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**The Ongoing BSE Crisis:
Perspective on the Science, the Logic of Regulation, and Food Safety**

SPECIAL REPORT

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Introduction

The third case of bovine spongiform encephalopathy (BSE) in Canada, the second within a ten-day period, has drawn renewed concern and public attention to Canada's beef industry, and to what is being done to control the spread of BSE. This has intensified because the latest case is in a cow born after the 1997 ban of meat and bone meal (MBM) in cattle feed rations. Also with this latest case, the public discussion around the issues appears to have taken a more desperate tone, with suggestions of a mass cull of cows¹, and exaggerated reports of feed contaminated with animal byproducts².

This suggests that some perspective is needed in interpreting recent events, understanding the logic of control measures that have been put in place and those that are being considered, and in developing future expectations. Concerns around BSE relate to the potential for spread of the disease to its variant in humans, and to the spread of BSE in the cattle population. The purpose of this special report is to clarify current discussions by outlining the basic science of BSE and its logical implications.

Science of BSE³

BSE was first diagnosed in the United Kingdom in 1986, largely in dairy cattle. It is now known that the disease emerged but was undetected for some time prior to that - the first real cases of BSE in the UK probably occurred in the late 1970s. There are alternative theories as to the origins of BSE; however, the most widely accepted is that BSE is a variant of a sheep nervous system ailment known as scrapie, and that the infectious agent that spreads BSE is a *prion*- an infectious form of protein. It is believed that BSE spread in the UK cattle population through prion-contaminated MBM fed in cattle rations. BSE is not readily transmitted to other species; hogs are only infected with BSE by repeated injection with contaminated material, and tests suggest that poultry cannot be infected.

The prion has only been found in the nervous system and very specific lymphoid tissues in cattle. It has been determined that the brain, spinal cord, ileum, eyes, tonsils, distal ileum and root ganglia are the tissues that can be infective. It is believed that trace amounts of infective tissue can cause BSE infection within cattle. The prion does not appear to be destroyed by heat and pressure in the rendering process, nor through treatment by enzymes. A practical means of safely destroying prions has yet to be devised.

Regulatory Responses to BSE

In response to the BSE situation in the UK, Canada, like most other developed countries, banned the use of MBM in ruminant feed rations and human food consumption in 1997. Following the

¹ Edmonton Journal, January 13, 2005

² For example, *Secret tests reveal cattle feed contaminated by animal parts: Mad cow fears spark review of 'vegetable-only' livestock feeds* by Chad Skelton, Vancouver Sun December 16th, 2004

³ This section draws from Chris Clark and John Campbell, "Bovine Spongiform Encephalopathy", *Large Animal Veterinary Rounds* 3(6). June/July 2003. Published by the Western College of Veterinary Medicine, University of Saskatchewan.

first Canadian BSE case in May, 2003, Canada went further and designated specific cattle tissues as “Specified Risk Materials” (SRMs)⁴, and began separating these materials in meat packing plants. In late 2004, the Canadian Food Inspection Agency (CFIA) introduced proposed regulations regarding the use of MBM. These include:

- Removal and separation of SRM materials in beef slaughter plants;
- Separate and dedicated transportation and rendering facilities for SRM’s and for the other inedible beef byproducts; and
- Destruction of rendered SRMs.

Additional regulatory measures that are in place, or have been proposed, represent redundancies to the above actions to eradicate BSE. Thus, the Canadian regulatory response actually goes further in providing failsafe measures than the best science would require.

The Implications of the Science and Regulatory Response

The best scientific knowledge relating to BSE posits that the prion is responsible for the spread of the disease. It also finds that the prion can only exist in the SRMs as defined above. Thus, the logic follows that if the SRMs are removed, the risks associated with BSE are also removed. The implications of this are profound:

- The removal and destruction of SRMs is a sufficient condition for the safety of beef as it relates to the spread of BSE in cattle and the related disease in humans, Creutzfeld-Jacob Disease (CJD) or variant-Creutzfeld-Jacob Disease (vCJD);
- Humans cannot contract vCJD from eating BSE infected beef if the SRMs are entirely removed and destroyed. The converse implication is that the victims of vCJD in the UK, if indeed beef was the source of vCJD, must have eaten foods made from SRM materials. Prions do not infect cattle tissues other than SRMs;
- Because rendering does not destroy the prion, MBM made from infected cattle byproducts could contaminate other cattle if SRMs were not removed. However, with SRMs removed, the ban on feeding MBM back to ruminants is actually a redundancy; any possibility of infection is removed with the removal of SRMs; and
- Additional observed cases of BSE in the future do not translate into greater food safety risks or more risk of BSE spreading in Canada if SRMs are removed and destroyed.

Prior to the 1997 MBM feed ban, some transmission could have occurred due to feeding ruminant MBM back to ruminants. Following the ban on feeding MBM to ruminants, this risk of

⁴ SRMs include skull, brain, trigeminal ganglia, eyes, tonsils, spinal cord, and dorsal root ganglia of cattle over 30 months of age, and the distal ileum of all cattle.

transmission must have diminished dramatically. However, with the removal of SRMs from the food and feed system, the science implies that the risk of spread is not just further reduced; it is *eliminated*. Even if older cows born prior to the banning of MBM in cattle feed were at greater risk of being exposed to BSE, removing and destroying the SRMs from these cattle when they are slaughtered eliminates all risk of BSE spread. Therefore, a cull of cows born prior to the 1997 feed ban would not provide any benefit with regard to either food safety or decreased spread of BSE.

Observations

Regulatory responses in Canada, as well as those in other countries, rely on the consistent application of scientific knowledge to the control of livestock diseases. That is why it is important that the logic behind BSE control measures and their implications are understood. It is also important because scientific knowledge is likely to evolve. For example, a recent Swiss study of mice treated with scrapie found that prions could move from the nervous system tissue into other tissues as part of an autoimmune response to a secondary infection from another illness or as a result of trauma⁵. Because it is in a different species, it is unclear what (if any) implications it has for BSE. It must also be noted that, in any case, sick or injured (“downer”) livestock delivered to packing plants are now excluded from the food system and routed for destruction with SRMs.

As identified above, some of the regulatory measures currently in place or proposed go well beyond what the best science implies is necessary. These redundancies are failsafe measures. One way to interpret them is that they serve as a form of hedge against future changes in the scientific understanding of BSE in ways not anticipated by current knowledge.

In addition, we cannot rule out that the best science, for whatever reason and however remote the possibility may simply be wrong regarding BSE. Adherence to science as the reference in policy decisions is, after all, a social choice (although the alternative of not adhering to science is unclear).

However, there are serious conversations regarding BSE safety and control measures that purport to use scientific arguments to reach conclusions that serious risks relating to the spread of BSE and food safety could exist under Canadian control measures⁶. The scientific discussions outlined in this report suggests that removing and destroying prions is sufficient to halt the spread of BSE and the risk to human health. Assertions contrary to this must either not be based on science, or are simply wrong.

⁵ Heikenwalder, M. *et al.* *Science* Published online: doi:10.1126/science.1106460 (2005).

⁶ For example, see *Claims and Assumptions Underpinning the Final USDA Minimal BSE Risk Rule: Are They Valid?* Published on the R-CALF website January 28th, 2005. Among the claims made is that chickens fed MBM that in turn are used in manufacturing chicken meal which is fed to cattle is a source of BSE spread. But by removing SRMs prior to MBM manufacture the above scenario in fact represents no risk whatsoever in spreading BSE; rather it represents a fundamental misunderstanding of the above logic relating to removal of SRMs.