Waste management of typical livestock mortalities in Canada: An overview of regulations and guidelines

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Waste management of typical livestock mortalities in Canada: An overview of regulations and guidelines. Canadian Biosystems Engineering/Le génie des biosystèmes au Canada. 52: 6.11–6.18. This review paper provides an overview of waste management practices for typical livestock mortalities in Canada. Provincial guidelines and regulations are provided (if available) for these practices. It is shown that there is significant variation amongst provincial guidelines for livestock mortality management and these guidelines and regulations are often based on “rules of thumb” borrowed from other waste disposal practices. From the information presented in this paper, it appears more research is needed to ensure that current guidelines and regulations for livestock mortality disposal are sufficient to protect human and environmental health. Keywords: Livestock mortality, disposal, burial, compost, provincial regulations.

INTRODUCTION

Waste management of livestock mortalities is an important consideration for all Canadian livestock farmers. Environmentally sound practices for proper disposal of dead livestock is necessary to protect existing livestock and for the protection of public health. In most cases, waste management practices are chosen in accordance with provincial guidelines or regulations imposed upon farmers to provide sustainable, long-term farm practices. Complete disposal of typical livestock mortalities by rendering has historically been the preferred method of disposal for most provinces in Canada. Recent federal controls on enhanced agriculture feed by the Canadian Food Inspection Agency (CFIA) has eliminated rendering as a complete disposal option (CFIA 2007). As a result, most provinces in Canada have revised their current waste management guidelines and regulations (if present). Eliminating rendering as a complete disposal option will eventually lead to increased use of alternative disposal methods.

Existing alternative livestock disposal options have already been outlined in the guidelines and regulations of many Canadian provinces. Typically these regulations and guidelines (if any) vary between provinces and appear to be based on previous regulations/guidelines for other wastes, local experience and/or judgment. Freedman and Fleming (2003) present one of the few review articles related to burial disposal of livestock mortalities with a focus on Canadian practices. For burial of dead livestock, it is shown by Freedman and Fleming (2003) that there is a paucity of research regarding environmental safety related to livestock disposal. To the authors’ knowledge, there are no review articles which provide an overall assessment of different methods for managing livestock mortalities in Canada. It is important to understand current waste management practices prior to instituting changes to existing regulations.

The purpose of this article is to provide a review of techniques available to farmers to deal with typical livestock mortalities (i.e., excluding diseased carcasses and carcasses after a catastrophic mortality event). A review of current provincial guidelines and regulations related to these waste management techniques is then provided. It is anticipated that this review will assist provincial regulators in assessing, and possibly developing, a national approach to managing typical livestock mortalities.

TYPICAL LIVESTOCK MORTALITIES: WASTE MANAGEMENT TECHNIQUES

The five major methods of typical livestock mortality disposal currently practiced over the past decade to varying degrees in Canada are: rendering, burial, composting, incineration and natural disposal. Alberta Agriculture Food and Rural Development, AAFRD, (2002) provides...
and it can be difficult to perform in the winter in many parts of Canada (Freedman and Fleming, 2003).

The burial of livestock mortalities at municipal landfill sites appears to be a disposal option in all provinces. Livestock mortalities can usually only be disposed of at municipal landfills if they are buried on the same day they are delivered and covered with a minimum depth of soil. Many municipal landfills do not have the staff or equipment available to perform this task and therefore do not offer this service. Municipal landfills that accept livestock mortalities often charge a significant tipping fee for any waste disposal.

Composting

On-farm composting of livestock mortalities appears to be a disposal option in all provinces in Canada. All provinces except Quebec, New Brunswick and PEI have adopted provincial guidelines or regulations for on-farm composting of livestock mortalities. Table 2 contains a summary of on-farm composting guidelines and regulations for each province.

The main advantages of on-farm composting of livestock mortalities are that it is relatively inexpensive and that it can be performed year round. The main disadvantages of this disposal method are that it can be labour intensive and difficult to perform properly, carbon amendments are required, and compost piles attract scavenging animals.

