United States
Environmental Protection
Agency

Office of Water
(4305)

EPA 823-B-94-005a
August 1994

EPA

Water Quality Standards Handbook:

Second Edition

"... to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

Section 101(a) of the Clean Water Act

Contains Update #1
August 1994

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WATER QUALITY STANDARDS

HANDBOOK

SECOND EDITION

Water Quality Standards Branch
Office of Science and Technology
U.S. Environmental Protection Agency
Washington, DC 20460

September 1993

Contains update #1
August 1994

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401 M Street, S.W.
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FOREWORD

Dear Colleague:

The following document entitled *Water Quality Standards Handbook - Second Edition* provides guidance issued in support of the Water Quality Standards Regulation (40 CFR 131, as amended). This Handbook includes the operative provisions of the first volume of the Handbook issued in 1983 and incorporates subsequent guidance issued since 1983. The 1993 Handbook contains only final guidance previously issued by EPA it contains no new guidance.

Since the 1983 Handbook has not been updated in ten years, we hope that this edition will prove valuable by pulling together current program guidance and providing a coherent document as a foundation for State and Tribal water quality standards programs. The Handbook also presents some of the evolving program concepts designed to reduce human and ecological risks, such as endangered species protection; criteria to protect wildlife, wetlands, and sediment quality; biological criteria to better define desired biological communities in aquatic ecosystems; and nutrient criteria.

This Handbook is intended to serve as a "living document," subject to future revisions as the water quality standards program moves forward, and to reflect the needs and experiences of EPA and the States. To this end, the Handbook is published in a loose leaf format designed to be placed in three ring binders. This copy of the Handbook includes updated material for 1994 (see Appendix X), and EPA anticipates publishing additional changes periodically and providing them to Handbook recipients. To ensure that you will receive these updates, please copy the reader response card in Appendix W and mail it to the address on the reverse.

The Handbook also contains a listing, by title and date, of the guidance issued since the Handbook was first published in 1983 that is incorporated in the Second Edition. Copies of these documents are available upon request.

The *Water Quality Standards Handbook - Second Edition* provides guidance on the national water quality standards program. EPA regional offices and States may have additional guidance that provides more detail on selected topics of regional interest. For information on regional or State guidance, contact the appropriate regional water quality standards coordinator listed in Appendix U.

EPA invites participation from interested parties in the water quality standards program, and appreciates questions on this guidance as well as suggestions and comments for improvement. Questions or comments may be directed to the EPA regional water quality standards coordinators or to:

David Sabock, Chief
U.S. Environmental Protection Agency
Water Quality Standards Branch (4305)
401 M Street, S.W.
Washington, D.C. 20460
Telephone (202) 475-7315

Betsy Southerland, Acting Director
Standards and Applied Science Division

Note to the Reader

The Water Quality Standards Handbook, first issued in 1983, is a compilation of EPA's guidance on the water quality standards program and provides direction for States in reviewing, revising and implementing water quality standards. The *Water Quality Standards Handbook - Second Edition* retains all the guidance in the 1983 Handbook unless such guidance was specifically revised in subsequent years. An annotated list of the major guidance and policy documents on the water quality standards program issued since 1983 is included in the Introduction and material added to the Second Edition by periodic updates since 1993 is summarized in Appendix X. Material in the Handbook contains only guidance previously issued by EPA; it contains no new guidance.

The guidance contained in each of the documents listed in the Introduction is either: 1) incorporated in its entirety, or summarized, in the text of the appropriate section of this Handbook, or 2) attached as an appendix (see Table of Contents). If there is uncertainty or perceived inconsistency on any of the guidance incorporated into this Handbook, the reader is directed to review the original guidance documents or call the Water Quality Standards Branch at (202) 260-1315. Copies of all original guidance documents not attached as appendices may be obtained from the source listed for each document in the Reference section of this Handbook.

Limited free copies of this Handbook may be obtained from:

Office of Water Resource Center, RC-4100
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Robert S. Shippen
Editor

TABLE OF CONTENTS

Appendices:

GLOSSARY

WATER QUALITY STANDARDS HANDBOOK

SECOND EDITION

GLOSSARY

The "Act" refers to the Clean Water Act (Public Law 92-500, as amended (33 USC 1251, et seq.) (40 CFR 131.3.)

"Acute" refers to a stimulus severe enough to rapidly induce an effect; in aquatic toxicity tests, an effect observed in 96- hours or less is typically considered acute. When referring to aquatic toxicology or human health, an acute affect is not always measured in terms of lethality (USEPA, 1991a.)

"Acute-chronic ratio" (ACR) is the ratio of the acute toxicity of an effluent or a toxicant to its chronic toxicity. It is used as a factor for estimating chronic toxicity on the basis of acute toxicity data, or for estimating acute toxicity on the basis of chronic toxicity data (USEPA, 1991a.)

"Acutely toxic conditions" are those acutely toxic to aquatic organisms following their short-term exposure within an affected area (USEPA, 1991a.)

"Additivity" is the characteristic property of a mixture of toxicants that exhibits a total toxic effect equal to the arithmetic sum of the effects of the individual toxicants (USEPA, 1991a.)

"Ambient toxicity" is measured by a toxicity test on a sample collected from a water body (USEPA, 1991a.)

"Antagonism" is the characteristic property of a mixture of toxicants that exhibits a less-than-additive total toxic effect (USEPA, 1991a.)

"Aquatic community" is an association of interacting populations of aquatic organisms in a given water body or habitat (USEPA, 1990; USEPA, 1991a.)

"Averaging period" is the period of time over which the receiving water concentration is averaged for comparison with criteria concentrations. This specification limits the duration of concentrations above the criteria (USEPA, 1991a.)

"Bioaccumulation" is the process by which a compound is taken up by an aquatic organism, both from water and through food (USEPA, 1991a.)

"Bioaccumulation factor" (BAF) is the ratio of a substance's concentration in tissue versus its concentration in ambient water, in situations where the organism and the food chain are exposed (USEPA, 1991a.)

"Bioassay" is a test used to evaluate the relative potency of a chemical or a mixture of chemicals by comparing its effect on a living organism with the effect of a standard preparation on the same type of organism. Bioassays are frequently used in the pharmaceutical industry to evaluate the potency of vitamins and drugs (USEPA, 1991a.)

"Bioavailability" is a measure of the physicochemical access that a toxicant has to the biological processes of an organism. The less the bioavailability of a toxicant, the less its toxic effect on an organism (USEPA, 1991a.)

"Bioconcentration" is the process by which a compound is absorbed from water through gills or epithelial tissues and is concentrated in the body (USEPA, 1991a.)

"Bioconcentration factor" (BCF) is the ratio of a substance's concentration in tissue versus its concentration in water, in situations where the food chain is not exposed or contaminated. For non-metabolized substances, it represents equilibrium partitioning between water and organisms (USEPA, 1991a.)

"Biological criteria" are narrative expressions or numeric values of the biological characteristics of aquatic communities based on appropriate reference conditions. As such, biological criteria serve as an index of aquatic community health. It is also known as **biocriteria** (USEPA, 1991a.)

"Biological integrity" is the condition of the aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by community structure and function (USEPA, 1991a.)

"Biological monitoring" describes the use of living organisms in water quality surveillance to indicate compliance with water quality standards or effluent limits and to document water quality trends. Methods of biological monitoring may include, but are not limited to, toxicity testing (such as ambient toxicity testing or whole-effluent toxicity testing) and biological surveys. It is also known as **biomonitoring** (USEPA, 1991a.)

"Biological survey or biosurvey" is collecting, processing, and analyzing a representative portion of the resident aquatic community to determine its structural and/or functional characteristics (USEPA. 1991a.)

"Biomagnification" is the process by which the concentration of a compound increases in species occupying successive trophic levels (USEPA, 1991a.)

"Cancer potency slope factor" (q_1*) is an indication of a chemical's human cancer-causing potential derived using animal studies or epidemiological data on human exposure; based on extrapolation of high-dose levels over short periods of time to low-dose levels and a lifetime exposure period through the use of a linear model (USEPA, 1991a.)

"Chronic" defines a stimulus that lingers or continues for a relatively long period of time, often one-tenth of the life span or more. Chronic should be considered a relative term depending on the life span of an organism. The measurement of a chronic effect can be reduced growth, reduced reproduction, etc., in addition to lethality (USEPA, 1991a.)

"Community component" is a general term that may pertain to the biotic guild (fish, invertebrates, algae), the taxonomic category (order, family, genus, species), the feeding strategy (herbivore, omnivore, predator), or the organizational level (individual, population, assemblage) of a biological entity within the aquatic community (USEPA, 1991a.)

"Completely mixed condition" is defined as no measurable difference in the concentration of a pollutant exists across a transect of the water body (e.g., does not vary by 5%) (USEPA, 1991a.)

"Criteria" are elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use. When criteria are met, water quality will generally protect the designated use (40 CFR 131.3.)

"Criteria continuous concentration" **(CCC)** is the EPA national water quality criteria recommendation for the highest instream concentration of a toxicant or an effluent to which organisms can be exposed indefinitely without causing unacceptable effect (USEPA, 1991a.)

"Criteria maximum concentration" **(CMC)** is the EPA national water quality criteria recommendation for the highest instream concentration of a toxicant or an effluent to which organisms can be exposed for a brief period of time without causing an acute effect (USEPA, 1991a.)

"Critical life stage" is the period of time in an organism's lifespan in which it is the most susceptible to adverse effects caused by exposure to toxicants, usually during early development (egg, embryo, larvae). Chronic toxicity tests are often run on critical life stages to replace long duration, life cycle tests since the most toxic effect usually occurs during the critical life stage (USEPA, 1991a.)

"Critical species" is a species that is commercially or recreationally important at the site, a species that exists at the site and is listed as threatened or endangered under section 4 of the Endangered Species Act, or a species for which there is evidence that the loss of the species from the site is likely to cause an unacceptable impact on a commercially or recreationally important species, a threatened or endangered species, the abundances of a variety of other species, or the structure or function of the community (USEPA, 1994a.)

"Design flow" is the flow used for steady-state waste load allocation modeling (USEPA, 1991a.)

"Designated uses" are those uses specified in water quality standards for each water body or segment whether or not they are being attained (40 CFR 131.3.)

"Discharge length scale" is the square root of the cross-sectional area of any discharge outlet (USEPA, 1991a.)

"Diversity" is the number and abundance of biological taxa in a specified location (USEPA, 1991a.)

"Effective concentration" **(EC)** is a point estimate of the toxicant concentration that would cause an observable adverse effect (such as death, immobilization, or serious incapacitation) in a given percentage of the test organisms (USEPA, 1991a.)

"Existing uses" are those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards (40 CFR 131.3.)

"**Federal Indian Reservation,**" "**Indian Reservation,**" **or** "**Reservation**" is defined as all land within the limits of any Indian reservation under the jurisdiction of the United States Government, notwithstanding the issuance of any patent, and including rights-of-way running through the reservation (40 CFR 131.3.)

"**Final acute value**" **(FAV)** is an estimate of the concentration of the toxicant corresponding to a cumulative probability of 0.05 in the acute toxicity values for all genera for which acceptable acute tests have been conducted on the toxicant (USEPA, 1991a.)

"**Frequency**" is how often criteria can be exceeded without unacceptably affecting the community (USEPA, 1991a.)

"**Harmonic mean flow**" is the number of daily flow measurements divided by the sum of the reciprocals of the flows. That is, it is the reciprocal of the mean of reciprocals (USEPA, 1991a.)

"**Indian Tribe**" **or** "**Tribe**" describes any Indian Tribe, band, group, or community recognized by the Secretary of the Interior and exercising governmental authority over a Federal Indian reservation (40 CFR 131.3.)

"**Inhibition concentration**" **(IC)** is a point estimate of the toxicant concentration that would cause a given percent reduction (e.g., IC25) in a non-lethal biological measurement of the test organisms, such as reproduction or growth (USEPA, 1991a.)

"**Lethal concentration**" is the point estimate of the toxicant concentration that would be lethal to a given percentage of the test organisms during a specified period (USEPA, 1991a.)

"**Lipophilic**" is a high affinity for lipids (fats) (USEPA, 1991a.)

"**Load allocations**" **(LA)** the portion of a receiving water TMDL that is attributed either to one of its existing or future nonpoint sources of pollution or to natural background sources (USEPA, 1991a.)

"**Lowest-observed-adverse-effect-level**" **(LOAEL)** is the lowest concentration of an effluent or toxicant that results in statistically significant adverse health effects as observed in chronic or subchronic human epidemiology studies or animal exposure (USEPA, 1991a.)

"**Magnitude**" is how much of a pollutant (or pollutant parameter such as toxicity), expressed as a concentration or toxic unit is allowable (USEPA, 1991a.)

"**Minimum level**" **(ML)** refers to the level at which the entire analytical system gives recognizable mass spectra and acceptable calibration points when analyzing for pollutants of concern. This level corresponds to the lowest point at which the calibration curve is determined (USEPA, 1991a.)

"**Mixing zone**" is an area where an effluent discharge undergoes initial dilution and is extended to cover the secondary mixing in the ambient water body. A mixing zone is an allocated impact zone where water quality criteria can be exceeded as long as acutely toxic conditions are prevented (USEPA, 1991a.)

"**Navigable waters**" refer to the waters of the United States, including the territorial seas (33 USC 1362.)

"**No-observed-adverse-effect-level**" **(NOAEL)** is a tested dose of an effluent or a toxicant below which no adverse biological effects are observed, as identified from chronic or subchronic human epidemiology studies or animal exposure studies (USEPA, 1991a.)

"**No-observed-effect-concentration**" **(NOEC)** is the highest tested concentration of an effluent or a toxicant at which no adverse effects are observed on the aquatic test organisms at a specific time of observation. Determined using hypothesis testing (USEPA, 1991a.)

"**Nonthreshold effects**" are associated with exposure to chemicals that have no safe exposure levels. (i.e., cancer) (USEPA, 1991a.)

"**Persistent pollutant**" is not subject to decay, degradation, transformation, volatilization, hydrolysis, or photolysis (USEPA, 1991a.)

"**Pollution**" is defined as the man-made or man-induced alteration of the chemical, physical, biological and radiological integrity of water (33 USC 1362.)

"**Priority pollutants**" are those pollutants listed by the Administrator under section 307(a) of the Act (USEPA, 1991a.)

"**Reference ambient concentration**" **(RAC)** is the concentration of a chemical in water which will not cause adverse impacts to human health; RAC is expressed in units of mg/l (USEPA, 1991a.)

"**Reference conditions**" describe the characteristics of water body segments least impaired by human activities. As such, reference conditions can be used to describe attainable biological or habitat conditions for water body segments with common watershed/catchment characteristics within defined geographical regions.

"**Reference tissue concentration**" **(RTC)** is the concentration of a chemical in edible fish or shellfish tissue which will not cause adverse impacts to human health when ingested. RTC is expressed in units of mg/kg (USEPA, 1991a.)

"**Reference dose**" **(RfD)** is an estimate of the daily exposure to human population that is likely to be without appreciable risk of deleterious effect during a lifetime; derived from NOAEL or LOAEL (USEPA, 1991a.)

"**Section 304(a) criteria**" are developed by EPA under authority of section 304(a) of the Act based on the latest scientific information on the relationship that the effect of a constituent concentration has on particular aquatic species and/or human health. This information is issued periodically to the States as guidance for use in developing criteria (40 CFR 131.3.)

"**Site-specific aquatic life criterion**" is a water quality criterion for aquatic life that has been derived to be specifically appropriate to the water quality characteristics and/or species composition at a particular location (USEPA, 1994a.)

"States" include: the 50 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, Virgin Islands, American Samoa, the Trust Territory of the Pacific Islands, and the Commonwealth of the Northern Mariana Islands, and Indian Tribes that EPA determines qualify for treatment as States for the purposes of water quality standards (40 CFR 131.3.)

"Steady-state model" is a fate and transport model that uses constant values of input variables to predict constant values of receiving water quality concentrations (USEPA, 1991a.)

"STORET" is EPA's computerized water quality database that includes physical, chemical, and biological data measured in water bodies throughout the United States (USEPA, 1991a.)

"Sublethal" refers to a stimulus below the level that causes death (USEPA, 1991a.)

"Synergism" is the characteristic property of a mixture of toxicants that exhibits a greater-than-additive total toxic effect (USEPA, 1991a.)

"Threshold effects" result from chemicals that have a safe level (i.e., acute, subacute, or chronic human health effects) (USEPA, 1991a.)

"Total maximum daily load" (TMDL) is the sum of the individual waste load allocations (WLAs) and load allocations (LAs); a margin of safety is included with the two types of allocations so that any additional loading, regardless of source, would not produce a violation of water quality standards (USEPA, 1991a.)

"Toxicity test" is a procedure to determine the toxicity of a chemical or an effluent using living organisms. A toxicity test measures the degree of effect on exposed test organisms of a specific chemical or effluent (USEPA, 1991a.)

"Toxic pollutant" refers to those pollutants, or combination of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, or on the basis of information available to the administrator, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction) or physical deformations, in such organisms or their offspring (33 USC section 1362.)

"Toxic units" (TUs) are a measure of toxicity in an effluent as determined by the acute toxicity units (TUa) or chronic toxicity units (TUc) measured (USEPA, 1991a.)

"Toxic unit acute" (TUa) is the reciprocal of the effluent concentration that causes 50 percent of the organisms to die by the end of the acute exposure period (i.e., $100/LC_{50}$) (USEPA, 1991a.)

"Toxic unit chronic" (TUc) is the reciprocal of the effluent concentration that causes no observable effect on the test organisms by the end of the chronic exposure period (i.e., 100/NOEC) (USEPA, 1991a.)

"Use attainability analysis" (UAA) is a structured scientific assessment of the factors affecting the attainment of the use which may include physical, chemical, biological, and economic factors as described in section 131.10(g) (40 CFR 131.3.)

"Waste load allocation" (WLA) is the portion of a receiving water's TMDL that is allocated to one of its existing or future point sources of pollution (USEPA, 1991a.)

"Waters of the United States" refer to:

(1) all waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(2) all interstate waters, including interstate wetlands;

(3) all other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use or degradation of which would affect or could affect interstate or foreign commerce, including any such waters:

  (i) which are or could be used by interstate or foreign travelers for recreational or other purposes;

  (ii) from which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

  (iii) which are or could be used for industrial purposes by industries in interstate commerce.

(4) all impoundments of waters otherwise defined as waters of the United States under this definition;

(5) tributaries of waters in paragraphs (1) through (4) of this definition;

(6) the territorial sea; and

(7) wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (1) through (6) of this definition. "Wetlands" are defined as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of the Act (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria for this definition) are not waters of the United States. (40 CFR 232.2.)

"Water-effect ratio" (WER) is an appropriate measure of the toxicity of a material obtained in a site water divided by the same measure of the toxicity of the same material obtained simultaneously in a laboratory dilution water (USEPA, 1994a.)

"Water quality assessment" is an evaluation of the condition of a water body using biological surveys, chemical-specific analyses of pollutants in water bodies, and toxicity tests (USEPA, 1991a.)

"Water quality limited segment" refers to any segment where it is known that water quality does not meet applicable water quality standards and/or is not expected to meet applicable water quality standards even after application of technology-based effluent limitations required by sections 301(b)(1)(A) and (B) and 306 of the Act (40 CFR 131.3.)

"Water quality standards" (WQS) are provisions of State or Federal law which consist of a designated use or uses for the waters of the United States, water quality criteria for such waters based upon such uses. Water quality standards are to protect public health or welfare, enhance the quality of the water and serve the purposes of the Act (40 CFR 131.3.)

"Whole-effluent toxicity" is the total toxic effect of an effluent measured directly with a toxicity test (USEPA, 1991a.)

INTRODUCTION

HISTORY OF THE WATER QUALITY STANDARDS PROGRAM

Statutory History

The first comprehensive legislation for water pollution control was the Water Pollution Control Act of 1948 (Public Law 845, 80th Congress). This law, passed after a half century of debate on the responsibility of the Federal Government for resolving water pollution problems, adopted principles of State-Federal cooperative program development, limited Federal enforcement authority, and provided limited financial assistance. These concepts were continued in the Federal Water Pollution Control Act (FWPCA) of 1956 (Public Law 660, 84th Congress) and in the Water Quality Act of 1965. Under the 1965 Act, States were directed to develop water quality standards for interstate waters. As a result of enforcement complexities and other problems, however, this approach was not sufficiently effective. In the FWPCA Amendments of 1972 (Public Law 92-500), Congress established a discharge permit system and provided a broader Federal role through more extensive Federal grants to finance local sewage treatment systems and through Federal (EPA) setting of technology-based effluent limitations. The 1972 Amendments extended the water quality standards program to intrastate waters and provided for implementation of water quality standards through discharge permits.

Section 303(c) of the 1972 FWPCA Amendments (33 USC 1313(c)) established the statutory basis for the current water quality standards program. It completed the transition from the previously established program of water quality standards for interstate waters to one requiring standards for all surface waters of the United States.

Although the major innovation of the 1972 FWPCA was technology-based controls, Congress maintained the concept of water quality standards both as a mechanism to establish goals for the Nation's waters and as a regulatory requirement when standardized technology controls for point source discharges and/or nonpoint source controls were inadequate. In recent years, Congress and EPA have given these water quality-based controls new emphasis in the continuing quest to enhance and maintain water quality to protect the public health and welfare.

Briefly stated, the key elements of section 303(c) are as follows:

(1) A water quality standard is defined as the designated beneficial uses of a water segment and the water quality criteria necessary to support those uses;

(2) The minimum beneficial uses to be considered by States in establishing water quality standards are specified as public water supplies, propagation of fish and wildlife, recreation, agricultural uses, industrial uses, and navigation;

(3) A requirement specifies that State standards must protect public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act;

(4) A requirement specifies that States must review their standards at least once each 3-year period using a process that includes public participation;

(5) The process is described for EPA review of State standards that might ultimately result in the promulgation of a superseding Federal rule in cases where a State's standards are not consistent with the applicable requirements of the CWA, or in situations where the Agency determines that Federal standards are necessary to meet the requirements of the Act.

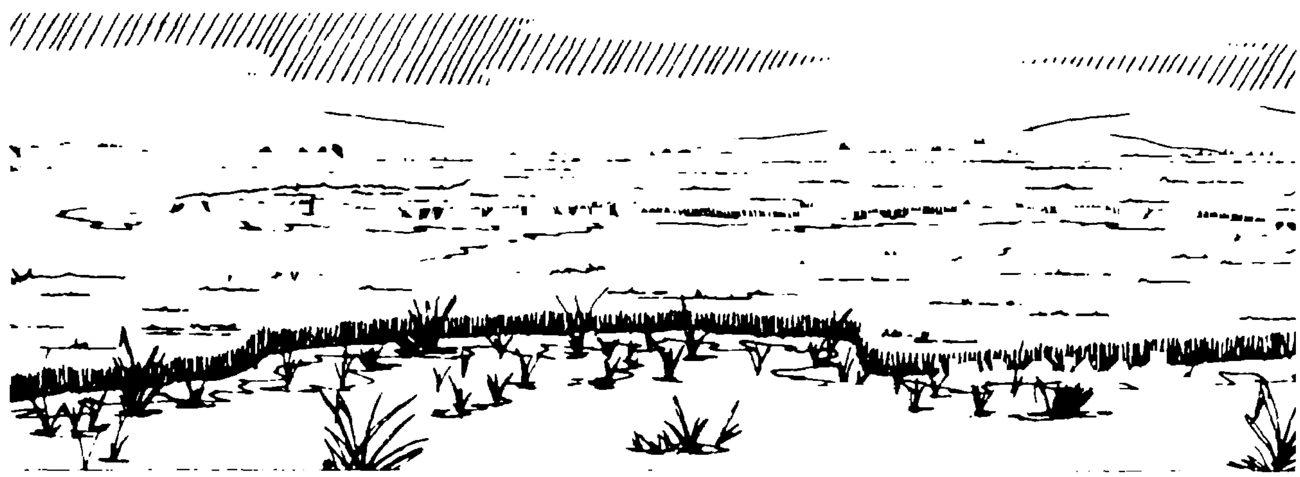
The Federal Water Pollution Control Act, including the major 1977, 1981, and 1987 Amendments are commonly referred to as the "Clean Water Act" (the Act or CWA).

On February 4, 1987, Congress enacted the Water Quality Act of 1987 (Public Law 100-4), making substantial additions to the Clean Water Act and directly affecting the standards program. Congress concluded that toxic pollutants in water constitute one of the most pressing water pollution problems. The Water Quality Act provided a new approach to controlling toxic pollutants by requiring ". . . States to identify waters that do not meet water quality standards due to the discharge of toxic substances, to adopt numerical criteria for the pollutants in such waters, and to establish effluent limitations for individual discharges to such water bodies" (from Senator Mitchell, 133 Congressional Record S733). As now amended, the Clean Water Act requires that States adopt numeric criteria for toxic pollutants listed under section 307(a) of the Clean Water Act for which section 304(a) criteria have been published, if the presence of these pollutants is likely to adversely affect the water body's use. Guidance on these changes is discussed in detail in section 3.4 of this Handbook. Additionally, for the first time, the Act explicitly recognizes antidegradation (see section 303(d)(4) of the Act).

Regulatory History

EPA first published a water quality standards regulation in 1975 (40 CFR 130.17, promulgated in 40 F.R. 55334, November 28, 1975) as part of EPA's water quality management regulations, mandated under section 303(e) of the Act. The first Water Quality Standards Regulation did not specifically address toxic pollutants or any other criteria. It simply required "appropriate" water quality criteria necessary to support designated uses.

