



Facts About...

Nitrogen Discharge Limit and Other Requirements for Spray/Drip Irrigation System (Date of recent revisions: 9/17/2013)

Recognizing the impact of groundwater discharge of treated wastewater on surface water quality and Chesapeake Bay or Coastal Bay, the amended 2010 MDE Guidelines for Land Application/Reuse of Municipal Wastewater includes a stipulation that MDE will determine the nitrogen input for a groundwater discharge which may impact surface water body. Listed below are determinations of nitrogen limits for various spray/drip irrigation systems to implement this directive included in MDE Land Application/Reuse Guidelines:

1. A new spray/drip Irrigation system with groundwater moving toward a tributary of Chesapeake Bay Watershed or Coastal Bay.

To minimize nutrient load to the Chesapeake Bay or Coastal Bay, use the yearly nitrogen balance equation included in MDE Land Application/Reuse Guidelines and shown in next page or other equivalent nitrogen balance equation to determine the nitrogen concentration ("y" term in the equation) in treated wastewater in order to achieve a hypothetical zero nitrogen concentration ("a" term in the equation, use zero for "a" term) in the groundwater percolate.

Depending on the hydraulic loading rate and crop to be planted on the spray/drip fields, the applicable nitrogen discharge limitation determined from the equation to achieve the hypothetical zero nitrogen in the percolate may be incorporated in the groundwater discharge permit.

In the winter months, the spray/drip irrigation system shall provide a minimum of 60 days storage for storing treated wastewater when irrigation cannot take place due to frozen ground. Irrigation during vegetation dormant month such as December and March may leach nitrogen to groundwater. The applicant shall determine the contribution of nitrogen load to surface water and demonstrate that the nitrogen load determined can be offset prior to the groundwater discharge permit application.

2. A new spray/drip irrigation system with groundwater moving toward a tributary outside the Chesapeake Bay Watershed or Coastal Bay

To protect the groundwater quality for drinking water supply, use the nitrogen balance equation included in MDE Land Application/Reuse Guidelines and shown in next page or other equivalent nitrogen balance equation to determine the nitrogen concentration ("y" term in the equation) in treated wastewater in order to ensure the nitrogen concentration ("a" term in the equation, use 10 mg/l for "a" term) in the groundwater percolate meet the nitrate drinking water standard of 10 mg/l.

Depending on the hydraulic loading rate and crop to be planted on the spray fields, the applicable nitrogen discharge limitation determined from the equation to achieve the nitrogen concentration of less than 10 mg/l in the percolate may be incorporated in the groundwater discharge permit.



In the winter months, the spray/drip irrigation system shall provide a minimum of 60 days storage for storing treated wastewater when irrigation cannot take place due to frozen ground. Irrigation during vegetation dormant month such as December and March may leach nitrogen to groundwater. The applicant shall determine the contribution of nitrogen load to surface water and demonstrate that the nitrogen load determined can be offset prior to the groundwater discharge permit application.

3. An existing spray/drip irrigation system will be required to meet 10 mg/l total nitrogen concentration in the groundwater percolate regardless the capacity of the system. The 10 mg/l total nitrogen concentration water quality goal at the root zone is based on vegetation uptake without dilution from groundwater. This limitation has been required for all existing spray irrigation systems in the past. These systems are also required to sample upgradient and downgradient groundwater wells to ensure that the groundwater aquifer is not being impacted above the nitrate MCL of 10 mg/l. Because the design of the permit requirements are not based on dilution, an additional margin of safety is potentially provided by the aquifer immediately beneath the irrigation property as long as the nitrogen limit of 10 mg/l is met at the perimeter of the property. A second margin of safety exists through the permit limit of 10 mg/l expressed as total nitrogen instead of nitrate nitrogen.
4. An existing spray/drip irrigation system with a proposal for expansion

The expansion portion of the wastewater flow will be evaluated similar to a new system described as Case 1 or Case 2 shown above. The existing wastewater flow will be evaluated similar to the existing system described as Case 3 shown above. A weight ratio between expansion flow and existing flow will be used to determine the nitrogen effluent limitation for the pretreatment system.

Nitrogen Balance Equation

$$W = \frac{4.43 C + a(P - ET) - cP}{y - a - y(d + n)}$$

where:

- W = wastewater loading (acre-inch/acre-year)
- C = removal of nitrogen in crop (lbs/acre-year)
- a = allowable nitrogen concentration in percolation or runoff water (mg/L)
- P = precipitation (acre-inch/acre-year)
- ET = potential evapotranspiration (assumes that P + W will allow potential ET to be realized in all cases) (acre-inch/acre-year)
- c = concentration of nitrogen in precipitation (mg/L)
- y = concentration of nitrogen in wastewater (mg/L)
- d = fraction of nitrogen which is denitrified (% x 10⁻²)
- n = fraction of nitrogen which is volatilized as ammonia (% x 10⁻²)

5. The owner/operator of the land application system including the spray/drip irrigation system is required to submit a nutrient management plan (NMP) to MDE during the permit



application /renewal process. The NMP shall describe how nitrogen will be removed via vegetative uptake in minimizing the nitrogen leaching to the groundwater system.

6. The nitrogen loading cap to surface water will be determined for each spray irrigation site and included in the discharge permit. Depending on location of the spray site, the following Bay Program's nitrogen delivery rate will be used: (1) An 80% delivery rate in critical area; (2) a 50% delivery rate within 1000 feet from any perennial surface water; and (3) a 30% delivery rate from distances greater than 1,000 feet from any perennial surface water. A spray irrigation system with a groundwater quality goal in meeting $TN \leq 10$ mg/l below root zone, the surface water nitrogen loading limit will be determined based on $TN = 10$ mg/l in the groundwater and the applicable delivery rate. A spray irrigation system with the groundwater quality goal in meeting no TN below root zone during growing season, the surface water nitrogen loading limit will be determined based on the pretreated nitrogen effluent limitation, irrigation days during non-growing season and the applicable delivery rate. The permittee is required to monitor the effluent nitrogen concentration and irrigation flow for determining the actual nitrogen load from the irrigation system.
7. Drip irrigation system shall be designed in accordance with the MDE Supplemental Design Guidelines for Drip Dispersal of Treated Wastewater posted in the following web site: <http://www.mde.state.md.us/programs/Permits/WaterManagementPermits/WaterDischargePermitApplications/Documents/WastewaterDesignGuidelines-2013.pdf>
8. The groundwater discharge permit issued for a drip irrigation system shall include operational requirements for detecting ponding or surface runoff in drip irrigation fields, such as monitoring dosing flow rate for leak detection, installing moisture sensors in the drip field for detecting soil saturation and completing operational logs for the drip fields.