Incineration

Incineration of livestock mortalities appears to be a disposal option in all provinces. Incineration does not include disposal of a carcass in an open fire. The main advantage of this waste management technique is that mortalities can be disposed of as they are generated, and hence no temporary storage is required. The main disadvantages of this disposal method are that it requires a major capital investment, fuel costs are becoming more expensive and it contributes to global warming. The high temperatures associated with this disposal method also cause it to be a safety hazard.

Natural Disposal

Natural disposal of dead livestock is not typically recommended by any province due to the risk of disease transmission and the potential for nuisance complaints. Natural disposal could include disposal in the forest or disposal in uncontrolled manure piles. However, it is conventionally accepted that this practice does exist, especially for smaller farming operations. Generally speaking, the practice may be permitted in some provinces (e.g. AAFRD 2002) provided various disposal conditions are met.

PROVINCIAL GUIDELINES AND REGULATIONS

As discussed above, in different provinces not every waste management technique is available to farmers. This section attempts to provide a comprehensive review of guidelines and regulations in each individual province. The guidelines
and regulations identified below were obtained through publicly available information and literature sources. Where possible, individuals with experience in livestock mortalities were also consulted to provide more details on information not easily accessible. It is possible that additional guidelines and regulations beyond that described below exist, but based on the literature found, a sufficient overview of provincial disposal guidelines and regulations is presented below. The report by Freedman and Fleming (2003) was a useful source for many of the burial regulations. It should be noted that these guidelines and regulations are in a constant state of change due to the adoption of CFIA enhanced feed controls on specified risk materials.

**British Columbia**

British Columbia (BC) regulates the disposal of livestock mortalities through the Agriculture Waste Control Regulation specified under the Waste Management Act and Health Act (Province of British Columbia 1992). The regulations are presented in the Code of Agriculture Practices for Waste Management. The Code was developed in 1992 to describe practices for using, storing and managing agricultural waste in an environmentally sound manner. Part 8 of the Code, On-farm Disposal of Mortalities, outlines regulations for disposal of livestock mortalities by burial, incineration and composting.

Subsequent to the Code, in 1998, the 2nd edition of the BC Agricultural Composting Handbook was published by the BC Ministry of Agriculture and Food (BCMAF 1998). The handbook consists of 18 factsheets related to the composting process, recommendations for implementing composting into a farming operation and discusses some environmental concerns associated with composting.

In 1999 the BCMAF published a series titled, “Environmental Evaluation of Agricultural Operations Checklists” (BCMAF 1999), which was developed to supplement a series of Environmental Guidelines for BC Producers. “Checklist #1, General Farm/Ranch Concerns”, was developed to assist producers or environmental advisors in assessing farm or ranch environmental conditions. “Section 11, Mortalities”, of Checklist #1 provides a recommended checklist for the disposal of livestock mortalities. The checklist includes all of the regulations specified in the Code for disposal of livestock mortalities by burial, incineration and composting. The checklist also provides additional guidelines for the burial of dead livestock that are not included in the Code.

British Columbia has in place the Canada/C1 British Columbia Environmental Farm Plan (BC Agricultural Research & Development Corporation 2010). The program is a partnership with various government agencies between Agriculture and Agri-food Canada (AAFC), the BC Ministry of Agriculture, Food and Fisheries and the

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**Table 1. Provincial Guidelines and Regulations for On-farm Burial of Typical Livestock Mortalities (Revised from Freedman and Fleming, 2003).**

