Independent Applicability of Chemical and Biological Criteria/Standards and Effluent Toxicity Testing

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Introduction

In 1985 the US EPA advocated a two-part approach for water pollution control involving chemical concentration-based effluent limitations for those parameters for which water quality criteria had been developed, and toxicity test-based effluent limitations. The chemical-specific component was designed to prevent exceedances of water quality criteria values in ambient waters receiving point and non-point source discharges or runoff; the water quality criteria were, in large part, developed to be chronic-exposure, safe concentrations for sensitive aquatic organisms. The toxicity-test component was designed to indicate potential toxicity effects associated with an activity, to account for the possible presence of a toxic contaminant that did not have a water quality criterion and to provide the opportunity for site-specific tuning of the chemical-specific criteria for synergism, antagonism, chemical availability, and exposure situations.

The US EPA has since expanded its recommended approaches to include a direct measure of biological characteristics (biological criteria) of surface waters. The biological criteria focus on the numbers, types and characteristics of organisms present downstream of a discharge or runoff compared with the numbers, types and characteristics expected based on the aquatic life habitat characteristics. A number of states, such as Ohio, have developed biological criteria and have been using them in water pollution control programs.

At a US EPA workshop on water quality criteria and standards held in June 1992, representatives from the US EPA headquarters revealed that the Agency would soon be releasing a position paper announcing the policy of **"Independent Applicability."** The June 1992 issue of the US EPA's "Newsletter Water Quality Criteria & Standards," however, stated that "Independent Applicability" *"is EPA's present position, and it is detailed in several documents."* That inconsistency notwithstanding, the policy and/or practice of "Independent Applicability" and its ramifications for water pollution control in the country truly deserves, as the US EPA's "Newsletter" seemed to comprehend in its article subtitle, a thorough "re-examination."

"Independent Applicability"

According to the US EPA representatives discussing "Independent Applicability" at the June 1992 workshop, by that policy all of the three above-mentioned regulatory approaches for the regulation of toxics would be applicable to all waters, and the approach that was most

"sensitive," i.e., most limiting, for a particular waterbody would guide management. Members of the workshop audience raised questions of the US EPA representatives about how the policy would handle a situation in which biological studies of the receiving waters showed healthy and wholesome fish and other aquatic life populations, the same as those that would be expected based on habitat characteristics, and short-term chronic toxicity testing of the waters in the region showed no aquatic life toxicity, but numeric water quality criteria (or standards equivalent to them) were exceeded.

The US EPA representatives stated the even under such circumstances, the discharger or source of runoff would have to implement control programs to eliminate the exceedances of the water quality criteria or standards, or change the standards. It was reported to be the US EPA's position under the policy of "Independent Applicability" to require that site-specific water quality criteria or standards be developed in order to justify not complying with the US EPA's water quality criteria, or more properly, state standards based on (equivalent to) those criteria.

It is appropriate to question the appropriateness of requiring dischargers and state regulatory agencies to develop site-specific water quality standards in response to that scenario (i.e., a situation in which it had been shown that there was no aquatic life toxicity in the receiving waters for the discharge/runoff and the populations of aquatic life in the region of expected impact were what would be expected based on habitat characteristics). There have been few attempts in the US to develop site-specific water quality standards as outlined in the US EPA's Water Quality Criteria Handbook. As a consequence of the state of California Water Resources Control Board's adoption of the US EPA criteria as state water quality objectives (standards) in April 1991, a number of studies have been undertaken in California in an effort to develop site-specific objectives. More than $300,000 were spent in such effort in the San Francisco Bay area; more than $1.1 million was spent in efforts to develop site-specific criteria/standards for the Santa Ana River in southern California. However, as discussed below, the funds spent in trying to develop site-specific water quality objectives for copper in San Francisco Bay were unsuccessful in achieving an objective that would protect designated beneficial uses of Bay waters from copper toxicity without significant unnecessary expenditures for copper control. The San Francisco Bay efforts were done in cooperation with US EPA. With such levels of effort needed to try to develop site-specific criteria/standards and then failing to achieve appropriate standards, it is clear that the development of site-specific standards is not the answer to escaping regulatory requirements that are unjustifiably overly restrictive.

