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

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This issue of the Newsletter is devoted to a review of the US EPA's recently announced **Strategy for Water Quality Standards and Criteria**. It includes comments on the adequacy of this "strategy" in developing a more appropriate regulatory approach for urban and rural area stormwater runoff water quality impacts than exists today. Also, **announcements** of two forthcoming conferences are included.

Announcements

1. EQA-Environmental Quality & Agriculture: Coexisting in the 21st Century (Balancing Nutrients and Enhancing the Environment), November 10-12, 2003, Des Moines Marriott, Des Moines, IA.

The US EPA, IMC Global, National Pork Board, The Fertilizer Institute and others have organized a three-day conference and workshops devoted to managing nutrient runoff from agricultural activities. The program will focus on best management practice implementation, considering their impacts on nutrient runoff and their cost. Educational workshops will be devoted to "Air Quality & Agriculture," "Tools used in Nutrient Management Plans," "Development of Comprehensive Nutrient Management Plans," "How Agriculture can be involved in developing workable and effective TMDLs," "Farming, Wildlife & Environment – Keeping the Balance," "Understanding & Implementing the P Index," and "New Equipment & Tillage Technologies, Manure Recycling & Nutrient Management." The detailed program and registration information is available at www.ctic.purdue.edu/eqa.

2. Third Annual Shipyard Environmental Issues Conference & International Symposium on Prevention of Pollution from Ships and Shipyards: Antifouling Coatings - Designed for Performance and the Environment, November 5-7, 2003, Lindy Boggs Convention Center, University of New Orleans, New Orleans, LA.

This conference focuses primarily on water quality issues relating to antifouling chemicals ("Release Rates," "Copper in the Marine Environment," "Copper Toxicity, Fate and Effects," "TMDL Studies and Future Direction of Copper Regulation," "New Antifoulants"), "Waste Treatment Technologies, Systems & Regulations," "Port and Harbor Issues and Concerns," "Stormwater Runoff Management in Ports and Harbors," and a "Panel Discussion of Current & Future Regulatory Questions." G. F. Lee and A. Jones-Lee will be presenting a paper at this conference entitled, "Regulating Water Quality Impacts of Port and Harbor Stormwater-Runoff-Caused Water Column and Sediment Contamination, Part A: Surface Water Impacts, Part B: Sediment Quality Impacts." A preliminary program for this conference and registration information is available at http://www.atrp.com/antifouling_coatings_program.htm.

US Environmental Protection Agency's September 2003
"Strategy for Water Quality Standards and Criteria"

As discussed in previous Newsletters (available at www.gfredlee.com, in the Newsletter section), the current regulatory approach for regulating urban area and highway stormwater runoff water quality impacts, as well as the evolving approach in some areas, such as in California, for regulating agricultural stormwater runoff water quality impacts, focuses on achieving water quality standards in the runoff waters or, if a mixing zone is allowed, at the edge of the mixing zone. This approach tends to significantly over-regulate urban area and rural stormwater runoff. It also fails to adequately regulate chemicals for which there are no water quality standards, such as pyrethroid-based pesticides.

The problems with appropriately regulating urban area, highway and agricultural stormwater runoff have been recognized since the late 1980s; however, little progress has been made in developing an appropriate regulatory approach to ensure that management practices implemented to control potential pollutants in runoff properly protect water quality – beneficial uses, without significant unnecessary expenditures for constituent control. Presented below is a summary of the US EPA's September 2003 "Strategy for Water Quality Standards and Criteria: Setting Priorities to Strengthen the Foundation for Protecting and Restoring the Nation's Waters" (US EPA Office of Science and Technology, Washington, D.C.). This Strategy is available from the US EPA website at www.epa.gov/waterscience/standards/strategy/final.pdf. This document was released in draft form in 2002, with a request for comments. G. F. Lee provided comments on the draft Strategy in Newsletter NL5-4. His comments focused on the need to more appropriately address regulating stormwater runoff water quality issues.