<table>
<thead>
<tr>
<th>Province</th>
<th>Minimum earth cover (m)</th>
<th>Minimum distance from pit bottom to groundwater (m)</th>
<th>Minimum distance to watercourse (m)</th>
<th>Minimum distance to well (m)</th>
<th>Maximum weight per pit (kg)</th>
<th>Guidelines vs. regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>1.0 (Guideline)</td>
<td>1.0 (Guideline)</td>
<td>15 (Guideline)</td>
<td>30 (Reg.)</td>
<td>700</td>
<td>Both</td>
</tr>
<tr>
<td>Alberta</td>
<td>1.0</td>
<td>1.0</td>
<td>100</td>
<td>40 (Guideline)</td>
<td>2500</td>
<td>Guidelines</td>
</tr>
<tr>
<td>Saskatchewan Non-Intensive</td>
<td>1.0</td>
<td>2.0-4.0*</td>
<td>90</td>
<td>90</td>
<td>–</td>
<td>Guidelines</td>
</tr>
<tr>
<td>Saskatchewan Intensive</td>
<td>Approval Required from Department of Agriculture</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manitoba &lt; 300 animal units</td>
<td>1.0</td>
<td>–</td>
<td>100</td>
<td>100</td>
<td>–</td>
<td>Regulations</td>
</tr>
<tr>
<td>Manitoba &gt; 300 animal units</td>
<td>Livestock Burial Not Permitted Unless Approval By Director</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ontario</td>
<td>0.6-0.9</td>
<td>0.9</td>
<td>100</td>
<td>50</td>
<td>2500</td>
<td>Regulations</td>
</tr>
<tr>
<td>Quebec</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>n/a</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>n/a</td>
</tr>
<tr>
<td>Prince Edward Island</td>
<td>0.6</td>
<td>0.6</td>
<td>60</td>
<td>300</td>
<td>–</td>
<td>Guidelines</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>Approval Required from Department of Environment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>0.6</td>
<td>1.4</td>
<td>30</td>
<td>90</td>
<td>700</td>
<td>Guidelines</td>
</tr>
</tbody>
</table>

Note: The dash (–) is used when the provincial regulations and/or guidelines did not cover the topic.

*Minimum distance between the bottom of the burial pit and a useable groundwater water source.
Table 2. Guidelines and Regulations for On-farm Composting of Typical Livestock Mortalities.

<table>
<thead>
<tr>
<th>Province</th>
<th>Minimum distance* to watercourse (m)</th>
<th>Minimum distance* to well (m)</th>
<th>Minimum distance* to residence (m)</th>
<th>Minimum temp. (°C)</th>
<th>Required # of (days) at minimum temperature</th>
<th>Required C:N ratio</th>
<th>Required moisture content (%)</th>
<th>Target pH</th>
<th>Guidelines vs. regulations</th>
</tr>
</thead>
<tbody>
<tr>
<td>British Columbia</td>
<td>15</td>
<td>30</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Regulations</td>
</tr>
<tr>
<td>Alberta</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>55</td>
<td>3</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Both</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>90</td>
<td>–</td>
<td>–</td>
<td>54</td>
<td>3</td>
<td>25:1–40:1</td>
<td>45–60</td>
<td>–</td>
<td>Guidelines</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Intensive Saskatchewan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intensive Manitoba</td>
<td>100</td>
<td>100</td>
<td>–</td>
<td>54–60</td>
<td>3</td>
<td>25:1–35:1</td>
<td>50–60</td>
<td>7</td>
<td>Both</td>
</tr>
<tr>
<td>Ontario</td>
<td>50</td>
<td>15</td>
<td>100</td>
<td>55</td>
<td>7</td>
<td>20:1–30:1</td>
<td>40–65</td>
<td>–</td>
<td>Guidelines</td>
</tr>
<tr>
<td>Quebec</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>n/a</td>
<td>–</td>
<td>n/a</td>
</tr>
<tr>
<td>New Brunswick</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>n/a</td>
<td>–</td>
<td>n/a</td>
</tr>
<tr>
<td>PEI</td>
<td>90</td>
<td>90</td>
<td>–</td>
<td>55</td>
<td>–</td>
<td>25:1</td>
<td>50–60</td>
<td>–</td>
<td>n/a</td>
</tr>
<tr>
<td>Nova Scotia</td>
<td>100</td>
<td>100</td>
<td>600</td>
<td>55</td>
<td>3–15</td>
<td>25:1</td>
<td>50–60</td>
<td>–</td>
<td>Guidelines, (primary phase)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>50:1</td>
<td></td>
<td></td>
<td>Guidelines, (secondary phase)</td>
</tr>
<tr>
<td>Newfoundland and Labrador</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>55</td>
<td>3</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Guidelines</td>
</tr>
</tbody>
</table>