In the San Francisco Bay situation, the development of Water Effect Ratio adjustment of the water quality standard resulted in increasing the copper water quality standard (called objective in California) from 2.9 g/L to 4.9 g/L. However, San Francisco Bay waters frequently contain from 10 to 15 g/L total copper without toxicity to the same organisms that were primarily used to develop the US EPA criterion for copper. Dissolved copper is also present in some Bay waters at a factor of more than twice the site-specific standard without aquatic life toxicity to the same organisms used to develop the criterion and other sensitive forms of aquatic life.

The failure of the US EPA Water Effect Ratio criteria/standard adjustment approach to develop a reliable appropriate criteria/standard reflects the Agency's failure to properly incorporate aquatic chemistry of contaminants in its site-specific criteria/standard development guidance. The

original and the February 1994 Water Effect Ratio guidance fail to address one of the most significant causes of chemical specific impacts that cause a chemical contaminant to be less toxic than that predicted based on the Agency's site-specific guidance. Chemical forms added to a waterbody from point and non-point source discharges and runoff and those within a waterbody do not necessarily equilibrate with toxic-available forms in the waterbody. This is especially true for particulate, including colloidal, forms. This means that there can be a significant pool of an inert contaminant in a waterbody that is not participating in any Water Effect Ratio adjustment testing. This pool, however, is measured to some undefined extent in the analytical methods as potentially toxic forms of the contaminant.

The Water Effect Ratio adjustment is based on the addition of toxic-available forms under standard laboratory test conditions. Discharges and non-point runoff can add appreciable amounts of inert contaminants even in so-called dissolved forms that do not participate in Water Effect Ratio equilibration reactions. Until the Agency develops an approach for properly considering the aqueous environmental chemistry of chemical contaminants in aquatic systems, it will not be possible to reliably use chemical-specific criteria/standards to regulate potentially toxic-available forms of contaminants without significant unjustified expenditures for contaminant control.

The numeric water quality criteria that were developed to be conservative best-guess estimates of safe concentrations for worst-case exposure of sensitive organisms were intended to provide guidance ultimately to dischargers on the amount of contaminant control needed to protect designated beneficial uses of receiving waters. Owing to chemical analytical deficiencies, those criteria by and large have not been able to be applied selectively to available-toxic forms of contaminants, but rather have been applied to the total or near-total concentrations of contaminants; this was done with the general understanding in the technical arena that such implementation added yet another degree of conservatism to those values. The origins and nature of the criteria were forgotten when "exceedance of the criteria values," itself, **became** an "adverse impact" deserving of prevention by whatever means were necessary. In truth, those familiar with the original development of the water quality criteria know that the criteria are tools, worst-case or near worst-case estimate indications of potential concerns, **NOT** end-points or adverse impacts in and of themselves.

"Independent Applicability" is now beginning to significantly distort the implementation of technically valid, cost-effective approaches for managing water quality in the US. An example of such distortion occurs in the US EPA's "National Water Quality Inventory 1994 Report to Congress." The US EPA informed states, as part of their guidance for developing the National Water Quality Inventory, that they should use an exceedance of a chemical specific criteria/standard as an "impaired" waterbody. This results in significant amounts of misinformation being presented to Congress and the public on the amount of truly impaired waters in the US that is now influencing public policy in contaminant control, especially in the area of developing programs for the control of contaminants in urban stormwater runoff. This issue is discussed in part two of this paper.

The US EPA water quality criteria are useful worst-case guidelines for signaling potential water quality concerns in the absence of more definitive information from appropriate

biological/toxicological assessments. However, there are tools in common use today, including the so-called short-term chronic toxicity tests and a number of the biological criteria, that are considerably more reliable in assessing the potential of complex effluents to adversely affect beneficial uses of receiving waters, than the worst-case numeric chemical criteria. It is sadly ironic, therefore, that the US EPA criteria cannot be recognized as having served their purpose and being now outdated for direct application and superseded by more direct and relevant measures of actual impact. Rather than moving ahead with using more technically valid assessment approaches to provide protection of beneficial uses of receiving waters without unjustified unnecessary controls - the mandated goal - the US EPA is forcing general compliance with what are typically unnecessarily and unjustifiably restrictive "criteria" and standards equivalent to them.