According to the US EPA, in its final "Strategy,"

> *"Water quality standards and criteria are the foundation for a wide range of programs under the Clean Water Act. This strategy contains priority strategic actions that the Office of Science and Technology will undertake in collaboration with other EPA offices, states and authorized tribes over the next six years to strengthen and improve this foundation.."*

This Strategy evolved from a number of public meetings held by the Agency to gain the public's views on what needs to be changed. It is also based on the National Research Council's 2001 report, "Assessing the TMDL Approach to Water Quality Management," and on the General Accounting Office's 2002 report, "Improved EPA Guidance and Support Can Help States Develop Standards that Better Target Cleanup Efforts." The US EPA indicates that the Strategy is a "planning" document. It is not regulations, nor does it change any current regulations. The Agency states that this Strategy is a "living" document that may be periodically updated without public notice.

The US EPA, in its Strategy Executive Summary, states,

> *"This strategy is built upon a long-term vision for the future:*

All waters of the United States will have water quality standards that include the highest attainable uses, combined with water quality criteria that reflect the current and evolving body of scientific information to protect those uses. Further, standards will have well-defined means for implementation through Clean Water Act programs."

The Agency indicates, as a priority strategic action,

"For example, the water quality standards and criteria program needs to help states strengthen water quality criteria for three pollutants (sedimentation, pathogens, and nutrients) that are responsible for an estimated 40 percent of water quality impairments nationally."

In a section entitled "The Role of Standards and Criteria in Water Quality Programs," the US EPA states,

"Water quality standards and criteria are undeniably key to protecting the quality of our Nation's waters. Water quality standards establish the environmental baselines used for measuring the success of Clean Water Act programs. In an evolving scientific arena, adequate protection of fish and wildlife, recreational uses, and sources of drinking water depends on having well-crafted standards and criteria in place for our waters. Having clear numeric baselines is also important for establishing treatment controls; for conducting watershed planning, protection and restoration; and for innovations such as market-based incentives and trading."

It is clear that those in the Office of Science and Technology responsible for developing this statement are perpetuating the chemically based water quality regulatory approach and are ignoring the well-established fact that such an approach leads to overregulation for many chemicals for which there are water quality criteria and standards and is contrary to inviting the search for new (undocumented or unrecognized) water quality – beneficial use impairments. Lee and Jones-Lee have provided detailed comments on the problems with regulating stormwater runoff under the chemically based criteria and standards approach. These discussions are available from their website in the Surface Water Quality, Water Quality Criteria, Development and Use section.

The US EPA has listed as the area of highest priority for the Strategy,

"1. Issue implementation guidance for the 1986 bacteria criteria for recreation."

In 1986 the US EPA published recreational water criteria based on *E. coli* and *Enterococcus*. Under this Strategy the US EPA plans to develop additional guidance for the states on how to implement these criteria into NPDES permits. One of the issues that has complicated the adoption of *E. coli* as an organism for regulating contact recreation is that it has been found that *E. coli* can reproduce in warm, moist soils. Kinzelman, et al., in October 2002 presented a paper entitled, "The influence of lake shore management approaches on *Escherichia coli* densities in sands at two northwestern Lake Michigan beaches," at the Fifth International Symposium on Sediment Quality Assessment (SQA5) "Aquatic Ecosystems and Public Health: Linking

Chemical, Nutrient, Habitat and Pathogen Issues" (in press in the proceedings of this conference). Therefore, it is necessary to distinguish between *E. coli* discharged in wastewaters or other sources of human and animal fecal material and those that develop in the soils that then become part of the water column *E. coli*. This is an issue that the US EPA and state regulatory agencies will have to address if the E. coli to gain acceptance as a reliable contact recreation sanitary quality regulatory approach.

The second highest priority is,

> *"2. Produce and implement a strategy for development of pathogen criteria for drinking water and recreational use."*

The focus of this part of the Strategy is on producing criteria for *Cryptosporidium*, which is of concern in both drinking water and contact recreation. Lee and Jones-Lee (1993), as part of the state of California Comparative Risk project, discuss the importance of *Cryptosporidium* as a pathogen of concern associated with contact recreation.