Note: The dash (–) is used when the provincial regulations and/or guidelines did not cover the topic.
*Distance to compost pile.
BC Agriculture Council (BCAC). The program was initiated to encourage producers to adopt beneficial management practices through voluntary environmental farm planning. To assist producers in developing an environmental action plan for their farm, the BC Agriculture Council has published a reference guide called, “British Columbia Environmental Farm Plan: Planning Workbook.” The 3rd edition of this reference guide was published in 2010 (BC Agricultural Research & Development Corporation 2010). In Section 3 of the reference guide entitled “Livestock” there is a sub-section titled “Mortality Disposal” that describes acceptable livestock mortality disposal methods.

In 2006 the BCMAF published a waste management factsheet titled, “Large Animal Disposal, On-Farm Burial Options, South Coastal Region of BC” (BCMAF 2006). The factsheet provides information to help farmers decide if on-farm burial of mortalities is a viable option for their farm operation.

Alberta

Alberta regulates the disposal of livestock mortalities through their Destruction and Disposal of Dead Animal Regulation specified under their Livestock Disease Act (Province of Alberta 2000). Section 2 of the regulation, “Methods of Disposal”, outlines regulations for the disposal of livestock mortalities by rendering, burial, incineration, composting and natural disposal.


Saskatchewan

Saskatchewan regulates the disposal of livestock mortalities under the Agricultural Operations Act (Province of Saskatchewan 1996). The Act was developed in 1995 and was registered on November 28, 1996. Part III of the Act outlines provisions for intensive livestock operations. An intensive livestock operation is defined as the confining of one animal unit to less than 370 m² (or 4000 ft²). The term animal unit provides a means to compare the scale or size of operations raising different species or different ages of animals. Operations with similar animal unit production will produce similar quantities of manure. Under the Intensive Livestock Provisions of the Agricultural Operations Act, intensive livestock operations are required to have a waste management plan that has been approved by the minister. The waste management plan must include a livestock mortality disposal plan.

In 2000, the SAF published, “Developing a Manure and Dead Animal Management Plan” (SAF 2000). The manual provides guidelines to assist producers in developing an acceptable waste management plan as required by the Agricultural Operations Act. Section 11, Management of Dead Animals, provides guidelines for the management of dead livestock by rendering, burial, incineration and composting.

SAF also published “Managing Livestock Mortalities” (SAF 2010). The factsheet describes acceptable disposal practices and identifies various contacts for additional assistance with each disposal method.

In 2005 the SAF also published, “Composting Animal Mortalities: A Producer’s Guide” (SAF 2005). The guide describes various composting methods, outlines new procedures and recommendations and includes worksheets to help farmers design their compost facilities.

Manitoba

Manitoba regulates the disposal of livestock mortalities through their Livestock Manure and Mortalities Management Regulation specified under their Environment Act (Province of Manitoba 1998). The regulation was registered March 30, 1998 and amended in 2009. Section 15 of the regulation, Disposal of Mortalities, outlines regulations for the disposal of livestock mortalities by burial, incineration and composting. To include composting as an alternative, the Manitoba Department of Agriculture, Food and Rural Initiatives (MAFRI) developed a website called, “Composting: An Alternative Method of Deadstock Disposal” (MAFRI 2004). This website provides an overview of on-farm composting of livestock mortalities. It also includes interactive screens to assist in planning a composting site.

Ontario

Ontario regulated the disposal of livestock mortalities under their Dead Animal Disposal Act (Province of Ontario, 1990), now replaced by Ontario Regulation 106/09 made under the Nutrient Management Act (Province of Ontario 2002).