In the late 1970s and early 1980s, the public and Congress raised concerns about toxic pollutant control. EPA realized that promulgating effluent guidelines or effluent standards under section 307 of the Act would not comprehensively address toxic pollutants. So, EPA decided to use the statutory connection between water quality standards and NPDES permits provided by section 301(b)(1)(C) to effectively control a range of toxic pollutants from point sources. To best accomplish this process, the Agency decided to amend the Water Quality Standards Regulation to explicitly address toxic criteria requirements in State



standards. Other legal and programmatic issues also necessitated a revision of the Standards Regulation. The culmination of this effort was the promulgation of the present Water Quality Standards Regulation on November 8, 1983 (54 F.R. 51400).

The present Water Quality Standards Regulation (40 CFR Part 131) is a much more comprehensive regulation than its predecessor. In subpart B, the Regulation addresses both the designated use component and the criteria component of a water quality standard. Section 131.11 of the Regulation requires States to review available information and ". . . to identify specific water bodies where toxic pollutants may be adversely affecting water quality . . . and must adopt criteria for such toxic pollutants applicable to the water body sufficient to protect the designated use." The Regulation provides that either or both numeric and narrative criteria may be appropriately used in water quality standards.

Since the middle of the 1980's, EPA's annual program guidance to the States reflected the increasing emphasis on controlling toxics. States were strongly encouraged to adopt criteria in their standards for the pollutants listed pursuant to section 307(a) of the Act, especially where EPA has published criteria guidance under section 304(a) of the Act.

State reaction to EPA's initiative was mixed. Several States proceeded to adopt large numbers of numeric toxic pollutant criteria, although primarily for the protection of aquatic life. Other States relied on a narrative "free from" toxicity criterion, using so-called "action levels" for toxic pollutants or for calculating site-specific criteria. Few States specifically addressed human health protection outside the National Primary Drinking Water Standards promulgated under the Safe Drinking Water Act.

In support of its 1983 regulation, EPA simultaneously issued program guidance entitled *Water Quality Standards Handbook* (December 1983). The foreword to the guidance noted that EPA's approach to controlling toxics included both chemical-specific numeric criteria and biological testing in whole-effluents or ambient waters. More detailed programmatic guidance on the application of biological testing was provided in the *Technical Support Document for Water Quality-based Toxics Control* (EPA 44/4-85-032, September 1985). This document provides the information needed to convert chemical-specific and biologically based criteria into permit limits for point source dischargers.

State water quality standards reviews submitted began to show the effects of EPA's efforts. More and more numeric criteria for toxics were being included in State standards as well as more aggressive use of the "free from toxics" narratives in setting protective NPDES permit limits. However, because of perceived problems in adopting numeric toxic pollutant criteria in State rulemaking proceedings, many States were reluctant to adopt numeric toxics criteria. Thus, in 1987, Congress responded to the lack of numeric criteria for toxic pollutants within State standards by mandating State adoption of such criteria.

In response to this new congressional mandate, EPA redoubled its efforts to promote and assist State adoption of water quality standards for priority toxic pollutants. EPA's efforts included the development and issuance of guidance to the States on December 12, 1988, which contained acceptable implementation procedures for several new sections of the Act, including sections 303(c)(2)(B).

EPA, in devising guidance for section 303(c)(2)(B), attempted to provide States with the maximum flexibility that complied with the express statutory language but also with the overriding congressional objective: prompt adoption and implementation of numeric toxics criteria. EPA believed that flexibility was important so that each State could comply with section 303(c)(2)(B) and to the extent possible, accommodate its existing water quality standards regulatory approach. The options EPA identified are described in section 3.4.1 of this Handbook.

EPA's December 1988 guidance also addressed the timing issue for State compliance with section 303(c)(2)(B). The statutory directive was clear: all State standards triennial reviews initiated after passage of the Act must include a consideration of numeric toxic criteria.

States significantly responded to the 1987 requirement for numeric criteria for toxic pollutants. For example, in 1986 on average, each State had 10 numeric criteria for freshwater aquatic life. By February 1990, the average number of freshwater aquatic life criteria was increased to 30. Also, States averaged 36 numeric criteria for human health in February 1990. However, by September 1990, many States had failed to fully satisfy the requirements of section 303(c)(2)(B).

The addition of section 303(c)(2)(B) to the Clean Water Act was an unequivocal signal to the States that Congress wanted toxics criteria in the State's water quality standards. EPA, consistent with this mandate, initiated Federal promulgation of toxic criteria for those States that had not complied with the Act. EPA proposed Federal criteria for toxic pollutants for 22 States and Territories, based on a preliminary assessment of compliance, on November 19, 1991 (56 F.R. 58420), and promulgated toxic criteria for 14 of those States on December 22, 1992 (57 F.R. 60848).

HANDBOOK CHANGES SINCE 1983

In December, 1983, EPA published its first *Water Quality Standards Handbook*. The 1983 Handbook was designed to help States implement the Water Quality Standards Regulation as revised in November 1983 (48 F.R. 51400). Since then, Congress enacted the Water Quality Act of 1987 (Public Law 100-4), making substantial additions to the Clean Water Act (CWA) directly affecting the standards program. In response to the Water Quality Act of 1987, and as a result of Federal promulgation actions, EPA amended the Water Quality Standards Regulation several times (see Appendices A and B). Since 1983 EPA also issued additional guidance to assist in the implementation of the WQS Regulation. *Water Quality Standards Handbook - Second Edition* incorporates all the WQS guidance issued since the 1983 Handbook was published. A summary of these guidance documents are as follows.

EPA Guidance on the Water Quality Act of 1987

On February 4, 1987, Congress enacted the Water Quality Act of 1987 (Public Law 100-4), making substantial additions to the Clean Water Act directly affecting the standards program. Section 303(c)(2)(B) of the Clean Water Act requires States to adopt numeric criteria for toxic pollutants listed under section 307(a) of the Clean Water Act for which section 304(a) criteria have been published, if the presence of these pollutants is likely to affect a water body's use. EPA published *Guidance for State Implementation of WQS for CWA section 303(c)(2)(B)* on December 12, 1988 (USEPA, 1988b). This guidance is incorporated into this Handbook at section 3.4.1.

The 1987 Act also added a new section 518, which requires EPA to promulgate a regulation specifying how the Agency will authorize qualified Indian Tribes to administer CWA programs including section 303 (water quality standards) and section 401 (certification) programs. Section 518 also requires EPA, in promulgating this regulation, to establish a mechanism to resolve unreasonable consequences that may result from an Indian Tribe and a State adopting differing water quality standards on common bodies of water. EPA promulgated a final regulation on December 12, 1991 (56 F.R. 64875). Guidance on water quality standards for Indian Tribes is contained in chapter 1.

Other EPA Guidance

Since 1983, EPA also developed additional policies and guidance on virtually all areas of the WQS Regulation. Following is a complete list of these guidance documents.

State Water Quality Standards Approvals: Use Attainability Analysis Submittals (USEPA, 1984d), clarifies EPA policy on several issues regarding approval of water body use designations less than the fishable/swimmable goal of the CWA. See section 6.2 for a discussion of this topic.

Interpretation of the Term "Existing Use" (USEPA, 1985e), expands on EPA's interpretation of when a use becomes an "existing use" as defined by the WQS Regulation. Discussion of "existing uses" is contained in section 4.4.

Selection of Water Quality Criteria in State Water Quality Standards (USEPA, 1985f), established EPA policy regarding the selection of appropriate water quality criteria for toxic pollutants in State water quality standards. This guidance preceded both the *Guidelines for Deriving Numerical National Water Quality Criteria for the for the Protection of Aquatic Organisms and Their Uses* (USEPA, 1985b), and the 1988 guidance on section 303(c)(2)(B) of the CWA, discussed above. Both of these later documents expand upon the February 1985 guidance, but the policy established therein has not been substantively changed. Adoption of criteria for toxic pollutants is discussed in section 3.4.

Variances in Water Quality Standards (USEPA, 1985g), reinterprets the factors that could be considered when granting water quality standards variances. Variances are discussed in section 5.3.

Antidegradation, Waste loads, and Permits (USEPA, 1985h), clarifies that the antidegradation policy is an integral component of water quality standards and must be considered when developing waste load allocations and NPDES permits. Antidegradation is discussed in chapter 4.

Questions and Answers on Antidegradation (Appendix G), provides guidance on various aspects of the antidegradation policy where questions had arisen since the 1983 Regulation and Handbook were published.

Antidegradation Policy (USEPA, 1985i), reiterates the need for all States to have: (1) an antidegradation policy that fully complies with the Federal requirements, and (2) a procedure for consistently implementing that policy.

Answers to Questions on Nonpoint Sources and WQS (USEPA, 1986e), responded to two questions on nonpoint source pollution and water quality standards. The relationship between nonpoint source pollution and water quality standards is discussed in section 7.

Determination of "Existing Uses" for Purposes of Water Quality Standards Implementation (USEPA, 1986f), responds to concerns expressed to EPA on the interpretation of when a recreational use becomes an "existing use" as defined by the Regulation. Discussion of "existing uses" is contained in section 4.4.

Nonpoint Source Controls and Water Quality Standards (USEPA, 1987d), provides further guidance on nonpoint sources pollution and water quality standards reflecting the requirements of section 319 of the CWA as added by the 1987 CWA amendments.

EPA Designation of Outstanding National Resource Waters (USEPA, 1989f), restates the basis for EPA's practice of not designating State waters as Outstanding National Resource Waters (ONRW) where a State does not do so. ONRWs are discussed in section 4.6.

Guidance for the Use of Conditional Approvals for State WQS (USEPA, 1989g), provides guidelines for regional offices to use in granting State water quality standards approvals conditioned on the performance of specified actions by the State. Conditional approvals are discussed in section 6.2.3.

Application of Antidegradation Policy to the Niagara River (USEPA, 1989c), provides guidance on acceptable interpretations of the antidegradation policy to help attain the CWA objective to "restore and maintain" the integrity of the Nation's waters.

Designation of Recreation Uses (USEPA, 1989h), summarizes previously issued guidance, and outlines a number of acceptable State options for designating recreational uses. The use designation process is discussed in chapter 2.

Biological Criteria: National Program Guidance for Surface Waters (Appendix C), provides guidance on the effective development and application of biological criteria in the water quality standards program. Biological criteria are discussed in section 3.5.3.

National Guidance: Water Quality Standards for Wetlands (Appendix D), provides guidance for meeting the EPA priority to develop water quality standards for wetlands.

Section 401 certification and FERC licenses (USEPA, 1991h), clarifies the range of water quality standards elements that States need to apply when making CWA section 401 certification decisions. Section 401 of the CWA is discussed in section 7.6.3.

Technical Support Document for Water Quality-based Toxics Control, (USEPA, 1991a), provides technical guidance for assessing and regulating the discharge of toxic substances to the waters of the United States.

Policy on the Use of Biological Assessments and Criteria in the Water Quality Program (USEPA, 1991i), provides the basis for EPA's policy that biological surveys shall be fully integrated with toxicity and chemical-specific assessment methods in State water quality programs. Further discussion of this policy is contained in section 3.3.

Numeric Water Quality Criteria for Wetlands (Appendix E), evaluates EPA's numeric aquatic life criteria to determine how they can be applied to wetlands. Wetland aquatic life criteria are discussed in section 3.5.6.

Endangered Species Act Joint Guidance (Appendix F), establishes a procedure by which EPA, the U.S. Fish and Wildlife Service, and the National Marine Fisheries Service will consult on the development of water quality criteria and standards.

Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria (USEPA, 1993f), transmits Office of Water (OW) policy and guidance on the interpretation and implementation of aquatic life criteria for the management of metals. Section 3.6 discusses EPA's policy on aquatic life metals criteria.

Interpretation of Federal Antidegradation Regulatory Requirement (USEPA, 1994a), provides guidance on the interpretation of the antidegradation policy in 40 CFR 131.12(a)(2) as it relates to nonpoint sources. Antidegradation and nonpoint sources are discussed in Section 4.6.

Interim Guidance on Determination and Use of Water-Effect Ratios for Metals (Appendix L), provides interim guidance concerning the experimental determination of water-effect ratios (WERs) for metals and supersedes all guidance concerning water-effect ratios and the Indicator Species Procedure in USEPA, 1983a and in USEPA, 1984f. It also supersedes the guidance in these earlier documents for the Recalculation Procedure for performing site-specific aquatic life criteria modifications. Site-specific aquatic life criteria are discussed in Section 3.7.

The guidance contained in each of the above documents is either incorporated into the text of the appropriate section of this Handbook or attached as appendices (see Table of Contents). The reader is directed to the original guidance documents for the explicit guidance on the topics discussed. Copies of all original guidance documents not attached as appendices may be obtained from the source listed for each document in the Reference section of this Handbook.

The *Water Quality Standards Handbook - Second Edition* is reorganized from the 1983 Handbook. An overview to Water Quality Standards and Water Quality Management programs has been added, and chapters 1 through 6 are organized to parallel the provisions of the Water Quality Standards Regulation. Chapter 7 briefly introduces the role of water quality standards in the water quality-based approach to pollution control.

The *Water Quality Standards Handbook - Second Edition* retains all the guidance in the 1983 Handbook unless such guidance was specifically revised in subsequent years.

OVERVIEW OF THE WATER QUALITY STANDARDS PROGRAM

A water quality standard defines the water quality goals of a water body, or portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by preventing degradation of water quality through antidegradation provisions. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act.

"Serve the purposes of the Act" (as defined in sections 101(a), 101(a)(2), and 303(c) of the Act) means that water quality standards:

- include provisions for restoring and maintaining chemical, physical, and biological integrity of State waters;

- wherever attainable, achieve a level of water quality that provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water ("fishable/swimmable"); and

- consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreation, agriculture and industrial purposes, and navigation.

Section 303(c) of the Clean Water Act provides the statutory basis for the water quality standards program. The regulatory requirements governing the program, the *Water Quality Standards Regulation*, are published at 40 CFR 131. The Regulation is divided into four subparts (A through D), which are summarized below.

General Provisions (40 CFR 131 - Subpart A)

Subpart A includes the scope (section 131.1) and purpose (section 131.2) of the Regulation, definitions of terms used in the Regulation (section 131.3), State (section 131.4) and EPA (section 131.5) authority for water quality standards, and the minimum requirements for a State water quality standards submission (section 131.6).

On December 12, 1991, the EPA promulgated amendments to Subpart A of the Water Quality Standards Regulation in response to the CWA section 518 requirements (see 56 F.R. 64875). The Amendments:

- establish a mechanism to resolve unreasonable consequences that may result from an Indian Tribe and a State adopting differing water quality standards on common bodies of water (section 131.7); and

- add procedures by which an Indian Tribe can qualify for the section 303 water quality standards and section 401 certification programs of the Clean Water Act (section 131.8).

The sections of Subpart A are discussed in chapter 1.

Establishment of Water Quality Standards - (Subpart B)

Subpart B contains regulatory requirements that must be included in State water quality standards: designated uses (section 131.10), criteria that protect the designated uses (section 131.11), and an antidegradation policy that protects existing uses and high water quality (section 131.12). Subpart B also provides for State discretionary policies, such as mixing zones and water quality standards variances (section 131.13).

Each of these sections is summarized below and discussed in detail in chapters 2 through 5 respectively.

Designation of Uses

The Water Quality Standards Regulation requires that States specify appropriate water uses to be achieved and protected by taking into consideration the use and value of the water body for public water supply, for propagation of fish, shellfish, and wildlife, and for recreational, agricultural, industrial, and navigational purposes. In designating uses for a water body, States examine the suitability of a water body for the uses based on the physical, chemical, and biological characteristics of the water body, its geographical setting and scenic qualities, and the social-economic and cultural characteristics of the surrounding area. Each water body does not necessarily require a unique set of uses. Instead, the characteristics necessary to support a use can be identified so that water bodies having those characteristics might be grouped together as supporting particular uses.

Any water body with standards not consistent with the section 101(a)(2) goals of the Act must be reexamined every 3 years to determine if new information has become available that would warrant a revision of the standard. In addition, the Regulation requires that where existing water quality standards specify designated uses less than those which are presently being attained, the State shall revise its standards to reflect the uses actually being attained.

When reviewing uses, States must perform and submit to EPA a use attainability analysis if:

- either the State designates or has designated uses that do not include the uses specified in section 101(a)(2) of the Act;
- the State wishes to remove a designated use that is specified in section 101(a)(2); or
- the State wishes to adopt subcategories of uses specified in section 101(a)(2) that require less stringent criteria than are currently adopted.

States may adopt seasonal uses as an alternative to reclassifying a water body or segment thereof to uses requiring less stringent criteria. In no case may a State remove an existing use. No use attainability analysis is required when designating uses that include those specified in section 101(a)(2) of the Act.

Criteria Development and Review

States adopt water quality criteria with sufficient coverage of parameters and of adequate stringency to protect designated uses. In adopting criteria to protect the designated uses, States may:

- adopt the criteria that EPA publishes under section 304(a) of the Act;
- modify the section 304(a) guidance to reflect site-specific conditions; or
- use other scientifically defensible methods.

Section 131.11 encourages States to adopt both numeric and narrative criteria. Numeric criteria are important where the cause of toxicity is known or for protection against pollutants with potential human health impacts or potential for bioaccumulation. Narrative toxic criteria, based on whole-effluent toxicity (WET) testing, can be the basis for limiting toxicity in waste discharges where a specific pollutant can be identified as causing or contributing to the toxicity but there are no numeric criteria in the State standards or where toxicity cannot be traced to a particular pollutant. Whole-effluent toxicity testing is also appropriate for discharges containing multiple pollutants because WET testing provides a method for evaluating synergistic and antagonistic effects on aquatic life.

Section 303(c)(2)(B) requires States to adopt criteria for all section 307(a) toxic pollutants for which the Agency has published criteria under section 304(a) of the Act, if the discharge or presence of the pollutant could reasonably be expected to interfere with the designated uses of the water body. The section 307(a) list contains 65 compounds and families of compounds, which the Agency has interpreted to include 126 "priority" toxic pollutants for regulatory purposes. If data indicate that it is reasonable to expect that one or more of the section 307(a) toxic pollutants will interfere with the attainment of the designated use, or is actually interfering with the designated use, then the State must adopt a numeric limit for the specific pollutant. Section 303(c)(2)(B) also provides that where EPA-recommended numeric criteria are not available, States shall adopt criteria based on biological monitoring or assessment methods.

Antidegradation Policy and Implementation Methods

Water quality standards include an antidegradation policy and methods through which the State implements the antidegradation policy. Section 131.12 sets out a three-tiered approach for the protection of water quality.

"Tier 1" (40 CFR 131.12(a)(1)) of antidegradation maintains and protects existing uses and the water quality necessary to protect these uses. An existing use can be established by demonstrating that fishing, swimming, or other uses have actually occurred since November 28, 1975, or that the water quality is suitable to allow such uses to occur, whether or not such uses are designated uses for the water body in question.

"Tier 2" (section 131.12(a)(2)) protects the water quality in waters whose quality is better than that necessary to protect "fishable/ swimmable" uses of the water body. 40 CFR 131.12(a)(2) requires that certain procedures be followed and certain showings be made (an "antidegradation review") before lowering water quality in high-quality waters. In no case may water quality on a Tier II water body be lowered to the level at which existing uses are impaired.

"Tier 3" (section 131.12 (a)(3)) protects outstanding national resource waters (ONRWs), which are provided the highest level of protection under the antidegradation policy. ONRWs generally include the highest quality waters of the United States. However, the ONRW antidegradation classification also offers special protection for waters of "exceptional ecological significance," i.e., those water bodies which are important, unique, or sensitive ecologically, but whose water quality, as measured by the traditional parameters such as dissolved oxygen or pH, may not be particularly high. Waters of exceptional ecological significance also include waters whose characteristics cannot adequately be described by traditional parameters (such as wetlands and estuaries).

Antidegradation implementation procedures address how States will ensure that the permits and control programs meet water quality standards and antidegradation policy requirements.

General Policies

The Water Quality Standards Regulation allows States to include in their standards State policies and provisions regarding water quality standards implementation, such as mixing zones, variances, and low-flow exemptions subject to EPA review and approval. These policies and provisions should be specified in the State's water quality standards document. The State's rationale and supporting documentation should be submitted to EPA for review during the water quality standards review and approval process.

Mixing Zones

States may, at their discretion, allow mixing zones for dischargers. The States' water quality standards should describe the methodology for determining the location, size, shape, outfall design, and in-zone quality of mixing zones. Careful consideration must be given to the

appropriateness of a mixing zone where a substance discharged is bioaccumulative, persistent, carcinogenic, mutagenic, or teratogenic.

Low-Flow Provisions

State water quality standards should protect water quality for the designated and existing uses in critical low-flow situations. States may, however, designate a critical low-flow below which numerical water quality criteria do not apply. When reviewing standards, States should review their low-flow provisions for conformance with EPA guidance.

Water Quality Standards Variances

As an alternative to removing a designated use, a State may wish to include a variance as part of a water quality standard, rather than change the standard across the board, because the State believes that the standard ultimately can be attained. By maintaining the standard rather than changing it, the State will assure that further progress is made in improving water quality and attaining the standard. EPA has approved State-adopted variances in the past and will continue to do so if:

- the variance is included as part of the water quality standard;
- the variance is subjected to the same public review as other changes in water quality standards;
- the variance is granted based on a demonstration that meeting the standard is not feasible due to the presence of any of the same conditions as if the State were removing a designated use (these conditions are listed in section 131.10(g) of the Regulation); and
- existing uses will be fully protected.

Water Quality Standards Review and Revision Process - (Subpart C)

The Clean Water Act requires States to hold a public hearing(s) to review their water quality standards at least once every 3 years and revise them if appropriate. After State water quality standards are officially adopted, a Governor or designee submits the standards to the appropriate EPA Regional Administrator for review. EPA reviews the State standards to determine whether the analyses performed are adequate. The Agency also evaluates whether the designated uses and criteria are compatible throughout the water body and whether the downstream water quality standards are protected. After reviewing the standards, EPA makes a determination whether the standards meet the requirements of the law and EPA's water quality standards regulations. If EPA disapproves a standard, the Agency indicates what changes must be made for the standard to be approved. If a State fails to make the required changes, EPA promulgates a Federal standard, setting forth a new or revised water quality standard applicable to the State.

State Review and Revision

States identify additions or revisions necessary to existing standards based on their 305(b) reports, other available water quality monitoring data, previous water quality standards reviews, or requests from industry, environmental groups, or the public. Water quality standards reviews and revisions may take many forms, including additions to and modifications in uses, in criteria, in the antidegradation policy, in the antidegradation implementation procedures, or in other general policies.

Some States review parts of their water quality standards every year. Other States perform a comprehensive review every 3 years. Such reviews are necessary because new scientific and technical data may become available. Environmental changes over time may also necessitate the need for the review.

EPA Review

When States adopt new or revised WQS, the State is required under CWA section 303(c) to submit such standards to EPA for review and approval/disapproval. EPA reviews and approves/disapproves the standards based on whether the standards meet the requirements of the CWA. As a result of the EPA review process, three actions are possible:

- EPA approval (in whole or in part) of the submitted State water quality standards; or
- EPA disapproval (in whole or in part) of the submitted State water quality standards; or
- EPA conditional approval (in whole or in part) of the submitted State water quality standards.

Revisions to State water quality standards that meet the requirements of the Act and the WQS Regulation are approved by the appropriate EPA Regional Administrator. If only a partial approval is made, the Region, in notifying the State, identifies the portions which should be revised (e.g., segment-specific requirements).

If the Regional Administrator determines that the revisions submitted are not consistent with or do not meet the requirements of the Act or the WQS Regulation, the Regional Administrator disapproves the standards within 90 days with a written notification to the State. The letter notifies the State that the Administrator will initiate promulgation proceedings if the State fails to adopt and submit the necessary revisions within 90 days after notification. The State water quality standard remains in effect, even though disapproved by EPA, until the State revises it or EPA promulgates a rule that supersedes the State water quality standard.

Federally Promulgated Water Quality Standards - (Subpart D)

As discussed above, EPA may promulgate Federal Water Quality Standards. Section 303 of the Clean Water Act permits the Administrator to promulgate Federal standards:

- if a revised or new water quality standards submitted by the State is determined by the Administrator not to be consistent with the applicable requirements of the Act; or
- in any case where the Administrator determines that a new or revised standard is necessary to meet the requirements of the Act.

Federal promulgations are codified under Subpart D of the Regulation.

THE ROLE OF WQS IN THE WATER QUALITY MANAGEMENT PROGRAM

State water quality standards play a central role in a State's water quality management program, which identifies the overall mechanism States use to integrate the various Clean Water Act quality control requirements into a coherent management framework. This framework includes, for example:

- setting and revising standards for water bodies;
- Water Quality Assessments to determine attainment of designated uses;
- CWA section 305(b) water quality monitoring to provide information upon which water quality-based decisions will be made, progress evaluated, and success measured;
- calculating total maximum daily loads (TMDLs), waste load allocations (WLAs) for point sources of pollution, and load allocations (LAs) for nonpoint sources of pollution;
- developing a water quality management plan, certified by the Governor and approved by EPA, which lists the standards and prescribes the regulatory and construction activities necessary to meet the standards;
- preparing section 305(b) reports and lists that document the condition of the State's water quality;
- developing, revising, and implementing an effective CWA section 319 program and CZARA section 6217 program to control NPS pollution;
- making decisions involving CWA section 401 certification of Federal permits or licenses; and
- issuing NPDES permits for all point source discharges. Permits are written to meet applicable water quality standards.