The third priority is,

> *"3. Produce and implement a strategy for the development of suspended and bedded sediment criteria."*

This component of the Strategy focuses on the physical impacts of sediment in the water column and in the sediment beds. The issue here is not the chemicals associated with the sediment, but the sediment itself. There is need for the US EPA to develop a technically valid approach for assessing the water quality significance of chemical constituents in bedded sediments.

As discussed by Lee and Jones-Lee in their papers on their website (www.gfredlee.com, in the Contaminated Sediment, Sediment Quality Criteria section), the chemically based sediment quality guidelines such as those developed by Long and Morgan and MacDonald are not technically valid for evaluating the water quality significance of chemical constituents in bedded sediments, since they are based on total concentrations of the chemicals. It has been known since the mid-1970s that the total concentration of a chemical in sediments is an unreliable indicator of its toxicity or bioavailability. The SQA5 symposium held in Chicago in October 2002 contained a number of keynote presentations (by DiToro, Chapman and Burton) which discussed the unreliability of chemically based sediment quality guidelines such as those developed by Long and Morgan and MacDonald.

Further, contrary to the statements often made, these co-occurrence (coincidence) based guidelines are not reliable for screening for potential water quality problems, since they do not include guideline values for some of the common toxicants in sediments, such as low dissolved oxygen, sulfides, ammonia, as well as the pyrethroid-based pesticides. These pesticides have replaced the organophosphorus pesticides diazinon and chlorpyrifos for use in urban areas and for some uses in agricultural areas. These pesticides are strongly sorbed by sediments and become part of the bedded sediments in the receiving waters for stormwater runoff where the pesticides are used. D. Weston (UC Berkeley, pers. comm., 2003) has found that pyrethroid-

based pesticides are present in measurable amounts in some sediments and that these pesticides are bioavailable. Further, the sediments in which they are located have been found to be toxic to some forms of aquatic life. It is not clear at this time whether the toxicity found is due to pyrethroid-based pesticides. These issues will be further discussed in forthcoming Newsletters.

The fourth priority is,

> *"4. Provide technical support to states and tribes for developing and adopting nutrient criteria and biological criteria."*

With respect to developing nutrient criteria, the Strategy calls for the US EPA to assist in review of state plans for criteria development during 2003-2004, to issue a methods manual for wetlands in 2003, and "issue criteria document for selected estuary and coastal waters" in 2005-2007. G. F. Lee has been participating in the US EPA Region 9 RTAG for nutrient criteria development in California, Nevada, Arizona and Hawaii. A couple of years ago this group was aggressively moving toward developing nutrient criteria for various types of waterbodies in this region. The California Regional Water Quality Control Boards' staff concluded that the US EPA's approach for developing default criteria was inappropriate, and opted to work toward developing site-specific nutrient criteria as the technically valid approach. However, as of last winter, this process has been greatly slowed down, due to a lack of funds available to the Regional Boards to do the studies needed to develop site-specific nutrient criteria.

Further, there apparently has been a significant reduction in the amount of funds that the US EPA is making available to its regions to assist states in developing nutrient criteria. In addition, while a couple of years ago the US EPA indicated that all states must have nutrient criteria developed to the point where they could be adopted as state standards in 2004, that date has apparently been extended to at least 2007, and even that date will not be met unless there is a major influx of funding from the US EPA to the states to fund the studies needed to develop the site-specific nutrient criteria. At least with respect to California, the financial situation of this state is such that it is highly unlikely that funds will become available from the state for nutrient criteria development in the next five years or so.

The Strategy also includes the development of biological criteria for use associated with bioassessments. This program is scheduled to take place over the next five years or so. As with nutrient criteria, at least California, and it is suspected many states, are going to need substantial US EPA funding to support the studies needed to develop biological criteria in a five-year period that are applicable to the state's waters. Without this funding, reliable criteria will not be developed in this period.

