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Nutrient Water Quality Standards

Nearly all production operations that process animal by-products generate wastewater that contains significant concentrations of nitrogen and phosphorus. Rendering plants generate wastewater that has nitrogen concentrations that are more than 30 times the levels in typical municipal sewage. Wastewater treatment for removal of nitrogen and phosphorus to extremely low amounts can be very expensive.

Water quality standards are developed by states for protection of streams and lakes. These standards define the allowable concentrations of contaminants in streams that are required for the protection of aquatic life and other stream uses such as recreation and drinking water supply. Water quality standards are used in the derivation of discharge permit limits for wastewater treatment facilities with many states developing total nitrogen and phosphorus standards that will significantly impact the rendering industry. It is important that renderers take an active role in the development and review of nutrient standards at the state level to ensure practical and economically achievable rules are developed.

Nitrogen and phosphorus are essential nutrients for life. However, discharges of excessive nitrogen and phosphorus to lakes and streams stimulate algae growth and subsequent secondary effects on water quality such as low dissolved oxygen. This nutrient-induced water quality condition is termed "eutrophic" and can impact both aquatic life and recreational uses.

Clean Water Act and Nutrient Regulation

The Great Lakes were the first bodies of water to raise significant national attention to the impacts of excess nutrients. Lake Erie was declared "dead" in the 1960s when algal blooms resulted in oxygen depletion that killed fish and coated beaches with slimy, odorous algal biomass. The Great Lakes Water Quality Agreement in 1972 resulted in a significant reduction in phosphorus discharge to the Great Lakes and a tremendous successful recovery of their aquatic life and water quality.

The United States (US) Clean Water Act (CWA) requires all waters to be "fishable" and "swimmable" and comply with state water quality standards for pollutant concentrations and "narrative" criteria such as "free from aesthetically objectionable conditions" and "free from substances in quantities which would produce undesirable or nuisance aquatic life." States must develop lists of waters that do not meet water quality standards, which are then classified as "impaired waters." Since most states have not adopted numeric water quality standards for nitrogen and phosphorus concentrations, waters with excessive algal growth attributed to nitrogen and phosphorus have been classified as impaired due to failure to meet narrative water quality standards.

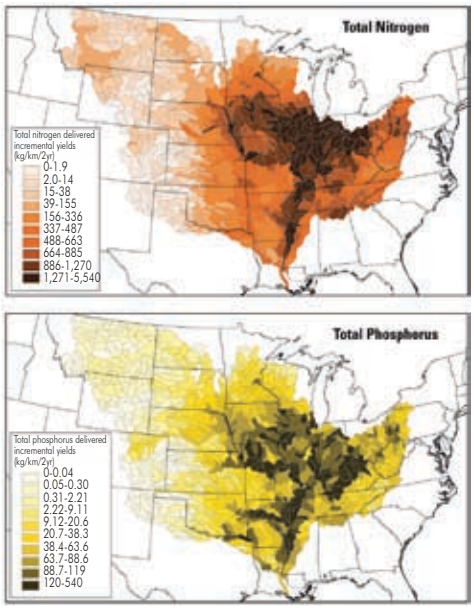
The total maximum daily load (TMDL) process is a Clean Water Act requirement for waters that are impaired. The process identifies the maximum amount of a pollutant that can be discharged from all sources to a stream or lake and still meet water quality standards. The allowable amount of pollutant discharge from each source (discharge permit limits for wastewater treatment plants) is then determined as the maximum watershed load and is allocated to each discharge source. Discharge sources include point sources such as treatment facility discharges and nonpoint sources such as stormwater runoff and tile drainage from agricultural land. In many agricultural areas, most of the nitrogen and phosphorus loads are attributed to nonpoint sources rather than wastewater treatment facility discharges.

Chesapeake Bay

Chesapeake Bay is perhaps the most notorious recent example of nutrient pollution and subsequent regulatory action followed by extensive litigation. Most of the bay was listed as impaired due to excess nitrogen, phosphorus, and sediment that attributed to the declines in blue crab, waterfowl, and fish populations. The US Environmental Protection Agency (EPA) issued the final Chesapeake Bay TMDL in late 2010 in response to President Barack Obama's 2009 executive order that directed the federal government to lead the effort to restore and protect the Chesapeake Bay watershed. This is the largest and most complex TMDL in the United States as it covers a 64,000 square mile watershed in six states and the District of Columbia. The TMDL allocated nitrogen and phosphorus loads to each major river basin and to point and nonpoint sources. Each state or jurisdiction is responsible for developing watershed improvement plans (WIPs) that include allocations of the nitrogen and phosphorus total basin allowable load to each source.