The authors have long maintained that dischargers or others who choose not to conduct appropriate site-specific evaluation of the impact of the subject discharge or runoff on receiving water beneficial uses (e.g., appropriate chronic toxicity tests and bioaccumulation) should have the worst-case numeric chemical criteria imposed on them as an administratively simple way to attain conservative water quality protection. However, forcing compliance with unnecessarily restrictive numeric chemical criteria/objectives when better information is available, is not without adverse consequences. In the state of California, the enforcement of the numeric chemical criteria-equivalent objectives is leading to the development of NPDES point-source and non-point-source runoff limitations that can result in significant unnecessary and unjustified expenditures for contaminant control beyond what is needed to protect the designated beneficial uses of a waterbody of interest to the public who ultimately has to fund all contaminant control programs.

In litigation initiated by several cities and an industry, the California courts have recently ruled that the state of California Water Resources Control Board's adoption of US EPA criteria as state water quality standards (objectives) in 1991 were inappropriately adopted because among other reasons the Board failed to consider the economic consequences of adopting these standards as required by state regulations. This means that the Water Resources Control Board now must start over in developing water quality standards for the state's waters, which include consideration of economic impacts of their implementation.

It might be argued, even, perhaps, with some justification, that if this country had surplus funds for meeting its environmental quality needs, as well as for meeting all of the social and other economic needs of the country, the US EPA's "Independent Applicability" policy could be appropriate. However, in the real world that exists today - where there is massive lack of funds for meeting social, educational, and economic welfare needs of the US population - it is highly appropriate to question whether such a policy should be implemented. In the Nation overall, and in many states including California, severe budget crises exist. The outlook for solving these economic and social problems in California and the nation in the next decade or so is extremely bleak. There is little likelihood that ten years from now the state of California (or many or all of the other states) will develop the resources necessary to adequately address the most pressing environmental problems as well as the social, educational, and economic problems of the state and the country.

It has taken the US EPA much longer than originally anticipated in 1972 when PL 92-500 was adopted, to begin to effectively address the control of toxics in US waters. Had these issues been addressed when they could and should have been, in the mid-1970's, a far more technically valid, cost-effective approach for managing toxics could be in place today. At that time, the approach for managing heavy metals-associated toxicity proposed by the US EPA in 1976 was based largely on toxicity tests, not worst-case numeric chemical criteria. The toxicity test approach evolved from the National Academies' of Science and Engineering, "Water Quality Criteria - 1972." A panel of experts convened by the National Academies concluded that the toxicity test approach provided a technically valid basis upon which to develop regulations for toxic impacts of heavy metals. The numeric chemical-specific approach was known at that time to be unreliable for that purpose. There is little justification for the US EPA to now adopt the "Independent Applicability" policy that would force the states to implement the overly protective, worst-case criteria or to spend the substantial resources to develop site-specific water quality standards (objectives) where studies of receiving waters have shown that the designated beneficial uses of potential interest to the public are being protected.

A Closer Look at the Three Components
(Numeric Chemical Criteria, Toxicity Testing, Biological Criteria)

The brief discussion of the US EPA's view of rationale for the "Independent Applicability" policy presented in the 1992 "Newsletter Water Quality Criteria & Standards" contained a number of misleading statements with regard to the nature and technically appropriate use of the US EPA water quality criteria; the "chemical numeric criteria justification" bias was evident. For example, the statement was made in the comparison of the three components of "Independent Applicability,"

"Chemical criteria are designed to address the effects of specific chemicals over the whole range of species."

While the numeric chemical criteria were developed based on available forms of specific chemicals and have relevance in that context, they are applied in practice to whatever forms of the chemicals are determined in the chemical analytical procedures used, i.e., typically all or most of the forms of the chemicals. Many chemicals exist in aquatic systems in a variety of chemical forms, only some of which are available to affect aquatic organisms. Since chemical analytical procedures do not, in general, discriminate between available and unavailable forms, the criteria are applied, *de facto*, against forms of contaminants that are unavailable/nontoxic.

The US EPA's October 1993 recommendation of the use of dissolved metals rather than total recoverable metals for implementing ambient water standards is a major step to correcting the gross overly protective approach the Agency adopted in the early 1980's for regulating heavy metals. Dissolved metals will also typically be over-protective because of non-toxic metal complexes and colloidal metal forms. The Agency is however persisting with total recoverable metals for "protection" of sediment quality and in implementing NPDES permits. Both of these approaches are unnecessary and are highly over-protective. Further, the Agency is still using total concentration for other contaminants. Dissolved contaminants coupled with ambient water

toxicity tests using sensitive forms of aquatic life and field assessment of bioaccumulation should be used for all contaminants, not just a few heavy metals.

