

Comments on US EPA TMDL Program

G. Fred Lee, PhD, PE, DEE

G. Fred Lee & Associates

27298 E. El Macero Dr., El Macero, CA 95618

Tel: (530)753-9630 – Fax: (530)753-9956 – Email: gfredlee@aol.com

www.gfredlee.com

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In mid-June 2001 newspapers across the country carried an Associated Press article indicating that a National Research Council (NRC) committee of the National Academy of Sciences had conducted a review of the water quality programs of the US, where in a report (“Assessing the TMDL Approach to Water Quality Management”) (NRC, 2001) it was stated that there were significant problems with the approaches being used to define water quality in the US and the goals that have been set to manage water quality. This evaluation was commissioned by the Bush administration, shortly after taking office. In the fall of 2001, apparently in response to the NRC’s and others’ criticism of the TMDL/NPDES program, the US EPA held a series of “Public Listening Sessions on the TMDL Program and Related Areas of the NPDES Program.” Presented herein are comments on some of the problems with the US EPA’s TMDL and NPDES programs, focusing on some of the same issues that were addressed in the NRC TMDL review.

The NRC committee failed to point out that the reason for these technical deficiencies began to occur in 1972 with the adoption of what has now become known as the Clean Water Act. Congress, under pressure from environmental groups, adopted a highly sophisticated approach for managing water quality that ultimately involves attainment of water quality standards. These standards are to be based on US EPA national water quality criteria, which can (through a complex process) be adjusted for site-specific conditions. However, this process does not always work, and often costs from \$250,000 to \$500,000 to adjust the national criteria for site-specific conditions which influence how a particular toxic/available constituent impacts aquatic life-related beneficial uses.

As discussed herein, the problems with the current US EPA TMDL program are inherent in the way in which the 1972 “Clean Water Act” has been implemented, with particular reference to adequately funding the development of the technical base of information needed for water quality criteria and standards development and appropriate implementation. The discussion presented below discusses a number of these problems. It is based on the author’s approximately 35 years of professional experience in developing and utilizing water quality criteria/standards for use in controlling the pollution of the nation’s waters. The author has published extensively on these issues over the past 20 years. Many of his papers and reports are available from his website, www.gfredlee.com.

Inadequate Funding of Regulatory Agency Activities

While the newspaper headlines state that the problems are due to the Clinton administration, those familiar with the problems with the water pollution control programs in the US know that these problems started with the Reagan administration and have continued ever since, under both Republican and Democratic administrations. These problems are not new. They first began to surface with the approach that was adopted in the Reagan administration, where US EPA headquarters staff, when facing the need to implement water pollution control programs without

adequate funding from Congress and the states to do so, chose a bureaucratically simple, but technically flawed approach for defining “polluted” waters based on exceedance of worst-case-based water quality criteria developed by the US EPA in accord with the approach mandated by Congress when they first adopted the Clean Water Act in 1972. At that time (at the height of E-day), the US Congress adopted a national water pollution control goal of swimmable, fishable waters by the early 1980s. However, Congress and the state legislatures did not then, nor are they today, providing the pollution control agencies with the funding needed to carry out their responsibilities in a technically valid, cost-effective manner, as mandated by the Clean Water Act. Under these conditions, the administrative agencies at the federal and state level have been charged with an impossible task of trying to develop pollution control programs where real “pollutants” – i.e., substances that impair the beneficial uses of water – are properly defined, and technically valid, cost-effective management programs are developed and implemented to control the impaired uses.

Regulating Heavy Metals. The approach for regulating heavy metals in wastewater discharges and stormwater runoff is a prime example of the inappropriate approach that has been followed in the US since the early 1980s. In the 1960s, when toxicity tests were first starting to be used to evaluate the toxicity of wastewater discharges, it was found that, often, elevated concentrations of heavy metals in some discharges, but not all, were in nontoxic forms. This finding was in accord with what would be predicted based on the aquatic chemistry of heavy metals, where heavy metals exist in a variety of chemical forms, only some of which are available/toxic to aquatic life. This situation was sufficiently well-known so that by the early 1970s, the National Academies of Science and Engineering, as part of developing their Blue Book of Water Quality Criteria (NAS/NAE, 1973), concluded that heavy metals in wastewater discharges could not be reliably regulated based on chemical concentrations. A toxicity test approach was required to determine whether the heavy metals, either alone or in combination with other metals or other substances, were in a toxic/available form. The National Academies of Science and Engineering Blue Book Criteria were adopted by the US EPA (1976) in their 1976 Red Book Criteria, which were the first official water quality criteria that developed out of the Clean Water Act.