The Act provides the basis for two different kinds of pollution control programs. Water quality standards are the basis of the water quality-based control program. The Act also provides for technology-based limits known as best available treatment technology economically achievable for industry and secondary treatment for publicly owned treatment works. In some cases, application of these technologically based controls will result in attaining water quality standards. Where such is not the case, the Act requires the development of more stringent limitations to meet the water quality standards.

Regulations, policy, and guidance have been issued on all the activities mentioned in this section. Chapter 7 contains a brief discussion of how water quality standards relate to many of these activities in the water quality-based approach to pollution control, but additional details on these other programs is beyond the scope of this Handbook. For further information, see the EPA guidance documents referenced in chapter 7.

FUTURE PROGRAM DIRECTIONS

Since the 1960's, the water science program has moved from solving a limited set of problems in a limited set of waters to one that is solving a broad range of complex problems in categories of U.S. waters and addressing cross-media aspects of water quality decisions. Initial efforts focused on the more visible sources of pollution such as organic loadings, solids, oil, and grease, and then shifted to toxics and more complex mixtures of pollutants.

Developments in two areas have significantly affected the scientific underpinnings of the water program. First is the science of risk assessment used to estimate risk to human health and the environment from exposure to contaminants. Second is our ability to measure pollutants in the environment at an increasing level of precision. The evolution of methods and capabilities within these two scientific disciplines has significantly advanced the sophistication of scientific analyses used to manage the water program.

As the water science program moves toward the 21st Century, we must provide technical information and tools that allow States, the regulated community, and the public to understand and apply the methods, criteria, and standards to environmental systems. This includes updating science and adapting technologies as appropriate to keep the foundation of our program solid as well as employing or modifying these approaches when appropriate for new problems.

The CWA provides broad authority through its goals and policy, such as:

> . . . to restore and maintain the chemical, physical, and biological integrity of the Nation's waters (section 101(a)); and
>
> . . . wherever attainable . . . water quality which provides for the protection and propagation of fish, shellfish, and wildlife . . . to protect the water of the United States (section 101(a)(2)).

The breadth of this authority is also reflected in specific EPA mandates such as those in section 304(a):

> [EPA] shall develop and publish . . . criteria for water accurately reflecting the latest scientific knowledge (A) on the kind and extent of all identifiable effects on health and welfare . . . (B) on the concentration and dispersion of pollutants . . . through biological, physical, and chemical processes; and (C) the effects of pollutants on biological community diversity, productivity, stability . . . including eutrophication and rates of . . . sedimentation . . . (CWA section 304(a)(1)); and
>
> [EPA] shall develop and publish . . . information (A) on the factors necessary to restore and maintain the chemical, physical, and biological integrity . . . (B) on the factors necessary for the protection and propagation of shellfish, fish, and wildlife . . . and to allow recreational activities in and on the water . . .".) (304(a)(2))(CWA section 304(a)(2))

EPA has traditionally focused on criteria for chemical pollutants, but has also developed criteria for a limited number of physical (e.g., color, turbidity, dissolves solids) and biological (bacteria, "free from" nuisance aquatic life) parameters (NAS/NAE, 1973; USEPA, 1976). However, as EPA's water quality protection program has evolved, it has become apparent that chemical criteria alone, without the criteria for the biological and physical/habitat components of water bodies, are insufficient to fully achieve the goals of the CWA.

Future directions in the criteria and standards program will focus on providing scientific and technical tools to aid regional, State, and local environmental managers in (1) implementating the standards program, and (2) developing new science and technology that will reduce human and ecological risks resulting from exposure to unaddressed contaminants and prevent pollution from point and nonpoint sources.

Setting future national program priorities will be based on the consideration of risk assessment; statutory and court-mandated obligations; the expressed needs of regional, State, and local environmental managers and the regulated community; and the potential effectiveness of a program to influence real environmental improvement.

EPA will be developing methodologies and criteria in areas beyond the traditional chemical-specific type criteria of the past. Areas of scientific examination and potential regulatory controls include criteria to protect wildlife, wetlands, and sediment quality; biological criteria to better define desired biological communities in aquatic ecosystems; and nutrient criteria. EPA has also moved in the direction of the physical and habitat components of water quality protection in other water quality programs. For example, the CWA section 404(b)(1) Guidelines (40 CFR 230) evaluate physical characteristics (such as suspended particulates, flow, and hydroperiod), and habitat components (such as food web organisms, breeding/nesting areas, and cover). Implementation of these various types of criteria will be influenced by the environmental concerns in specific watersheds.

To protect human health, program emphasis will shift to focus on the human health impacts of pathogenic microorganisms in ambient waters that cause illness in humans, and will address concerns about the risk that contaminated fish may pose to sensitive populations whose daily diet includes large quantities of fish.

In an expanded effort to protect ecology, there will be increasing emphasis on the watershed approach by assessing all potential and actual threats to a watershed's integrity. Risk assessment of the watershed and setting priorities based on those risks will become increasingly important in future program efforts in criteria and standards as supporting elements to the watershed approach.

Over the next few years, there will be more emphasis on developing effective risk reduction strategies that include both traditional and non-traditional controls and approaches.

Future program directions in criteria development and then adoption and implementation of water quality standards will be based on the principle of ecological and human health risk reduction through sound and implementable science.

Endangered Species Act

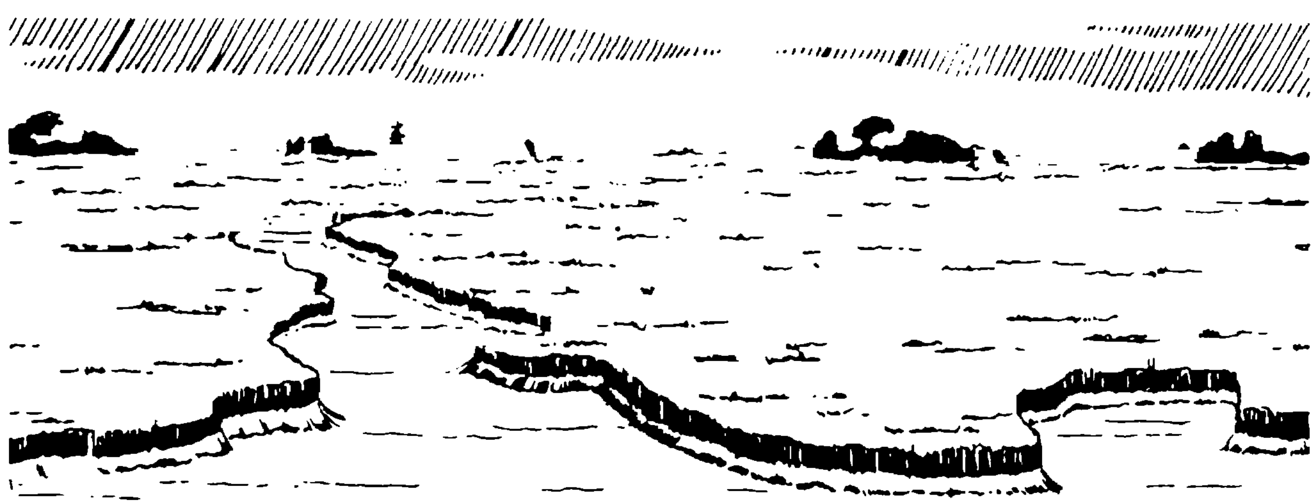
An important consideration in future criteria and standards development will be the conduct of the consultation provisions of the Endangered Species Act (ESA) and the implementation of any revisions to standards resulting from those consultations. Section 7 of the Endangered Species Act requires all Federal agencies, in consultation with the Fish and Wildlife Service and the National Marine Fisheries Service (the Services) to assure that any action authorized, funded, or implemented by a Federal agency does not jeopardize the existence of endangered or threatened species or result in the destruction or adverse modification of their critical habitat. The definition of a Federal action is very broad and encompasses virtually every water program administered by EPA.

The responsibility for ensuring that consultation occurs with the Services lies with EPA, although in fulfilling the requirements a non-Federal representative may be designated for informal consultation. (Note: Consultation may be formal or informal; the latter form is the most prevalent.) Protection of threatened and endangered species and their habitat is a critical national priority, and the criteria and standards programs can be effective tools to meet this national priority. All aspects of standards, including aquatic life criteria, uses, antidegradation, and implementation actions related to the standards are subject to consultation. All future revised aquatic life criteria, sediment, wildlife, and biological criteria will be subject to the consultation requirements as will their adoption into enforceable standards.

To form an effective partnership between the Services and EPA in creating a framework for meeting the responsibilities under section 7 of the Endangered Species Act and applicable EPA regulations, the Services and EPA entered into a joint guidance agreement in July 1992 (see Appendix F). This agreement sets forth the procedures to be followed by the Services and EPA to assure compliance with section 7 of the ESA in the development of water quality criteria published pursuant to section 304(a) of the CWA and the adoption of water quality standards under section 303(c). This agreement also indicated that the regional and field offices of EPA and the Services could establish sub-agreements specifying how they would implement the joint national guidance.

During the preparation of this second edition Handbook, the Services and EPA initiated a work group to develop a more extensive joint agreement. This group was charged with the responsibility of reviewing the July 1992 agreement, making appropriate revisions to the water quality criteria and standards sections, and adding a new section discussing the consultation procedures to be followed for the NPDES permit program. When the revised agreement is approved by the Agencies, it will replace the agreement included in this Handbook as Appendix F.

Both the current agreement and the proposed revision seek to ensure a nationally consistent consultation process that allows flexibility to deal with site-specific issues and to streamline the process to minimize the regulatory burden. The overriding goal is to provide for the protection and support of the recovery of threatened and endangered species and the ecosystems on which they depend.



CHAPTER 1

GENERAL PROVISIONS

(40 CFR 131 - Subpart A)

Table of Contents

CHAPTER 1
GENERAL PROVISIONS

1.1 Scope - 40 CFR 131.1

The Water Quality Standards Regulation (40 CFR 131) describes State requirements and procedures for developing, reviewing, revising, and adopting water quality standards (WQS), and EPA requirements and procedures for reviewing, approving, disapproving, and promulgating water quality standards as authorized by section 303(c) of the Clean Water Act. This Handbook serves as guidance for implementing the Water Quality Standards Regulation and its provisions.

1.2 Purpose - 40 CFR 131.2

A water quality standard defines the water quality goals for a water body, or portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by protecting water quality through antidegradation provisions. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act (the Act). "Serve the purposes of the Act" means that water quality standards should:

- wherever attainable, achieve a level of water quality that provides for the protection and propagation of fish, shellfish, and wildlife, and for recreation in and on the water, and take into consideration the use and value of public water supplies, and agricultural, industrial, and other purposes, including navigation (sections 101(a)(2) and 303(c) of the Act); and

- restore and maintain the chemical, physical, and biological integrity of the Nation's waters (section 101(a)).

CLEAN WATER ACT GOALS

- Achieve a level of water quality that provides for the protection and propagation of fish, shellfish, and wildlife, and for recreation in and on the water, where attainable.

- Restore and maintain the chemical, physical, and biological integrity of the Nation's waters.

These standards serve dual purposes: They establish the water quality goals for a specific water body, and they serve as the regulatory basis for establishing water quality-based treatment controls and strategies beyond the technology-based levels of treatment required by sections 301(b) and 306 of the Act.

1.3 Definitions - 40 CFR 131.3

Terms used in the Water Quality Standards Regulation are defined in section 131.3 of the regulation. These definitions, as well as others appropriate to the water quality standards program, are contained in the glossary of this Handbook. No additional guidance is necessary to explain the definitions; however, some background information on the definitions of "States" and "waters of the United States" may be helpful.

1.3.1 States

Indian Tribes may now qualify for the water quality standards and 401 certification programs. The February 4, 1987, Amendments to the Act added a new section 518 requiring EPA to promulgate regulations specifying how the Agency will treat qualified Indian Tribes as States for the purposes of, the section 303 (water quality standards) programs, the section 401 (certification) programs, and other programs. On December 12, 1991, the EPA promulgated amendments to Subpart A of the Water Quality Standards Regulation in response to the CWA section 518 requirements (see 56 F.R. 64893). These amendments modified the definition of States by adding the phrase ". . . and Indian Tribes that EPA determines qualify for treatment as States for purposes of water quality standards."

1.3.2 Waters of the United States

Section 303(c) of the CWA requires States to adopt water quality standards for "navigable waters," which are defined at section 502(7) of the Act as "waters of the United States." The Water Quality Standards Regulation contains no definition of "waters of the United States," although this term is used in the definition of "water quality standards." The phrase "waters of the United States" has been defined elsewhere in Federal regulations (e.g., in regulations governing the National Pollutant Discharge Elimination System (NPDES) and section 404 programs (40 CFR sections 122.2, 230.3, and 232.3, respectively). This definition appears in the glossary of this Handbook and is used in interpreting the phrase "water quality standards."

The definition of "waters of the United States" emphasizes protection of a broad range of waters, including interstate and intrastate lakes, streams, wetlands, other surface waters, impoundments, tributaries of waters, and the territorial seas.

EPA believes that some States may not be providing the same protection to wetlands that they provide to other surface waters. Therefore, EPA wishes to emphasize that wetlands deserve the same protection under water quality standards. For more information on the application of water quality standards to wetlands, see Appendix D of this Handbook.

WATERS OF THE UNITED STATES

- **Interstate/intrastate lakes**
- **Streams**
- **Wetlands**
- **Other surface waters**
- **Impoundments**
- **Tributaries of waters**
- **Territorial seas**

Concerns have been raised regarding applicability of water quality standards to riparian areas other than riparian wetlands. "Riparian areas" are areas in a stream's floodplain with life characteristic of a floodplain. Wetlands are often found in portions of riparian areas. The Clean Water Act requires States to adopt water quality standards only for "waters of the United States," such as wetland portions of riparian areas that meet the regulatory definition. Of course, States may, at their discretion, choose to adopt water quality standards or other mechanisms to protect other riparian areas.

1.4 State Authority - 40 CFR 131.4

States (including Indian Tribes qualified for the purposes of water quality standards) are responsible for reviewing, establishing, and revising water quality standards. Under section 510 of the Act, States may develop water quality standards more stringent than required by the Water Quality Standards Regulation.

Under section 401 of the Act, States also have authority to issue water quality certifications for federally permitted or licensed activities. This authority is granted because States have jurisdiction over their waters and can influence the design and operation of projects affecting those waters. Section 401 is intended to ensure that Federal permits and licenses comply with applicable water quality requirements, including State water quality standards, and applies to all

Federal agencies that grant a license or permit. (For example, EPA-issued permits for point source discharges under section 402 and discharges of dredged and fill material under section 404 of the Clean Water Act; permits for activities in navigable waters that may affect navigation under sections 9 and 10 of the Rivers and Harbors Act (RHA); and licenses required for hydroelectric projects issued under the Federal Power Act). Section 401 certifications are normally issued by the State in which the discharge originates.

States may deny certification, approve certification, or approve certification with conditions. If the State denies certification, the Federal permitting or licensing agency is prohibited from issuing the permit or license. Certifications are subject to objection by downstream States where the downstream State determines that the proposed activity would violate its water quality standards. [For more information on the 401 certification process, refer to *Wetlands and 401 Certification: Opportunities for States and Eligible Indian Tribes* (USEPA, 1989a).]

1.5 EPA Authority - 40 CFR 131.5

Under section 303(c) of the Act, EPA is to review and to approve or disapprove State-adopted water quality standards. This review involves a determination of whether:

- the State has adopted water uses consistent with the requirements of the Clean Water Act;

- the State has adopted criteria that protect the designated water uses;

- the State has followed its legal procedures for revising or adopting standards;

- the State standards that do not include the uses specified in section 101(a)(2) of the Act are based upon appropriate technical and scientific data and analyses; and

- the State submission meets the requirements included in section 131.6 of the Water Quality Standards Regulation.

EPA reviews State water quality standards to ensure that the standards meet the requirements of the Clean Water Act. If EPA determines that State water quality standards are consistent with the five factors listed above, EPA approves the standards. EPA disapproves the State water quality standards and may promulgate Federal standards under section 303(c)(4) of the Act if State-adopted standards are not consistent with the factors listed above. Section 510 of the Act provides that the States are not precluded from adopting requirements regarding control or abatement of pollution as long as such requirements are not less stringent than the requirements of the Clean Water Act. The Agency is not authorized to disapprove a State water quality standard on the basis that EPA considers the standard to be too stringent. EPA may also promulgate a new or revised standard where necessary to meet the requirements of the Act. In certain cases, EPA may conditionally approve a State's standards. A conditional approval is appropriate only:

- to correct minor deficiencies in a State's standards; <u>and</u>

- when a State agrees to a specific time schedule to make the corrections in as short a time as possible. Section 6.2 provides guidance on conditional approvals.

EPA also has the authority to issue section 401 certification where a State or interstate agency has no authority to do so.

1.6 Requirements for Water Quality Standards Submission - 40 CFR 131.6

The following elements must be included in each State's water quality standards submittal to EPA for review:

- use designations consistent with the provisions of sections 101(a)(2) and 303(c)(2) of the Act;

- methods used and analyses conducted to support water quality standards revisions;

- water quality criteria sufficient to protect the designated uses, including criteria for priority toxic pollutants and biological criteria;

- an antidegradation policy and implementation methods consistent with section 131.12 of the Water Quality Standards Regulation;

- certification by the State Attorney General or other appropriate legal authority within the State that the water quality standards were duly adopted pursuant to State law; and

- general information to aid the Agency in determining the adequacy of the scientific bases of the standards that do not include the uses specified in section 101(a)(2) of the Act as well as information on general policies applicable to State standards that may affect their application and implementation.

EPA may also request additional information from the State to aid in determining the adequacy of the standards.

1.7 Dispute Resolution Mechanism - 40 CFR 131.7

Section 518 of the Act requires EPA to establish a "mechanism for the resolution of any unreasonable consequences that may arise as a result of differing water quality standards that may be set by States and Indian Tribes located on common bodies of water." EPA's primary responsibility in response to this requirement is to establish a practical procedure to address and, where possible, resolve such disputes as they arise. However, the Agency's authority is limited.

For example, EPA does not believe that section 518 grants EPA authority to override section 510 of the Act. EPA believes that the provisions of section 510 would apply to Indian Tribes that qualify for treatment as States. Section 518(e) and its accompanying legislative history suggest that Congress intended for section 510 to apply to Tribes as well as States. Were Tribes prohibited from establishing standards more stringent than minimally approvable by EPA, there would be little need for the dispute resolution mechanism required by section 518(e)(2). Therefore, EPA does not believe that section 518 authorizes the Agency to disapprove a State or Tribe water quality standard and promulgate a less stringent standard as a means of resolving a State/Tribe dispute.

EPA also believes there are strong policy reasons to allow Tribes to set any water quality standards consistent with the Water Quality Standards Regulation. First, it puts Tribes and States on equal footing with respect to standards setting. There is no indication that Congress intended to treat Tribes as "second class" States under the Act. Second, treating Tribes as essentially equivalent to States is consistent with EPA's 1984 Indian Policy. Third, EPA believes it would be unfeasible to require Tribes to adopt "minimum" standards allowed under Federal law. EPA has no procedures in place for defining a "minimum" level of standards for Indian Tribes. EPA evaluates only whether the standards are stringent enough, not how much more stringent than any Federal minimum.

1.7.1 Responsibility Is With Lead EPA Regional Administrator

EPA's role in dispute resolution is to work with all parties to the dispute in an effort to reach an agreement that resolves the dispute. The Agency does not automatically support the Indian position in all disputes over water quality standards. Rather, EPA employees serving as mediators or arbitrators will serve outside the normal Agency chain of command and are expected to act in a neutral fashion.

The lead EPA Regional Administrator will be determined using OMB Circular A-95. The lead Region is expected to enlist the aid of other affected Regions in routine dispute resolution. EPA Headquarters will also oversee the process to ensure that the interests of all affected Regions are represented. Designation as the lead Region for resolving a dispute or programmatic issues within EPA does not mean that the lead Region has a license to act unilaterally. Rather, designation as lead Region assigns the responsibility to ensure that the process leading to a decision is fair to all parties.

The Regional Administrator may include other parties besides Tribes and States in the dispute resolution process. In some cases, the inclusion of permittees or landowners subject to nonpoint source restrictions may be needed to arrive at a meaningful resolution of the dispute. However, only the Tribe and State are in a position to implement a change in water quality standards and are, thus, the only "necessary" parties in the dispute resolution.

1.7.2 When Dispute Resolution May Be Initiated

The regulation establishes conditions under which the Regional Administrator would be responsible for initiating a dispute resolution action. Such actions would be initiated where, in the judgment of the Regional Administrator:

- there are unreasonable consequences;
- the dispute is between a State and a Tribe (i.e., not between a Tribe and another Tribe or a State and another State);
- a reasonable effort has been made to resolve the dispute before requesting EPA involvement;
- the requested relief is within the authority of the Act (i.e., not a request to replace State or Tribe standards that comply with the Act with less stringent Federal standards);
- the differing standards have been adopted pursuant to State or Tribe law and approved by EPA;
- a valid written request for EPA involvement has been submitted to the Regional Administrator by the State or Tribe.

Although the Regional Administrator may decline to initiate a dispute resolution action based on any of the above factors, EPA is willing to discuss specific situations. EPA is also willing to informally mediate disputes between Tribes consistent with the procedures for mediating disputes between States (see 48 F.R. 51412).

The regulation does not define "unreasonable consequences" because:

- it would be a presumptuous and unjustified Federal intrusion into local and State concerns for EPA to define what an unreasonable consequence might be as a basis for a national rule;
- EPA does not want to unnecessarily narrow the scope of problems to be addressed by the dispute resolution mechanism; and
- the possibilities of what might constitute an unreasonable consequence are so numerous as to defy a logical regulatory requirement.

Also, the occurrence of such "unreasonable" consequences is dependent on the unique circumstances associated with the dispute. For example, what might be viewed as an unreasonable consequence on a stream segment in a large, relatively unpopulated, water-poor area with a single discharge would likely be viewed quite differently in or near an area characterized by numerous discharges and/or large water resources. The Regional Administrator has discretion to determine when consequences warrant initiating a dispute resolution action.

1.7.3 Who May Request Dispute Resolution and How

Either the State or the Tribe may request EPA involvement in the dispute. The requesting party must include the following items in its written request:

- a statement describing the unreasonable consequences;
- description of the actions taken to resolve the dispute before requesting EPA involvement;
- a statement describing the water quality standards provision (such as the particular criterion) that has resulted in the unreasonable consequences;
- factual data substantiating the claim of unreasonable consequences; and
- a statement of relief sought (that is, the desired outcome of the dispute resolution action).

1.7.4 EPA Procedures in Response to Request

When the Regional Administrator decides that EPA involvement is appropriate (based on the factors discussed in section 1.7.2, above), the Regional Administrator will notify the parties in writing that EPA dispute resolution action is being initiated and will solicit their written response. The Regional Administrator will also make reasonable efforts to ensure that other interested individuals or groups have notice of this action. These "reasonable efforts" will include, and are not limited to, the following:

- written notice to responsible Indian and State Agencies and other affected Federal Agencies;
- notice to the specific individual or entity that is claiming that an unreasonable consequence is resulting from differing standards having been adopted for a common water body;
- public notice in local newspapers, radio, and television, as appropriate;
- publication in trade journal newsletters; and
- other appropriate means.

1.7.5 When Tribe and State Agree to a Resolution

EPA encourages Tribes and States to resolve the differences without EPA involvement and to consider jointly establishing a mechanism to resolve disputes before such disputes arise. The Regional Administrator has responsibility to review and either approve or disapprove the Tribe-State agreement. Section 518(d) provides that Tribe-State agreements in general for water quality management are to be approved by EPA. As a general rule, EPA will defer to the procedure for resolving disputed jointly established by the Tribe and State so long as the procedure and the end result are consistent with the provisions of the CWA and Water Quality Standards Regulation.

1.7.6 EPA Options for Resolving the Dispute

The dispute resolution mechanism included in the final "Indian Rule" provides EPA Regional Administrators with several alternative courses of action. The alternatives are mediation, non-binding arbitration, and a default procedure.

The first technique, mediation, would allow the Regional Administrator to appoint a mediator whose primary function would be to facilitate discussions between the parties with the objective of arriving at a State/Tribe agreement or other resolution acceptable to the parties. The mediated negotiations could be informal or formal, public or private. The mediator could also establish an advisory group, consisting of representatives from the affected parties, to study the problem and recommend an appropriate resolution.

The second technique, non-binding arbitration, would require the Regional Administrator to appoint an arbitrator (or arbitration panel) whose responsibilities would include gathering all information pertinent to the dispute, considering the factors listed in the Act, and recommending an appropriate solution. The parties would not be obligated, however, to abide by the arbitrator's or arbitration panel's decision. The arbitrator or arbitration panel would be responsible for issuing a written recommendation to all parties and the Regional Administrator. Arbitrators or arbitration panel members who are EPA employees would be allowed to operate independently from the normal chain of commend within the Agency while conducting the arbitration process. Arbitrators or arbitration panel members would not be allowed to have *ex parte* communication pertaining to the dispute, except that they would be allowed to contact EPA's Office of the General Counsel for legal advise.

EPA has also provided for a dispute resolution default procedure to be used where one or more parties refuse to participate in mediation or arbitration. The default procedure will be used only as a last resort, after all other avenues of resolving the dispute have been exhausted. This dispute resolution technique would be similar to arbitration, but has been included as a separate Regional Administrator option because arbitration generally refers to a process whereby all parties participate voluntarily.