The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) has published “On-farm Composting of Deadstock” (OMAFRA 2009a). This factsheet provides an overview of composting of on-farm mortalities and how one can apply composting to a livestock operation. The factsheet also includes basic instructions for constructing a bin composting unit and guidelines for starting, managing and monitoring the composting unit. In addition to composting, OMAFRA has also published “Burial of On-Farm Deadstock” (OMAFRA 2009b). This factsheet deals with burial as an option for on-farm disposal of deadstock.

Quebec

Quebec regulates livestock facilities and manure management through their Agricultural Operations Regulation specified under their Environmental Quality Act (Province of Quebec 2010). The regulation was registered on June 15, 2002 and replaced the “Respecting the Reduction of Pollution from Agricultural Sources” Regulation (Province of Quebec 2002). The object of this regulation is to protect the environment, particularly water and soil against pollution caused by certain agricultural activities. No regulations related to the disposal of livestock mortalities could be found in this document.
New Brunswick

New Brunswick regulates agricultural operations through the administration of three Acts; Agriculture Land Protection and Development Act (ALPDA) (Province of New Brunswick 1998), Livestock Operations Act (LOA) (Province of New Brunswick 1999) and Agricultural Operations Practices Act (AOPA) (Province of New Brunswick 2003). The ALPDA contains provisions that deal with the protection of agricultural land through a land planning and zoning process. The LOA contains provisions to facilitate the development of livestock industry, with the recognition of the needs of rural community and the protection of the environment. The AOPA provides a resolution process to deal with nuisance complaints pertaining to agricultural operations. No regulations related to the disposal of livestock mortalities are specified in any of these Acts.

Prince Edward Island

Prince Edward Island regulates the disposal of livestock mortalities under their Environmental Protection Act (EPA) (Province of Prince Edward Island 1998). In September 2004 the PEI Department of Agriculture, Fisheries and Aquaculture (PEIAFA) published, “Disposal of Dead Farm Livestock” under the authority of Section 3 of the EPA (PEIAFA 2004). The guidelines specify two acceptable livestock mortality disposal methods; rendering and composting. Burial is also possible, but not preferred. The document states that information on composting techniques is available from the PEIAFA.

Nova Scotia

There is currently no specific legislation in Nova Scotia which focuses on livestock mortality disposal. However, Section 67 of the Environment Act (Province of Nova Scotia 1995) prohibits the release of any substance into the environment which may cause an adverse effect. With respect to current disposal methods, Nova Scotia has a licensed deadstock collection service which transport mortalities to a local rendering facility. This service does not cover the entire province and many farmers have had to rely on other disposal methods. The Nova Scotia Department of Agriculture and Fisheries (NSDAF) promotes the use of composting for on-farm mortality management and has published a mortality composting manual (NSDAF 2004). Approval from the Nova Scotia Department of Environment and Labour is required for any composting facility processing greater than 60 m³ of material per day. The NSDAF also recommends that the Guidelines for the Use of Animal Manure in Nova Scotia (NSDAF 1991) be followed if the composting end-product is to be land-applied.

Newfoundland and Labrador

Newfoundland and Labrador, livestock mortalities must be disposed of in accordance with the Waste Materials Disposal Act (Province of Newfoundland and Labrador 1996). The Act provides general regulations for waste disposal but does not include specific regulations for the disposal of livestock mortalities.

In September 2002 the Newfoundland and Labrador Department of Agriculture (NFLLA) published, “Environmental Guidelines for Livestock Producers” (NFLLA 2002). The guidelines presented in this factsheet were developed to assist livestock producers in their efforts to prevent pollution and to provide a standard that may be used by industry and government in determining normal, acceptable farming practice. Section 10.1 of the factsheet, “Disposal of Dead Animals”, provides guidelines for the disposal of livestock mortalities by rendering, burial, composting and incineration.

