing legislation at some point in the future.

United Kingdom

In the United Kingdom, all keepers of caprine and ovine must be registered with their local authorities and must obtain a Country Parish Holding Number (CPH) for the land on which the animals will be kept. Once a keeper is registered and has obtained a CPH number, he/she is then assigned a unique flock mark (for ovine) or herd mark (for caprine), which is then used to identify the producer's animals. The herd or flock mark is also required to purchase tags/identifiers (U.K. Animal Health and Veterinary Laboratories Agency, 2013a; The Scottish Government, 2010a; Welsh Government, 2010).

In both England and Wales, caprine and ovine must be identified within six months of birth if housed overnight or in an intensive husbandry system; within nine months of birth if not housed overnight/raised in an extensive husbandry system; or whenever they are moved off their holding of birth, whichever event occurs first (U.K. Animal Health and Veterinary Laboratories Agency, 2013a, Welsh Government, 2010). Producers in England that keep caprine and ovine over the age of twelve months must identify these animals with two identifiers (typically two ear tags). For ovine, one of these identifiers must be electronic (U.K. Animal Health and Veterinary Laboratories Agency, 2013a). Ovine producers in Wales are required to double identify all breeding ovine as well as ovine that are to be kept beyond 12 months of age with one electronic identifier and one visual identifier. Caprine are not subject to compulsory full EID but their identity must be indicated in the herd records (Welsh Government, 2013).

In Scotland, caprine and ovine that are born or identified after 31 December 2009, as well as those animals that are kept for breeding purposes or beyond the age of 12 months, must bear two identifiers, one of which must be electronic for ovine (The Scottish Government, 2010b).



When lambs or kids are intended for slaughter before they reach 12 months of age in England, the producer has the option to identify his/her animals with only one ear tag bearing their flock or herd mark (U.K. Animal Health and Veterinary Laboratories Agency, 2013a). In Wales, lambs that are intended for slaughter before the age of 12 months can be identified with either full EID or a batch slaughter tag (visual or EID). Caprine intended for slaughter before the age of twelve months can be tagged with a single visual or EID batch slaughter tag (Welsh Government, 2010). Similar requirements are in place in Scotland, where both lambs and kids that are intended for slaughter within 12 months of birth must be identified with one tag (referred to as a slaughter tag and which is an electronic tag for lambs) (The Scottish Government, 2010b).

On-farm records (referred to as holding registers) also a requirement in the United Kingdom. In England, caprine and ovine keepers are required to record detailed information regarding their holding as well as each animal on the holding in their registers. Keepers may either record the movement details for each individual animal themselves, or they may opt to have this information recorded by a central recording point once the caprine and ovine have left the holding (U.K. Animal Health and Veterinary Laboratories Agency, 2013a). Central Point Recording Centres (or CPRCs) are locations such as markets, abattoirs and collection centres that are approved as reading points to record the details of electronically identified caprine and ovine that have been moved to these premises (U.K. Department of Environment, Food and Rural Affairs, 2013a). The CPRCs read individual EIDs on behalf of keepers and subsequently provide this information to keepers for use in completing their holding registers (U.K. Animal Health and Veterinary Laboratories Agency, 2013a).

Caprine and ovine keepers in Scotland and Wales are also required to keep holding registers or herd/flock records. The registers and records must contain detailed and precise information on the holding itself, on the animals kept on the holding and on animal movements on or off the farm (The Scottish Government, 2010c, Welsh Government, 2010).

Both individual animal and mob-based (or batch) movements of caprine and ovine are required to be recorded and reported in England when animals are moved to land with a different CPH number than the main holding. For movements where there is no change of keepership, the move may be recorded as a batch for all animals. However, once there is a change of keepership, the move must be recorded and reported individually for double-identified animals or for those that are moved in a mixed batch (for slaughter animals) (U.K. Department of Environment, Food and Rural Affairs, 2009). All movements must be recorded in a keeper's holding register and on the movement document called the AML1 (U.K. Animal Health and Veterinary Laboratories Agency, 2013b).

In Scotland, individual animal recording is required for electronically identified ovine, with the exception of farm-to-farm moves where there is no change of ownership. In the latter situation, mob- or batch based recording is allowed. The movement of double identified caprine is



required to be reported on an individual basis, with the exception of mob movements from one farm to another where there is no change of ownership. Individual animal recording is not required for lambs and kids intended for slaughter within 12 months of birth and batch movement recording is permitted for these animals (The Scottish Government, 2010b). Animal movements in Scotland must be recorded using the movement document (MD) and reported to the Scottish Animal Movement Unit (SAMU). Additionally, all animal movements from a holding must be accompanied by a movement document (The Scottish Government, 2010d). Critical Control Point (CCP) recording centres, which are similar to the Central Point Recording Centres in England, are available to producers in Scotland (The Scottish Government, 2010e).

Caprine and ovine keepers in Wales are required to use the AML1 movement document to record animal movements. All caprine and ovine born on or after 31 December 2009 must be individually identified on movement documents (Welsh Government, 2013). Batch movement recording is permitted when caprine and ovine are moved to from one holding to another, provided both holdings are under the same ownership, and when animals are sent to a Central Point Recording Centre to have their individual identities read (Welsh Government, 2010).