The default procedure simply provides for the Agency to review available information and to issue a recommendation for resolving the dispute. EPA's recommendation in this situation would have no enforceable impact. The Agency hopes that public presentation of its position will result in either public pressure or reconsideration by either affected party to continue resolution negotiations. Any written recommendation resulting from this procedure would be provided to all parties involved in the dispute.

EPA envisions a number of possible outcomes that, individually or in combination, would likely resolve most of the disputes that would arise. These actions might include, but are not limited to, the following:

- a State or Tribe agrees to revise the limits of a permit to ensure that downstream water quality standards are met;
- a State or Tribe agrees to permanently remove a use (consistent with 40 CFR 131.10(g));
- a State or Tribe issues a variance from water quality standards for a particular discharge;
- a permittee or landowner agrees to provide additional water pollution control;
- EPA assumes permit-issuing authority for a State or Tribe and re-issues a permit to ensure that downstream water quality standards are met; or
- EPA promulgates Federal water quality standards where a State or Tribe standard does not meet the requirements of the Act.

In some cases (last example, above), EPA recognizes that the Agency will have to act to resolve the dispute. An example would be where a National Pollutant Discharge Elimination System (NPDES) permit for an upstream discharger does not provide for the attainment of the water quality standards for a downstream jurisdiction. The existing NPDES permitting and certification processes under the Act may be used by the downstream jurisdiction to prevent such situations. Today's rule does not alter or minimize the role of these processes in establishing appropriate permit limits to ensure attainment of water quality standards. States and Tribes are encouraged to participate in these permitting and certification processes rather than wait for unreasonable consequences to occur.

In these cases, EPA believes that the Agency has authority to object to the upstream NPDES permit and, if necessary, to assume permitting authority. This authority was upheld in a case in which EPA assumed authority to issue a permit for a North Carolina discharge that, among other factors, did not meet Tennessee's downstream water quality standards.[1]

Mediators and arbitrators may be EPA employees, employees of other Federal agencies, or other individuals with appropriate qualifications. Because of resource constraints, EPA anticipates that mediators and arbitrators will generally be EPA employees rather than consultants. Employees from other Federal agencies would be selected where appropriate, subject to their availability. EPA intends for mediators and arbitrators to conduct the dispute resolution mechanism in a fair and impartial manner, and will select individuals who have not been involved with the particular dispute. Members of arbitration panels will be selected by the Regional Administrator in consultation with the parties. In some cases, such panels may consist of one representative from each party to the dispute plus one neutral panel member. Implicit in the regulation is the sense that mediators and arbitrators will act fairly and impartially. Although not specifically covered in the regulation, EPA believes it is well within the Regional Administrator's power to remove any mediator or arbitrator for any reason (including showing bias or unfairness or taking illegal or unethical actions).

Arbitrators and arbitration panel members shall be selected to include only individuals who are agreeable to all affected parties, are knowledgeable concerning the water quality standards program requirements, have a basic understanding of the political and economic interests of Tribes, and will fulfill the duties fairly and impartially. These requirements are not applicable to mediators. EPA did not provide for State or Tribe approval of mediators because EPA believes that such an approval process would provide too great an opportunity to delay the initiation of the mediation process and because the role of the mediator is limited to acting as a neutral facilitator. There is no prohibition against the Regional Administrator consulting with the parties regarding a mediator; there is just no requirement to do so.

Where one of the parties to the dispute believes that an arbitrator has recommended an action to resolve the dispute which is not authorized by the Act, the regulation allows the party to appeal the arbitrator's decision to the Regional Administrator. Such requests must be in writing and must include a statement of the statutory basis for altering the arbitrator's recommendation.

1.7.7 Time Frame for Dispute Resolution

The regulation does not include a fixed time frame for resolving disputes. While EPA intends to proceed as quickly as possible and to encourage parties to the dispute to resolve it quickly and to establish informal time frames, the variety of potential disputes to be resolved would appear to preclude EPA from specifying a single regulatory time limit. EPA believes it is better to obtain a reasonable agreement or decision than to arbitrarily establish a time frame within which an agreement or decision must be made.

1.8 Requirements for Indian Tribes To Qualify for the WQS Program - 40 CFR 131.8

Consistent with the statutory requirement of section 518 of the Act, the Water Quality Standards Regulation establishes procedures by which an Indian Tribe may qualify for the water quality standards and section 401 certification programs. Section 131.8 of the Water Quality Standards Regulation is intended to ensure that Tribes treated as States for standards are qualified, consistent with Clean Water Act requirements, to conduct a standards program protective of public health and the environment. The procedures are not intended to act as a barrier to tribal program assumption. For the section 401 certification program, 131.4(c) establishes that where EPA determines that a Tribe is qualified for the water quality standards program, that Tribe would, without further effort or submission of information, also qualify for the section 401 certification program.

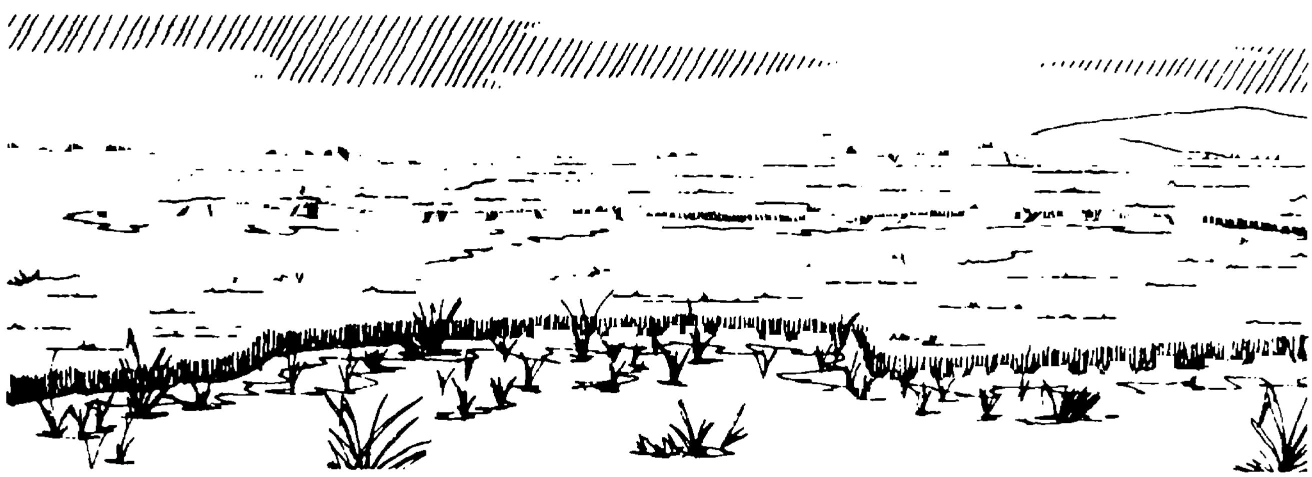
Section 518 authorizes EPA to qualify a Tribe for programs involving water resources that are:

> . . . held by an Indian Tribe, held by the U.S. in trust for Indians, held by a member of an Indian Tribe if such property interest is subject to a trust restriction on alienation, or otherwise within the borders of an Indian reservation . . . .

Tribes are limited to obtaining program authorization only for water resources within the borders of the reservation over which they possess authority to regulate water quality. The meaning of the term "reservation" must, of course, be determined in light of statutory law and with reference to relevant case law. EPA considers trust lands formally set apart for the use of Indians to be "within a reservation" for purposes of section 518 (e)(2), even if they have not been formally designated as "reservations."[2] This means it is the status and use of the land that determines if it is to be considered "within a reservation" rather than the label attached to it. EPA believes that it was the intent of Congress to limit Tribes authority to lands within the reservation. EPA bases this conclusion, in part, on the definition of "Indian Tribe" found in CWA section 518(h)(2). EPA also does not believe that section 518(e)(2) prevents EPA from recognizing tribal authority over non-Indian water resources located within the reservation if the Tribe can demonstrate (1) the requisite authority over such water resources, and (2) the authority to regulate as necessary to protect the public health, safety, and welfare of its tribal members.

1.8.1 Criteria Tribes Must Meet

New section 131.8 of the Water Quality Standards Regulation includes the criteria Tribes are required to meet to be authorized to administer the water quality standards and 401 certification programs. These criteria are provided in section 518 of the Act. The Tribe must:



- be federally recognized;
- carry out substantial governmental duties and powers over a Federal Indian reservation;
- have appropriate authority to regulate the quality of reservation waters; and
- be reasonably expected to be capable of administering the standards program.

The first criterion requires the Tribe to be recognized by the Department of the Interior. The Tribe may address this requirement by stating that it is included on the list of federally recognized Tribes published periodically by the Department of the Interior, or by submitting other appropriate documentation (e.g., the Tribe is federally recognized but not yet included on the Department of the Interior list).

The second criterion requires the Tribe to have a governing body that is carrying out substantial governmental duties and powers. EPA defines "substantial governmental duties and powers" to mean that the Tribe is currently performing governmental functions to promote the health, safety, and welfare of the affected population within a defined geographical area. Examples of such functions include, but are not limited to, the power to tax, the power of eminent domain, and police power. Federal recognition by the Department of the Interior does not, in and of itself, satisfy this criterion. Tribes must submit a narrative statement describing the form of tribal government, describing the types of essential governmental functions currently performed, and identifying the sources of authorities to perform these functions (e.g., tribal constitutions, codes).

The third criterion, concerning tribal authority, means that EPA may authorize an Indian Tribe to administer the water quality standards program only where the Tribe already possesses and can adequately demonstrate authority to manage and protect water resources within the reservation borders. The Clean Water Act authorizes use of existing tribal regulatory authority for managing EPA programs, but the Act does not grant additional authority to Tribes. EPA recognizes that, in general, Tribes possess the authority to regulate activities affecting water quality on the reservation. The Agency does not believe, however, that it is appropriate to recognize tribal authority and approve tribal administration of the water quality standards program in the absence of verifying documentation. EPA will not delegate water quality standards program authority to a Tribe unless the Tribe adequately shows that it possesses the requisite authority.

EPA does not read the Supreme Court's decision in *Brendale*[3] as preventing EPA from recognizing Tribes' authority to regulate water quality on fee lands within the reservation, even if section 518 is not an express delegation of authority. The primary significance of *Brendale* is its result, fully consistent with *Montana* v. *United States*,[4] which previously had held:

> To be sure, Indian tribes retain inherent sovereign power to exercise some forms of civil jurisdiction over non-Indians on their reservations, even on non-Indian fee lands. A tribe may regulate . . . the activities of non-members who enter consensual relationships with the tribe or its members, through commercial dealing, contracts, leases, or other arrangements. . . . A tribe may also retain inherent power to exercise civil authority over the conduct of non-Indians on fee lands within its reservation when that conduct threatens or has some direct effect on the political integrity, the economic security, or the health or welfare of the tribe.

The ultimate decision regarding tribal authority must be made on a Tribe-by-Tribe basis, and EPA has finalized the proposed process for making those determinations. EPA sees no reason in light of *Brendale* to assume that Tribes would be *per se* unable to demonstrate authority over water quality management on fee lands within reservation borders. EPA believes that as a general matter there are substantial legal and factual reasons to assume that Tribes ordinarily have the legal authority to regulate surface water quality within a reservation.

In evaluating whether a Tribe has authority to regulate a particular activity on land owned in fee by nonmembers but located within a reservation, EPA will examine the Tribe's authority in light of the evolving case law as reflected in *Montana* and *Brendale*. The extent of such tribal authority depends on the effect of that activity on the Tribe. As discussed above, in the absence of a contrary statutory policy, a Tribe may regulate the activities of non-Indians on fee lands within its reservation when those activities threaten or have a direct effect on the political integrity, the economic security, or the health or welfare of the Tribe.

The Supreme Court, in recent cases, has explored several options to ensure that the impacts upon Tribes of the activities of non-Indians on fee land, under the *Montana* test, are more than *de minimis*, although to date the Court has not agreed, in a case on point, on any one reformulation of the test. In response to this uncertainty, the Agency will apply, as an interim operating rule, a formulation of the standard that will require a showing that the potential impacts of regulated activities on the Tribe are serious and substantial.

The choice of an Agency operating rule containing this standard is taken solely as a matter of prudence in light of judicial uncertainty and does not reflect an Agency endorsement of this standard *per se*. Moreover, as discussed below, the Agency believes that the activities regulated under the various environmental statutes generally have serious and substantial impacts on human health and welfare. As a result, the Agency believes that Tribes usually will be able to meet the Agency's operating rule, and that use of such a rule by the Agency should not create an improper burden of proof on Tribes or create the administratively undesirable result of checkerboarding reservations.

Whether a Tribe has jurisdiction over activities by nonmembers will be determined case by case, based on factual findings. The determination as to whether the required effect is present in a particular case depends on the circumstances.

Nonetheless, the Agency may also take into account the provisions of environmental statutes, and any legislative findings that the effects of the activity are serious, in making a generalized finding that Tribes are likely to possess sufficient inherent authority to control reservation environmental quality.[5] As a result, in making the required factual findings as to the impact of a water-related activity on a particular Tribe, it may not be necessary to develop an extensive and detailed record in each case. The Agency may also rely on its special expertise and practical experience regarding the importance of water management, recognizing that clean water, including critical habitat (e.g., wetlands, bottom sediments, spawning beds), is absolutely crucial to the survival of many Indian reservations.

The Agency believes that congressional enactment of the Clean Water Act establishes a strong Federal interest in effective management of water quality. Indeed, the primary objective of the CWA "is to restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (section 101(a)), and to achieve that objective, the Act establishes the goal of eliminating all discharges of pollutants into the navigable waters of the United States and attaining a level of water quality that is fishable and swimmable (sections 101(a)(1) and (2)). Thus the statute itself constitutes, in effect, a legislative determination that activities affecting surface water and critical habitat quality may have serious and substantial impacts.

EPA also notes that, because of the mobile nature of pollutants in surface waters and the relatively small length or size of stream segments or other water bodies on reservations, it would be very difficult to separate the effects of water quality impairment on non-Indian fee land within a reservation as compared with those on tribal portions. In other words, any impairment that occurs on, or as a result of, activities on non-Indian fee lands is very likely to impair the water and critical habitat quality of the tribal lands. This also suggests that the serious and substantial effects of water quality impairment within the non-Indian portions of a reservation are very likely to affect the tribal interest in water quality. EPA believes that a "checkerboard" system of regulation, whereby the Tribe and State split up regulation of surface water quality on the reservation, would ignore the difficulties of assuring compliance with water quality standards when two different sovereign entities are establishing standards for the same small stream segments.

EPA also believes that Congress has expressed a preference for tribal regulation of surface water quality to ensure compliance with CWA goals. This is confirmed by the text and legislative history of section 518 itself. The CWA establishes a policy of "recogniz[ing], preserv[ing], and protect[ing] the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution, [and] to plan the development and use (including restoration, preservation, and enhancement) of land and water resources" (section 101(b)). By extension, the treatment of Indian Tribes as States means that Tribes are to be primarily responsible for the protection of reservation water resources. As Senator Burdick, floor manager of the 1987 CWA Amendments, explained, the purpose of section 518 was to "provide clean water for the people of this Nation" (133 Congressional Record S1018, daily ed., Jan. 21, 1987). This goal was to be accomplished, he asserted, by giving "tribes . . . the primary authority to set water quality standards to assure fishable and swimmable water and to satisfy all beneficial uses."[6]

In light of the Agency's statutory responsibility for implementing the environmental statutes, its interpretations of the intent of Congress in allowing for tribal management of water quality within the reservation are entitled to substantial deference.[7]

The Agency also believes that the effects on tribal health and welfare necessary to support tribal regulation of non-Indian activities on the reservation may be easier to establish in the context of water quality management than with regard to zoning, which was at issue in *Brendale*. There is a significant distinction between land use planning and water quality management. The Supreme Court has explicitly recognized such a distinction: "Land use planning in essence chooses particular uses for the land; environmental regulation . . . does not mandate particular uses of the land but requires only that, however the land is used, damage to the environment is kept within prescribed limits."[8] The Court has relied on this distinction to support a finding that States retain authority to carry out environmental regulation even in cases where their ability to carry out general land use regulation is preempted by Federal law.[9]

Further, water quality management serves the purpose of protecting public health and safety, which is a core governmental function whose exercise is critical to self-government. The special status of governmental actions to protect public health and safety is well established. By contrast, the power to zone can be exercised to achieve purposes that have little or no direct nexus to public health and safety.[10] Moreover, water pollution is by nature highly mobile, freely migrating from one local jurisdiction to another, sometimes over large distances. By contrast, zoning regulates the uses of particular properties with impacts that are much more likely to be contained within a given local jurisdiction.

Operationally, EPA's generalized findings regarding the relationship of water quality to tribal health and welfare will affect the legal analysis of a tribal submission by, in effect, supplementing the factual showing a Tribe makes in applying for authority to administer the water quality standards program. Thus, a tribal submission meeting the requirements of section 131.8 of this regulation will need to make a relatively simple showing of facts that there are waters within the reservation used by the Tribe or tribal members (and thus that the Tribe or tribal members could be subject to exposure to pollutants present in, or introduced into, those waters), and that the waters and critical habitat are subject to protection under the Clean Water Act. The Tribe must also explicitly assert that impairment of such waters by the activities of non-Indians would have a serious and substantial effect on the health and welfare of the Tribe. Once the Tribe meets this initial burden, EPA will, in light of the facts presented by the Tribe and the generalized statutory and factual findings regarding the importance of reservation water quality discussed above, presume that there has been an adequate showing of tribal jurisdiction on fee lands, unless an appropriate governmental entity (e.g., an adjacent Tribe or State) demonstrates a lack of jurisdiction on the part of the Tribe.

The Agency recognizes that jurisdictional disputes between Tribes and States can be complex and difficult and that it will, in some circumstances, be forced to address such disputes. However, EPA's ultimate responsibility is protection of the environment. In view of the mobility of environmental problems, and the interdependence of various jurisdictions, it is imperative that all affected sovereigns work cooperatively for environmental protection rather than engage in confrontations over jurisdiction.

To verify authority, the Tribe is required to include a statement signed by the tribal legal counsel, or an equivalent official, explaining the legal basis for the Tribe's regulatory authority. Tribe also is required to provide appropriate additional documentation (e.g., maps, tribal codes, and ordinances).

The fourth criterion requires that the Tribe, in the Regional Administrator's judgment, should be reasonably capable of administering an effective standards program. The Agency recognizes that certain Tribes have not had substantial experience in administering surface water quality programs. For this reason, the Agency requires that Tribes either show that they have the necessary management and technical skills or submit a plan detailing steps for acquiring the necessary management and technical skills. The plan must also address how the Tribe will obtain the funds to acquire the administrative and technical expertise. When considering tribal capability, the Agency will also consider whether the Tribe can demonstrate the existence of institutions that exercise executive, legislative, and judicial functions, and whether the Tribe has a history of successful managerial performance of public health or environmental programs.

1.8.2 Application for Authority To Administer the Water Quality Standards Program

The specific information required for tribal applications to EPA is described in 40 CFR. The application is required, in general, to include a statement on tribal recognition by the Department of the Interior, documentation that the tribal governing body has substantial duties and powers, documentation of tribal authority to regulate water quality on the federally recognized reservation, a narrative statement of tribal capability to administer water quality standards programs, and any other information requested by the Regional Administrator.

When evaluating tribal experience in public health and environmental programs (under paragraph 131.8(b)(4)(ii), EPA will look for indications that the Tribe has participated in such programs, whether the programs are administered by EPA, other Federal agencies, or Tribes. For example, several Tribes are known to have participated in developing areawide water management plans or tribal water quality standards. EPA will also look for evidence of historical budget allocations dealing with public health or environmental programs along with any experience in monitoring related programs.

The regulation allows a Tribe to describe either how it presently has the capability to manage an effective water quality standards program or how it proposes to acquire the additional administrative and technical expertise to manage such a program. EPA will carefully review for reasonableness any plans that propose to acquire expertise. EPA will not approve tribal capability demonstrations where such plans do not include reasonable provisions for acquisition of needed personnel as well as reliable funding sources. This requirement is consistent with other Clean Water Act programs. Tribes may wish to apply for section 106 funds to support their water quality standards programs and may include this source in any discussion of obtaining necessary funds.

If the Tribe has qualified to administer other Clean Water Act or Safe Drinking Water Act programs, then the Tribe need only provide the information that has not been submitted previously.

Qualifying for administration of the water quality standards program is optional for Indian Tribes and there is no time frame limiting when such application may be made. As a general policy, EPA will not deny a tribal application. Rather than formally deny the Tribe's request, EPA will continue to work cooperatively with the Tribe in a continuing effort to resolve deficiencies in the application or the tribal program so that tribal authorization may occur. EPA also concurs with the view that the intent of Congress and the EPA Indian Policy is to support tribal governments in assuming authority to manage various water programs. Authority exists for EPA to re-assert control over certain water programs due to the failure of the State or Tribe to execute the programs properly. Specifically, in the water quality standards program, the Administrator has authority to promulgate Federal standards.

1.8.3 Procedure Regional Administrator Will Apply

The review procedure established in section 131.8 is the same procedure applicable to all water programs. Although experience with the initial application in other programs indicated some delay in the process, EPA believes that as EPA and the Tribes gain experience with the procedures, delays will be minimal.

The EPA review procedure in paragraph 131.8(c) specifies that following receipt of tribal applications, the Regional Administrator will process such applications in a timely manner. The procedure calls for prompt notification to the Tribe that the application has been received, notification within 30 days to appropriate governmental entities (e.g., States and other governmental entities located contiguous to the reservation and that possess authority to regulate water quality under section 303 of the Act) of the application and the substance and basis for the Tribe's assertion of authority over reservation waters, and allowance of 30 days for review of the Tribe's assertion of authority.

EPA recognizes that city and county governments which may be subject to or affected by tribal standards may also want to comment on the Tribe's assertion of authority. Although EPA believes that the responsibility to coordinate with local governments falls primarily on the State, the Agency will make an effort to provide notice to local governments by placing an announcement in appropriate newspapers. Because the rule limits EPA to considering comments from governmental entities with Clean Water Act section 303 authority, such newspaper announcements will advise interested parties to direct comments on tribal authority to appropriate State governments.

Where a Tribe's assertion of authority is challenged, the Regional Administrator, in consultation with the Tribe, the governmental entity challenging the Tribe's assertion of authority, and the Secretary of the Interior, will determine whether the Tribe has adequately demonstrated authority to regulate water quality on the reservation. Where the Regional Administrator concludes that the Tribe has not adequately demonstrated its authority with respect to an area in dispute, then tribal assumption of the standards program would be restricted accordingly. If the authority in dispute were focused on a limited area, this would not necessarily delay the Agency's decision to authorize the Tribe to administer the program for the nondisputed areas.

The procedure allowing participation by other governmental entities in EPA's review of tribal authority does not imply that States or Federal agencies (other than EPA) have veto power over tribal applications for treatment as a State. Rather, the procedure is simply intended to identify any competing jurisdictional claim and thereby ensure that the Tribe has the necessary authority to administer the standards program. EPA will not rely solely on the assertions of a commenter who challenges the Tribe's authority; EPA will make an independent evaluation of the tribal showing and all available information.

When evaluating tribal assertions of authority, EPA will apply the test from *Montana* v. *United States*, 450 U.S. 544 (1981), and will consider the following:

- all information submitted with the Tribe's assertion of authority;
- all information submitted during the required 30-day comment period by the governmental entities identified in 40 CFR 131.8(c)(2); and
- all information obtained by the Agency via consultation with the Department of the Interior (such consultation is required where the Tribe's assertion of authority is challenged).

EPA and the Department of the Interior have agreed to procedures for conducting consultations between the agencies. The procedure established as the Secretary of the Interior's designees the Associate Solicitor, Division of Indian Affairs, and the Deputy Assistant Secretary - Indian Affairs (Trust and Economic Development). EPA will forward a copy of the application and any documents asserting a competing or conflicting claim of authority to such designees as soon as possible. For most applications, an EPA-DOI conference will be scheduled from 1 to 3 weeks after the date the Associate Solicitor receives the application. Comments from the Interior Department will discuss primarily the law applicable to the issue to assist EPA in its own deliberations. Responsibility for legal advice to the EPA Administrator or other EPA decision makers will remain with the EPA General Counsel. EPA does not believe that the consultation process with the Department of the Interior should involve notice and opportunity for States and Tribes because such parties are elsewhere provided appropriate opportunities to participate in EPA's review of tribal authority.

EPA will take all reasonable means to advise interested parties of the decision reached regarding challenges of tribal assertions of authority. At least, written notice will be provided to State(s) and other governmental entities sent notice of the tribal application. In addition, the Water Quality Standards Regulation requires EPA to publish an annual list of standards approval actions taken within the preceding year. EPA will expand that listing to include Indian Tribes qualifying for treatment as States in the preceding year.

Comments on tribal compliance with criteria necessary for assuming the program is limited to the criterion for tribal authority. The Clean Water Act does not require EPA to provide public comment on the entire tribal application, nor does EPA believe that public comment will assist with EPA's decision- making regarding the other criteria. (The other criteria are the recognition of the Tribe by the Department of the Interior, a description of the tribal governing body, and the capability of the Tribe to administer an effective standards program.) EPA believes that providing public comment on these three criteria would unnecessarily complicate and potentially delay the process.

1.8.4 Time Frame for Review of Tribal Application

EPA has not specified a time frame for review of tribal application. The Agency believes it is impossible to approve or disapprove all applications within a designated time frame. Because EPA has no reasonable way to predetermine how complete initial applications might be, what challenges might arise, or how numerous or complex the issues might be, the Agency deems it inappropriate to attempt to establish time frames that might not allow sufficient time for resolution. Similarly, EPA's experience with States applying for various EPA programs indicates that, at times, meetings and discussions between EPA and the States are necessary before all requirements are met. The Agency believes that the same communication with Tribes will be important to ensure expeditious processing of tribal applications.