Another significant factor of conservatism is that the US EPA criteria were developed for long-term or critical life-stage exposure of organisms; they do not take into account actual exposure durations, patterns or exposure, or period of exposure encountered in natural waters. This is especially important after assessing impacts of contaminants at the edge of the mixing zone. Thus, while the US EPA criteria were "designed" to address the effects of specific chemicals, they are not applied/implemented in a manner consistent with their design. Furthermore, the numeric chemical criteria were developed to be protective of selected "sensitive" species. The criteria are being applied, however, to waterbodies which for reasons other than chemical contaminants do not support such "sensitive" species. Thus, the US EPA statement in defense of the regulatory implementation of its numeric chemical criteria is misleading.

Bias is also reflected in the description of the whole effluent toxicity testing (WET) provided by the US EPA. It stated,

"WET limits are meant to catch unknown or unmeasured chemicals or synergistic effects, and use a very limited set of species."

WET limits should similarly be viewed as providing an ability to "catch" **antagonistic** effects (interactions that make chemicals less toxic than expected based on the worst-case criteria developed for available forms of chemical contaminants), and to "catch" situations in which chemical forms discharged and present are not toxic/available. This aspect of this evaluation and management tool provides a technically valid avenue by which to develop cost-effective management approaches that focus on "pollutants" - i.e., those contaminants that can adversely affect water quality - while minimizing unnecessary expenditures on unjustified contaminant control. The quoted US EPA statement does not reflect the conservative properties of such testing and, in fact, could cause a reader to conclude that it is less than conservative by using "a very limited set of species." The exposure conditions employed in effluent toxicity testing are typically substantially more rigorous than those that would likely be encountered in a receiving water. While a few species are selected for testing, those selected are from among those identified as being "sensitive" and would be expected to be as sensitive or more sensitive than those that may inhabit the receiving water. The US EPA clearly loaded its brief statement of purpose for the WET with considerable spin.

The highly over-protective nature of WET is especially important in implementing TUa (acute toxicity) and TUc (chronic toxicity) NPDES permit requirements. There is little possibility of water column aquatic organisms receiving the same exposure conditions in a mixing zone or at its edge as generated in the standard toxicity tests.

With regard to the third component to be applied, the US EPA stated,

"Biological criteria are meant to catch more subtle imbalances in the whole ecology."

Biological criteria that have been developed by the US EPA and others can provide useful information to assist in the evaluation of impacts of discharges on beneficial uses of areas of receiving waters. However, to indicate that they can *"catch more subtle imbalances in the whole ecology"* that can be related to a contaminant discharge as the cause, significantly exaggerates the capabilities of biological criteria in many situations. Biological criteria in general assess the numbers and types of organisms present at a location compared with what may be expected based on the habitat characteristics. Applied properly, they are an integrator of the wide variety of factors that influence the numbers and types of organisms in a waterbody or area of a waterbody. However, many of the factors that influence the numbers and types of organisms have nothing to do with pollution by chemical contaminants. In addition to habitat characteristics, factors such as flow, disease, competition, biological pollution by invading species, food characteristics and availability, overall trophic status, harvesting of organism (e.g., fishing), seasonal and specific climatic events, and other factors including sampling biases, influence the numbers and types of organisms that may be determined to be present at any location. While various biological assessment approaches have been available for decades, many of the wide variety of factors unrelated to chemical contaminants that control and influence populations present are still poorly understood, unable to be meaningfully quantified, and virtually impossible to reliably study or verify in the field. Even with those limitations, reliable biological assessment studies are costly. Thus, while differences in the numbers and types of organisms found "upstream" and "downstream" of a discharge (where habitat types and other characteristics are identical) may be indicative of effects of the discharge, the difference, itself, is not sufficient to demonstrate that the cause of the difference is the discharge.

The US EPA concluded from its three statements of purpose for the three components involved in "Independent Applicability,"

"Thus the measures are meant to be different, and so should be applied independently."