EPA continues to maintain close surveillance of the WIP

Figure 1. Nitrogen and phosphorous loads to the Mississippi River Basin.



Source: US Geological Survey, http://wi.water.usgs.gov/ma/9km30/index.html.

implementation process to ensure the nitrogen, phosphorus, and sediment loads are reduced. The agency plans to take more aggressive steps in reducing nutrient loads if required, including significantly more stringent discharge limits on wastewater treatment plants and more aggressive regulation of agricultural operations, if the target nutrient load reductions are not achieved.

Agricultural groups including the American Farm Bureau and several commodity and producer groups filed a lawsuit that challenges the Chesapeake Bay TMDL. The lack of federal authority to issue and implement a TMDL unless a state fails to act is one of the most significant legal issues in this case. The reliance by EPA on inaccurate information to establish the TMDL is one of the most significant technical issues. Point source discharge groups and environmental coalitions have intervened in the lawsuits. The most fundamental issue with these groups is how to equitably spread the burden of improving water quality between heavily regulated point sources and relatively unregulated agricultural nonpoint sources. Hundreds of millions of dollars have been and continue to be spent on legal battles and environmental studies regarding the Chesapeake Bay nutrient issues.

More information on the Chesapeake Bay TMDL is available at www.epa.gov/reg3wapd/tmdl/ChesapeakeBay/tmdlexec.html.

Florida

Florida was in the process of implementing an EPA approved plan for nutrient criteria in 2008 when several environmental groups sued EPA to force immediate development of numeric nutrient standards. They successfully argued that the Florida narrative standards were not adequate for protection of aquatic life and recreational uses. The courts forced EPA to establish stringent numeric nitrogen and phosphorus water quality standards for Florida. The agency later approved some of the standards that were developed by the state. Several lawsuits were filed in response to EPA's actions alleging the standards are not scientifically sound. Florida is an example of how legal actions can force adoption of stringent, technically questionable nitrogen and phosphorus standards even though the state is actively implementing an EPA approved nutrient control plan.

EPA Nutrient Reduction Framework Memo

Very few states have adopted numeric nutrient and phosphorus criteria. Based on the Florida experience, EPA indicated it does not want to set state nutrient standards, instead each state should develop its own standards.

In March 2011, EPA Acting Assistant Administrator Nancy Stoner issued a memo, *Working in Partnership with States to Address Phosphorus and Nitrogen Pollution Through Use of a Framework for State Nutrient Reductions*, which set forth an eight-point approach for states to reduce nutrient loads.

1. Prioritize watersheds.
2. Set watershed goals.
3. Ensure effectiveness of point source permits.
4. Develop watershed plans that target the most effective practices in agricultural areas in highest priority watersheds.
5. Identify tools to reduce nutrient discharges from communities not covered by Municipal Separate Storm Sewers Systems programs (storm water and septic systems discharges).
6. Verify and quantify imple-mentation of best management practices and achieving load reductions in targeted watersheds.
7. Publish an annual report of progress in reducing nutrient loads from targeted watersheds.
8. Develop work plan and schedule for numeric criteria (water quality standards) development.

This "Stoner framework memo" has become a standard guideline used by many states in developing nutrient standards and nutrient reduction programs.

Gulf of Mexico Hypoxia Zone

Nitrogen and phosphorous loads to the Mississippi River basin have been identified as the most significant factor in the dead zone, or "hypoxia zone," in the northern Gulf of Mexico. Hypoxia refers to the condition of low dissolved oxygen. Excessive algal growth results in decreased dissolved oxygen in the lower levels of the water column. Free-swimming aquatic organisms leave the hypoxia zone and other organisms die. Fish and shrimp are less abundant in the Gulf hypoxia zone. The 2008 Hypoxia Action Plan established a goal of 45 percent reduction in nitrogen and phosphorus loads from the Mississippi River. Figure 1 illustrates the significant nitrogen and phosphorus loads from the Midwestern Corn Belt agricultural states of Iowa, Illinois, Indiana, and Ohio.