1.8.5 Effect of Regional Administrator's Decision

A decision by the Regional Administrator that a Tribe does not meet the requirements for administering the water quality standards program does not preclude the Tribe from resubmitting the application at a future date. Rather than formally deny the Tribe's request, EPA will continue to work cooperatively with the Tribe in a continuing effort to resolve deficiencies in the application or the tribal program so that tribal authorization may occur. EPA believes that the intent of Congress and of EPA's Indian Policy is to support tribal governments in assuming authority to manage various water programs.

Where the Regional Administrator determines that the tribal application satisfies all of the requirements of section 131.8, the Regional Administrator will promptly notify the Tribe that the Tribe has qualified to administer the water quality standards program.

1.8.6 Establishing Water Quality Standards on Indian Lands

Where Tribes qualify to be treated as States for the purposes of water quality standards, EPA has the responsibility to assist the Tribe in establishing standards that are appropriate for the reservation and consistent with the Clean Water Act. EPA recognizes that Tribes have limited resources for development of water quality standards.

EPA considers the following three options acceptable to complete the task of establishing water quality standards on Indian lands:

- the Tribe may negotiate a cooperative agreement with an adjoining State to apply the State's standards to the Indian lands;

- the Tribe may incorporate the standards from an adjacent State as the Tribe's own; or

- the Tribe may independently develop and adopt standards that account for unique site-specific conditions and water body uses.

The first two options would be the quickest and least costly ways for establishing tribal water quality standards. Under option 1, the negotiated agreement could also cover requirements such as monitoring, permitting, certifications, and enforcement of water quality standards on the reservation. Option 2 would make full use of information and data developed by the State which may apply to the reservation. Tribes, as sovereign governments, have the legal authority to negotiate cooperative agreements with a State to apply that State's standards to waters on the reservation or to use State standards as the basis for tribal standards. These options do not suggest that the Tribe relinquishes its sovereign powers or enforcement authority or that the State can unilaterally apply its standards to reservation waters.

Option 3 would require more time and resources to implement because it would require the Tribe to create an entire set of standards "from scratch." EPA does not intend to discourage this approach, but notes that Indian Tribes may want to make full use, where appropriate, of programs of adjacent States. Tribes should use this Handbook as guidance when developing standards.

EPA emphasizes that the development of tribal water quality standards is an iterative process, and that the standards development option initially selected by the Tribe can change in subsequent years. For example, a Tribe may want to use option 1 or 2 to get the standards program started. This does not preclude the Tribe from developing its own water quality standards in subsequent years.

Tribes establishing standards for the first time should carefully consider which water body uses are appropriate. Once designated uses are adopted, removing the use or adopting a subcategory of use would be subject to the requirements of section 131.10 of the Water Quality Standards Regulation.

EPA expects that, where Tribes qualify to be treated as States for the purposes of water quality standards, standards will be adopted and submitted to EPA for review within 3 years (a triennium) from the date that the Tribe is notified that it is qualified to administer the standards program. This time frame corresponds to that provided to States under the provisions of the 1965 Federal Water Pollution Control Act, when the water quality standards program was created. EPA believes that this is an equitable arrangement, and that the Tribes should be allowed sufficient time to develop their programs

and adopt appropriate standards for reservation waters.

Once EPA determines that a Tribe qualifies to administer the standards program, tribal development, review, and adoption of water quality standards are subject to the same requirements that States are subject to under the Clean Water Act and EPA's implementing regulations.

Until Tribes qualify for the standards program and adopt standards under the Clean Water Act, EPA will, when possible, assume that existing water quality standards remain applicable. EPA's position on this issue was expressed in a September 9, 1988, letter from EPA's then General Counsel, Lawrence Jensen, to Dave Frohnmayer, Attorney General for the State of Oregon. This letter states: "if States have established standards that purport to apply to Indian reservations, EPA will assume without deciding that those standards remain applicable until a Tribe is authorized to establish its own standards or until EPA otherwise determines in consultation with a State and Tribe that the State lacks jurisdiction . . . ." This policy is not an assertion that State standards apply on reservations as a matter of law, but the policy merely recognizes that fully implementing a role for Tribes under the Act will require a transition period. EPA may apply State standards in this case because (1) there are no Federal standards that apply generally, and (2) to ignore previously developed State standards would be a regulatory void that EPA believes would not be beneficial to the reservation water quality. However, EPA will give serious consideration to Federal promulgation of water quality standards on Indian lands where EPA finds a particular need.

Where a State asserts authority to establish future water quality standards for a reservation, EPA policy is to ensure that the affected Tribe is made aware of the assertion so that any issues the Tribe may wish to raise can be reviewed as part of the normal standards setting process. EPA also encourages State-Tribe communication on standards issues, with one possible outcome being the establishment of short-term cooperative working agreements pertaining to standards and NPDES permits on reservations.

1.8.7 EPA Promulgation of Standards for Reservations

If EPA determines that a Tribe possesses authority to regulate water quality on a reservation but the Tribe declines to seek authority to administer the water quality standards program, EPA has the authority under section 303 of the Act to promulgate Federal water quality standards. EPA's responsibility stems from the Act's directive to establish water quality standards for all "navigable waters." Depending on the circumstances, EPA may use the standards of an adjacent State as a starting point for such a promulgation. EPA will prioritize the promulgations based on various factors, not the least of which is availability of Agency resources to undertake the Federal rulemaking process. Because the Federal promulgation process is slow and complex, EPA may promulgate water quality standards in conjunction with re-issuing permits on the reservations.

The intent of the Clean Water Act is for States and Tribes qualifying for treatment as States to have the first opportunity to set standards. Thus, EPA prefers to work cooperatively with States and Tribes on water quality standards issues and to initiate Federal promulgation actions only where absolutely necessary.

EPA's entire policy with respect to Federal promulgation is straightforward. EPA much prefers to work with the States and have them adopt standards that comply with CWA requirements. Where Federal promulgation is necessary to achieve CWA compliance, however, EPA will act. This same philosophy will apply to Indian Tribes authorized to administer the program.

1.9 Adoption of Standards for Indian Reservation Waters

This guidance recognizes that Tribes have varying abilities to develop water quality standards. Some Tribes have more technical capability and experience in drafting implementable regulations than other Tribes and may be capable of adopting more complex standards. However, most Tribes may not have access to sufficient resources, either in personnel or in contractor funds, to pursue this course. Moreover, EPA does not have the resources to provide substantial technical assistance to individual Tribes to develop other than basic water quality standards.

1.9.1 EPA's Expectations for Tribal Water Quality Standards

Tribal water quality standards, initially at least, should focus on basic contents and reflect existing uses and existing water quality. The standards must be established for an inventory of "waters of the United States," including wetlands. The Tribes should focus on the basic structure of a water quality standards system: designated uses for identified water segments, appropriate narrative and numeric criteria, an antidegradation policy, and other general implementation policies. How complex or sophisticated these elements need to be depends upon the abilities of the Tribe and the environmental concerns affected by tribal standards.

EPA has consistently recommended to Tribes that they use directly, or with slight modification, the standards of the adjacent States as a beginning for tribal standards. Tribal water quality standards should be developed considering the quality and designated uses of waters entering and leaving reservations. It is important that the Tribes recognize what the surrounding State (or another Indian reservation) water quality standards are even though there is no requirement to match those standards, although the water quality standards regulation does require consideration of downstream water quality standards (see section 2.2, this Handbook).

At a minimum, tribal water quality standards should be established upstream and downstream from point sources where NPDES permits are applicable. It is also desirable that water quality standards be applied to waters where significant nonpoint sources enter so that the effectiveness of best management practices on the reservation's waters can be evaluated.

Water quality criteria should be carefully selected recognizing that making criteria more stringent in subsequent water quality standards reviews is more feasible than attempting relaxation of stringent criteria. While there is no mandatory list of criteria, the following should be considered the minimum:

- narrative "free froms";
- dissolved oxygen;
- pH;
- temperature;
- bacteriological criteria (for recreational and ceremonial uses); and
- toxics (including nonconventionals, e.g., ammonia and chlorine). [Use of option 1, section 2.1.3, is recommended.]

1.9.2 Optional Policies

The Tribes must also specify which optional policies they wish to use pursuant to 40 CFR 131.13 (see chapter 6, this Handbook). These include the following:

- mixing zones for point sources;
- variances for point sources;
- design low-flow specification for the application of numeric criteria; and
- schedules of compliance for criteria in NPDES, and permits.

Guidance for applying these policies are generally available in either this Handbook or in the *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a).

1.9.3 Tribal Submission and EPA Review

The initial submission of the tribal water quality standards must contain the items listed in 40 CFR 131.6 plus use attainability analyses for all waters not classified "fishable/swimmable" (see section 2.9, this Handbook). In addition, it should contain identification of endangered or threatened aquatic species or wildlife subject to protection by water quality standards. There should also be included a record containing information on the regulatory and public participation aspects of the water quality standards, public comments made, and the Tribe's responses to those comments and other relevant material required by 40 CFR 131.20.

1.9.4 Regional Reviews

The Regions should carefully coordinate the reviews within the Water Management Divisions to ensure:

- that the required items in section 131.6 are included;
- that all waters with NPDES permits have water quality standards; and
- that the tribal rulemaking meets the requirements of 40 CFR 131.20.

In commenting on tribal water quality standards, the Regions should identify situations where the dispute resolution mechanism in 40 CFR 131.7 may ultimately be called into play and should attempt to de-fuse such situations as early as possible in the standards adoption process. One possibility is to encourage Tribes and States to establish review procedures <u>before</u> any specific problem develops as suggested in section 131.7(e) of the regulation.

Where NPDES permits exist, the downstream jurisdiction and the Region should determine if total maximum daily loads or waste load allocations will be needed. Where this burden falls on the Tribe, EPA may need to assist the Tribe in these assessments or perform the necessary modeling for the Tribe. The Region also should assess the scope of any section 401 procedures needed in future NPDES permit renewals. The interstate nature of tribal water quality standards may become important to EPA because of the recent *Arkansas* v. *Oklahoma* U.S. Supreme Court case (112 section 1046, February 26, 1992), especially when EPA is the permit writing authority.

NOTE: Additional discussion supporting the Agency's rulemaking with respect to Indian Tribes and EPA's views on related questions may be found in the preamble discussion to the final rule (56 F.R. 64893, December 12, 1991).

Endnotes

1. *Champion International Corp. v. EPA*, 850 F.2d 182 (4th Cir. 1988)

2. *Oklahoma Tax Commission v. Citizen Band Potawatomi Indian Tribe of Oklahoma*, 111 S.Ct. 905, 910 (1991).

3. *Brendale v. Confederated Tribes and Bands of the Yakima Nation*, 492 U.S. 408, (1989)

4. *Montana v. United States*, 450 U.S. at 565-66 (citations omitted).

5. See, *e.g.*, *Keystone Bituminous Coal Assoc. v. DeBenedictis*, 480 U.S. 470, 476-77 and notes 6, 7 (1987).

6. *Id.*

7. *Washington Dept. of Ecology v. EPA*, 752 F.2d 1465, 1469 (9th Cir. 1985); see generally *Chevron, USA v. NRDC*, 467 U.S. 837, 843-45 (1984).

8. *California Coastal Commission v. Granite Rock Co.*, 480 U.S. 572, 587 (1987).

9. *Id.* at 587-89.

10. See *e.g. Brendale*, 492 U.S. at 420 n.5 (White, J.) (listing broad range of consequences of state zoning decision).

CHAPTER 2

DESIGNATION OF USES

(40 CFR 131.10)

Table of Contents

CHAPTER 2

DESIGNATION OF USES

(40 CFR 131.10)

Table of Contents

CHAPTER 2
DESIGNATION OF USES

2.1 Use Classification - 40 CFR 131.10(a)

A water quality standard defines the water quality goals of a water body or portion thereof, in part, by designating the use or uses to be made of the water. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act. "Serve the purposes of the Act" (as defined in sections 101(a)(2), and 303(c) of the Act) means that water quality standards should:

- provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water ("fishable/swimmable"), and
- consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreation, agriculture and industrial purposes, and navigation.

These sections of the Act describe various uses of waters that are considered desirable and should be protected. The States must take these uses into consideration when classifying State waters and are free to add use classifications. Consistent with the requirements of the Act and Water Quality Standards Regulation, States are free to develop and adopt any use classification system they see as appropriate, except that waste transport and assimilation is not an acceptable use in any case (see 40 CFR 131.10(a)). Among the uses listed in the Clean Water Act, there is no hierarchy. EPA's Water Quality Standards Regulation emphasizes the uses specified in section 101(a)(2) of the Act (first bullet, above). To be consistent with the 101(a)(2) interim goal of the Act, States must provide water quality for the *protection and propagation of fish, shellfish, and wildlife, and provide for recreation in and on the water* ("fishable/swimmable") where attainable (see 40 CFR 131.10(j)).

DESIGNATED USES
40 CFR 131.3(f)

Uses specified in Water Quality Standards for each water body or segment whether or not they are being attained.

2.1.1 Public Water Supplies

This use includes waters that are the source for drinking water supplies and often includes waters for food processing. Waters for drinking water may require treatment prior to distribution in public water systems.

2.1.2 Protection and Propagation of Fish, Shellfish, and Wildlife

This classification is often divided into several more specific subcategories, including coldwater fish, warmwater fish, and shellfish. For example, some coastal States have a use specifically for oyster propagation. The use may also include protection of aquatic flora. Many States differentiate between self-supporting fish populations and stocked fisheries. Wildlife protection should include waterfowl, shore birds, and other water-oriented wildlife.

To more fully protect aquatic habitats and provide more comprehensive assessments of aquatic life use attainment/non-attainment, it is EPA's policy that States should designate aquatic life uses that appropriately address biological integrity and adopt biological criteria necessary to protect those uses (see Appendix R).

TYPES OF USES
CWA SECTION 303(c)(2)(A)

- Public water supplies
- Protection and propagation of fish, shellfish, and wildlife
- Recreation
- Agriculture
- Industry
- Navigation
- Coral reef preservation
- Marinas
- Groundwater recharge
- Aquifer protection
- Hydroelectric power

2.1.3 Recreation

Recreational uses have traditionally been divided into primary contact and secondary contact recreation. The primary contact recreation classification protects people from illness due to activities involving the potential for ingestion of, or immersion in, water. Primary contact recreation usually includes swimming, water-skiing, skin-diving, surfing, and other activities likely to result in immersion. The secondary contact recreation classification is protective when immersion is unlikely. Examples are boating, wading, and rowing. These two broad uses can be logically subdivided into an almost infinite number of subcategories (e.g., wading, fishing, sailing, powerboating, rafting.). Often fishing is considered in the recreational use categories.

Recreation in and on the water, on the other hand, may not be attainable in certain waters, such as wetlands, that do not have sufficient water, at least seasonally. However, States are encouraged to recognize and protect recreational uses that do not directly involve contact with water, including hiking, camping, and bird watching.

A number of acceptable State options may be considered for designation of recreational uses.

Option 1

Designate primary contact recreational uses for all waters of the State, and set bacteriological criteria sufficient to support primary contact recreation. This option fully conforms with the requirement in section 131.6 of the Water Quality Standards Regulation to designate uses consistent with the provisions of sections 101(a)(2) and 303(c)(2) of the CWA. States are not required to conduct use attainability analyses (for recreation) when primary contact recreational uses are designated for all waters of the State.

Option 2

Designate either primary contact recreational uses or secondary contact recreational uses for all waters of the State and, where secondary contact recreation is designated, set bacteriological criteria sufficient to support primary contact recreation. EPA believes that a secondary contact recreational use (with criteria sufficient to support primary contact recreation) is consistent with the CWA section 101(a)(2) goal. The rationale for this option is discussed in the preamble to the Water Quality Standards Regulation, which states: ". . . even though it may not make sense to encourage use of a stream for swimming because of the flow, depth or the velocity of the water, the States and EPA must recognize that swimming and/or wading may occur anyway. In order to protect public health, States must set criteria to reflect recreational uses if it appears that recreation will in fact occur in the stream." Under this option, future revisions to the bacteriological criterion for specific stream segments would be subject to the downgrading provisions of the Federal Water Quality Standards Regulation (40 CFR 131.10).

Option 3

Designate either primary contact recreation, secondary contact recreation (with bacteriological criteria sufficient to support primary contact recreation), or conduct use attainability analyses demonstrating that recreational uses consistent with the CWA section 101(a)(2) goal are not attainable for all waters of the State. Such use attainability analyses are required by section 131.10 of the Water Quality Standards Regulation, which also specifies six factors that may be used by States in demonstrating that attaining a use is not feasible. Physical factors, which are important in determining attainability of aquatic life uses, may not be used as the basis for not designating a recreational use consistent with the CWA section 101(a)(2) goal. This precludes States from using 40 CFR 131.10(g) factor 2 (pertaining to low-flows) and factor 5 (pertaining to physical factors in general). The basis for this policy is that the States and EPA have an obligation to do as much as possible to protect the health of the public. In certain instances, people will use whatever water bodies are available for recreation, regardless of the physical conditions. In conducting use attainability analyses (UAAs) where available data are scarce or nonexistent, sanitary surveys are useful in determining the sources of bacterial water quality indicators. Information on land use is also useful in predicting bacteria levels and sources.

Other Options

- States may apply bacteriological criteria sufficient to support primary contact recreation with a rebuttable presumption that the indicators show the presence of human fecal pollution. Rebuttal of this presumption, however, must be based on a sanitary survey that demonstrates a lack of contamination from human sources. The basis for this option is the absence of data demonstrating a relationship between high densities of bacteriological water quality indicators and increased risk of swimming-associated illness in animal-contaminated waters. Maine is an example of a State that has successfully implemented this option.

- Where States adopt a standards package that does not support the swimmable goal and does not contain a UAA to justify the omission, EPA may conditionally approve the package provided that (1) the State commits, in writing, to a schedule for rapid completion of the UAAs, generally within 90 days (see conditional approval guidance in section 6.2 of this Handbook); <u>and</u> (2) the omission may be considered a minor deficiency (i.e., after consultation with the State, EPA determines that there is no basis for concluding that the UAAs would support upgrading the use of the water body). Otherwise, failure to support the swimmable goal is a major deficiency and must be disapproved to allow prompt Federal promulgation action.

- States may conduct basinwide use attainability analyses if the circumstances relating to the segments in question are sufficiently similar to make the results of the basinwide analyses reasonably applicable to each segment.

States may add other recreation classifications as they see fit. For example, one State protects "consumptive recreation" (i.e., "human consumption of aquatic life, semi-aquatic life, or terrestrial wildlife that depend on surface waters for survival and well-being"). States also may adopt seasonal recreational uses (see section 2.6, this Handbook).

2.1.4 Agriculture and Industry

The agricultural use classification defines waters that are suitable for irrigation of crops, consumption by livestock, support of vegetation for range grazing, and other uses in support of farming and ranching and protects livestock and crops from injury due to irrigation and other exposures.

The industrial use classification includes industrial cooling and process water supplies. This classification protects industrial equipment from damage from cooling and/or process waters. Specific criteria would depend on the industry involved.

The *Report of the Committee on Water Quality Criteria*, the "Green Book" (FWPCA, 1968) and *Water Quality Criteria 1972*, the "Blue Book" (NAS/NAE, 1973) provide information for certain parameters on protecting agricultural and industrial uses, although section 304(a)(1) criteria for protecting these uses have not been specifically developed for numerous other parameters, including toxics.

Where criteria have not been specifically developed for agricultural and industrial uses, the criteria developed for human health and aquatic life are usually sufficiently stringent to protect these uses. States also may establish criteria specifically designed to protect these uses.

2.1.5 Navigation

This use classification is designed to protect ships and their crews and to maintain water quality so as not to restrict or prevent navigation.

2.1.6 Other Uses

States may adopt other uses they consider to be necessary. Some examples include coral reef preservation, marinas, groundwater recharge, aquifer protection, and hydroelectric power. States also may establish criteria specifically designed to protect these uses.

2.2 Consider Downstream Uses - 40 CFR 131.10(b)

When designating uses, States should consider extraterritorial effects of their standards. For example, once States revise or adopt standards, upstream jurisdictions will be required, when revising their standards and issuing permits, to provide for attainment and maintenance of the downstream standards.

Despite the regulatory requirement that States ensure downstream standards are met when designating and setting criteria for waters, occasionally downstream standards are not met owing to an upstream pollutant source. The Clean Water Act offers three solutions to such problems.

First, the opportunity for public participation for new or revised water quality standards provides potentially affected parties an approach to avoiding conflicts of water quality standards. States and Tribes are encouraged to keep other States informed of their water quality standards efforts and to invite comment on standards for common water bodies.

Second, permit limits under the National Pollutant Discharge Elimination System (NPDES) program (see section 402 of the Act) are required to be developed such that applicable water quality standards are achieved. The permit issuance process also includes opportunity for public participation and, thus, provides a second opportunity to consider and resolve potential problems regarding extraterritorial effects of water quality standards. In a decision in *Arkansas* v. *Oklahoma* (112 section 1046, February 26, 1992), the U.S. Supreme Court held that the Clean Water Act clearly authorized EPA to require that point sources in upstream States not violate water quality standards in downstream States, and that EPA's interpretation of those standards should govern.

Third, NPDES permits issued by EPA are subject to certification under the requirements of section 401 of the Act. Section 401 requires that States grant, deny, or condition "certification" for federally permitted or licensed activities that may result in a discharge to waters of the United States. The decision to grant or to deny certification, or to grant a conditional certification is based on a State's determination regarding whether the proposed activity will comply with applicable water quality standards and other provisions. Thus, States may deny certification and prohibit EPA from issuing an NPDES permit that would violate water quality standards. Section 401 also allows a State to participate in extraterritorial actions that will affect that State's waters if a federally issued permit is involved.

In addition to the above sources for solutions, when the problem arises between a State and an Indian Tribe qualified for treatment as a State for water quality standards, the dispute resolution mechanism could be invoked (see section 1.7, of this Handbook).

2.3 Use Subcategories - 40 CFR 131.10(c)

States are required to designate uses considering, at a minimum, those uses listed in section 303(c) of the Clean Water Act (i.e., public water supplies, propagation of fish and wildlife, recreation, agriculture and industrial purposes, and navigation). However, flexibility inherent in the State process for designating uses allows the development of subcategories of uses within the Act's general categories to refine and clarify specific use classes. Clarification of the use class is particularly helpful when a variety of surface waters with distinct characteristics fit within the same use class, or do not fit well into any category. Determination of non-attainment in waters with broad use categories may be difficult and open to alternative interpretations. If a determination of non-attainment is in dispute, regulatory actions will be difficult to accomplish (USEPA, 1990a).

The State selects the level of specificity it desires for identifying designated uses and subcategories of uses (such as whether to treat recreation as a single use or to define a subcategory for secondary recreation). However, the State must be at least as specific as the uses listed in sections 101(a) and 303(c) of the Clean Water Act.

Subcategories of aquatic life uses may be on the basis of attainable habitat (e.g., coldwater versus warmwater habitat); innate differences in community structure and function (e.g., high versus low species richness or productivity); or fundamental differences in important community components (e.g., warmwater fish communities dominated by bass versus catfish). Special uses may also be designated to protect particularly unique, sensitive, or valuable aquatic species, communities, or habitats.

Data collected from biosurveys as part of a developing biocriteria program may assist States in refining aquatic life use classes by revealing consistent differences among aquatic communities inhabiting different waters of the same designated use. Measurable biological attributes could then be used to divide one class into two or more subcategories (USEPA, 1990a).

If States adopt subcategories that do not require criteria sufficient to fully protect the goal uses in section 101(a)(2) of the Act (see section 2.1, above), a use attainability analysis pursuant to 40 CFR 131.10(j) must be conducted for waters to which these subcategories are assigned. Before adopting subcategories of uses, States must provide notice and opportunity for a public hearing because these actions are changes to the standards.

2.4 Attainability of Uses - 40 CFR 131.10(d)

When designating uses, States may wish to designate only the uses that are attainable. However, if the State does not designate the uses specified in section 101(a)(2) of the Act, the State must perform a use attainability analysis under section 131.10(j) of the regulation. States are encouraged to designate uses that the State believes can be attained in the future.

"Attainable uses" are, at a minimum, the uses (based on the State's system of water use classification) that can be achieved 1) when effluent limits under sections 301(b)(1)(A) and (B) and section 306 of the Act are imposed on point source dischargers and 2) when cost-effective and reasonable best management practices are imposed on nonpoint source dischargers.

2.5 Public Hearing for Changing Uses - 40 CFR 131.10(e)

The Water Quality Standards Regulation requires States to provide opportunity for public hearing before adding or removing a use or establishing subcategories of a use. As mentioned in section 2.2 above, the State should consider extraterritorial effects of such changes.

2.6 Seasonal Uses - 40 CFR 131.10(f)

In some areas of the country, uses are practical only for limited seasons. EPA recognizes seasonal uses in the Water Quality Standards Regulation. States may specify the seasonal uses and criteria protective of that use as well as the time frame for the ". . . season, so long as the criteria do not prevent the attainment of any more restrictive uses attainable in other seasons."

For example, in many northern areas, body contact recreation is possible only a few months out of the year. Several States have adopted primary contact recreational uses, and the associated microbiological criteria, for only those months when primary contact recreation actually occurs, and have relied on less stringent secondary contact recreation criteria to protect for incidental exposure in the "non-swimming" season.