Ireland

In Ireland, the National Sheep Identification System (NSIS) provides full traceability for all ovine, on an individual animal basis (Ireland Department of Agriculture, Food and the Marine, 2013a). The system requires that all ovine flock keepers and their holdings be registered, that all ovine be identified and that the total number of ovine as well as details of all ovine present on the holding be recorded annually in an on-farm flock register. Complete recordings in the register of all on- and off-farm ovine movements are also required (Ireland Department of Agriculture, Food and the Marine, 2012).

Registered keepers are issued a flock number and all extensively reared ovine must be tagged with a least one tag before they reach the age of 9 months or before they leave their holding of birth, whichever event occurs first. Ovine that are reared under intensive husbandry conditions must be identified before they reach 6 months of age or before they leave the holding, whichever occurs first. All breeding ovine must be tagged electronically (Ireland Department of Agriculture, Food and the Marine, 2012). Ovine that are destined for slaughter before the age of 12 months are only required to be tagged once, with a conventional slaughter tag (Ireland Department of Agriculture, Food and the Marine, accessed 4 July 2013b). Furthermore, all ovine born after 31 December 2009 are also required to retain one tag number during the course of their life that comes from the holding of origin. This first tag number is to be recorded on all movement documentation throughout the course of the animal's life (Ireland Department of Agriculture, Food and the Marine, 2012).

Ovine producers are required to complete a dispatch or movement document each time ovine are moved on or off of their holding. When ovine are sent to marts or slaughter houses, these movements are notified to the Animal Identification and Movement (AIM) computer system by



the mart or other food business operator (Ireland Department of Agriculture, Food and the Marine, 2012).

The National Goat Identification System (NGIS) is based on the double tagging of all caprine by the age of six months or on movement from the holding, whichever event occurs first, as well as the use of herd registers and the use of dispatch documents to record animal movement events. All caprine keepers must apply to have their holding registered with their local authority (Ireland Department of Agriculture, Food and the Marine, accessed 4 July 2013c).

The electronic identification of caprine is optional in Ireland. If EID is not used, then caprine must be double tagged using conventional tags, both bearing the same individual identification number (Ireland Department of Agriculture, Food and the Marine, accessed 4 July 2013c).

A dispatch/movement document must accompany caprine that are moved off of a holding and must remain with them throughout their movement. It must include the individual identification code of all the caprine being moved, unless the caprine were born before 31 December 2009 and are being moved to a slaughterhouse (Ireland Department of Agriculture, Food and the Marine, accessed 4 July 2013d).

Cervid

The principle components of traceability programs for farmed cervids (deer and elk) both in North America as well as other countries are primarily focused on the tagging (identification) of animals, movement recording, premises identification and record keeping requirements, as is the case with other livestock species. Although there are some countries and jurisdictions that have more specific and detailed regulatory requirements than others, there are also many similarities between the different regulatory frameworks with regards to the traceability requirements for cervid species.

Australia

Unlike bovine, ovine and caprine, deer are not subject to the National Livestock Identification System in Australia (Meat & Livestock Australia, 2012d). However, there are some state- or territory-specific requirements with regards to the traceability requirements for farmed deer in this country.

The state of South Australia requires that all properties that have deer on them have a Property Identification Code (PIC) (Government of South Australia, 2013a). Deer that are moved within South Australia must be identified with an ear tag indicating their PIC, but no movement documentation is required in these cases. Deer that enter South Australia from another state (i.e., interstate movement) are required to be accompanied by a South Australian Health Certificate and a movement permit (Government of South Australia, 2013b).



In Western Australia, deer must be identified and livestock owners must be registered with the state Department of Agriculture and Food. Registered owners are then issued a PIC as well as identifiers (such as earmarks and brands) related to that PIC. Deer in Western Australia may be identified with any or all of the following identifiers: the owner's registered brand that has been impressed on an approved ear tag and applied to the ear specified on the PIC card; the owner's registered earmark applied to the ear specified on the PIC card; and/or any identifier that has been approved by a breed society. Deer must be identified either at first muster, before they reach 12 months of age, or before they are moved from the property, whichever event occurs first. However, animals below the age of 12 months do not have to be identified if they are moved in the company of their legally identified mother, provided the movement is to another property with the same PIC. Deer that are sold and that bear registered identifiers belonging to the previous owner do not need to be re-identified provided that current owner has proof of purchase. With regards to movement documentation requirements in Western Australia, a waybill is required for all movements on and off a given property. A waybill is not required when animals are moved to properties with the same Property Identification Code, provided that the PIC card (or a full copy of it) is provided; when animals are imported into Western Australia and are accompanied by the appropriate Health Certificate; or when they are moved to another Australian state, provided that are accompanied by the importing state's Health Certificate (Government of Western Australia, 2013).

Australia's Northern Territory does not require that deer be identified. However, producers are required to be registered and have a PIC and a NT Health Certificate and Waybill is required to move deer into the Territory (Northern Territory Government, 2013). Similar requirements are in place in the states of Queensland (Queensland Government, 2013abc), New South Wales (New South Wales Livestock Health and Pest Authorities, accessed 11 July 2013abc) and Victoria (State of Victoria Department of Environment and Primary Industries, 2013ab).