The fifth highest priority is,

> *"5. Develop and apply a systematic selection process to produce new and revised water quality criteria for chemicals to address emerging needs."*

Basically, this priority is focusing on developing new and updated water quality criteria. The Strategy points out that the US EPA has issued national numeric criteria guidance for 165

pollutants, of which 101 are priority toxic pollutants, 106 are synthetic organic chemicals, 30 are pesticides, 17 are metals, 7 are inorganics, 4 are physical/chemical properties, and 1 is bacteria. The US EPA did not identify the constituents or even the types of constituents that it is going to focus on in the approaches that it is to follow in implementing this Strategy.

One of the areas of particular concern to stormwater runoff managers is the pyrethroid pesticides that are now being widely used in urban areas as a result of the some of the organophosphorus (OP) pesticides (chlorpyrifos) no longer being available for use in urban areas. Further, the manufacture and sale of the other commonly used organophosphorus pesticide (diazinon) is being phased down, and it will be illegal to sell it for urban use after December 2004.

As discussed in previous Newsletters (NL2-1, 3-5, 6-3), the most significant water quality problem associated with stormwater runoff from urban areas and many rural areas in California and in some other areas is pesticide toxicity. The US EPA has known of this problem for many years – i.e., since at least the early 1990s – yet the Agency still has not developed water quality criteria for diazinon and, while criteria were developed for chlorpyrifos, the Agency did not require that the states adopt them. With the phase-out of the sale of OP pesticides for urban residential use, the pyrethroid pesticides are being sold over the counter and are being used in large amounts in urban areas. This is occurring in rural areas, as well. As discussed above, these pesticides are highly toxic to some forms of aquatic life, including fish. As it stands now, there is need for water quality and sediment quality criteria for pyrethroid-based pesticides.

The sixth highest priority is,

> *"6. Complete the national consultation with the Federal Services on existing aquatic life criteria."*

This part of the Strategy involves working with the US Fish and Wildlife Service and National Marine Fisheries to review the adequacy of the existing water quality criteria to protect endangered species. This is going to be a difficult area to address since the database that is needed to properly apply the existing criteria to endangered species generally does not exist. As a result, considerable uncertainty will exist as to whether endangered species have the same sensitivity to the chemical as the species that are used to develop the criteria.

The seventh priority item is,

> *"7. Provide technical support, outreach, training and workshops to assist states and tribes with designated uses, including use attainability analyses and tiered aquatic life uses."*

This priority focuses on providing a more appropriate designation for aquatic-life-related beneficial uses. In some areas, such as California, there is need for a graded categorization of aquatic life beneficial uses and the criteria that should be associated with each of the subcategories.

The eighth highest priority is,

> *"8. Provide implementation support concerning technical issues affecting permits and TMDLs, beginning with technical support and outreach concerning the duration and frequency component of existing water quality criteria."*

This priority potentially specifically addresses the arbitrary development of the one-hour average "acute" criterion and four-day average "chronic" criterion, and any exceedance of a standard by any amount more than once every three years representing a violation of a water quality standard. It will also provide technical support and training and outreach on additional implementation issues of importance, such as wet weather conditions. This particular area could be extremely important to stormwater dischargers.

G. F. Lee, in previous Newsletters, has discussed the appropriateness of developing wet weather criteria/standards to regulate urban area stormwater runoff. As he has discussed, the current water quality criteria developed by the US EPA, and especially the Agency's approach for their application to NPDES permitted discharges, such as urban stormwater runoff, does not properly reflect how potential pollutants in urban stormwater runoff impact the beneficial uses of receiving waters for the runoff. The same kinds of regulatory problems are beginning to occur in California as part of the regulatory approach that is required by the state legislature for agricultural stormwater runoff and tailwater discharges under the ag waiver program to not cause violations of water quality standards (objectives) in the receiving waters for the runoff.