In March 2012, a broad coalition of environmental advocacy groups filed a lawsuit against EPA in US District Court for the Eastern District of Louisiana that demands EPA force states in the Mississippi River Basin to adopt stringent numeric nitrogen and phosphorus water quality standards. The suit also demands that EPA prepare a TMDL for the entire Mississippi basin. On the same day, the Natural Resources Defense Council filed a separate lawsuit in the US District for the Southern District of New York that demanded EPA revise the definition of secondary wastewater treatment technology for municipal plants to include nitrogen and phosphorus discharge limits. These minimum "technology-based limits" would be applicable to all municipal wastewater treatment facilities in the United States. These two lawsuits could have very significant impacts on the rendering industry in the Midwest and throughout the country.

EPA Nutrient Criteria

In 1998, EPA developed guidelines for nitrogen and phosphorus water quality standards that included recommendations for 14 "nutrient ecoregion" numeric criteria. These recommendations have received significant criticism from the scientific community due to a lack of scientific evidence correlating excessive algal growth and other negative impacts with specific nitrogen and phosphorus concentrations. Based on the EPA criteria, more than 50 percent of the streams in the United States would exceed the phosphorus criteria and be classified as impaired.

Adoption of these stringent EPA numeric criteria as state

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water quality standards would result in discharge limits for facilities on small streams that would not be technically or economically achievable. For example, the 1998 EPA criteria for the upper Midwest region are 2.18 milligrams per liter (mg/L) total nitrogen and 0.076 mg/L total phosphorus. The limits of biological nutrient removal treatment technology are 3.0 mg/L total nitrogen and 0.10 mg/L total phosphorus. Dischargers to small streams would have extremely stringent limits with values nearly the same as the EPA criteria. Table 1 is a summary of the EPA criteria and four tiers of nutrient removal technology for municipal wastewater treatment facilities. As illustrated, the EPA ecoregion criteria are more rigorous than the limits of technology. Therefore, several states are opting to use the narrative criteria approach rather than the "one size fits all" numeric standard approach. The narrative approach relies on observed stream water aquatic life quality and other indicators of nutrient induced stresses in evaluation of acceptable nitrogen and phosphorus loads.

Iowa Nutrient Reduction Strategy

Iowa released the draft Iowa Nutrient Reduction Strategy for public comment in November 2012, a coordinated plan for assessing and reducing nitrogen and phosphorus discharges to Iowa streams and lakes from point and nonpoint sources. There are two significant overall objectives:

1. Reduce Iowa's nitrogen and phosphorus loads to the Gulf of Mexico by at least 45 percent (as per the Gulf Hypoxia Task Force); and

2. Improve and protect Iowa's waters with respect to nutrient impacts.

The strategy was developed by a cooperative effort of the Iowa Department of Agriculture and Land Stewardship, the Iowa Department of Natural Resources (DNR), and a team of nonpoint source experts from Iowa State University, the US Department of Agriculture, and EPA with significant input from point and nonpoint source stakeholders. The strategy follows the March 16, 2011, Stoner framework memo for state nutrient reduction programs. It was developed in response to the Gulf Hypoxia Task Force goal of at least 45 percent reduction in nitrogen and phosphorus loads to the Gulf of Mexico and the EPA requirements for development of nutrient water quality standards for protection of Iowa's streams and lakes.

Very detailed evaluations of management practices and edge of field treatment alternatives for reducing nutrient discharges from nonpoint sources are included in the strategy. The evaluation contains capital and operation cost estimates, including costs per pound of nitrogen and phosphorus reduction for each nonpoint source reduction alternative. This is probably the most comprehensive evaluation of nonpoint source alternatives to date in the United States. This information will be used in developing nonpoint source policy and incentive programs for nonpoint source nutrient reduction.

The strategy is based on the State of Kansas approach to nitrogen and phosphorus standards. The concept was actively promoted to the Iowa DNR by point source discharger groups, including the Iowa Water Environment Association.

The strategy takes the following general pragmatic and coordinated approach to nutrient reduction and nutrient water quality standards.

1. Reduce nutrient loads from point and nonpoint sources now.

2. Evaluate stream and lake water quality based on nutrient stressor-response analysis (dissolved oxygen, chlorophyll A, and biological assemblage indicators such as algae, invertebrates, and fish).

3. Continue to reduce nutrient loads as required to achieve water quality goals (adaptive watershed management approach).

4. Evaluate the need for numeric nitrogen and phosphorus water quality standards as part of the DNR triennial water quality standards review process and implement appropriate standards long-term on a site-specific basis

Point sources contribute an estimated eight percent of the total nitrogen load and 20 percent of the total phosphorus load on Iowa's streams and lakes. These relative contributions from point and nonpoint sources are typical of many agricultural economy-based states. Even though point sources have a relatively low impact on the nutrient load to the Gulf of Mexico as compared with nonpoint sources, point sources can have significant impacts on nutrient concentrations and water quality in small streams during low flow conditions.