While the measures are, in fact, different, they are not equally reliable and applicable for assessing the impact of chemical contaminants in discharges or runoff on beneficial uses of the receiving water. The authors agree with the 1992 US EPA's indication that where the results of the three types of evaluations are seemingly inconsistent, the results should be evaluated in light of their differences to resolve apparent conflicts. However, the authors find the bias regarding the utility and purpose of these evaluation tools articulated by the US EPA, very disturbing. That expressed bias in conjunction with the US EPA's "present position" or proposed policy of "Independent Applicability" leaves little confidence that so-called "conflicts" in results (more correctly seen as differences in reliability and/or applicability to particular situations) would, in fact, be addressed in light of the nature and reliability of the instruments.

Key aspects of many of the components of the development and implementation of US EPA water quality criteria and toxics control programs that cause them to be, in general, overly restrictive for meeting the mandate to protect designated beneficial uses of receiving waters are briefly summarized below.

The US EPA numeric water quality criteria do not recognize that many contaminants exist in aquatic systems in a variety of chemical forms, only some of which are toxic to aquatic life.

The US EPA water quality criteria typically do not adequately consider the aquatic chemistry of a contaminant relative to the contaminant's aquatic toxicology.

The US EPA's acute and short-term chronic toxicity tests of effluents significantly overestimate the toxicity that would actually occur in the receiving waters, especially near the point of discharge outside the mixing zone.

The duration of exposure (one-hour average for acute and four-day average for chronic) and frequency of occurrence (once in three years) specifications in the US EPA criteria are grossly overly restrictive compared to what is needed to protect the designated beneficial uses of the surface waters of the United States.

In the 22 years that the US EPA has been in existence, it has advanced and retreated from a number of "applicability" policies for its water quality criteria. From the 1970's until November 1980, the US EPA stood on the policy of "presumptive applicability;" the US EPA water quality criteria were presumed to be applicable to a waterbody unless demonstrated otherwise. The technical water quality community was critical of that policy owing to the worst-case nature of some of the criteria. In the 1980's, with the development of much more strict requirements, especially for Priority Pollutant potential carcinogens, the US EPA rescinded its policy of presumptive applicability but indicated that states were to develop numeric chemical water quality standards using the guidance of the US EPA criteria. By the mid-1980's, however, the US EPA began to retreat again to the policy of presumptive applicability, albeit unofficially. It did, however, in the early 1990's take steps to recognize the issue of contaminant availability, at least for some of the heavy metals where the Agency acknowledged the possibility of states using the "soluble" (generally more available) forms of heavy metals as a basis for numeric chemical concentration regulations. Even so, it is well-known that that approach can also be more restrictive than necessary to protect designated beneficial uses of receiving waters and does not address the highly over-protective nature of using total concentrations of contaminants for other potentially toxic-bioaccumulatable chemicals.

Progress that had been made toward realistic assessments of potential impacts of available forms and protection of beneficial uses of receiving waters of the 1980's faded in 1992. At that time the US EPA adopted a policy that would require that all states without numeric water quality standards adopt the generally worst-case US EPA water quality criteria for toxic chemicals as enforceable standards. While since the mid-1980's there had been some flexibility in the presumptive applicability policy, the policy of "Independent Applicability" is an affirmation of the Agency's adhering to it more tightly. As discussed elsewhere herein, such an approach will increase the likelihood that overly restrictive contaminant control programs will be required, at substantially greater costs than would be necessary to provide protection of designated beneficial uses of receiving waters.

Objectives of US Water Pollution Control Programs

In 1972, the US Congress set forth as the overall objective of the country's water pollution control program the protection of designated beneficial uses of US waters. It specifically noted the water pollution control goal of achieving "fishable" and "swimmable" waters in the

attainment of the ultimate goal of "zero *pollutant*" discharge. One of the fundamental problems at the foundation of the US EPA's approaches for implementing water pollution control programs is the Agency's failure to make clear and recognize in implementation the difference between "contaminants" and "pollutants." By tradition in the water pollution control field and by law, "pollutants" are contaminants whose available-form concentrations are sufficient and to which sensitive organisms receive a sufficient duration of exposure to adversely impact the designated beneficial uses of a waterbody. A contaminant, on the other hand, is anything added to water independent of whether or not it has an impact. Any potentially toxic contaminant may be present in a water at concentrations of available forms below those which would cause adverse impacts on beneficial uses; under those circumstances, the contaminant would not be a "pollutant." The water quality protection goal expressed in PL-92-500 is protection of beneficial uses from pollutants, not to prevent the existence in water of contaminants that are not adversely affecting beneficial uses. The assumption that contaminants are necessarily pollutants, frequently made by environmental groups and some regulatory agencies, leads to unjustified unnecessary expenditures for control of contaminants beyond that needed to protect the designated beneficial uses of a waterbody.