This is an area to which the US EPA should give a high priority, in order to eliminate the current impossible situation of requiring that urban NPDES stormwater dischargers participate in the BMP ratcheting-down process, in which ever increasingly effective management practices are implemented to control violations of water quality standards. It is known that the BMPs that are now being used are expensive and cannot achieve compliance with water quality criteria/standards in developed areas, because of the high cost to those who own property in these areas. It has been clear for over 10 years that there is need for a different regulatory approach for stormwater runoff than exists now, to reduce overregulation, eliminate the waste of funds on ineffective BMPs, and provide for protection of receiving water beneficial uses for unregulated constituents in urban stormwater runoff.

The ninth highest priority is,

> *"9. Identify any drinking-water source waters whose water quality standards do not protect the use, and work with regions, states and tribes to correct any deficient standards as soon as possible."*

It is unclear whether the US EPA plans to attempt to develop water quality standards for such constituents as total organic carbon (TOC), which is a constituent of concern to some domestic water utilities because of its potential to lead to trihalomethane carcinogens in the treated water as a result of the disinfectants reacting with the TOC components. Lee and Jones-Lee (2003a) have recently discussed the importance of recognizing that TOC in some discharges, such as urban stormwater runoff and wastewater discharges, exists in labile (degradable) forms and in

refractory (non-degradable) forms. For many situations, controlling the labile forms of TOC in urban stormwater runoff would be a waste of funds, since the labile TOC components will be degraded before they reach a water supply treatment works. Similarly, for agricultural and urban discharges of nutrients that lead to the development of algae that cause a significant increase in the TOC content of the water, the need for control of the algal related TOC should include an evaluation of whether the algal related TOC is degraded before it reaches a water supply treatment works. Typically, algal related TOC persists for only a short period of time in waterbodies. These issues have been reviewed by Lee and Jones-Lee (2003a). The current approach for regulating constituents in discharges that exceed a drinking water MCL at the point of discharge, which are known to not persist to a water supply intake is technically invalid, and can lead to significant waste of public and private funds on unnecessary wastewater treatment. This issue needs to be addressed by the US EPA in its implementation of drinking water standards.

The tenth highest priority is,

> *"10. Develop a web-based clearinghouse for exchanging information on critical water quality standards issues, beginning with antidegradation."*

The US EPA needs to more appropriately address the increases of chemical constituents that do not impair water quality – beneficial uses of waterbodies. Degradation should be assessed in terms of impairment of beneficial uses – not chemical concentrations.

The US EPA has proposed a second set of priority strategic actions. The first of these is to *"Update the aquatic life methodology for developing ambient water quality criteria."* This is an important area that needs to be addressed, since there are a number of problems with how the US EPA water quality criteria are developed that, in turn, lead to inappropriate regulation of discharges.

The second is to *"Provide technical support, outreach and training to assist states and tribes implementing mercury criteria in assessments, TMDLs and permits."* This effort will shift the approach the US EPA has been using for regulating mercury from a water column concentration approach to fish tissue contamination levels and a site-specific translator from water column to tissue. Lee and Jones-Lee (2003b) have recently reviewed the current regulatory approach for mercury, discussing why there is need to shift from a water chemical concentration based approach to a fish tissue based approach. From what is known about the current excessive bioaccumulation of mercury in fish, this translator will have to include site-specific evaluation of sediment methylation processes.

Item 3 is to *"Provide technical support, outreach and training to assist states and tribes in refining human health criteria to reflect local bioaccumulation and fish consumption patterns."* The Agency plans to update its approach toward determining appropriate tissue residues for various organochlorine pesticides and PCBs, providing guidance on developing site-specific bioaccumulation factors. Again, as with mercury, the regulatory approach should be based on a fish tissue residue concentration and a site-specific translator to a waterbody water column and sediment concentration. As discussed by Lee and Jones-Lee (2002), attempts to regulate

hazardous, bioaccumulatable chemicals, such as "legacy" organochlorine pesticides, PCBs, dioxins, etc., based on water column concentrations and a general bioaccumulation factor are not technically valid. This issue was pointed out with respect to PCB bioaccumulation in the American Fisheries Society water quality section "Review of the EPA Red Book: Quality Criteria for Water," published in 1979. Hopefully the Agency now will begin to meaningfully address the inappropriate regulatory approach that has been used over the past 25 years for regulating bioaccumulatable chemicals.