The point source approach is based on reduction in total nitrogen and total phosphorus discharges from major municipal and industrial wastewater treatment facilities using technology-based total nitrogen and total phosphorus discharge limits. This approach is an alternative to the numeric stream water quality standard approaches that have been forced on some states by litigation and EPA. The strategy requires installation of nutrient removal at 102 major municipal treatment facilities (facilities greater than one million gallons per day average wet weather design capacity) and 28 major industrial treatment facilities where nutrient removal is economically and technically feasible. Schedules for construction of plant improvements will be negotiated and the schedules will consider affordability.

Industrial wastewater treatment facilities that are subject to EPA categorical industry technology-based total nitrogen and phosphorus discharge limits will continue to have limits equal to EPA categorical industry limits. For example, meat packing and rendering facilities with direct discharge treatment facilities will have total nitrogen limits that are equal to the technology-based EPA Effluent Limitations Guidelines and New Source Performance Standards for the Meat and Poultry Products Point Source Category (40 *Code of Federal Regulations*, Part 432), or 134 mg/L monthly average total nitrogen concentration. Currently there are no total phosphorus effluent limitation guidelines for meatpacking and rendering facilities. The nitrogen and phosphorus discharge limits will not be more stringent for 10 years after completion of plant improvements for nutrient removal.

The implementation of nutrient removal at the major treatment plants has the potential for four percent reduction in nitrogen and 16 percent reduction in phosphorus loads from the current total point and nonpoint source annual loads.

The draft Iowa Nutrient Reduction Strategy is designed to achieve a near-term significant reduction in nutrient loads without establishing overly stringent numeric stream water quality standards. It results in efficient expenditure of limited resources in attaining the maximum environmental benefits per dollar invested. The strategy for point sources has received favorable review comments from EPA Region VII and EPA headquarters staff. The draft strategy received favorable review comments from many industrial and trade association groups including the National Renderers Association, American Meat Institute, and Iowa Association of Business and Industry. Some other Midwestern states are considering adopting nutrient reduction programs similar to the Iowa approach.

The draft Iowa Nutrient Reduction Strategy is available at www.nutrientstrategy.iastate.edu.

Summary

The implementation of nitrogen and phosphorus water quality standards will have significant impacts on the rendering industry. Legal actions have forced the adoption of stringent numeric water quality standards in some states that may not be economically or technically achievable with conventional wastewater treatment technology.

Alternative approaches to numeric water quality standards are being developed at the state level. These alternative methods, such as the Iowa Nutrient Reduction Strategy and the Kansas approach, include flexible technology-based discharge limits that result in the most efficient capital investment per pound on nitrogen and phosphorus reduction. Significant reductions in point source nutrient loads are realized now with investment in treatment facility modifications rather than wasting money on litigation regarding appropriate numeric standards. Appropriate numeric stream water quality standards are developed on a site-specific basis over a period of several years, rather than adopting the EPA "one size fits all" ecoregion numeric standards.

Although these nutrient water quality decisions are being made at the state level, there is significant national attention and pressure from environmental groups to expedite the implementation of nutrient standards. The March 2012 lawsuits may force EPA to take action regarding nutrient standards in the Mississippi River basin and require technology-based nitrogen and phosphorus discharge limits for all wastewater treatment facilities throughout the United States.

It is important that impacted stakeholders, including firms and trade organizations in the protein processing industries such as the meatpacking, poultry, and rendering industries, take an active role in the development of nutrient standards and nutrient reduction policies at the state level. If states do not take action, they are at risk of legal actions that may result in excessively stringent numeric nitrogen and phosphorus standards that result in unachievable nitrogen and phosphorus discharge limits. **R**

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Table 1. Effluent concentrations (mg/L) achievable with various levels of treatment technology

Level of treatment technology	Total nitrogen	Total phosphorus
1 – Biological nutrient removal (BNR)	10.00	1.00
2 – Enhanced BNR with chemical treatment	6.00	0.20
3 – Limits of BNR technology	3.00	0.10
4 – Limits of technology (membrane processes)	2.00	0.02
EPA ecoregion criteria	3.00	0.07
Typical municipal sewage	25.00	7.00
Typical dead stock rendering wastewater	900.00	40.00
EPA categorical standard for rendering	134.00	No standard