In the early 1980's the US EPA abandoned the approach recommended by the National Academies of Science and Engineering of focusing on toxic/available forms of metals, and adopted a policy of assuming that the worst-case national water quality criteria were appropriate for regulating heavy metals in all waters based on total recoverable metals – i.e., those that are measurable after strong acid digestion. While it was understood by many Agency personnel that this approach was inappropriate, the Agency was trapped again by the situation of having to develop regulations without adequate funds to develop technically valid, cost-effective approaches. There was an attempt to develop a more appropriate definition of heavy metals that are to be regulated by the national water quality criteria through what was proposed to be a dilute nitric acid digestion procedure; however, the Agency did not have the funds necessary to develop this procedure to the point where it could be incorporated into the regulatory approach that was adopted in the mid-1980s as part of what has become known as the “Gold Book” of Water Quality Criteria (US EPA, 1987).

In the mid-1980s, as part of revising the Clean Water Act to its current form, the administration and Congress broadened the scope of the Act without addressing the significant problems associated with

overregulation of some constituents and misdirected regulation of others, and persisted with the inadequate funding at the federal and state level to enable the development of a more appropriate approach. This has been a chronic problem with both Republican and Democratic administrations and legislatures. Some relief from the overregulation of heavy metals was provided under the Clinton administration, where ambient water dissolved metals were adopted as the regulatory approach (US EPA, 1995). Focusing on dissolved metals at that time was not based on any new information. It was well-established in the 1960s and 1970s that particulate forms of heavy metals in the water column were nontoxic. The same situation applies to many other constituents; however, the Agency has not addressed this issue.

Regulation of Toxics

The problems with the approaches in developing and implementing water quality criteria that were being adopted in the early 1980s by the US EPA administration were recognized as situations that could lead to inappropriate regulation (overregulation). Lee, *et al.* (1982) and Lee and Jones (1987) discussed alternative approaches which focused financial resources available on first defining those constituents which adversely impact the beneficial uses of a waterbody, and then controlling them to the extent necessary to protect these uses.

These problems, while recognized, were not addressed, primarily because the regulations that were developed were not being enforced by either the US EPA or many of the states. Many of the states' water pollution personnel understood the inappropriateness of the US EPA's approach, which evolved out of the Clean Water Act, and chose not to adopt US EPA criteria as the basis for developing water quality standards. This ultimately led to the National Toxics Rule, where, through the revised Clean Water Act, Congress mandated that states had to use US EPA criteria for toxics, or the US EPA would impose them on the states. By the early 1990s, all states had adopted US EPA criteria for "toxics." California, however, soon found, through court action, that the regulations adopting the US EPA criteria were determined to be invalid since California state law requires an evaluation of economic impact of the water pollution control regulations. Since the State Water Resources Control Board did not comply with these regulations, the courts determined that the regulations must be voided. This set up a situation where, for many years, California did not have water quality criteria/objectives for "toxics." Finally, in 2000, the US EPA Region 9 imposed what became known as the California Toxics Rule criteria (US EPA, 2000). These are the US EPA criteria for "toxics" that were originally adopted in the mid-1980s, unless updated by subsequent releases, such as the US EPA (1995, 1999) updates of the criteria.