Item 4 is to *"Provide updated analytical methods for new and existing criteria."* This is an important area that needs to be addressed, especially for some of the new or expanded-use pesticides, where the analytical methods available cannot necessarily determine the pesticide at concentrations that are toxic to aquatic life. The US EPA Office of Science and Technology needs to work with the US EPA Office of Pesticide Programs to establish an approach where a pesticide cannot be registered for use under conditions where it could be present in stormwater runoff at concentrations that are potentially toxic to aquatic life or that could exceed a water quality criteria/standard, without there being a reliable analytical method for determination of the pesticide in water and/or sediments at concentrations at least a factor of two below the toxic/criteria concentration.

Item 5 is to *"Foster broad participation in the setting of water quality standards by providing training, outreach, and education, including Internet-based distance learning access to the Water Quality Standards Academy."* There is considerable misinformation about how water quality criteria and standards are developed and should be used. The Agency needs to do a much better job in educating the regulated community, environmental groups, legislators and the public on these issues. In this way, the Agency could gain the support it needs to proceed to refine the criteria/standards to protect the beneficial uses of the nation's waters in a technically valid, cost-effective manner. Educating the legislators on the current problems with the water quality criteria and standards regulatory approach could become an important step in acquiring the funding needed to address the problems that have been known to exist since the mid-1970s.

As discussed by Lee (2002), the National Research Council (NRC) critique of the TMDL process was justified in many areas, with particular emphasis on the use of US EPA criteria and standards based on these criteria as the basis for listing 303(d) waterbodies and as TMDL goals. However, the NRC failed for political reasons to discuss the primary basis for these problems – namely, that the Clean Water Act, as developed in 1972, is based on a highly sophisticated technical approach for regulating water quality. In order for this approach to be implemented properly, the federal and state governments must adequately fund the US EPA and state regulatory agencies to develop the information needed to develop and implement appropriate water quality criteria and standards for use for evaluating water quality and as TMDL goals. Thus far, the US EPA and the state water pollution agencies have failed to adequately educate the legislatures on the significant increase in funding needed to properly implement the Clean Water Act.

Chapter 3 of the Strategy is devoted to implementing the Strategy and further Strategy refinements. One of the issues that is not addressed is how the Agency is going to obtain the funds, under the current financial situation in the federal and state governments, to conduct an

expanded program in these areas. Without significant additional funding, this Strategy will be little more than a document published on glossy paper, with pictures and other inserts, which will not likely influence the current state of affairs in water pollution control.

The Strategy includes an appendix specifically devoted to providing additional information on site-specific water quality criteria for chemicals that tend to bioaccumulate to excessive levels in fish that are used as food. It also discusses the need to develop approaches for assessing the risk of multiple stressors to wildlife populations and the need for chemical-specific criteria for wetlands. Particular attention is proposed to be given to providing technical support and outreach to states on antidegradation implementation issues and the review and update of the 1984 Water Quality Standards handbook.

Weight-of-Evidence Approach

The Agency in its Strategy does not discuss the fact that its current approach for regulating chemicals in water, focusing on a chemical concentration-based approach, is obviously flawed with respect to controlling the concentrations of real, significant pollutants in a technically valid, cost-effective manner. The Agency must, if it is to ever gain the support of the technical and regulated community, abandon such inappropriate approaches as Independent Applicability of chemical criteria even though toxicity testing and biological assessment show that the chemical concentration approach is technically invalid for assessing impairment of beneficial uses of waterbodies. There is widespread recognition among the leading experts in how chemicals impact the beneficial uses of water that a best professional judgment triad weight-of-evidence approach is the approach that should be used to establish the allowable concentrations of potential pollutants in a waterbody's water column and/or sediments. The US EPA, as part of developing this Strategy, should begin to develop a weight-of-evidence approach as a regulatory approach for water quality management. This issue will be discussed in the next Stormwater Runoff Water Quality Science/Engineering Newsletter.

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