Appendix 3C: Description of Model Output Tables and Graphs

Because the simulation model used in this analysis is probabilistic, the results depend on values selected for random quantities (*e.g.*, whether a particular packet of prohibited MBM is mislabeled). In order to characterize the range of plausible results associated with particular scenario (*i.e.*, with particular set of assumptions), we have simulated each scenario 1,000 times. All table quantities are reported to two significant figures. Some probabilities reported on graphs are reported to three significant figures to distinguish between small positive values and zero.

The range of results generated by these simulations runs are characterized by a set of summary statistics for each outcome quantity (*e.g.*, total number of infected cattle, total number of clinical cattle, total number of cattle oral ID_{50s} to humans *etc.*). These statistics include the 5th, 25th, 50th, 75th and 95th, percentiles and the arithmetic average.

We use box and whisker plot to illustrate some of the results. These figures plot the interquartile range (*i.e.*, range extending from the 25th percentile to the 75th percentile) as a box. The horizontal line within the box designate the median of the distribution. Extending from the ends of the box are the whiskers that designate the 5th and the 95th percentiles. Values that are less than the 5th percentile or greater than the 95th percentile are individually displayed as an "x". Figure 1 is an example of a box and whisker plot.

For each simulation run we present both tabular and graphical summaries of the output. Each format summarizes different sorts of information. The tabular summary (see Section 1 in this appendix) presents cumulative values for the entire simulated period. Many of the graphs (see Section 2 in this appendix) illustrate the evolution of the simulated environment over time, using box and whisker plot to characterize the range of plausible values for various quantities, and bar graphs to illustrate the probability that the quantities exceed zero.

1　　Tabular Output Summaries

The following list defines the entries in the table generated for each simulation run. Tables for all simulation runs appear in Appendix 3A.

Endpoint	Description
Epidemic Statistics	
Total Infected	Total number of animals infected with BSE during the simulation
Total Infected w/o Imports	Number of new infected animals in addition to those imported during the simulation
Total Clinical	Number of infected animals that remain alive long enough to develop clinically detectable signs of BSE during the simulation
Probability N Infected > 0	Probability that at least one animal is infected at the end of the simulation
Mode of Infection	
Maternal	Number of animals infected *via* transmission from mother to calf during the simulation
Spontaneous	Number of animals infected during the simulation *via* spontaneous infections, (exceeds zero only for the scenario that assumes spontaneous infections are possible).
Protein	Number of animals infected due to consumption of infectivity in MBM during the simulation
Blood	Number of animals infected due to consumption use of blood as a feed supplement during the simulation
Exogenous	Number of animals infected by infectivity introduced exogenously during the simulation (*e.g.*, *via* introduction of scrapie into the feed supply, *etc.*)
Mode of Death for Infected Animals	
Slaughter	Number of infected animals slaughtered during the simulation
Die on Farm - Render	Number of infected animals that die on the farm that are rendered during the simulation
Die on Farm - No Render	Number of infected animals during the simulation that die on the farm that are buried on the farm or otherwise diverted from applications that can result in the exposure of additional animals to infectivity in the animal disposed
Disposition of ID_{50}s	
From Slaughter	Number of ID_{50}s from animals sent to slaughter during the simulation
From Death on Farm	Number of ID_{50}s in animals that die on the farm and are rendered during the simulation
Eliminated by SRM ban	Number of ID_{50}s during the simulation removed from material that cattle or humans may consume due to implementation of a UK-like specified risk material ban

Endpoint	Description
To Prohibited MBM	Number of ID_{50}s during the simulation sent to rendering plants designated for production of prohibited MBM
To NP MBM – Misdirected	Number of ID_{50}s during the simulation incorrectly sent to rendering plants designated for production of non-prohibited MBM
To NP MBM – Contamination	Number of ID_{50}s during the simulation entering the supply of non-prohibited MBM due contamination in mixed rendering facilities
To NP MBM – Mislabeling	Number of ID_{50}s during the simulation entering the supply of non-prohibited MBM due to mislabeling of prohibited material as non-prohibited
Eliminated by Rendering	Number of ID_{50}s during the simulation eliminated in the rendering process
Out After Rendering	Number of ID_{50}s during the simulation in MBM diverted to uses for which these is no potential for either human or cattle exposure in the U.S. (*e.g.*, export)
To Prohibited Feed	Number of ID_{50}s during the simulation sent to feed plants designated for the production of prohibited feed
To NP Feed – Misdirected	Number of ID_{50}s during the simulation in prohibited MBM that is used to make non-prohibited MBM
To NP Feed – Contamination	Number of ID_{50}s during the simulation entering the supply of non-prohibited feed due to contamination in mixed feed mills
To NP Feed – Mislabeling	Number of ID_{50}s during the simulation entering the supply of non-prohibited feed due to mislabeling of prohibited material as non-prohibited
To Blood	Number of ID_{50}s in blood meal during the simulation
Out After Feed Production	Number of ID_{50}s during the simulation in feed diverted to uses for which there is no potential for either human or cattle exposure in the U.S. (*e.g.*, pet food)
Misfed to Cattle	Number of ID_{50}s during the simulation in prohibited feed inappropriately administered to cattle on the farm
Total to Cattle	Number of ID_{50}s in feed and blood meal administered to cattle during the simulation
Total to Humans	Number of ID_{50}s potentially available for human consumption during the simulation.
Potential Sources of Human Exposure to Transmissible Agent	
Brain	Number of ID_{50}s in cattle brain potentially available for human consumption during the simulation.

