

COMPLETION NOTICE

SA ¶4(c) Conduct QMRA (based on measurement of pathogenic organisms and indicators) to estimate illness at a freshwater beach impacted by agricultural animal sources of fecal contamination (location to be determined) (P4)

Summary of the Study

A Quantitative Microbial Risk Assessment (QMRA) was conducted to estimate the human health risks associated with recreational exposure to water containing agricultural animal (cattle, poultry, pigs) fecal contamination. To conduct this risk assessment, EPA gathered data from the peer reviewed scientific literature and from targeted field experiments designed to characterize the fate and transport potential of zoonotic pathogens and fecal indicator bacteria from the site of manure application to surface waters.

The risk assessment was conducted to address two questions:

- 1) What is the risk of illness to humans from recreational exposure to fresh surface waters impacted by agricultural animal (cattle, poultry, and pigs) sources of fecal contamination?
- 2) How do those risks compare to risks associated with freshwater beaches impacted by human sources of fecal contamination?

Two different risk assessment approaches were used to address these questions. In the first approach, the risk associated with each fecal contamination source is characterized as the total probability of GI illness from each source-specific reference pathogen. In the second approach, the estimated risks are calculated for a hypothetical waterbody that contains fecal indicator bacteria levels at the current recommended geometric mean recreational water quality criteria (i.e., 33 cfu per 100 mL *Enterococcus* spp. and 126 cfu per 100 mL *E. coli*). The resulting risk distributions are then compared to known benchmark risks for human-impacted waters.

Summary of Findings

In addressing question 1, EPA estimated the density of reference pathogens in the runoff from each fecal source and found:

- *E. coli* O157:H7 is the predicted dominant reference pathogen of concern in cattle-impacted water, followed by *Campylobacter* and *Cryptosporidium*. For pig-impacted water, *Campylobacter* and *Cryptosporidium* are the predicted dominant reference pathogens of concern, followed by *Giardia*. For poultry-impacted waters *Campylobacter* is the predicted dominant reference pathogen of concern.¹
- The predicted median cumulative risk of illness from recreational exposure to a cattle-impacted waterbody is similar to the risk of illness associated with the current criteria based on human fecal contamination.

¹ Another study estimated the primary etiological agent in recreational freshwaters impacted by human sources of fecal contamination to be norovirus (Soller et al. 2010. Wat Res 44:4736-4747).

- The predicted median cumulative risk of illness from recreational exposure to a pig-impacted waterbody is approximately four-times lower than the risk of illness associated with the current criteria based on human fecal contamination.
- The predicted median cumulative risk of illness from recreational exposure to a poultry-impacted waterbody is approximately 300-times lower than the risk of illness that is associated with the current criteria based human fecal contamination.

In addressing question 2, to compare estimated human health risks between different fecal sources at a specific density of fecal indicator bacteria for a hypothetical waterbody (i.e., 33 cfu enterococci per 100 ml or 126 cfu *E. coli* per 100 ml) EPA found:

- The predicted median relative risk of illness from recreational exposure to a cattle-impacted waterbody is approximately 25 to 150 times lower than risk of illness associated with recreational exposure to human sources of contamination.
- The predicted median relative risk of illness from recreational exposure to a pig-impacted waterbody is approximately 30 times lower than the risk of illness that is associated with human sources of contamination.
- The predicted median relative risk of illness from recreational exposure to a poultry-impacted waterbody is approximately 20 to 5000 times lower than risk of illness that is associated with human sources of contamination.

This study has been completed as of December 15, 2010.