ACM/975

ADVISORY COMMITTEE ON THE MICROBIOLOGICAL SAFETY OF FOOD

INFORMATION PAPER

Background information on supershedders

The report of the inquiry into the outbreak of *E. coli* O157 in Wales in 2005 included the Recommendation 24: The feasibility of identifying "supershedder" cattle on farms should be explored as a potential means of reducing the likelihood of spreading *E.coli* O157 to other cattle." Attached is information provided by Dr Chris Low (Scottish Agricultural College) that provides some background and summary points about supershedders.

Secretariat
December 2009

VIA EMAIL – Ade Adeoye

ACMSF Secretariat

Our Ref: CL/cl

11 December 2009

Dear Ade,

The report of the inquiry into the outbreak of *E. coli* O157 in Wales in 2005 included the Recommendation 24: The feasibility of identifying "supershedder" cattle on farms should be explored as a potential means of reducing the likelihood of spreading *E.coli* O157 to other cattle." In considering the recommendation I have provided below some background and summary points about supershedders that you and your colleagues may find useful.

Background:

There is good laboratory and field evidence that some cattle excrete far more *Escherichia coli* O157 than others; these have become known as 'super-shedders'. However, despite an increasing number of published articles on *E. coli* O157 super-shedders, no formal definition was available prior to the Nature Reviews publication (Chase-Topping et al., 2008).

This review identifies that field studies have shown the majority (75%) of positive faecal samples contain $<10^2$ colony forming units (CFU) CFU.g^{-1} faeces of *E. coli* O157. This is above the detection threshold for immuno-magnetic separation (IMS) techniques but below the threshold for accurate enumeration. By comparison, a few animals (approximately 1 to 3%) may be excreting *E. coli* O157:H7 at levels up to $3.6x10^7$ CFU.g^{-1} faeces. The consequences of this high level excretion or 'supershedding' are substantial and have important consequences for the epidemiology of *E. coli* O157 in cattle - its main reservoir - and for the risk of human infection.

Summary points are:

- There is **no** evidence that 'supershedding' by cattle is a permanent or persistent state.

- The most logical explanation for 'supershedding' is that it is dependent upon colonisation, by the organism, of the terminal rectum of cattle.

- Experimental and field work has shown that rectal colonisation with high level faecal excretion is likely to be maintained for short periods of days or weeks.

- The animal and bacterial factors that lead to an animal becoming a 'supershedder' are unclear. However, high-level excretion is most commonly seen in young cattle post weaning.

- 'Supershedders' **are detectable** through existing cultural tests by using a non-enrichment method with a high detection threshold or testing a 1 in 1,000 dilution of the original faecal sample. Results may be available in 2 to 3 working days.

- Some commercially available assays, used by the food industry, have been assessed for use as pen-side detection methods, but to date consistency of results has been an issue.

- There is currently **no** pen-side test that would allow the immediate detection of high-level faecal excretion of *E. coli* O157.

- In a policy context, it is not feasible at present to consider the **testing** for 'supershedding' as a routine means for risk management in commercial cattle herds. However, there are circumstances such as: follow-up investigation of herds to human cases of infection where bacterial testing and enumeration of the faecal carriage of *E. coli* O157 would be useful.
- High level shedding, or supershedding, cattle are proportionately more important to environmental contamination, and presumably exposure of other animals, than many cattle with low level carriage of the organism.

I trust this information is useful to you and I'll be happy to discuss in greater depth if you need.

Yours sincerely

Dr Chris Low

Animal Health Group Manager

CC. Peter Stevenson (DEFRA).

Appendix extract from Chase-Topping et. al., 2008:

ii) E. coli O157 super-shedders.

A super-shedding *E. coli* O157 infection is likely to arise as a combination of a particular strain of *E. coli* O157 colonising a particular animal with an appropriate flora (bacteria and bacteriophage) and immune status. For *E. coli* O157, several working definitions of a super-shedder can be found in the literature. The most basic of these are derived from single direct counts of *E. coli* O157 in faecal samples. Cut-offs for super-shedding have been suggested at counts $\geq 10^3$ or $\geq 10^4$ colony forming units (CFU) g^{-1} faeces[18,21,59,60], or the simple identification of outlying counts has been used[61]. Mixture distribution analysis has suggested a cut-off of 3,135 CFU g^{-1} faeces (low and high confidence threshold: 1,658 and 10,395)[13]. Such measures are simple to use but do not directly indicate whether an animal is colonized at the terminal rectum, nor do they allow for (possibly substantial) sample-to-sample variation in bacteria counts during the course of an infection. A study of cattle at slaughter found that shedding $>10^3$ CFU g^{-1} faeces was associated with bacterial carriage close to the terminal rectum whereas shedding $<10^3$ was not[18] and implies that super-shedding is closely related to colonization of the terminal rectum and it is known that such colonization may persist for weeks. A recent study[20] using recto-anal mucosal swabs (RAMS) defined a super-shedder on the basis of both mean concentration ($\geq 10^4$ CFU/RAMS) and persistent colonization (≥ 4 consecutive positive RAMS, where sampling was carried out twice per week for 14 weeks). In a study of sheep at slaughter in Scotland, the counts of *E. coli* O157 in faeces were occasionally $>10^7$ CFU ml^{-1}, suggestive of the existence of other host species as super-shedders of the organism (unpublished data). In addition, a high prevalence of *E. coli* O157 was observed[25] in a sheep flock in Scotland with individuals in flock shedding up to 10^6 CFU.g^{-1}.