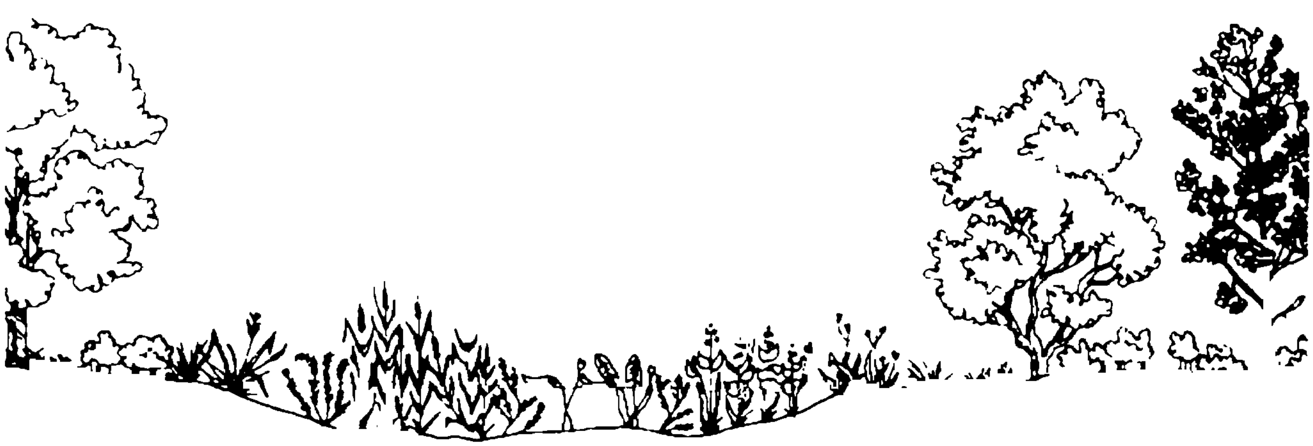
Seasonal uses that may require more stringent criteria are uses that protect sensitive organisms or life stages during a specific season such as the early life stages of fish and/or fish migration (e.g., EPA's *Ambient Water Quality Criteria for Dissolved Oxygen* (see Appendix I) recommends more stringent dissolved oxygen criteria for the early life stages of both coldwater and warmwater fish).

2.7 Removal of Designated Uses - 40 CFR 131.10(g) and (h)

Figure 2-1 shows how and when designated uses may be removed.

2.7.1 Step 1 - Is the Use Existing?

Once a use has been designated for a particular water body or segment, the water body or water body segment cannot be reclassified for a different use except under specific conditions. If a designated use is an existing use (as defined in 40 CFR 131.3) for a particular water body, the existing use cannot be removed unless a use requiring more stringent criteria is added (see



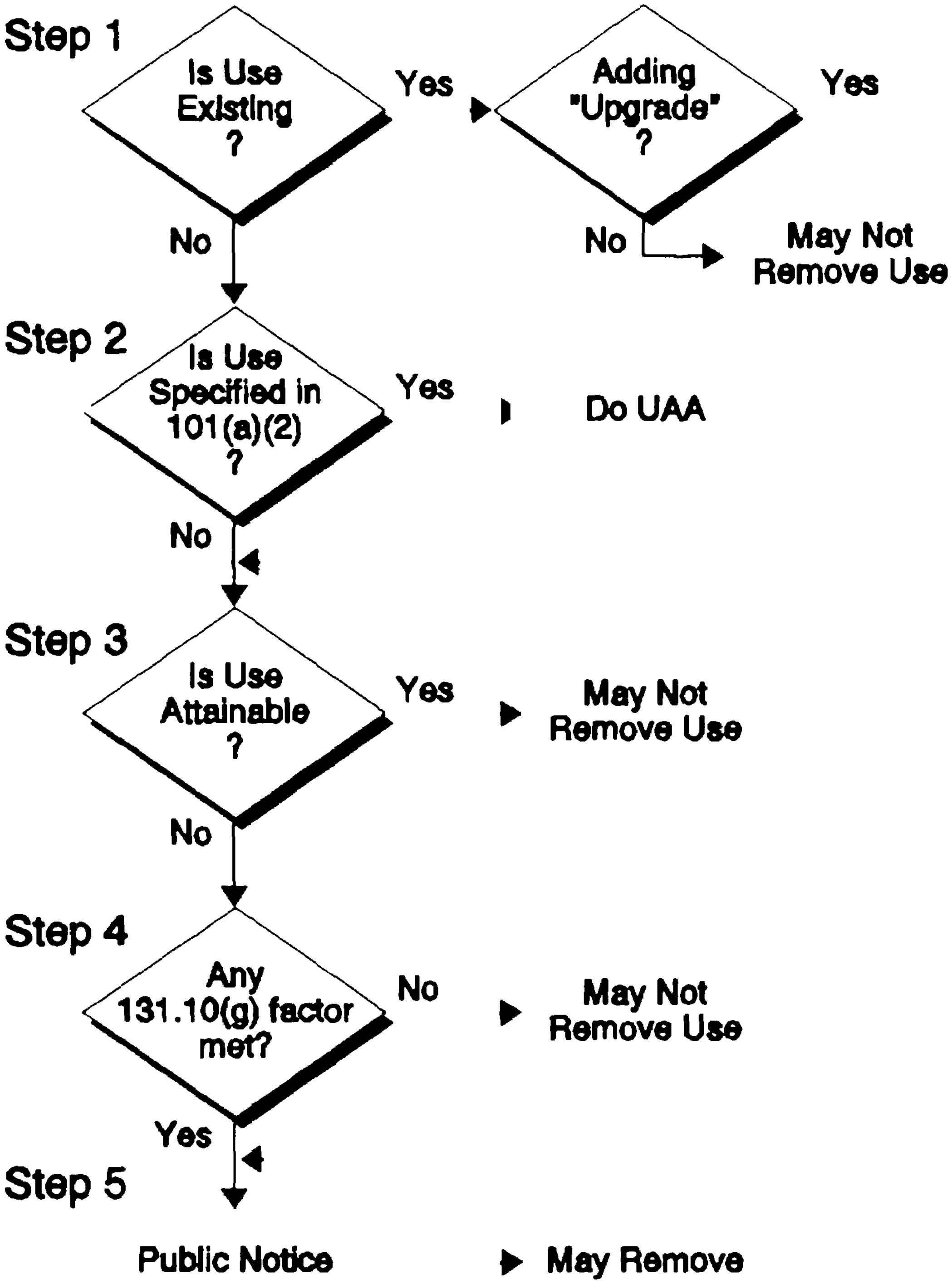


Figure 2-1. Process for Removing a Designated Use

section 4.4, this Handbook, for further discussion of existing uses). However, uses requiring more stringent criteria may always be added because doing so reflects the goal of further improvement of water quality. Thus, a recreational use for wading may be deleted if a recreational use for swimming is added, or the State may add the swimming use and keep the wading use as well.

2.7.2 Step 2 - Is the Use Specified in Section 101(a)(2)?

If the State wishes to remove a designated use specified in section 101(a)(2) of the Act, the State must perform a use attainability analysis (see section 131.10(j)). Section 2.9 of this Handbook discusses use attainability analyses for aquatic life uses.

2.7.3 Step 3 - Is the Use Attainable?

A State may change activities within a specific use category but may not change to a use that requires less stringent criteria, unless the State can demonstrate that the designated use cannot be attained. (See section 2.4, above, for the definition of "attainable uses.") For example, if a State has a broad aquatic life use, EPA generally assumes that the use will support all aquatic life. The State may demonstrate that, for a specific water body, such parameters as dissolved oxygen or temperature will not support trout but will support perch when technology-based effluent limitations are applied to point source dischargers and when cost-effective and reasonable best management practices are applied to nonpoint sources.

2.7.4 Step 4 - Is a Factor from 131.10(g) Met?

Even after the previous steps have been considered, the designated use may be removed, or subcategories of a use established, only under the conditions given in section 131.10(g). The State must be able to demonstrate that attaining the designated use is not feasible because:

(1) naturally occurring pollutant concentrations prevent the attainment of the use;

(2) natural, ephemeral, intermittent, or low-flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met;

(3) human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;

(4) dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in the attainment of the use;

(5) physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to [chemical] water quality, preclude attainment of aquatic life protection uses; or

(6) controls more stringent than those required by sections 301(b)(1)(A) and (B) and 306 of the Act would result in substantial and widespread economic and social impact.

2.7.5 Step 5 - Provide Public Notice

As provided for in section 131.10(e), States must provide notice and opportunity for public hearing in accordance with section 131.20(b) (discussed in section 6.1 of this Handbook). Of course, EPA intends for States to make appropriate use of all public comments received through such notice.

2.8 Revising Uses to Reflect Actual Attainment - 40 CFR 131.10(i)

When performing its triennial review, the State must evaluate what uses are being attained. If a water body is designated for a use that requires less stringent criteria than a use that is being attained, the State must revise the use on that water body to reflect the use that is being attained.

2.9 Use Attainability Analyses - 40 CFR 131.10(j) and (k)

Under section 131.10(j) of the Water Quality Standards Regulation, States are required to conduct a use attainability analysis (UAA) whenever:

(1) the State designates or has designated uses that do not include the uses specified in section 101(a)(2) of the Act; or

(2) the State wishes to remove a designated use that is specified in section 101(a)(2) of the Act or adopt subcategories of uses specified in section 101(a)(2) that require less stringent criteria.

States are not required to conduct UAAs when designating uses that include those specified in section 101(a)(2) of the Act, although they may conduct these or similar analyses when determining the appropriate subcategories of section 101(a)(2) goal uses.

States may also conduct generic use attainability analyses for groups of water body segments provided that the circumstances relating to the segments in question are sufficiently similar to make the results of the generic analyses reasonably applicable to each segment.

As defined in the Water Quality Standards Regulation (40 CFR 131.3), a use attainability analysis is:

> . . . a structured scientific assessment of the factors affecting the attainment of a use which may include physical, chemical, biological, and economic factors as described in section 131.10(g).

The evaluations conducted in a UAA will determine the attainable uses for a water body (see sections 2.4 and 2.8, above).

The physical, chemical, and biological factors affecting the attainment of a use are evaluated through a *water body survey and assessment*. The guidance on water body survey and assessment techniques that appears in this Handbook is for the evaluation of fish, aquatic life, and wildlife uses only (EPA has not developed guidance for assessing recreational uses). Water body surveys and assessments conducted by the States should be sufficiently detailed to answer the following questions:

- What are the aquatic use(s) currently being achieved in the water body?
- What are the causes of any impairment of the aquatic uses?
- What are the aquatic use(s) that can be attained based on the physical, chemical, and biological characteristics of the water body?

The analysis of economic factors determines whether substantial and widespread economic and social impact would be caused by pollution control requirements more stringent than (1) those required under sections 301(b)(1)(A) and (B) and section 306 of the Act for point source dischargers, and (2) cost-effective and reasonable best management practices for nonpoint source dischargers.

2.9.1 Water Body Survey and Assessment - Purpose and Application

The purpose of this section is to identify the physical, chemical, and biological factors that may be examined to determine whether an aquatic life protection use is attainable for a given water body. The specific analyses included in this guidance are optional. However, they represent the type of analyses EPA believes are sufficient for States to justify changes in uses designated in a water quality standard and to determine uses that are attainable. States may use alternative analyses as long as they are scientifically and technically supportable. This guidance specifically addresses streams and river systems. More detailed guidance is given in the *Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses, Volume I* (USEPA, 1983c). EPA has also developed guidance for estuarine and marine systems and lakes, which is summarized in following sections. More detailed guidance for these aquatic systems is available in the *Technical Support Manual, Volume II, Estuarine Systems*, and *Volume III, Lake Systems* (USEPA, 1984a,b).

Several approaches for analyzing the aquatic life protection uses to determine if such uses are appropriate for a given water body are discussed. States are encouraged to use existing data to perform the physical, chemical, and biological evaluations presented in this guidance document. Not all of these evaluations are necessarily applicable. For example, if an assessment reveals that the physical habitat is the limiting factor precluding a use, a chemical evaluation would not be required. In addition, wherever possible, States also should consider grouping together water bodies having similar physical, chemical, and biological characteristics either to treat several water bodies or stream segments as a single unit or to establish representative conditions applicable to other similar water bodies or stream segments within a river basin. Using existing data and establishing representative conditions applicable to a number of water bodies or segments should conserve the limited resources available to the States.

Table 2-1 summarizes the types of physical, chemical, and biological factors that may be evaluated when conducting a UAA. Several approaches can be used for conducting the physical, chemical, and biological evaluations, depending on the complexity of the situation. Details on the various evaluations can be found in the *Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses, Volume I* (USEPA, 1983c). A survey need not consider all of the parameters listed; rather, the survey should be designed on the basis of the water body characteristics and other considerations relevant to a particular survey.

These approaches may be adapted to the water body being examined. Therefore, a close working relationship between EPA and the States is essential so that EPA can assist States in determining the appropriate analyses to be used in support of any water quality standards revisions. These analyses should be made available to all interested parties before any public forums on the water quality standards to allow for full discussion of the data and analyses.

2.9.2 Physical Factors

Section 101(a) of the Clean Water Act recognizes the importance of preserving the physical integrity of the Nation's water bodies. Physical habitat plays an important role in the overall aquatic ecosystem and impacts the types and number of species present in a particular body of water. Physical parameters of a water body are examined to identify factors that impair the propagation and protection of aquatic life and to determine what uses could be obtained in the water body given such limitations. In general, physical parameters such as flow, temperature, water depth, velocity,

PHYSICAL FACTORS	CHEMICAL FACTORS	BIOLOGICAL FACTORS
♦ **instream characteristics** - size (mean width/depth) - flow/velocity - annual hydrology - total volume - reaeration rates - gradient/pools/ riffles - temperature - sedimentation - channel modifications - channel stability ♦ **substrate composition and characteristics** ♦ **channel debris** ♦ **sludge deposits** ♦ **riparian characteristics** ♦ **downstream characteristics**	♦ **dissolved oxygen** ♦ **toxicants** ♦ **suspended solids** ♦ **nutrients** - nitrogen - phosphorus ♦ **sediment oxygen demand** ♦ **salinity** ♦ **hardness** ♦ **alkalinity** ♦ **pH** ♦ **dissolved solids**	♦ **biological inventory (existing use analysis)** - fish - macroinvertebrates - microinvertebrates - phytoplankton - periphyton - macrophytes ♦ **biological potential analysis** - diversity indices - HSI models - tissue analyses - recovery index - intolerant species analysis - omnivore-carnivore analysis ♦ **biological potential analysis** - reference reach comparison

Table 2-1. Summary of Typical Factors Used in Conducting a Water Body Survey and Assessment

substrate, reaeration rates, and other factors are used to identify any physical limitations that may preclude attainment of the designated use. Depending on the water body in question, any of the physical parameters listed in Table 2-1 may be appropriately examined. A State may use any of these parameters to identify physical limitations and characteristics of a water body. Once a State has identified any physical limitations based on evaluating the parameters listed, careful consideration of "reversibility" or the ability to restore the physical integrity of the water body should be made.

Such considerations may include whether it would cause more environmental damage to correct the problem than to leave the water body as is, or whether physical impediments such as dams can be operated or modified in a way that would allow attainment of the use.

Several assessment techniques have been developed that correlate physical habitat characteristics to fishery resources. The identification of physical factors limiting a fishery is a critical assessment that provides important data for management of the water body. The U.S. Fish and Wildlife Service has developed habitat evaluation procedures (HEP) and habitat suitability indices (HSI). Several States have begun developing their own models and procedures for habitat assessments. Parameters generally included in habitat assessment procedures are temperature, turbidity, velocity, depth, cover, pool and riffle sizes, riparian vegetation, bank stability, and siltation. These parameters are correlated to fish species by evaluating the habitat variables important to the life cycle of the species. The value of habitat for other groups of aquatic organisms such as macroinvertebrates and periphyton also may be considered. Continued research and refinement of habitat evaluation procedures reflect the importance of physical habitat.

If physical limitations of a stream restrict the use, a variety of habitat modification techniques might restore a habitat so that a species could thrive where it could not before. Some of the techniques that have been used are bank stabilization, flow control, current deflectors, check dams, artificial meanders, isolated oxbows, snag clearing when determined not to be detrimental to the life cycle or reproduction of a species, and installation of spawning beds and artificial spawning channels. If the habitat is a limiting factor to the propagation and/or survival of aquatic life, the feasibility of modifications might be examined before additional controls are imposed on dischargers.

2.9.3 Chemical Evaluations

The chemical characteristics of a water body are examined to determine why a designated use is not being met and to determine the potential of a particular species to survive in the water body if the concentration of particular chemicals were modified. The State has the discretion to determine the parameters required to perform an adequate water chemistry evaluation. A partial list of the parameters that may be evaluated is provided in Table 2-1.

As part of the evaluation of the water chemistry composition, a natural background evaluation is useful in determining the relative contribution of natural background contaminants to the water body; this may be a legitimate factor that effectively prevents a designated use from being met. To determine whether the natural background concentration of a pollutant is adversely impacting the survival of species, the concentration may be compared to one of the following:

- 304(a) criteria guidance documents; or
- site-specific criteria; or
- State-derived criteria.

Another way to obtain an indication of the potential for the species to survive is to determine if the species are found in other waterways with similar chemical concentrations.

In determining whether human-caused pollution is irreversible, consideration needs to be given to the permanence of the damage, the feasibility of abating the pollution, or the additional environmental damage that may result from removing the pollutants. Once a State identifies the chemical or water quality characteristics that are limiting attainment of the use, differing levels of remedial control measures may be explored. In addition, if instream toxicants cannot be removed by natural processes and cannot be removed by human effort without severe long-term environmental impacts, the pollution may be considered irreversible.

In some areas, the water's chemical characteristics may have to be calculated using predictive water quality models. This will be true if the receiving water is to be impacted by new dischargers, changes in land use, or improved treatment facilities. Guidance is available on the selection and use of receiving water models for biochemical oxygen demand, dissolved oxygen, and ammonia for instream systems (USEPA, 1983d,e) and dissolved oxygen, nitrogen, and phosphorus for lake systems, reservoirs, and impoundments (USEPA, 1983f).

2.9.4 Biological Evaluations

In evaluating what aquatic life protection uses are attainable, the biology of the water body should be evaluated. The interrelationships between the physical, chemical, and biological characteristics are complex, and alterations in the physical and/or chemical parameters result in biological changes. The biological evaluation described in this section encourages States to:

- provide a more precise statement of which species exist in the water body and should be protected;
- determine the biological health of the water body; and
- determine the species that could potentially exist in the water body if the physical and chemical factors impairing a use were corrected.

This section of the guidance will present the conceptual framework for making these evaluations. States have the discretion to use other scientifically and technically supportable assessment methodologies deemed appropriate for specific water bodies on a case-by-case basis. Further details on each of the analyses presented can be found in the *Technical Support Manual for Conducting Use Attainability Analyses* (USEPA, 1983c).

Biological Inventory (Existing Use Analysis)

The identification of which species are in the water body and should be protected serves several purposes:

- By knowing what species are present, the biologist can analyze, in general terms, the health of the water body. For example, if the fish species present are principally carnivores, the quality of the water is generally higher than in a water body dominated by omnivores. It also allows the biologist to assess the presence or absence of intolerant species.
- Identification of the species enables the State to develop baseline conditions against which to evaluate any remedial actions. The development of a regional baseline based upon several site-specific species lists increases an understanding of the regional fauna. This allows for easier grouping of water bodies based on the biological regime of the area.
- By identifying the species, the decision-maker has the data needed to explain the present condition of the water body to the public and the uses that must be maintained.

The evaluation of the existing biota may be simple or complex depending on data availability. As much information as possible should be gathered on the categories of organisms listed in Table 2-1. It is not necessary to obtain complete data for all six categories. However, it is recommended that fish should be included in any combination of categories chosen because:

- the general public can relate better to statements about the condition of the fish community;
- fish are typically present even in the smallest streams and in all but the most polluted waters;
- fish are relatively easy to identify, and samples can be sorted and identified at the field site;
- life-history information is extensive for many fish species so that stress effects can be evaluated (Karr, 1981). In addition, since fish are mobile, States are encouraged to evaluate other categories of organisms.

Before any field work is conducted, existing data should be collected. EPA can provide data from intensive monitoring surveys and special studies. Data, especially for fish, may be available from State fish and game departments, recreation agencies, and local governments, or through environmental impact statements, permit reviews, surveys, and university or other studies.

Biological Condition/Biological Health Assessment

The biological inventory can be used to gain insight into the biological health of the water body by evaluating:

- species richness or the number of species;
- presence of intolerant species;
- proportion of omnivores and carnivores;
- biomass or production; and
- number of individuals per species.

The role of the biologist becomes critical in evaluating the health of the biota because the knowledge of expected richness or expected species comes only from understanding the general biological traits and regimes of the area. Best professional judgments by local biologists are important. These judgments are based on many years of experience and on observations of the physical and chemical changes that have occurred over time.

Many methods for evaluating biotic communities have been and continue to be developed. The *Technical Support Manual for Conducting Use Attainability Analyses* (USEPA, 1983c) and *Rapid Bioassessment Protocols for Use in Streams and Rivers* (USEPA, 1989e) describe methods that States may want to consider using in their biological evaluations.

A number of other methods have been and are being developed to evaluate the health of biological components of the aquatic ecosystem including short-term *in situ* or laboratory bioassays and partial or full life-cycle toxicity tests. These methods are discussed in several EPA publications, including the *Biological Methods Manual* (USEPA, 1972). Again, it is not the intent of this document to specify tests to be conducted by the States. This will depend on the information available, the predictive accuracy required, site-specific conditions of the water body being examined, and the cooperation and assistance the State receives from the affected municipalities and industries.

Biological Potential Analysis

A significant step in the use attainability analysis is the evaluation of what communities could potentially exist in a particular water body if pollution were abated or if the physical habitat were modified. The approach presented is to compare the water body in question to reference reaches within a region. This approach includes the development of baseline conditions to facilitate the comparison of several water bodies at less cost. As with the other analyses mentioned previously, available data should be used to minimize resource impacts.

The biological potential analysis involves:

- defining boundaries of fish faunal regions;
- selecting control sampling sites in the reference reaches of each area;
- sampling fish and recording observations at each reference sampling site;
- establishing the community characteristics for the reference reaches of each area; and
- comparing the water body in question to the reference reaches.

In establishing faunal regions and sites, it is important to select reference areas for sampling sites that have conditions typical of the region.

The establishment of reference areas may be based on physical and hydrological characteristics. The number of reference reaches needed will be determined by the State depending on the variability of the waterways within the State and the number of classes that the State may wish to establish. For example, the State may want to use size, flow, and substrate as the defining characteristics and may consequently desire to establish classes such as small, fast running streams with sandy substrate or large, slow rivers with cobble bottom. It is at the option of the State to:

- choose the parameters to be used in classifying and establishing reference reaches; and
- determine the number of classes (and thus the refinement) within the faunal region.

This approach can also be applied to other aquatic organisms such as macroinvertebrates (particularly freshwater mussels) and algae.

Selection of the reference reaches is of critical importance because the characteristics of the aquatic community will be used to establish baseline conditions against which similar reaches (based on physical and hydrological characteristics) are compared. Once the reference reaches are established, the water body in question can be compared to the reference reach. The results of this analysis will reveal whether the water body in question has the typical biota for that class or a less desirable community and will provide an indication of what species may potentially exist if pollution were abated or the physical habitat limitations were remedied.

2.9.5 Approaches to Conducting the Physical, Chemical, and Biological Evaluations

In some cases, States that assess the status of their aquatic resources, will have relatively simple situations not requiring extensive data collection and evaluation. In other situations, however, the complexity resulting from variable environmental conditions and the stress from multiple uses of the resource will require both intensive and extensive studies to produce a sound evaluation of the system. Thus, procedures that a State may develop for conducting a water body assessment should be flexible enough to be adaptable to a variety of site-specific conditions.

A common experimental approach used in biological assessments has been a hierarchical approach to the analyses. This can be a rigidly tiered approach. An alternative is presented in Figure 2-2.

The flow chart is a general illustration of a thought process used to conduct a use attainability analysis. The process illustrates several alternative approaches that can be pursued separately or, to varying degrees, simultaneously depending on:

- the amount of data available on the site;
- the degree of accuracy and precision required;
- the importance of the resource;
- the site-specific conditions of the study area; and
- the controversy associated with the site.

The degree of sophistication is variable for each approach. Emphasis is placed on evaluating available data first. If information is found to be lacking or incomplete, then field testing or field surveys should be conducted.

The major elements of the process are briefly described below.

