

## ***Manure Management and Antibiotic Contamination***

***Jessica G. Davis, PhD  
Soil and Crop Sciences  
Colorado State University***

Low levels of antibiotics have recently been detected in surface water bodies, such as rivers and lakes, around the country. Is this going to become an environmental crisis for the American dairy industry? The answer will depend in part on whether dairy antibiotic use contributes to this contamination. There are actions that dairy producers can take to minimize this hazard. The purpose of this article is to inform producers about this area of concern and to provide some suggestions for how to avoid potential problems with antibiotic contamination of the environment.

At this point, the sources of the antibiotics detected in these studies have not been identified. They could have either human, urban sources and/or veterinary, agricultural sources. Could dairies be a source of antibiotics in surface water? Colorado State University recently sampled seven dairy lagoons and seven dairy manure stockpiles and analyzed them for several antibiotic classes. The lagoon samples ranged from non-detectable levels to 17, 17, and 19 parts per billion for the tetracyclines, sulfonamides, and macrolides. The solid manure samples also ranged from non-detectable levels to 5130, 46, and 5 parts per billion of tetracyclines, sulfonamides, and macrolides. Although results demonstrate the presence of antibiotics in dairy manure and lagoons, these antibiotic levels are quite low, less than 50 parts per billion, with the exception of one high measurement of tetracyclines in solid manure.

Knowing that antibiotics have been found in water bodies and in dairy manure sources, the question remains: can antibiotics be transported from dairy manure and wastewater storage areas to water bodies? We have begun transport studies to evaluate runoff and leaching of antibiotics, but at this point there are many unanswered questions. There are many potential sources including pharmaceutical production facilities, wastewater treatment plants, feed mills, seepage from wastewater lagoons, or runoff from livestock operations or manured fields.

In addition to identifying contamination sources, we need to know whether the antibiotic levels measured in water bodies are high enough to have negative environmental impacts. In general, most measured concentrations have been well below (ten times lower) the levels that have been shown to be toxic to standard testing organisms. There are some exceptions to this general observation, but these are mostly related to antibiotics in manure itself and in soil where manure is applied, rather than in water sources.

In addition to direct toxicity effects, antibiotics in the environment could lead to the development of antibiotic resistance, a critical concern as it relates to the efficacy of antibiotics in the treatment of disease. This is not a new issue; in 1989, the National Academy of Sciences concluded that the use of antibiotics in animal feeding operations was seriously undermining the ability of antibiotics to protect human health. The World Health Organization called for a ban on routine feeding of antibiotics to livestock in 1997. Scientists are researching this area to determine whether antibiotic resistance develops in surface water bodies where antibiotic concentrations have been documented.

If dairies and other livestock operations are indeed a source of antibiotic contamination of water

bodies, then it will be important to know what manure management decisions can be made to hasten the degradation of antibiotics and limit their potential negative impacts. Scientists are currently evaluating treatments such as composting, lagoon aeration, and phytoremediation in order to be prepared to give producers solid recommendations about management options to limit the spread of antibiotics in the environment.

Antibiotics that are commonly used in livestock production have been found in surface water bodies. What are the sources of contamination? Are the concentrations high enough to cause harm to humans or ecosystems? If the sources include dairies or other livestock operations, what can be done to prevent further contamination?

As scientists seek answers to these questions, what can dairies do in the meantime? Following Best Management Practices (BMPs) for manure nutrients will also reduce the potential for contamination of water bodies with antibiotics. Ask yourself these questions to be sure you are following BMPs:

1. Is all of the runoff from your dairy (except for clean roof runoff) contained in your runoff storage pond? Or does some leave your property and enter ditches or creeks?
2. Are your wastewater lagoons designed, built, and maintained properly?
3. Are your lagoons lined to prevent seepage?
4. Do you inspect the lagoon berms regularly to look for cracks, rodent burrows, bulges, or sink holes that may be signs of a damaged liner?
5. Do you keep the lagoon water level below the marker (identified with a staff gauge) so that it can hold runoff from a 25-yr, 24-hr storm at all times?
6. If you furrow irrigate with wastewater, do you collect the tailwater?
7. If you sprinkle irrigate with wastewater, do you apply at a rate that the soil can soak in to avoid runoff?

By following these runoff and lagoon management practices, dairies can reduce the risk of antibiotic runoff into surface waters.