Some water pollution control programs do not reflect an understanding and significance of the term, "designated beneficial uses." The designation of "beneficial uses" is an integral part of the design of federal water pollution control regulations; it provides a focus and defines the object of "protection." Site-specific characteristics (e.g., habitat), priorities, and needs enter into the designation of beneficial uses. It is suggested that the highest priority should be given to protecting those forms of aquatic life that are of the greatest interest to the public, such as game fish-shellfish that can be sustained, and food organisms for those game fish-shellfish. It seems to make little sense to force communities, for example, to spend large amounts of money for additional wastewater treatment or stormwater runoff contaminant control which at best, because of habitat and other characteristics of the waterbody, will enable a few more carp or other rough fish to develop in the waterbody.

The approach that was advocated by US EPA representatives at the June 1993 US EPA workshop held in San Francisco of requiring that wastewater dischargers and sources of runoff spend the funds necessary to protect "water fleas" in the receiving waters for the discharge-runoff when it is acknowledged that such protection will not result in improvement in a desirable game-sportsfishery in the waterbody, would likely be considered inappropriate by many of the public.

The authors feel that it is time to get the public involved in making decisions regarding the degree to which potentially toxic contaminants should be controlled in this country over the next ten years. Significant efforts should be made to involve the public in re-examination of the goals of the water pollution control programs of this country in light of what is known today about the aquatic chemistry and toxicology of those contaminants, and the economic, and social situations that exist today and will likely exist over the foreseeable future. Questions such as the following should receive the public's attention:

Should the public be forced to pay for controlling chemicals that are adverse for a short distance to water fleas when the characteristics of the receiving waters are such that fishable waters cannot be achieved because of lack of suitable habitat?

Should the public be forced to pay for the clean-up of a chemically contaminated sediment when studies of the region in which the sediment is located and under the potential influence of it show that there is a desirable sportsfishery?

Should the public be forced to pay for additional wastewater treatment and control of contaminants from non-point sources to possibly achieve the ultimate in a sportsfishery for the habitat that exists when a good desirable sportsfishery already exists?

Should the public be forced to pay for the control of contaminants in water or sediments that empirically correlate with altered enzyme activity or some other biochemical-physiological response for which there is no discernible linkage of that "response" to responses of desirable whole organisms?

The authors are not advocating inattention to gross and obvious pollution; clearly such problems should be cleaned up as rapidly as possible. They are also not advocating that obvious aquatic life toxicity (such as that measured by the US EPA's short-term chronic toxicity tests) in ambient water that could otherwise support a desirable sportsfishery, not be addressed and eliminated if a sportsfishery were desired for the area. What is being advocated is that the funds available today for water pollution control programs be focused on real, discernible problems for which there is a fairly well-defined link between the additional contaminant control and benefits in designated beneficial uses.

A prioritized toxics control program is suggested below. Such a program is designed to focus the funds available for the control of contaminants, first on the most significant, obvious water quality problems caused by toxics. It requires additional evaluation of the characteristics of the waterbody receiving wastewater discharges or stormwater runoff than those typically required today. Wastewater dischargers and sources of runoff who choose not to participate in conducting the necessary studies of the receiving waters for the discharge should be required to implement worst-case based contaminant control programs associated with the discharge-runoff. The focus of this program is on protection of designated beneficial uses of waterbodies (ambient waters as opposed to effluents-runoff) in which from an aquatic life toxicity perspective emphasis is given to the numbers, types, and characteristics of desirable fish and other aquatic organisms and their wholesomeness for use as food by man and other higher trophic level organisms.

Evaluate for the receiving waters discharge-runoff whether the ambient waters during various flow, climatic, and other dominant condition regimes are toxic to the fish and shellfish larvae used in the US EPA's short-term chronic toxicity tests. If no toxicity is found under representative conditions, then there should be no need to initiate toxics control beyond that already in place. Under these conditions, periodic monitoring of the ambient waters of the discharge should be required.