DISCUSSION

The intent of the new feed controls (CFIA 2007) is to accelerate the eradication of the bovine spongiform encephalopathy (BSE) from Canadian cattle. However, the impact of eliminating rendering as a complete disposal option must be considered with respect to the impact on individual farmers and their ability to implement waste management techniques. As the new feed controls proposed by the CFIA are adopted, it is expected that small scale, on-farm composting and burial will become a preferred method of disposal for most farmers. However, in general there is a substantial lack of design criteria for these two options. Few provinces have complete guidelines for burial, including key criteria such as depth to groundwater, setback distances and maximum weight per pit. Only some of the provinces have specified the minimum depth to groundwater within their guidelines/regulations and it appears that none of provinces have included soil characteristics (i.e., hydraulic conductivity) within their guidelines. According to Jansen (personal communication, May 2006) the SFA require a geotechnical investigation prior to approving any intensive livestock mortality management plan. Also, hydraulic conductivity testing may be required, depending on site conditions (Jansen 2006). Also, as can be seen in Tables 1 and 2, there are discrepancies in recommendations put forth by the various provinces. With respect to burial, British Columbia and Newfoundland recommend a maximum weight of 700 kg/pit, while Alberta and Ontario allows 2500 kg/pit. The minimum setback distance from a burial pit to a watercourse varies from 15 to 100 m. There is little information available to assess the appropriateness of these recommendations.

Nova Scotia and Manitoba appear to have relatively well-developed protocols for the composting deadstock. In contrast other provinces include composting within their regulations (e.g., British Columbia) while only specifying setback distances. Achieving elevated temperatures for extended periods of time within compost piles is crucial to ensuring pathogen destruction (Kalbasi et al. 2005). Seven provinces are recommending maintaining a minimum temperature of 55°C for 3 d, as most researchers have found that the majority of pathogens within a mortality composting system are inactivated after exposure to temperatures exceeding 55°C for at least 2–3 d (Wilkinson 2007). However, there is the potential for transport of pathogens from a compost pile as it is heating up, as many of the approaches being employed on-farm do not include...
full containment systems. This risk has not been adequately assessed within previous studies. Wilkinson (2007) conducted a thorough review of the available literature related to pathogen survival within mortality composting systems, and concluded that there was a lack of peer-reviewed studies relating to this topic. The survival and potential transport of pathogens from livestock mortalities that have been buried is also an issue that has not been specifically addressed in the literature. It is unlikely that temperatures in burial pits would reach levels necessary for rapid pathogen inactivation. There is a wealth of literature related to the survival and transport of microorganisms within soil and groundwater systems, which suggests that pathogenic microorganisms could survive for extended periods of time (months) within subsurface environments (Jamieson et al. 2002; Foppen and Schijven 2006).

SUMMARY AND CONCLUSIONS

New feed controls have forced many provinces to review their existing guidelines and regulations pertaining to the management of livestock mortalities. Farmers will be looking for information and resources to help them develop alternative disposal methods. On-farm disposal methods, such as composting or burial, are the most cost-effective alternatives. Several provinces have developed guidelines and/or regulations for the on-farm disposal of livestock mortalities. Provinces that currently do not possess regulations and resource material for on-farm disposal can use the information presented in this paper as a resource for on-farm mortality disposal strategies. Further research and assessment is required to ensure these practices do not impact the environment. In particular, systems and methodologies for preventing the migration of pathogens and other disease causing materials from on-farm disposal facilities should be evaluated. Prior to adopting the new feed controls, steps must be taken to ensure that current guidelines and regulations for on-farm management of livestock mortalities provide adequate protection against environmental contamination.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Mr. Gordon Finley of the Nova Scotia Department of Agriculture, Mr. Vic Klassen of Agriculture and Agri-Food Canada, and Mr. Andy Jansen of Saskatchewan Agriculture and Food for providing input to various regulations described in the paper. Attempts have been made to ensure accuracy in interpretation of guidelines but it is recommended that readers verify the most current content of each guideline and regulation referenced in this paper.

REFERENCES