Steps 1 and 2

Steps 1 and 2 are the basic organizing steps in the evaluation process. By carefully defining the objectives and scope of the evaluation, there will be some indication of the level of sophistication required in subsequent surveys and testing. States and the regulated community can then adequately plan and allocate resources to the analyses. The designated use of the water body in question

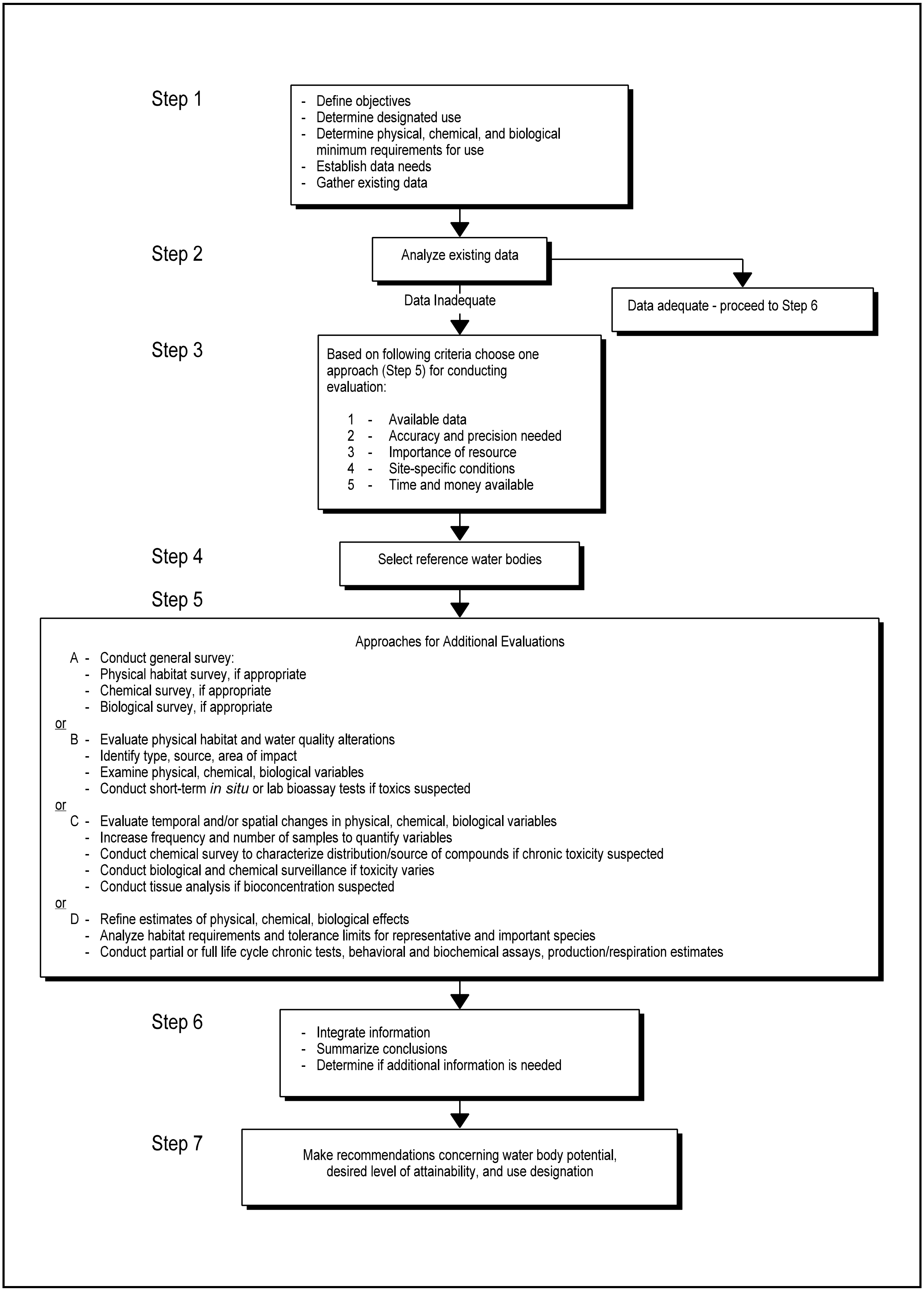


Figure 2-2. Steps in a Use Attainability Analysis

should be identified as well as the minimum chemical, physical, and biological requirements for maintaining the use. Minimum requirements may include, for example, dissolved oxygen levels, flow rates, temperature, and other factors. All relevant information on the water body should be collected to determine if the available information is adequate for conducting an appropriate level of analysis. It is assumed that all water body evaluations, based on existing data, will either formally or informally be conducted through Steps 1 and 2.

Steps 3 and 4

If the available information proves inadequate, then decisions regarding the degree of sophistication required in the evaluation process will need to be made. These decisions will, most likely, be based on the five criteria listed in Step 3 of Figure 2-2. Based on these decisions, reference areas should be chosen (Step 4), and one or more of the testing approaches should be followed.

Steps 5A, B, C, D

These approaches are presented to illustrate several possible ways of analyzing the water body. For example, in some cases chemical data may be readily available for a water body but little or no biological information is known. In this case, extensive chemical sampling may not be required, but enough samples should be taken to confirm the accuracy of the available data set. Thus, to accurately define the biological condition of the resource, 5C may be chosen, but 5A may be pursued in a less intensive way to supplement the chemical data already available.

Step 5A is a general survey to establish relatively coarse ranges for physical and chemical variables, and the numbers and relative abundances of the biological components (fishes, invertebrates, primary producers) in the water body. Reference areas may or may not need to be evaluated here, depending on the types of questions being asked and the degree of accuracy required.

Step 5B focuses more narrowly on site-specific problem areas with the intent of separating, where possible, biological impacts due to physical habitat alteration versus those due to chemical impacts. These categories are not mutually exclusive but some attempt should be made to define the causal factors in a stressed area so that appropriate control measures can be implemented if necessary.

Step 5C would be conducted to evaluate possibly important trends in the spatial and/or temporal changes associated with the physical, chemical, and biological variables of interest. In general, more rigorous quantification of these variables would be needed to allow for more sophisticated statistical analyses between reference and study areas which would, in turn, increase the degree of accuracy and confidence in the predictions based on this evaluation. Additional laboratory testing may be included, such as tissue analyses, behavioral tests, algal assays, or tests for flesh tainting. Also, high-level chemical analyses may be needed, particularly if the presence of toxic compounds is suspected.

Step 5D is, in some respects, the most detailed level of study. Emphasis is placed on refining cause-effect relationships between physical-chemical alterations and the biological responses previously established from available data or steps 5A through 5C. In many cases, state-of-the-art techniques will be used. This pathway would be conducted by the States only where it may be necessary to establish, with a high degree of confidence, the cause-effect relationships that are producing the biological community characteristics of those areas. Habitat requirements or tolerance limits for representative or important species may have to be determined for those factors limiting the potential of the ecosystem. For these evaluations, partial or full life-cycle toxicity tests, algal assays, and sediment bioassays may be needed along with the shorter term bioassays designed to elucidate sublethal effects not readily apparent in toxicity tests (e.g., *preference-avoidance* responses, production-respiration estimates, and bioconcentration estimates).

Steps 6 and 7

After field sampling is completed, all data must be integrated and summarized. If this information is still not adequate, then further testing may be required and a more detailed pathway chosen. With adequate data, States should be able to make reasonably specific recommendations concerning the natural potential of the water body, levels of attainability consistent with this potential, and appropriate use designations.

The evaluation procedure outlined here allows States a significant degree of latitude for designing assessments to meet their specific goals in water quality and water use.

2.9.6 Estuarine Systems

This section provides an overview of the factors that should be considered in developing use attainability analyses for estuaries. Anyone planning to conduct a use attainability analysis for an estuary should consult the *Technical Support Manual: Waterbody Surveys and Assessments for Conducting Use Attainability Analyses, Volume II: Estuarine Systems* (USEPA, 1984a) for more detailed guidance. Also, much of the information for streams and rivers that is presented above and in Volume I of the Technical Support Manual, particularly with respect to chemical evaluations, will apply to estuaries and is not repeated here.

The term "estuaries" is generally used to denote the lower reaches of a river where tide and river flows interact. Estuaries are very complex receiving waters that are highly variable in description and are not absolutes in definition, size, shape, aquatic life, or other attributes. Physical, chemical, and biological attributes may require consideration unique to estuaries and are discussed below.

Physical Processes

Estuarine flows are the result of a complex interaction of the following physical factors:

- tides;
- wind shear;
- freshwater inflow (momentum and buoyancy);
- topographic frictional resistance;
- Coriolis effect;
- vertical mixing; and
- horizontal mixing.

In performing a use attainability study, one may simplify the complex prototype system by determining which of these effects or combination of effects is most important at the time scale of the evaluation (days, months, seasons, etc.).

Other ways to simplify the approach to analyzing an estuary is to place it in a broad classification system to permit comparison of similar types of estuaries. The most common groupings are based on geomorphology, stratification, circulation patterns, and time scales. Each of these groupings is discussed below.

Geomorphological classifications can include types such as drowned river valleys (coastal plain estuaries), fjords, bar-built estuaries, and other estuaries that do not fit the first three classifications (those produced by tectonic activity, faulting, landslides, or volcanic eruptions).

Stratification is most often used for classifying estuaries influenced by tides and freshwater inflows. Generally, highly stratified estuaries have large river discharges flowing into them, partially mixed estuaries have medium river discharges; and vertically homogeneous have small river discharges.

Circulation in an estuary (i.e., the velocity patterns as they change over time) is primarily affected by the freshwater outflow, the tidal inflow, and the effect of wind. In turn, the difference in density between outflow and inflow sets up secondary currents that ultimately affect the salinity distribution across the estuary. The salinity distribution is important because it affects the distribution of fauna and flora within the estuary. It is also important because it is indicative of the mixing properties of the estuary as they may affect the dispersion of pollutants (flushing properties). Additional factors such as friction forces and the size and geometry of the estuary also contribute to the circulation patterns. The complex geometry of estuaries, in combination with the presence of wind, the effect of the Earth's rotation (Coriolis effect), and other effects, often results in residual currents (i.e., of longer period than the tidal cycle) that strongly influence the mixing processes in estuaries.

Consideration of time scales of the physical processes being evaluated is very important for any water quality study.

Short-term conditions are much more influenced by a variety of short-term events that perhaps have to be analyzed to evaluate a "worst case" scenario. Longer term (seasonal) conditions are influenced predominantly by events that are averaged over the duration of that time scale.

Estuary Substrate Composition

Characterization of sediment/substrate properties is important in a use attainability analysis because such properties:

- determine the extent to which toxic compounds in sediments are available to the biota; and
- determine what types of plants and animals could potentially become established, assuming no interference from other factors such as nutrient, dissolved oxygen (DO), and/or toxics problems.

The bottom of most estuaries is a mix of sand, silt, and mud that has been transported and deposited by ocean currents or by freshwater sources. Rocky areas may also be present, particularly in the fjord-type estuary. None of these substrate types is particularly hospitable to aquatic plants and animals, which accounts in part for the paucity of species seen in an estuary.

The amount of material transported to the estuary will be determined by the types of terrain through which the river passes, and upon land use practices that may encourage runoff and erosion. It is important to take land use practices into consideration when examining the attainable uses of the estuary. Deposition of particles varies with location in the estuaries and velocity of the currents.

It is often difficult for plants to colonize estuaries because of a lack of suitable anchorage points and because of the turbidity of the water, which restricts light penetration (McLusky, 1971). Submerged aquatic vegetation (SAV) (macrophytes) develops in sheltered areas where silt and mud accumulate. These plants help to slow the currents, leading to further deposition of silt. The growth of plants often keeps pace with rising sediment levels so that over a long period of time substantial deposits of sediment and plant material may be seen.

SAV serves very important roles as habitat and as a food source for much of the biota of the estuary. Major estuary studies have shown that the health of SAV communities serves as an important indicator of estuary health.

Adjacent Wetlands

Tidal and freshwater wetlands adjacent to the estuary can serve as a buffer to protect the estuary from external phenomena. This function may be particularly important during wet weather periods when relatively high stream flows discharge high loads of sediment and pollutants to the estuary. The wetlands slow the peak velocity, to some extent alleviate the sudden shock of salinity changes, and filter some of the sediments and nutrients that would otherwise be discharged directly into the estuary.

Hydrology and Hydraulics

The two most important sources of freshwater to the estuary are stream flow and precipitation. Stream flow generally represents the greatest contribution to the estuary. The location of the salinity gradient in a river-controlled estuary is to a large extent a function of stream flow. Location of the iso-concentration lines may change considerably, depending upon whether stream flow is high or low. This in turn may affect the biology of the estuary, resulting in population shifts as biological species adjust to changes in salinity. Most estuarine species are adapted to survive temporary changes in salinity either by migration or some other mechanism (e.g., mussels can close their shells). However, many cannot withstand these changes indefinitely. Response of an estuary to rainfall events depends upon the intensity of rainfall, the drainage area affected by the rainfall, and the size of the estuary. Movement of the salt front is dependent upon tidal influences and freshwater flow to the estuary. Variations in salinity generally follow seasonal patterns such that the salt front will occur farther down-estuary during a rainy season than during a dry season. The salinity profile also may vary from day to day, reflecting the effect of individual rainfall events, and may undergo major changes due to extreme meteorological events.

Anthropogenic activity also may have a significant effect on salinity in an estuary. When feeder streams are used as sources of public water supply and the withdrawals are not returned, freshwater flow to the estuary is reduced, and the salt wedge is found farther up the estuary. If the water is returned, usually in the form of wastewater effluent, the salinity gradient of the estuary may not be affected, although other problems attributable to nutrients and other pollutants in the wastewater may occur.

Salinity also may be affected by the way that dams along the river are operated. Flood control dams result in controlled discharges to the estuary rather than relatively short but massive discharge during high-flow periods. Dams operated to impound water for water supplies during low-flow periods may drastically alter the pattern of freshwater flow to the estuary, and although the annual discharge may remain the same, seasonal changes may have significant impact on the estuary and its biota.

Influence of Physical Characteristics on Use Attainability

"Segmentation" of an estuary can provide a useful framework for evaluating the influence of estuarine physical characteristics such as circulation, mixing, salinity, and geomorphology on use attainability. Segmentation is the compartmentalization of an estuary into subunits with homogeneous physical characteristics. In the absence of water pollution, physical characteristics of different regions of the estuary tend to govern the suitability for major water uses. Once the segment network is established, each segment can be subjected to a use attainability analysis. In addition, the segmentation process offers a useful management structure for monitoring conformance with water quality goals in future years.

The segmentation process is an evaluation tool that recognizes that an estuary is an interrelated ecosystem composed of chemically, physically, and biologically diverse areas. It assumes that an ecosystem as diverse as an estuary cannot be effectively managed as only one unit because different uses and associated water quality goals will be appropriate and feasible for different regions of the estuary. However, after developing a network based upon physical characteristics, sediment boundaries can be refined with available chemical and biological data to maximize the homogeneity of each segment.

A potential source of concern about the construction and utility of the segmentation scheme for use attainability evaluations is that the estuary is a fluid system with only a few obvious boundaries, such as the sea surface and the sediment-water interface. Fixed boundaries may seem unnatural to scientists, managers, and users, who are more likely to view the estuary as a continuum than as a system composed of separable parts. The best approach to dealing with such concerns is a segmentation scheme that stresses the dynamic nature of the estuary. The scheme should emphasize that the segment boundaries are operationally defined constructs to assist in understanding a changeable, intercommunicating system of channels, embayments, and tributaries.

To account for the dynamic nature of the estuary, it is recommended that estuarine circulation patterns be a prominent factor in delineating the segment network. Circulation patterns control the transport of and residence times for heat, salinity, phytoplankton, nutrients, sediment, and other pollutants throughout the estuary. Salinity should be another important factor in delineating the segment network. The variations in salinity concentrations from head of tide to the mouth typically produce a separation of biological communities based on salinity tolerances or preferences.

Chemical Parameters

The most critical chemical water quality indicators for aquatic use attainment in an estuary are dissolved oxygen, nutrients and chlorophyll-a, and toxicants. Dissolved oxygen (DO) is an important water quality indicator for all fisheries uses. In evaluating use attainability, assessments of DO impacts should consider the relative contributions of three different sources of oxygen demand:

- photosynthesis/respiration demand from phytoplankton;
- water column demand; and
- benthic oxygen demand.

If use impairment is occurring, assessments of the significance of each oxygen sink can be used to evaluate the feasibility of achieving sufficient pollution control to attain the designated use.

Chlorophyll-a is the most popular indicator of algal concentrations and nutrient overenrichment, which in turn can be related to diurnal DO depressions due to algal respiration. Typically, the control of phosphorus levels can limit algal growth near the head of the estuary, while the control of nitrogen levels can limit algal growth near the mouth of the estuary; however, these relationships are dependent upon factors such as nitrogen phosphorus ("N/P") ratios and light penetration potential, which can vary from one estuary to the next. Excessive phytoplankton concentrations, as indicated by chlorophyll-a levels, can cause adverse DO impacts such as:

- wide diurnal variations in surface DO due to daytime photosynthetic oxygen production and nighttime oxygen depletion by respiration; and
- depletion of bottom DO through the decomposition of dead algae.

Excessive chlorophyll-a levels also result in shading, which reduces light penetration for submerged aquatic vegetation (SAV). Consequently, the prevention of nutrient over-enrichment is probably the most important water quality requirement for a healthy SAV community.

The nutrients of greatest concern in the estuary are nitrogen and phosphorus. Their sources typically are discharges from sewage treatment plants and industries and runoff from urban and agricultural areas. Increased nutrient levels lead to phytoplankton blooms and a subsequent reduction in DO levels and light penetration, as discussed above.

Sewage treatment plants are typically the major source of nutrients, particularly phosphorus, to estuaries in urban areas. Agricultural land uses and urban land uses represent significant nonpoint sources of nutrients, particularly nitrogen. It is important to base control strategies on an understanding of the sources of each type of nutrient, both in the estuary and in its feeder streams.

Point sources of nutrients are typically much more amenable to control than nonpoint sources. Because phosphorus removal for municipal wastewater discharges is typically less expensive than nitrogen removal operations, the control of phosphorus discharges is often the method of choice for the prevention or reversal of use impairment in the upper estuary (i.e., tidal fresh zone). However, nutrient control in the upper reaches of the estuary may cause algal blooms in the lower reaches, e.g., control of phosphorus in the upper reaches may reduce the algal blooms there, but in doing so also increase the amount of nitrogen transported to the lower reaches where nitrogen is the limiting nutrient causing a bloom there. Tradeoffs between nutrient controls for the upper and lower estuary should be considered in evaluating measures for prevention of reversing use impairment.

Potential interferences from toxic substances, such as pesticides, herbicides, heavy metals, and chlorinated effluents, also need to be considered in a use attainability study. The presence of certain toxicants in excessive concentrations within bottom sediments of the water column may prevent the attainment of water uses (particularly fisheries propagation/harvesting and sea grass habitat uses) in estuary segments that satisfy water quality criteria for DO, chlorophyll-a/nutrient enrichment, and fecal coliform.

Biological Community Characteristics

The *Technical Support Manual, Volume II* (USEPA, 1984a) provides a discussion of the organisms typically found in estuaries in more detail than is appropriate for this Handbook. Therefore, this discussion will focus on more general characteristics of estuarine biota and their adaptations to accommodate a fluctuating environment.

Salinity, light penetration, and substrate composition are the most critical factors to the distribution and survival of plant and animal communities in an estuary. The estuarine environment is characterized by variations in circulation, salinity, temperature, and dissolved oxygen supply. Colonizing plants and animals must be able to withstand the fluctuating conditions in estuaries.

The depth to which attached plants may become established is limited by turbidity because plants require light for photosynthesis. Estuaries are typically turbid because of large quantities of detritus and silt contributed by surrounding marshes and rivers. Algal growth also may hinder light penetration. If too much light is withheld from the lower depths, animals cannot rely heavily on visual cues for habitat selection, feeding, or finding a mate.

Estuarine organisms are recruited from the sea, freshwater environments, and the land. The major environmental factors to which organisms must adjust are periodic submersion and desiccation as well as fluctuating salinity, temperature, and dissolved oxygen.

Several generalizations concerning the responses of estuarine organisms to salinity have been noted (Vernberg, 1983) and reflect a correlation of an organism's habitat to its tolerance:

- organisms living in estuaries subjected to wide salinity fluctuations can withstand a wider range of salinities than species that occur in high-salinity estuaries;

- intertidal zone animals tend to tolerate wider ranges of salinities than do subtidal and open-ocean organisms;

- low intertidal species are less tolerant of low salinities than are high intertidal species; and

- more sessile animals are likely to be more tolerant of fluctuating salinities than organisms that are highly mobile and capable of migrating during times of salinity stress.

Estuaries are generally characterized by low diversity of species but high productivity because they serve as the nursery or breeding grounds for some species. Methods to measure the biological health and diversity of estuaries are discussed in USEPA (1984a).

Techniques for Use Attainability Evaluations

In assessing use levels for aquatic life protection, determination of the present use and whether this corresponds to the designated use is evaluated in terms of biological measurements and indices. However, if the present use does not correspond to the designated use, physical and chemical factors are used to explain the lack of attainment and the highest level the system can achieve.

The physical and chemical evaluations may proceed on several levels depending on the level of detail required, amount of knowledge available about the system (and similar systems), and budget for the use attainability study. As a first step, the estuary is classified in terms of physical processes so that it can be compared with reference estuaries in terms of differences in water quality and biological communities, which can be related to man-made alteration (i.e., pollution discharges).

The second step is to perform desktop or simple computer model calculations to improve the understanding of spatial and temporal water quality conditions in the present system. These calculations include continuous point source and simple box model-type calculations. A more detailed discussion of the desktop and computer calculations is given in USEPA (1984a).

The third step is to perform detailed analyses through the use of more sophisticated computer models. These tools can be used to evaluate the system's response to removing individual point and nonpoint source discharges, so as to assist with assessments of the cause(s) of any use impairment.

2.9.7 Lake Systems

This section will focus on the factors that should be considered in performing use attainability analyses for lake systems. Lake systems are in most cases linked physically to rivers and streams and exhibit a transition from riverine habitat and conditions to lacustrine habitat and conditions. Therefore, the information presented in section 2.9.1 through 2.9.5 and the *Technical Support Manual, Volume I* (USEPA, 1983c) will to some extent apply to lake systems. EPA has provided guidance specific to lake systems in the *Technical Support Manual for Conducting Use Attainability Analyses, Volume III: Lake Systems* (USEPA, 1984b). This manual should be consulted by anyone performing a use attainability analysis for lake systems.

Aquatic life uses of a lake are defined in reference to the plant and animal life in a lake. However, the types and abundance of the biota are largely determined by the physical and chemical characteristics of the lake. Other contributing factors include the location, climatological conditions, and historical events affecting the lake.

Physical Parameters

The physical parameters that describe the size, shape, and flow regime of a lake represent the basic characteristics that affect physical, chemical, and biological processes. As part of a use attainability analysis, the physical parameters must be examined to understand non-water quality factors that affect the lake's aquatic life.

The origins of a lake determine its morphologic characteristics and strongly influence the physical, chemical, and biological conditions that will prevail. Therefore, grouping lakes formed by the same process often will allow comparison of similar lake systems. Measurement of the following morphological characteristics may be of importance to a water body survey:

- surface area;
- volume;
- inflow and outflow;
- mean depth;
- maximum depth;
- length;
- length of shoreline;
- depth-area relationships;
- depth-volume relationships; and
- bathymetry (submerged contours).

These physical parameters can in some cases be used to predict biological parameters. For example, mean depth has been used as an indicator of productivity. Shallow lakes tend to be more productive, and deep, steep-sided lakes tend to be less productive. These parameters may also be used to calculate other characteristics of the lake such as mass flow rate of a chemical, surface loading rate, and detention time.

Total lake volume and inflow and outflow rates are physical characteristics that indirectly affect the lake's aquatic community. Large inflows and outflows for lakes with small volumes produce low detention times or high flow-through rates. Aquatic life under these conditions may be different than when relatively small inflows and outflows occur for a large-volume lake where long detention times occur.

The shape factor (lake length divided by lake width) also may be correlated to chemical and biological characteristics. This factor has been used to predict parameters such as chlorophyll-a levels in lakes. For more detailed lake analysis, information describing the depth-area and depth-volume relationships and information describing the bathymetry may be required.

In addition to the physical parameters listed above, it is also important to obtain and analyze information concerning the lake's contributing watershed. Two major parameters of concern are the drainage area of the contributing watershed and the land uses of that watershed. Drainage area will aid in the analysis of inflow volumes to the lake due to surface runoff. The land use classification of the area around the lake can be used to predict flows and also nonpoint source pollutant loadings to the lake.

The physical parameters discussed above may be used to understand and analyze the various physical processes that occur in lakes. They can also be used directly in simplistic relationships that predict productivity to aid in aquatic use attainability analyses.

Physical Processes

Many complex and interrelated physical processes occur in lakes. These processes are highly dependent on the lake's physical parameters, location, and characteristics of the contributing watershed. Several of the major processes are discussed below.

Lake Currents

Water movement in a lake affects productivity and the biota because it influences the distribution of nutrients, microorganisms, and plankton. Lake currents are propagated by wind, inflow/outflow, and the Coriolis force. For small shallow lakes, particularly long and narrow lakes, inflow/outflow characteristics are most important, and the predominant current is a steady-state flow through the lake. For very large lakes, wind is the primary generator of currents, and except for local effects, inflow/outflow have a relatively minor effect on lake circulation. Coriolis effect, a deflecting force that is the function of the Earth's rotation, also plays a role in circulation in large lakes such as the Great Lakes.

Heat Budget

Temperature and its distribution within lakes and reservoirs affects not only the water quality within the lake but also the thermal regime and quality of a river system downstream of the lake. The thermal regime of a lake is a function of the heat balance around the body of water. Heat transfer modes into and out of the lake include heat transfer through the air-water interface, conduction through the mud-water interface, and inflow and outflow heat advection.

Heat transfer through the air-water interface is primarily responsible for typical annual temperature cycles. Heat is transferred across the air-water interface by three different processes: radiation exchange, evaporation, and conduction. The heat flux of the air-water interface is a function of location (latitude/longitude and elevation), season, time of day, and meteorological conditions (cloud cover, dew-point, temperature, barometric pressure, and wind).

Light Penetration

Transmission of light through the water column influences primary productivity (phytoplankton and macrophytes), distribution of organisms, and behavior of fish. The reduction of light through the water column of a lake is a function of scattering and absorption. Light transmission is affected by the water surface film, floatable and suspended particulates, turbidity, dense populations of algae and bacteria, and color.

