LIQUID MANURE IN TILE DRAINS: PATHWAYS AND RISK REDUCTION STRATEGIES

John Panuska [1/] and Peter J. Kleinman [2/]

Land application is the most common method of animal waste management in Wisconsin. A significant risk of land spreading manure is its entry into streams, lakes and groundwater. Oxygen demanding organic matter, bacteria, pathogens and nutrients from manure can be transported into surface and groundwater posing significant public health and environmental risks. The most common and readily apparent transport pathway for surface-applied liquid manure into surface waters is via surface runoff. To reduce odors and runoff risk and to capture maximum fertilizer value, many producers inject liquid manure directly into field soils. For non-tiled fields surface application and injection are appropriate methods of manure application when soil conditions (moisture, slope, frost, etc.) are right and when done at application rates appropriate for soil assimilation. The existence of tile drains may, however, render surface application and injection inappropriate by providing direct transport pathways for liquid manure to surface waters. Manure can enter tile drains via surface inlets, open cavities created by tile blow-outs and via soil macro-pores (earthworm holes, soil structural cracks and former root channels).

Management to reduce the risk of manure entry into surface inlets is to avoid surface applications on fields with tile surface inlets, replace surface inlets with closely spaced sub-surface tile laterals or use injection. To reduce the risk of manure entering open cavities from tile blow-outs, repair blow-outs properly and/or make the necessary tile system design changes to prevent blow-outs from re-occurring. The risk of manure leaching through macro-pores can be reduced by tillage timing and equipment type. For both surface and sub-surface application, high soil moisture (near or above field capacity) and tile flow during application significantly increase the risk of leaching losses. Pre-application tillage over tiles reduces surface application risk, but adds time, cost and requires accurate knowledge of tile line location. Completely avoiding tiled areas with manure application reduces loss risk, but limiting the manure application land base is also not practical. Recent research (summer 2009) on one type of tillage equipment suggests manure leaching via macro-pores can be significantly reduced by using an ant-leach sweep injector shank operated at a ~ 6 in injection depth. The sweep simultaneously applies manure and aggressively mixes it with soil. This method showed significantly less leaching for a swine manure slurry (~ 1% solids) applied at an 8,000 gal/acre rate when compared to shallow injection and surface application. Other types of tillage equipment are also effective at sealing soil macro-pores during manure application, thus reducing leaching. Careful attention to field conditions, application rate and soil moisture along with use of appropriate application equipment can reduce the risk of liquid manure leaching into tile drains and shallow groundwater, thus reducing environmental risks.

[1/] Natural Resources Extension Specialist, Biological Systems Engineering Dept., UW-Madison, 460 Henry Mall, Madison, WI 53706, jcpanuska@wisc.edu.

[2/] USDA – ARS, Pasture Systems and Watershed Management Research Unit, Building 3702, Curtin Rd., University Park, PA 16802, peter.kleinman@ars.usda.gov