Priority Pollutant List. The 1972 Federal Water Pollution Control Act (i.e., Clean Water Act) mandated that the US EPA must develop a list of "priority pollutants" and develop national water quality criteria for each of the pollutants which would protect fish and aquatic life in all waters. Congress, however, did not fund the Agency adequately to carry out this mandate. Finally, when the Agency could not develop what became known as the "Priority Pollutant List" in accord with the timeframe allowed, environmental groups filed suit to force the Agency to promulgate a list of Priority Pollutants. This was done in the mid-1970s, where the Agency's attorneys and environmental group attorneys, with limited technical input and without public peer review,

promulgated what are now known as the Priority Pollutants. Priority Pollutants include many of the heavy metals that are of primary concern because of their toxicity to aquatic life.

A review of the Priority Pollutant list shows that it was not properly developed, and its primary focus is on what are known as rodent carcinogens – i.e., those constituents that cause cancer in rats at high concentrations. Unfortunately, large amounts of public resources have been devoted to analyzing for and then developing control programs for many of the rodent carcinogens, especially the chlorinated solvents, which have been found to cause cancer in rodents at high concentrations over extended periods of time. There are still, 20 years after the first adoption, serious questions about the appropriateness of the Agency's approach for defining the water quality criteria for chlorinated solvents.

An example of inappropriate regulation is the situation that exists where the chlorinated solvents and the chlorinated compounds, such as the trihalomethanes that are formed during drinking water and wastewater disinfection, are regulated in wastewater discharges at drinking water acceptable concentrations. There is no technical validity for this approach. These chemicals are not toxicants to aquatic life. They do not bioaccumulate, and they are rapidly lost to the atmosphere. Their persistence in surface waters is quite limited. The removal of these constituents from domestic wastewaters can be expensive and is totally unnecessary. Rarely could a water supply face a problem of having excessive trihalomethanes in its treated waters because of the concentrations of these constituents in a domestic wastewater discharge. Any water utility that faces this type of problem has its intake too close to a city sewage discharge, and faces far greater problems than the rodent carcinogens, such as chloroform or low molecular weight chlorobromo compounds. The regulation of municipal and industrial wastewater discharges – and, for that matter, agricultural runoff and urban stormwater runoff – should be based on controlling constituents that are or could be significantly adverse to the beneficial uses of the receiving waters for the discharge.

The Priority Pollutant list has been strongly detrimental to properly defining the constituents that are significantly adverse to the beneficial uses of waterbodies. Those not familiar with how this list was developed generally assume that 120 or so chemicals on this list are all the chemicals that could be adverse to the beneficial uses of a waterbody that need to be examined for in a water pollution control investigation. Those familiar with the situation know that there are over 75,000 chemicals in use today, where only about 200 of these are regulated. Further, about 1,000 new chemicals are developed each year. There is an urgent need to greatly expand the arena of potentially detrimental or hazardous chemicals that are considered/evaluated for their impacts on the beneficial uses of waterbodies. This expansion should include substantial funding to search for new/unrecognized hazardous or deleterious chemicals.

Problems with TMDLs

The NRC's review of the problems with the US EPA's TMDL program is appropriate with respect to discussing the significant technical deficiencies in this program. There is no question about the fact that waterbodies are placed on the 303(d) list of impaired waterbodies inappropriately, and that the TMDL goals, which are typically water quality standards, are inappropriate goals for solving real significant water quality use impairment problems in a technically valid, cost-effective manner.

Also, and most importantly, there is inadequate time and inadequate funding available to support the development of TMDLs as they are being administered through the US EPA and state regulatory agencies.

The 1972 Clean Water Act approach for regulating chemical constituents is only technically valid if Congress and/or the states, as well as the regulated community, provide the funds necessary to develop the site-specific criteria/standards needed to properly classify a waterbody as impaired, based on exceedance of the standard, and to serve as the TMDL goal for managing beneficial use impairments of the waterbody. For aquatic life-related beneficial uses, it should be assessed in terms of the numbers, types and characteristics of aquatic life in the waterbody relative to the waterbody's habitat characteristics. Without substantial biological assessment work, it is not possible to determine whether a waterbody's beneficial uses are, in fact, impaired at all, or impaired due to chemical constituents or altered habitat characteristics. The funding necessary to develop the site-specific biological and chemical information to properly develop and implement TMDLs is woefully lacking. Further, even if the funding were available, the ability to develop this information in the totally inadequate timeframe that the US EPA Regions have locked stakeholders in the region where a TMDL has been adopted, into, would preclude development of a technically valid, cost-effective TMDL and its appropriate allocation to stakeholders/dischargers.

