Stormwater Runoff Water Quality Science/Engineering Newsletter Devoted to Urban/Rural Stormwater Runoff Water Quality Management Issues

* * * * *

Volume 6 Number 5
May 27, 2003

Editor: Anne Jones-Lee, PhD
Contributor to this Issue:
G. Fred Lee, PhD, PE, DEE

* * * * *

This issue of the Newsletter is devoted to a review of some of the issues that should be considered in developing a technically valid, cost-effective **pollutant trading** program. Pollutant trading issues will likely become important in regulating chemical constituents in urban stormwater runoff and agricultural stormwater runoff/discharges. Upon review of the US EPA's pollutant trading policy discussed below, it is found that this policy does not necessarily incorporate the current science related to defining pollutants – i.e., those substances that impair the beneficial uses of waterbodies. The mechanical, non-technically-valid application of the US EPA's pollutant trading policy, in which all constituents of a type, such as total phosphorus, are considered pollutants, could result in technically invalid pollutant trading programs, which will not achieve the desired improvement in water quality. Lee and Jones-Lee (1992, 1994, 1996) have previously reviewed issues that need to be incorporated into valid pollutant trading programs. A summary of key issues is presented below.

In January 2003 US EPA Administrator Christie Whitman announced a *"... new Water Quality Trading Policy."* This announcement, along with more information on the US EPA's Trading Policy, can be accessed on the Internet at www.epa.gov/owow/watershed/trading.htm. According to Ms. Whitman,

> *"The Water Quality Trading Policy I am announcing today recognizes that within a watershed, the most effective and economical way to reduce pollution is to provide incentives to encourage action by those who can achieve reductions easily and cost-effectively. Our new Water Quality Trading Policy will result in cleaner water, at less cost, and in less time. It provides the flexibility needed to meet local challenges while demanding accountability to ensure that water quality does improve."*

On page 2 of the US EPA Pollutant Trading press release, the fifth paragraph states,

> *"In order for a water quality trade to take place, a pollution reduction 'credit' must first be created. EPA's water quality trading policy states that sources should reduce pollution loads beyond the level required by the most stringent water quality based requirements in order to create a pollution reduction 'credit' that can be traded. For example, a landowner or a farmer could create credits by changing cropping practices and planting shrubs and trees next to a stream. A municipal wastewater treatment plant then could use these credits to meet water quality limits in its permit."*

The suggestion that a farmer could plant shrubs and trees next to a stream as part of a pollutant trading program and gain pollutant trading credits, should be carefully evaluated. Lee and Jones-Lee (2002) have reviewed the current information on management practices for controlling nutrients in stormwater runoff/discharges from agricultural lands. A critical review of existing information shows that, except for a few instances, there is inadequate information on the effectiveness of buffer strips in controlling phosphorus in runoff from agricultural areas. Where these strips have been found to be effective are areas where there is substantial, frequent rainfall, and there is dense vegetation – i.e., not where a few trees or shrubs line a creek bank. Further, much of the removal of phosphorus that occurs by vegetative strips is by trapping of particulate phosphorus which, as discussed below, is largely unavailable to support algal growth.

On page 4, under III. Water Quality Trading Policy Statement, the third paragraph states,

> *"C. Pollutants and Parameters Traded. EPA supports trading that involves nutrients (e.g., total phosphorus and total nitrogen) or sediment loads. In addition, EPA recognizes that trading of pollutants other than nutrients and sediments has the potential to improve water quality and achieve ancillary environmental benefits if trades and trading programs are properly designed. EPA believes that such trades may pose a higher level of risk and should receive a higher level of scrutiny to ensure that they are consistent with water quality standards. EPA may support trades that involve pollutants other than nutrients and sediments on a case-by-case basis where prior approval is provided through an NPDES permit, a TMDL or in the context of a watershed plan or pilot trading project that is supported by a state, tribe or EPA."*

Previous Stormwater Runoff Water Quality Science/Engineering Newsletters (4-3/4, 5-1) have discussed the technically invalid approach that the US EPA has been following in developing its chemical-specific numeric water quality criteria for phosphorus, in which the Agency is focusing on total phosphorus, rather than algal-available phosphorus. Copies of these Newsletters are available from www.gfredlee.com. They contain a summary of the literature on algal-available phosphorus.

As discussed, substantial parts of the particulate phosphorus associated with erosion from agricultural and urban areas have been found to be not available to support algal growth in the receiving waters for stormwater runoff from these areas. This particulate phosphorus also does not convert to algal-available phosphorus in the receiving waters. Further, techniques have been available since the late 1960s to distinguish between algal-available and non-available forms of phosphorus. As discussed by Lee and Jones-Lee (1992, 1994, 1996), a number of the so-called pollutant trades that have occurred for phosphorus, such as in Colorado and North Carolina, ignored the fact that some of the phosphorus credits traded were for phosphorus that was in a non-available form. This situation has resulted in technically invalid pollutant trades.

On page 4, the next to the last paragraph states,

> *"Where state or tribal water quality standards allow for mixing zones, EPA does not support any trading activity that would exceed an acute aquatic life criteria within a mixing zone or a chronic aquatic life or human health criteria at the edge of a mixing zone using design flows specified in the water quality standards."*

The above restrictions on mixing zones can lead to unnecessarily restrictive discharges of constituents which are measured by standard methods, some of which are not true pollutants. Toxicity conditions in a mixing zone should be assessed based on appropriately conducted and interpreted toxicity tests, considering duration of exposure in the test, relative to that in the mixing zone – not chemical analyses and a mechanical comparison to US EPA worst-case-based criteria and state standards based on these criteria.