Endpoint	Description
Spinal Cord	Number of $ID_{50}s$ in cattle spinal cord potentially available for human consumption during the simulation
Blood	Number of $ID_{50}s$ in cattle blood potentially available for human consumption during the simulation
Distal Ileum	Number of $ID_{50}s$ in cattle distal ileum potentially available for human consumption during the simulation
Contaminated Organ Meat	Number of $ID_{50}s$ in cattle organ meat potentially available for human consumption during the simulation
Eyes	Number of $ID_{50}s$ in cattle eyes potentially available for human consumption during the simulation
Muscle Contamination	Number of $ID_{50}s$ in cattle muscle due to contamination potentially available for human exposure during the simulation
AMR	Number of $ID_{50}s$ in AMR product due to contamination potentially available for human consumption during the simulation
Beef on Bone	Number of $ID_{50}s$ in cattle beef on bone potentially available for human consumption during the simulation
Trigeminal Ganglia	Number of $ID_{50}s$ potentially available for human exposure from consumption of cheek meat tissue associated with the trigeminal ganglia during the simulation

2   Graphical Output Summaries

Graphical output for the simulations appear in Appendix 3B. For each run, we present six pairs of graphs (*i.e*., twelve graphs in all). The second graph in each pair (the "range of values" graph) describes the distribution for all recorded values. However, because of most graphs often use a log scale, they do not clearly illustrate the probability that the quantity described equals zero. For that reason, we also present graphs ("probability of value exceeding zero") that clearly illustrate these probabilities. The pairs of graphs focus on the following important simulation results.

2.1   Probability Graphs

- *Number of Cattle Infected – Probability of Value Exceeding Zero*: This illustrates how likely is that BSE will be present in the US in each year following the start of the simulation. The value at each point is the probability that there is at least one case (either asymptomatic or with signs) of BSE in the US in that year.

- *Number of Cattle Infected – Range of Values*: This box and whisker plot illustrates the range of values for the number of infected cattle in US each year. It is a stock statistics and hence reflects those infected animals that survived form the preceding year, the addition of new infected animals, and the removal of infected animals that died or were slaughtered during the preceding year.

- *Number of Cattle Clinical – Probability of Value Exceeding Zero*: This figure illustrates the likelihood of at least one animal with observable signs of BSE each year of the simulation

- *Number of Cattle Clinical – Range of Values*: This figure is a box and whisker plot that illustrates the range of values for the number of animals that have observable signs each year. .

- *ID_{50s} to Cattle – Probability of Value Exceeding Zero:* This plot illustrates the probability that a non-zero amount of infectivity will be administered to cattle in either feed or blood meal.

2.2 Range of Value Graphs

- *ID_{50s} to Cattle – Range of Values*: This plot illustrates the range of values for the number of ID_{50s} that are administered to cattle each year of the simulation.

- *Disposition of ID_{50s} – Probability that Quantity Exceeds Zero:* This is a bar graph illustrates the probability that the number of ID_{50s} over the entire period simulated in each listed pathway exceeds zero (see description of the pathways in the table above and in Section ????).

- *Disposition of ID_{50s} – Range of Values*: This plot the range of values for the number of ID_{50s} moving through each pathway over the entire period simulated.

- *ID_{50s} to Humans– Probability that Quantity Exceeds Zero*: This is a bar graph illustrates the probability that BSE infectivity is available for potential human exposure at each time point simulated. These probabilities do no reflect actual human exposure because they do not account for consumption rates, waste and other factors.

- *ID_{50s} to Humans– Range of Values*: This figure characterizes the range of values for number of cattle oral ID_{50s} potentially available for human exposure, in those cases when there are nonzero predictions. Again, this does not reflect actual human exposure because it does not account for consumption rates, waste, and other factors.

- *ID_{50s} to Humans by Tissue– Probability that Quantity Exceeds Zero*: This figure illustrates the likelihood that at least some infectivity becomes available for potential human exposure as a result of its presence in each of the specified tissues.

- *ID_{50s} to Humans by Tissue– Range of Values*: This figure illustrates the range of values for the number of cattle oral ID_{50s} in each of various tissues available for potential human exposure.
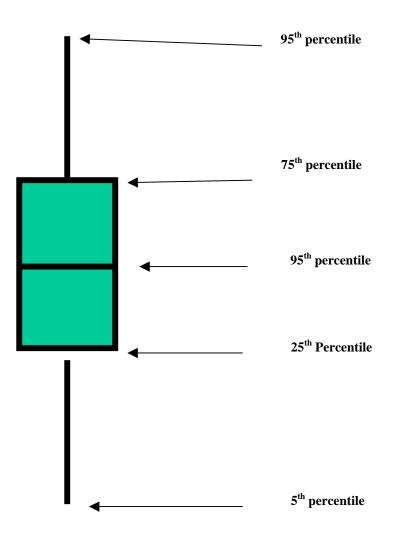
Appendix 3C

FIGURE 1
Exmple of a Box and Whisker Plot

95th percentile

75th percentile

95th percentile

25th Percentile

5th percentile