New Zealand

National Animal Identification and Tracing (NAIT) (NAIT Ltd., 2013a) is New Zealand's national livestock traceability database. Animal identification and tracing have been mandatory for deer in New Zealand since 1 March 2013 (NAIT Ltd., 2013c). In order for deer producers to comply with the regulatory requirements of the NAIT Scheme, they must register themselves as a PICA (person in charge of Animals) with NAIT and obtain a NAIT number for their property. Regulated animals must be tagged using NAIT approved RFID tags and these animals must then be registered in the NAIT system (NAIT Ltd., 2013b). Deer are to be tagged before the age of 6 months (while they are easier to handle) or before their first off-farm movement, whichever occurs first. Animals born before 1 March 2013 have a three-year grace period in which to be tagged, unless they are being moved off farm. Deer that are already tagged with an Animal Health Board tag but that are impractical or too dangerous to tag with a new NAIT RFID tag can



be sent to slaughter without the required NAIT tag. However, the processor will charge a levy for each untagged deer that is slaughtered (NAIT Ltd., 2013d). All on- and off-farm movements of deer must be recorded in the NAIT database, as do all deaths, losses and exports of live deer registered in the NAIT system. NAIT accredited sale yards and meat processors can also record animal movements on behalf of producers (NAIT Ltd., 2013b).

United Kingdom

In the U.K., deer farmers must register the land where the animals will be kept and obtain a Country Parish Holding (CPH) number from the appropriate local authority before deer can be kept on a holding (U.K. Animal Health and Veterinary Laboratories Agency, 2012).

Producers in England must uniquely identify their animals with an ear tag if they have been tested for tuberculosis or if they leave their farm of origin. The tag must display the animal's herd number as well as the deer's own unique identification number. The herd registration number can be assigned either through the Department for Environment, Food & Rural Affairs (Defra) or through the British Deer Farmers Association (BDFFA). However, if a BDFFA herd number is used, the producer must inform their local animal health authority and provide details of the mark being used. Animal movements must be recorded and reported and must comply with the conditions of the General Licence for the Movement of Deer. All movements are to be accompanied by the Standard Movement Document – AML 24 (U.K. Department for Environment, Food & Rural Affairs, 2013b).

Similar regulatory requirements are also in place in Scotland. All keepers of deer, as well as their animals must be registered (The Scottish Government, 2010f). Deer are to be identified after the age of 16 weeks using approved tags and before they are moved off the premises (as indicated in The Tuberculosis (Deer) Order 1989 (Government of the United Kingdom, accessed 12 July 2013)). Furthermore, they are to be moved in accordance with the General Licence for Movement of Bovine, Ovine, Caprine and Other Ruminating Animals (Except Camelids) and Swine Within Scotland (The Scottish Government, 2013). Deer producers in Wales must also identify their animals as per The Tuberculosis (Deer) Order 1989. Additionally, they must use a General licence for the movement of deer to move animals within Wales (Welsh Government, 2009) and an Animal Movement Licence (AML) 24 document to record and report these movements (Welsh Government, 2011).

United States of America

The United States recently published the Final Rule on Traceability for Livestock Moving Interstate (9 January 2013), which amended federal regulations in order to establish minimum national official identification and documentation requirements for the interstate movement of livestock in the US. Captive cervids (i.e., deer and elk) are subject to these regulatory

requirements and must be officially identified and accompanied by an interstate certificate of veterinary inspection or other type of documentation when they are moved (U.S. Department of Agriculture, 2013).

Deer and elk are required to be identified with at least two forms of identification attached to the animal. The means of animal identification must be approved by the Animal and Plant Health Inspection Service (APHIS) and must either be an electronic implant, flank tattoo, ear tattoo, tamper-resistant ear tag, or other device approved by APHIS. One of the identifiers must be an official identifier as stated in the regulations and must have a nationally unique animal identification number associated with it that is linked to the individual deer/elk in the chronic wasting disease (CWD) National Database or in an approved State database. The other identifier must be unique for the individual animal within the herd and must also be linked to that animal and herd in the CWD National Database or in an approved State database (U.S. Code of Federal Regulations, accessed 12 July 2013). Cervids must be officially identified before they are moved interstate and are to be accompanied by the required documentation as outlined in Title 9, Code of Federal Regulations (9 CFR) part 77 (U.S. Animal and Plant Health Inspection Service, 2013).

Additionally, state-specific requirements relating to the identification and movement of deer and elk have been noted the following states: Utah (Utah Department of Agriculture and Food, accessed 12 July 2013), Minnesota (Minnesota Board of Animal Health, accessed 12 July 2013), Oklahoma (Oklahoma Agriculture Food and Forestry, accessed 12 July 2013), Wisconsin (Wisconsin Department of Agriculture, Trade and Consumer Protection, 2013), Kentucky (Kentucky Department of Agriculture, 2013) and Montana (Montana Official State Website, accessed 12 July 2013).