The US EPA needs to critically reevaluate the TMDL program to specifically address gaining adequate funding to properly develop and implement national water quality criteria, site-specific water quality criteria, appropriate 303(d) listing of waterbodies (which includes biological assessment of impairment of uses if the issue of concern is potential aquatic life toxicity), and the development of a flexible timeline for TMDL development and implementation that considers the variety of factors that influence how a chemical constituent impacts the beneficial uses of a waterbody.

The first step in the TMDL process must be an assessment of the appropriateness of the water quality standards that were used to establish the 303(d) listing and the standards that are used as TMDL goals to correct the water quality impairment. Since a considerable part of the TMDL program is directed toward nonpoint source constituent sources such as ag runoff and, while classified as a point source for administrative purposes, urban runoff, both of which frequently contain substantial amounts of nontoxic, non-available forms of constituents, it is important that the US EPA and the states focus TMDL programs on controlling toxic available forms, as opposed to total concentrations of constituents.

While the Agency finally (after 20 years) adopted ambient water-soluble metals as the basis for regulating metals that are potentially toxic to aquatic life, the Agency has not made the similar correction for particulate forms of many other constituents. In addition to particulate forms of metals being non-available, the same is true for many organics and nutrients.

Regulation of Nutrients. An example of a technically invalid approach is the US EPA's current efforts toward developing nutrient criteria, where the Agency is focusing on total phosphorus rather than algal-available phosphorus. Basically, the Agency staff responsible for this approach have

ignored the substantial agriculture and water quality research which demonstrates that substantial parts of the total phosphorus are in non-algal-available forms, and they do not, even over extended incubation periods, convert to algal-available forms. It would be a serious error on the part of the US EPA to develop nutrient criteria based on total P, which are to be applied to runoff from agricultural and urban areas. Such programs could result in massive expenditures for phosphorus control from ag and urban sources which will have little or no impact on the eutrophication-related water quality of waterbodies.

Independent Application. One of the most inappropriate approaches that was adopted by the US EPA under the previous Bush administration was the “Independent Application” policy, where chemically-based, numeric water quality standards had to be met, even though toxicity testing or aquatic organism assemblage information showed that the chemicals of concern in a particular discharge were in nontoxic/non-available forms. This is part of the bureaucratic mentality that has prevailed through the Agency upper management, through both Democratic and Republican administrations, that leads to gross overregulation and stymies attempts to conduct studies to determine whether constituents in a particular discharge are adverse to the beneficial uses of a waterbody.

Lee and Jones-Lee (1995a) have discussed the problems with the independent application policy. These are understood by the previous administration, where discussions were being held about the potential for changing the independent application policy as part of the ANPRM (Announced Proposed Rule-Making for revised water quality standards). The current Bush administration should actively support the ANPRM to begin to address the significant problems that exist in appropriately regulating water pollution control in the US.

The issue of developing appropriate water quality criteria to regulate water pollution control without unnecessary expenditures is a long-standing problem. Various US EPA administrations, and especially the senior staff, have repeatedly made claims about the great success that has been achieved through the water quality criteria approach adopted by the Agency in the early 1980s as they were applied to point source discharges. The facts are, however, that the regulation of point source discharges through the worst-case-based criteria has, in many instances, resulted in significant overregulation and unnecessary public expenditures for water pollution control.