On page 6 of the US EPA's Water Quality Trading Policy Statement, under "F. Alignment With The CWA," item 4 (on page 7) states,

> *"4. Consistency With Standard Methods. Where methods and procedures (e.g., sampling protocols, monitoring frequencies) are specified by federal regulations or in NPDES permits, they should continue to be used where applicable for measuring compliance for point sources that engage in trading. EPA believes this is necessary to provide clear and consistent standards for measuring compliance and to ensure that appropriate enforcement action can be taken."*

Since "standard methods" typically used do not measure toxic available forms, they tend to overestimate the effects of particulate or nontoxic, non-available forms of constituents. It is important that pollutant trading be based on pollutants – i.e., those constituents that impair beneficial uses – not on chemical concentrations, where there is a potential for part of the measured constituent to be in nontoxic, non-available forms.

On page 8, under "G. Common Elements of Credible Trading Programs," the second paragraph under item 4 Quantifying Credits and Addressing Uncertainty (page 9) states,

> "*Where trading involves nonpoint sources, states and tribes should adopt methods to account for the greater uncertainty in estimates of nonpoint source loads and reductions. Greater uncertainty in nonpoint source estimates is due to several factors including but not limited to variability in precipitation, variable performance of land management practices, time lag between implementation of some practices and full performance, and the effect of soils, cover and slope on pollutant load delivery to receiving waters."*

The US EPA fails to address one of the most important issues with respect to nonpoint sources – namely, the fact that part of the potential pollutants are in non-available forms. This is usually, but not always, more of a problem for nonpoint sources than point sources. The failure of the US EPA, states and dischargers to specifically address the issues of available forms of potential pollutants is another example of the regulatory agencies' failure to reliably incorporate aquatic chemistry/toxicology/biology into their water quality management programs. The issue of toxic/available forms of potential pollutants has been well known since the late 1960s. The National Academies of Science and Engineering, in their Blue Book of Water Quality Criteria 1972 (NAS/NAE, 1973), recognized this situation when the Academy committees concluded that the regulation of heavy metals in wastewater effluent should be based on toxicity testing, and not chemical concentrations.

Since the 1980s, the US EPA has been attempting to largely ignore the aqueous environmental chemistry of particulate pollutants in the receiving waters as they may impact the beneficial uses of these waters. While the Agency finally adopted dissolved forms of some heavy metals in receiving waters as the regulated forms, it still has not addressed this problem for many other potential pollutants.

Still under item 4 Quantifying Credits and Addressing Uncertainty, the second paragraph on page 10 states,

> *"For storm water runoff other than agriculture, EPA recommends monitoring or modeling to estimate pollutant loads and load reductions. EPA believes this may be based on local hydrology and actual data or pollutant loading factors that relate land use patterns, percent imperviousness or percent disturbed land and controls or management practices in a watershed to per acre or per unit pollutant loads, where other methods are not specified in a permit or regulation."*

This approach can readily lead to erroneous pollutant trading, since the currently available models that are used for this purpose, while labeled "water quality models," are only chemical constituent concentration models that do not incorporate water quality impacts in the model. Rather than focusing on chemical concentrations, pollutant trades should be based on chemical impacts on a receiving water's beneficial uses.

An issue that should be considered in any pollutant trade is near-field versus far-field impacts. There can readily be adverse impacts of pollutants near the point of discharge, where there is limited opportunity for mixing, which would not be manifested in a downstream waterbody where much larger dilution is available. Pollutant trades should be based on a careful evaluation of the beneficial use impairment of the waterbody receiving the pollutant, near the point of discharge, and in downstream waterbodies. The Evaluation Monitoring approach described by Jones-Lee and Lee (1998) can be used for this purpose.

Overall, the US EPA is still not incorporating the science that has been available for about 30 years in assessing the water quality impacts of chemical constituents in point and nonpoint source discharges. So long as the Agency continues to focus its pollution control programs on chemical constituents rather than pollutants, in which the emphasis is on achieving worst-case-based water quality criteria and standards based on these criteria, the Agency's and states' pollutant trading programs will not achieve the desired goal of controlling pollution in the most effective and economical way. Focusing on the control of pollutants as opposed to chemical constituents is particularly critical in implementing technically valid TMDLs.

References

Jones-Lee, A. and Lee, G. F., "Evaluation Monitoring as an Alternative to Conventional Water Quality Monitoring for Water Quality Characterization/Management," Proc. of the NWQMC National Conference "Monitoring: Critical Foundations to Protect Our Waters," US Environmental Protection Agency, Washington, D.C., pp. 499-512 (1998).

Lee, G. F. and Jones-Lee, A., "Comments on US EPA Point/Point Source Pollutant Trading Project Proposal to Allow Trading of Discharge Requirements," Submitted to the US EPA in connection with Federal Register notice Vol. 57, No. 97, pp 21244-21245, May 19, 1992, G. Fred Lee & Associates, El Macero, CA June (1992).

Lee, G. F. and Jones-Lee, A., "Valid Pollutant Credit Trading," *Water Environment & Technology*, 6:10 (1994).

Lee, G. F. and Jones-Lee, A., "Water Quality Issues in Pollutant Trading," Report of G. Fred Lee & Associates, El Macero, CA, February (1996).

Lee, G. F. and Jones-Lee, A., "Review of Management Practices for Controlling the Water Quality Impacts of Potential Pollutants in Irrigated Agriculture Stormwater Runoff and Tailwater Discharges," California Water Institute Report TP 02-05 to California Water Resources Control Board/Central Valley Regional Water Quality Control Board, 128 pp, California State University Fresno, Fresno, CA, December (2002). http://www.gfredlee.com/BMP_Rpt.pdf

NAS/NAE, Water Quality Criteria 1972, EPA R3 73 033, National Academy of Sciences, National Academy of Engineering, Washington, D.C. (1973).