Toxicity tests on aquatic plants such as algae should not be the basis for establishing water pollution control programs for control of contaminants from point or non-point sources unless it can be demonstrated that there is a fairly direct link between the results of the toxicity tests and the impact on desirable fish and shellfish populations in receiving waters for the discharge-runoff.

Whole organism toxicity testing should be the basis for testing and regulatory programs. Results of enzymatic or other biological or physiological tests should not be used for regulatory purposes unless a clear relationship is found between whole organism testing and the biochemical-physiological response.

If toxicity is found in the receiving waters for the discharge-runoff, evaluate the potential benefits in terms of improved sports and/or commercial fishery that would accrue as a result of proposed control programs. If the habitat characteristics of the receiving waters for the discharge-runoff are such that it is not possible to develop a desirable sportsfishery, there should be no need to control the cause of the toxicity until the habitat or other limiting factors have been addressed. If it is found, however, that the sportsfishery could be improved by control of toxicity, then the toxics control program should be implemented.

In order to evaluate whether bioaccumulation of contaminants of concern to higher trophic levels including man is occurring in the receiving waters for a discharge-runoff, fish, shellfish, and other desirable organisms (from a food point of view) should be analyzed for the chemicals of potential concern, such as chlorinated hydrocarbons that tend to accumulate in fish tissue, and mercury. If excessive concentrations are found relative to FDA action levels, then proceed to control the sources of the chemicals that are causing the excessive levels. If the concentrations found in the fish or shellfish tissue are below the FDA action level or if there is no FDA action level, evaluation should be made of the potential change in cancer incidence that would have developed as a result of controlling the bioaccumulation. Typically the maximum concentrations of carcinogens in fish tissue are such that consuming 1 to 2 meals of contaminated fish per month over a lifetime would change the cancer incidence in a million people who consume these fish by at most one cancer per million people per year. Significant questions can and should be raised about the appropriateness of trying to control the carcinogens in drinking water and fish tissue to one additional cancer per million people over 70 years as is typically advocated today.

The US EPA should not under the current economic situation in the many states and in the United States continue to implement the **Independent Applicability** policy.

Aquatic life toxicity tests and/or aquatic organism population evaluations in the receiving waters for the discharge should be considered definitive for regulatory purposes irrespective of whether US EPA water quality criteria, or criteria-equivalent standards are exceeded in the waterbody. The exceedance of the water quality criteria should be used as a trigger for site-specific contaminant evaluation programs associated with altered numbers and types of desired organisms and/or aquatic life toxicity.

Site-specific water quality criteria or standards (objectives) should not need to be developed to address exceedances of the water quality criteria or standards if no toxicity to fish and shellfish

larvae is found in the ambient waters or if the numbers and types of desirable fish and shellfish in the receiving waters are thought to be appropriate for the habitat characteristics.

Results of ambient water toxicity evaluations should take precedence over the results of effluent toxicity tests. Dischargers and sources of runoff should not be required, as is being practiced today, to achieve effluent toxicity limits when receiving water studies show that there is no ambient water toxicity associated with the effluent or runoff.

The control of toxics associated with domestic water supply impairment should be based on whether the concentrations discharged to or present in runoff into a waterbody actually cause an impairment of the uses of the water for an existing domestic water supply based on either surface or groundwater sources.

It is suggested that this program be immediately implemented for the remainder of the 1990's. In the year 2000, a re-evaluation of these issues should be conducted and a determination should be made of the appropriate degree of control of chemicals beyond those set forth in this program in light of the economic, social, educational, and environmental needs of the country at that time. If at that time, the public determines that it is appropriate to use funds to achieve a greater degree of designated beneficial uses than would be achieved through this program, then such programs can and should be implemented.

While the suggested program is oriented toward aquatic life-related water quality criteria in the watercolumn, it is also applicable and recommended for use in the development of sediment quality criteria, such as is being done by the US EPA and several states. Notwithstanding the sediment quality criteria being proposed by the US EPA and the state of California's Water Resources Control Board, under no circumstances should chemical composition-based sediment quality criteria override the results of aquatic organism bioassays and/or aquatic organism assemblage analysis/evaluation. Properly developed chemical composition-based criteria can be useful in the identification of causes of aquatic life toxicity in sediments and help direct future pollutant control programs for sediment associated contaminants. They should not be used as the primary regulatory tool upon which sediment clean-up objectives are developed.

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