As part of correcting the significant deficiencies in the TMDL regulations and how they are being implemented, the US EPA needs to immediately abandon the ill-conceived independent applicability policy, where an exceedance of a worst-case-based water quality standard represents a condition that requires that a TMDL be developed, even though other studies show that the constituents of concern (which cause the exceedance) are in nontoxic, non-available forms. There is no justification for regulating organics or other constituents in urban or highway stormwater runoff, which are clearly demonstrated to be in nontoxic forms, just because the concentrations exceed a worst-case-based water quality criterion. It should never be necessary for the public/dischargers to have to spend \$500,000 conducting site-specific adjustments of the water quality criteria in accord with US EPA (1994) recommended approaches to demonstrate what is well-known regarding the lack of toxicity/availability. As discussed by Lee and Jones-Lee (1995b), water quality criteria should not

be used as pass/fail values which, if exceeded, lead to a 303(d) listing and a TMDL. They should be used as guidelines to potential water quality problems, where there is adequate funding made available to determine if the exceedance of a criterion/standard represents an impairment of the beneficial uses of the waterbody. Adoption of this approach will go a long way toward addressing the significant problems that exist today with the US EPA's TMDL program.

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**Summary of
G. Fred Lee's
Academic Background and Professional Experience**

Dr. G. Fred Lee is President of G. Fred Lee & Associates, which consists of Drs. G. Fred Lee and Anne Jones-Lee as the principals in the firm. They specialize in addressing advanced technical aspects of water supply water quality, water and wastewater treatment, water pollution control, and solid and hazardous waste impact evaluation and management.

After obtaining a bachelor's degree at San Jose State University in 1955, a Master of Science Degree in Public Health from the University of North Carolina in 1957 and a PhD from Harvard University in 1960 in Environmental Engineering and Environmental Sciences, Dr. Lee taught graduate level university environmental engineering and environmental science courses for 30 years at several major U.S. universities. During this time, he conducted over \$5 million of research and published over 500 papers and reports. Dr. Anne Jones-Lee was a university professor for a period of 11 years in environmental engineering and environmental sciences. Their combined environmental engineering, aquatic chemistry, aquatic biology, toxicology and public health expertise and experience enable them to address complex problem areas in water quality and solid and hazardous waste impact evaluation and management.

Dr. Lee was active as a part-time consultant during his 30-year university teaching and research career. Drs. G.F. Lee and A. Jones-Lee have been full-time consultants since 1989. Dr. Lee has extensive experience in developing approaches that work toward protection of water quality without significant unnecessary expenditures for chemical constituent control. He has been active in developing technically valid, cost-effective approaches for the evaluation and management of chemical constituents in domestic and industrial wastewater discharges and urban stormwater runoff since 1960.

Dr. Lee has extensive experience in developing water quality criteria for a variety of inorganic and organic constituents. He served as a peer reviewer for the National Academies of Science and Engineering for the Bluebook of Water Quality Criteria, published in 1973. He was a member of the American Fisheries Society review panel for the critique of the US EPA Red Book of Water Quality Criteria of 1976. During the early 1980s, he was a US EPA peer reviewer for the Agency's current approach for developing water quality criteria, as well as for several of the criterion documents. He is frequently involved in the review of water quality criteria in connection with their application to specific situations.

Further information on Dr. Lee's experience and expertise is available at <http://www.gfredlee.com>.

**Surface and Groundwater Quality Evaluation and Management
and
Municipal Solid & Industrial Hazardous Waste Landfills
<http://www.gfredlee.com>**

Dr. G. Fred Lee and Dr. Anne Jones-Lee have prepared professional papers and reports on the various areas in which they are active in research and consulting including domestic water supply water quality, water and wastewater treatment, water pollution control, and the evaluation and management of the impacts of solid and hazardous wastes. Publications are available in the following areas:

- Landfills and Groundwater Quality Protection
- Water Quality Evaluation and Management for Wastewater Discharges, Stormwater Runoff, Ambient Waters and Pesticide Water Quality Management Issues, TMDL Development, State Stormwater Quality Task Force – Task Force Activities
- Impact of Hazardous Chemicals – Superfund, LEHR Superfund Site Reports
- Contaminated Sediment – Aquafund, BPTCP
- Domestic Water Supply Water Quality
- Excessive Fertilization/Eutrophication
- Reuse of Reclaimed Wastewaters
- Watershed Based Water Quality Management Programs:
 - Sacramento River Watershed Program,
 - Delta – CALFED Program,
 - Upper Newport Bay Watershed Program,
 - San Joaquin River Watershed DO and OP Pesticide TMDL Programs

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