An important parameter based on the transmission of light is the depth to which photosynthetic activity is possible. The minimum light intensity required for photosynthesis has been established to be about 1.0 percent of the incident surface light (Cole, 1979). The portion of the lake from the surface to the depth at which the 1.0 percent intensity occurs is referred to as the "euphotic zone."

Lake Stratification

Lakes in temperate and northern latitudes typically exhibit vertical density stratification during certain seasons of the year. Stratification in lakes is primarily due to temperature differences, although salinity and suspended solids concentrations may also affect density. Typically, three zones of thermal stratification are formed.

The upper layer of warmer, lower density water is termed the "epilimnion," and the lower, stagnant layer of colder, higher density water is termed the "hypolimnion." The transition zone between the epilimnion and the hypolimnion, referred to as the "metalimnion," is characterized by the maximum rate of temperature decline with depth (the thermocline). During stratification, the presence of the thermocline suppresses many of the mass transport phenomena that are otherwise responsible for the vertical transport of water quality constituents within a lake. The aquatic community present in a lake is highly dependent on the thermal structure.

With respect to internal flow structure, three distinct classes of lakes are defined:

- strongly stratified, deep lakes characterized by horizontal isotherms;
- weakly stratified lakes characterized by isotherms that are tilted along the longitudinal axis of the reservoir; and
- non-stratified, completely mixed lakes characterized by isotherms that are essentially vertical.

Retardation of mass transport between the hypolimnion and the epilimnion results in sharply differentiated water quality and biology between the lake strata. One of the most important differences between the layers is often dissolved oxygen. As this is depleted from the hypolimnion without being replenished, life functions of many organisms are impaired, and the biology and biologically mediated reactions fundamental to water quality are altered.

Vertical stratification of a lake with respect to nutrients can also occur. Dissolved nutrients are converted to particulate organic material through photosynthetic processes in the epilimnion in ecologically advanced lakes. This assimilation lowers the ambient nutrient concentrations in the epilimnion. When the algae die and sink to the bottom, nutrients are carried to the hypolimnion where they are released by decomposition.

Temperature also has a direct effect on biology of a lake because most biological processes (e.g., growth, respiration, reproduction, migration, mortality, and decay) are strongly influenced by ambient temperature.

Annual Circulation Pattern and Lake Classification

Lakes can be classified on the basis of their pattern of annual mixing. These classifications are described below.

(1) Amictic - Lakes that never circulate and are permanently covered with ice, primarily in the Antarctic and very high mountains.

(2) Holomictic - Lakes that mix from top to bottom as a result of wind-driven circulation. Several subcategories are defined:

- Oligomictic - Lakes characterized by circulation that is unusual, irregular, and short in duration; generally small to medium tropical lakes or very deep lakes.
- Monomictic - Lakes that undergo one regular circulation per year.
- Dimictic - Lakes that circulate twice a year, in spring and fall, one of the most common types of annual mixing in cool temperate regions such as central and eastern North America.
- Polymictic - Lakes that circulate frequently or continuously, cold lakes that are continually near or slightly above 4°C, or warm equatorial lakes where air temperature changes very little.

(3) Meromictic - Lakes that do not circulate throughout the entire water column. The lower water stratum is perennially stagnant.

Lake Sedimentation

Deposition of sediment received from the surrounding watershed is an important physical process in lakes. Because of the low water velocities through the lake or reservoir, sediments transported by inflowing waters tend to settle out.

Sediment accumulation rates are strongly dependent both on the physiographic characteristics of a specific watershed and on various characteristics of the lake. Prediction of sedimentation rates can be estimated in two basic ways:

- periodic sediment surveys on a lake; and
- estimation of watershed erosion and bed load.

Accumulation of sediment in lakes can, over many years, reduce the life of the water body by reducing the water storage capacity. Sediment flow into the lake also reduces light penetration, eliminates bottom habitat for many plants and

animals, and carries with it adsorbed chemicals and organic matter that settle to the bottom and can be harmful to the ecology of the lake. Where sediment accumulation is a major problem, proper watershed management including erosion and sediment control must be put into effect.

Chemical Characteristics

Freshwater chemistry is discussed in section 2.9.3 and in the *Technical Support Manual, Volume I* (USEPA, 1983c). Therefore, the discussion here will focus on chemical phenomena that are of particular importance to lakes. Nutrient cycling and eutrophication are the primary factors of concern in this discussion, but the effects of pH, dissolved oxygen, and redox potential on lake processes are also involved.

Water chemistry in a lake is closely related to the stages in the annual lake turnover. Once a thermocline has formed, the dissolved oxygen levels in the hypolimnion tend to decline. This occurs because the hypolimnion is isolated from surface waters by the thermocline and there is no mechanism for aeration.

The decay of organic matter and the respiration of fish and other organisms in the hypolimnion serve to deplete DO. Extreme depletion of DO may occur in ice- and snow-covered lakes in which light is insufficient for photosynthesis. If depletion of DO is great enough, fish kills may result. With the depletion of DO, reducing conditions prevail and many compounds that have accumulated in the sediment by precipitation are released to the surrounding water. Chemicals solubilized under such conditions include compounds of nitrogen, phosphorus, iron, manganese, and calcium. Phosphorus and nitrogen are of particular concern because of their role in the eutrophication process in lakes.

Nutrients released from the bottom sediments during stratified conditions are not available to phytoplankton in the epilimnion. However, during overturn periods, mixing of the layers distributes the nutrients throughout the water column. The high nutrient availability is short-lived because the soluble reduced forms are rapidly oxidized to insoluble forms that precipitate out and settle to the bottom. Phosphorus and nitrogen are also deposited through sorption to particles that settle to the bottom and as dead plant material that is added to the sediments.

Of the many raw materials required by aquatic plants (phytoplankton and macrophytes) for growth, carbon, nitrogen, and phosphorus are the most important. Carbon is available from carbon dioxide, which is in almost unlimited supply. Since growth is generally limited by the essential nutrient that is in lowest supply, either nitrogen or phosphorus is usually the limiting nutrient for growth of primary producers. If these nutrients are available in adequate supply, massive algal and macrophyte blooms may occur with severe consequences for the lake. Most commonly in lakes, phosphorus is the limiting nutrient for aquatic plant growth. In these situations, adequate control of phosphorus, particularly from anthropogenic sources, can control growth of aquatic vegetation. Phosphorus can in some cases, be removed from the water column by precipitation, as described in the *Technical Support Manual, Volume III* (USEPA, 1984b).

Eutrophication and Nutrient Cycling

The term "eutrophication" is used in two general ways: (1) eutrophication is defined as the process of nutrient enrichment in a water body; and (2) eutrophication is used to describe the effects of nutrient enrichment, that is, the uncontrolled growth of plants, particularly phytoplankton, in a lake or reservoir. The second use also encompasses changes in the composition of animal communities in the water body. Both uses are commonly found in the literature, and the distinction, if important, must be discerned from the context of use.

Eutrophication is often greatly accelerated by anthropogenic nutrient enrichment, which has been termed "cultural eutrophication." Nutrients are transported to lakes from external sources, and once in the lake, may be recycled internally. A consideration of attainable uses in a lake must include an understanding of the sources of nitrogen and phosphorus, the significance of internal cycling, especially of phosphorus, and the changes that might be anticipated if eutrophication could be controlled.

Significance of Chemical Phenomena to Use Attainability

The most critical water quality indicators for aquatic use attainment in a lake are DO, nutrients, chlorophyll-a, and toxicants. In evaluating use attainability, the relative importance of three forms of oxygen demand should be considered: respiratory demand of phytoplankton and macrophytes during non-photosynthetic periods, water column demand, and benthic demand. If use impairment is occurring, assessments of the significance of each oxygen sink can be useful in evaluating the feasibility of achieving sufficient pollution control, or in implementing the best internal nutrient management practices to attain a designated use.

Chlorophyll-a is a good indicator of algal concentrations and of nutrient overenrichment. Excessive phytoplankton concentrations, as indicated by high chlorophyll-a levels, can cause adverse DO impacts such as:

- wide diurnal variation in surface DO due to daytime photosynthesis and nighttime respiration, and

- depletion of bottom DO through the decomposition of dead algae.

As discussed previously, nitrogen and phosphorus are the nutrients of concern in most lake systems, particularly where anthropogenic sources result in increased nutrient loading. It is important to base control strategies on an understanding of the sources of each type of nutrient, both in the lake and in its feeder streams.

Also, the presence of toxics such as pesticides, herbicides, and heavy metals in sediments or the water column should by considered in evaluating uses. These pollutants may prevent the attainment of uses (particularly those related to fish propagation and maintenance in water bodies) that would otherwise be supported by the water quality criteria for DO and other parameters.

Biological Characteristics

A major concern for lake biology is the eutrophication due to anthropogenic sources of nutrients. The increased presence of nutrients may result in phytoplankton blooms that can, in turn, have adverse impacts on other components of the biological community. A general trend that results from eutrophication is an increase in numbers of organisms but a decrease in diversity of species, particularly among nonmotile species. The biological characteristics of lakes are discussed in more detail in the *Technical Support Manual, Volume III.*

Techniques for Use Attainability Evaluations

Techniques for use attainability evaluations of lakes are discussed in detail in the *Technical Support Manual, Volume III.* Several empirical (desktop) and simulation (computer-based mathematical) models that can be used to characterize and evaluate lakes for use attainability are presented in that document and will not be included here owing to the complexity of the subject.

CHAPTER 3

WATER QUALITY CRITERIA

(40 CFR 131.11)

Table of Contents

CHAPTER 3
WATER QUALITY CRITERIA

The term "water quality criteria" has two different definitions under the Clean Water Act (CWA). Under section 304(a), EPA publishes water quality criteria that consist of scientific information regarding concentrations of specific chemicals or levels of parameters in water that protect aquatic life and human health (see section 3.1 of this Handbook). The States may use these contents as the basis for developing enforceable water quality standards. Water quality criteria are also elements of State water quality standards adopted under section 303(c) of the CWA (see sections 3.2 through 3.6 of this Handbook). States are required to adopt water quality criteria that will protect the designated use(s) of a water body. These criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use.

3.1 EPA Section 304(a) Guidance

EPA and a predecessor agency have produced a series of scientific water quality criteria guidance documents. Early Federal efforts were the "Green Book" (FWPCA, 1968) and the "Red Book" (USEPA, 1976). EPA also sponsored a contract effort that resulted in the "Blue Book" (NAS/NAE, 1973). These early efforts were premised on the use of literature reviews and the collective scientific judgment of Agency and advisory panels. However, when faced with the need to develop criteria for human health as well as aquatic life, the Agency determined that new procedures were necessary. Continued reliance solely on existing scientific literature was deemed inadequate because essential information was not available for many pollutants. EPA scientists developed formal methodologies for establishing scientifically defensible criteria. These were subjected to review by the Agency's Science Advisory Board of outside experts and the public. This effort culminated on November 28, 1980, when the Agency published criteria development guidelines for aquatic life and for human health, along with criteria for 64 toxic pollutants (USEPA, 1980a,b). Since that initial publication, the aquatic life methodology was amended (Appendix H), and additional criteria were proposed for public comment and finalized as Agency criteria guidance. EPA summarized the available criteria information in the "*Gold Book*" (USEPA, 1986a), which is updated from time to time. However, the individual criteria documents (see Appendix I), as updated, are the official guidance documents.

EPA's criteria documents provide a comprehensive toxicological evaluation of each chemical. For toxic pollutants, the documents tabulate the relevant acute and chronic toxicity information for aquatic life and derive the criteria maximum concentrations (acute criteria) and criteria continuous concentrations (chronic criteria) that the Agency recommends to protect aquatic life resources. The methodologies for these processes are described in Appendices H and J and outlined in sections 3.1.2 and 3.1.3 of this Handbook.

3.1.1 State Use of EPA Criteria Documents

EPA's water quality criteria documents are available to assist States in:

- adopting water quality standards that include appropriate numeric water quality criteria;
- interpreting existing water quality standards that include narrative "no toxics in toxic amounts" criteria;

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- making listing decisions under section 304(1) of the CWA;
- writing water quality-based NPDES permits and individual control strategies; and
- providing certification under section 401 of the CWA for any Federal permit or license (e.g., EPA-issued NPDES permits, CWA section 404 permits, or Federal Energy Regulatory Commission licenses).

In these situations, States have primary authority to determine the appropriate level to protect human health or welfare (in accordance with section 303(c)(2) of the CWA) for each water body. However, under the Clean Water Act, EPA must also review and approve State water quality standards; section 304(1) listing decisions and draft and final State-issued individual control strategies; and in States where EPA writes NPDES permits, EPA must develop appropriate water quality-based permit limitations. The States and EPA therefore have a strong interest in assuring that the decisions are legally defensible, are based on the best information available, and are subject to full and meaningful public comment and participation. It is very important that each decision be supported by an adequate record. Such a record is critical to meaningful comment, EPA's review of the State's decision, and any subsequent administrative or judicial review.

Any human health criterion for a toxicant is based on at least three interrelated considerations:

- cancer potency or systemic toxicity,
- exposure, and
- risk characterization.

States may make their own judgments on each of these factors within reasonable scientific bounds, but documentation to support their judgments, when different from EPA's recommendation, must be clear and in the public record. If a State relies on EPA's section 304(a) criteria document (or other EPA documents), the State may reference and rely on the data in these documents and need not create duplicative or new material for inclusion in their records. However, where site-specific issues arise or the State decides to adopt an approach to any one of these three factors that differs from the approach in EPA's criteria document, the State must explain its reasons in a manner sufficient for a reviewer to determine that the approach chosen is based on sound scientific rationale (40 CFR 131.11(b)).

3.1.2 Criteria for Aquatic Life Protection

The development of national numerical water quality criteria for the protection of aquatic organisms is a complex process that uses information from many areas of aquatic toxicology. (See Appendix H for a detailed discussion of this process.) After a decision is made that a national criterion is needed for a particular material, all available information concerning toxicity to, and bioaccumulation by, aquatic organisms is collected and reviewed for acceptability. If enough acceptable data for 48- to 96-hour toxicity tests on aquatic plants and animals are available, they are used to derive the acute criterion. If sufficient data on the ratio of acute to chronic toxicity concentrations are available, they are used to derive the chronic or long-term exposure criteria. If justified, one or both of the criteria may be related to other water quality characteristics, such as pH, temperature, or hardness. Separate criteria are developed for fresh and salt waters.

The Water Quality Standards Regulation allows States to develop numerical criteria or modify

EPA's recommended criteria to account for site-specific or other scientifically defensible factors. Guidance on modifying national criteria is found in sections 3.6 and 3.7. When a criterion must be developed for a chemical for which a national criterion has not been established, the regulatory authority should refer to the EPA guidelines (Appendix H).

Magnitude for Aquatic Life Criteria

Water quality criteria for aquatic life contain two expressions of allowable magnitude: a criterion maximum concentration (CMC) to protect against acute (short-term) effects; and a criterion continuous concentration (CCC) to protect against chronic (long-term) effects. EPA derives acute criteria from 48- to 96-hour tests of lethality or immobilization. EPA derives chronic criteria from longer term (often greater than 28-day) tests that measure survival, growth, or reproduction. Where appropriate, the calculated criteria may be lowered to be protective ofcomercially or recreationally important species.

Duration for Aquatic Life Criteria

The quality of an ambient water typically varies in response to variations of effluent quality, stream flow, and other factors. Organisms in the receiving water are not experiencing constant, steady exposure but rather are experiencing fluctuating exposures, including periods of high concentrations, which may have adverse effects. Thus, EPA's criteria indicate a time period over which exposure is to be averaged, as well as an upper limit on the average concentration, thereby limiting the duration of exposure to elevated concentrations. For acute criteria, EPA recommends an averaging period of 1 hour. That is, to protect against acute effects, the 1-hour average exposure should not exceed the CMC. For chronic criteria, EPA recommends an averaging period of 4 days. That is, the 4-day average exposure should not exceed the CCC.

Frequency for Aquatic Life Criteria

To predict or ascertain the attainment of criteria, it is necessary to specify the allowable frequency for exceeding the criteria. This is because it is statistically impossible to project that criteria will never be exceeded. As ecological communities are naturally subjected to a series of stresses, the allowable frequency of pollutant stress may be set at a value that does not significantly increase the frequency or severity of all stresses combined.

EPA recommends an average frequency for excursions of both acute and chronic criteria not to exceed once in 3 years. In all cases, the recommended frequency applies to actual ambient concentrations, and excludes the influence of measurement imprecision. EPA established its recommended frequency as part of its guidelines for deriving criteria (Appendix H). EPA selected the 3-year average frequency of criteria exceedence with the intent of providing for ecological recovery from a variety of severe stresses. This return interval is roughly equivalent to a 7Q10 design flow condition. Because of the nature of the ecological recovery studies available, the severity of criteria excursions could not be rigorously related to the resulting ecological impacts. Nevertheless, EPA derives its criteria intending that a single marginal criteria excursion (i.e., a slight excursion over a 1-hour period for acute or over a 4-day period for chronic) would require little or no time for recovery. If the frequency of marginal criteria excursions is not high, it can be shown that the frequency of severe stresses, requiring measurable recovery periods, would be extremely small. EPA thus expects the 3-year return interval to provide a very high degree of protection.

3.1.3 Criteria for Human Health Protection

This section reviews EPA's procedures used to develop assessments of human health effects in developing water quality criteria and reference ambient concentrations. A more complete human health effects discussion is included in the *Guidelines and Methodology Used in the*

Preparation of Health Effects Assessment Chapters of the Consent Decree Water Documents (Appendix J). The procedures contained in this document are used in the development and updating of EPA water quality criteria and may be used in updating State criteria and in developing State criteria for those pollutants lacking EPA human health criteria. The procedures may also be applied as site-specific interpretations of narrative standards and as a basis for permit limits under 40 CFR 122.44 (d)(1)(vi).

Magnitude and Duration

Water quality criteria for human health contain only a single expression of allowable magnitude; a criterion concentration generally to protect against long-term (chronic) human health effects. Currently, national policy and prevailing opinion in the expert community establish that the duration for human health criteria for carcinogens should be derived assuming lifetime exposure, taken to be a 70-year time period. The duration of exposure assumed in deriving criteria for noncarcinogens is more complicated owing to a wide variety of endpoints: some developmental (and thus age-specific and perhaps gender-specific), some lifetime, and some, such as organoleptic effects, not duration-related at all. Thus, appropriate durations depend on the individual noncarcinogenic pollutants and the endpoints or adverse effects being considered.

Human Exposure Considerations

A complete human exposure evaluation for toxic pollutants of concern for bioaccumulation would encompass not only estimates of exposures due to fish consumption but also exposure from background concentrations and other exposure routes, The more important of these include recreational and occupational contact, dietary intake from other than fish, intake from air inhalation, and drinking water consumption. For section 304(a) criteria development, EPA typically considers only exposures to a pollutant that occur through the ingestion of water and contaminated fish and shellfish. This is the exposure default assumption, although the human health guidelines provide for considering other sources where data are available (see 45 F.R. 79354). Thus the criteria are based on an assessment of risks related to the surface water exposure route only (57 F.R. 60862-3).

The consumption of contaminated fish tissue is of serious concern because the presence of even extremely low ambient concentrations of bioaccumulative pollutants (sublethal to aquatic life) in surface waters can result in residue concentrations in fish tissue that can pose a human health risk. Other exposure route information should be considered and incorporated in human exposure evaluations to the extent available.

Levels of actual human exposures from consuming contaminated fish vary depending upon a number of case-specific consumption factors. These factors include type of fish species consumed, type of fish tissue consumed, tissue lipid content, consumption rate and pattern, and food preparation practices. In addition, depending on the spatial variability in the fishery area, the behavior of the fish species, and the point of application of the criterion, the average exposure of fish may be only a small fraction of the expected exposure at the point of application of the criterion. If an effluent attracts fish, the average exposure might be greater than the expected exposure.

With shellfish, such as oysters, snails, and mussels, whole-body tissue consumption commonly occurs, whereas with fish, muscle tissue and roe are most commonly eaten. This difference in the types of tissues consumed has implications for the amount of available bioaccumulative contaminants likely to be ingested. Whole-body shellfish consumption presumably means ingestion of the entire burden of bioaccumulative contaminants. However, with most fish, selective cleaning and removal of internal organs, and sometimes body fat as well, from edible tissues, may result in removal of much of the lipid material in which bioaccumulative contaminants tend to concentrate.

Fish Consumption Values

EPA's human health criteria have assumed a human body weight of 70 kg and the consumption of 6.5 g of fish and shellfish per day. Based on data collected in 1973-74, the national per capita consumption of freshwater and estuarine fish was estimated to average 6.5 g/day. Per capita consumption of all seafood (including marine species) was estimated to average 14.3 g/day. The 95th percentile for consumption of all seafood by individuals over a period of 1 month was estimated to be 42 g/day. The mean lipid content of fish and shellfish tissue consumed in this study was estimated to be 3.0 percent (USEPA, 1980c).

Currently, four levels of fish and shellfish consumption are provided in EPA guidance (USEPA, 1991a):

- 6.5 g/day to represent an estimate of average consumption of fish and shellfish from estuarine and freshwaters by the entire U.S. population. This consumption level is based on the average of both consumers and nonconsumers of.
- 20 g/day to represent an estimate of the average consumption of fish and shellfish from marine, estuarine, and freshwaters by the U.S. population. This average consumption level also includes both consumers and nonconsumers of.
- 165 g/day to represent consumption of fish and shellfish from marine, estuarine, and freshwaters by the 99.9th percentile of the U.S. population consuming the most fish or seafood.
- 180 g/day to represent a "reasonable worst case" based on the assumption that some individuals would consume fishand shellfish at a rate equal to the combined consumption of red meat, poultry, fish, and shellfish in the United States.

EPA is currently updating the national estuarine and freshwater fish and shellfish consumption default values and will provide a range of recommended national consumption values. This range will include:

- mean values appropriate to the population at large; and
- values appropriate for those individuals who consume a relatively large proportion of fish and shellfish in their diets (maximally exposed individuals).

Many States use EPA's 6.5 g/day consumption value. However, some States use the above-mentioned 20 g/day value and, for saltwaters, 37 g/day. In general, EPA recommends that the consumption values used in deriving criteria from the formulas in this chapter reflect the most current, relevant, and/or site-specific information available.

Bioaccumulation Considerations

The ratio of the contaminant concentrations in fish tissue versus that in water is termed either the bioconcentration factor (BCF) or the bioaccumulation factor (BAF). Bioconcentration is defined as involving contaminant uptake from water only (not from food). The bioaccumulation factor (BAF) is defined similarly to the BCF except that it includes contaminant uptake from both water and food. Under laboratory conditions, measurements of tissue/water partitioning are generally considered to involve uptake from water only. On the other hand, both processes are likely to apply in the field since the entire food chain is exposed.

The BAF/BCF ratio ranges from 1 to 100, with the highest ratios applying to organisms in higher trophic levels, and to chemicals with logarithm of the octanol-water partitioning coefficient (log P) close to 6.5.

Bioaccumulation considerations are integrated into the criteria equations by using food chain multipliers (FMs) in conjunction with the BCF. The bioaccumulation and bioconcentration factors for a chemical are related as follows:

$$BAF = FM \times BCF$$

By incorporating the FM and BCF terms into the criteria equations, bioaccumulation can be addressed.

In Table 3-1, FM values derived from the work of Thomann (1987, 1989) are listed according to log P value and trophic level of the organism. For chemicals with log P values greater than about 7, there is additional uncertainty regarding the degree of bioaccumulation, but generally, trophic level effects appear to decrease due to slow transport kinetics of these chemicals in fish, the growth rate of the fish, and the chemical's relatively low bioavailability. Trophic level 4 organisms are typically the most desirable species for sport fishing and, therefore, FMs for trophic level 4 should generally be used in the equations for calculating criteria. In those very rare situations where only lower trophic level organisms are found, e.g., possibly oyster beds, an FM for a lower trophic level might be considered.

Measured BAFs (especially for those chemicals with log P values above 6.5) reported in the literature should be used when available. To use experimentally measured BAFs in calculating the criterion, the (FM x BCF) term is replaced by the BAF in the equations in the following section. Relatively few BAFs have been measured accurately and reported, and their application to sites other than the specific ecosystem where they were developed is problematic and subject to uncertainty. The option is also available to develop BAFs experimentally, but this will be extremely resource intensive if done on a site-specific basis with all the necessary experimental and quality controls.

	Trophic Levels		
Log P	2	3	4
3.5	1.0	1.0	1.0
3.6	1.0	1.0	1.0
3.7	1.0	1.0	1.0
3.8	1.0	1.0	1.0
3.9	1.0	1.0	1.0
4.0	1.1	1.0	1.0
4.1	1.1	1.1	1.1
4.2	1.1	1.1	1.1
4.3	1.1	1.1	1.1
4.4	1.2	1.1	1.1
4.5	1.2	1.2	1.2
4.6	1.2	1.3	1.3
4.7	1.3	1.4	1.4
4.8	1.4	1.5	1.6
4.9	1.5	1.8	2.0
5.0	1.6	2.1	2.6
5.1	1.7	2.5	3.2
5.2	1.9	3.0	4.3
5.3	2.2	3.7	5.8
5.4	2.4	4.6	8.0
5.5	2.8	5.9	11
5.6	3.3	7.5	16
5.7	3.9	9.8	23
5.8	4.6	13	33
5.9	5.6	17	47
6.0	6.8	21	67
6.1	8.2	25	75
6.2	10	29	84
6.3	13	34	92
6.4	15	39	98
6.5	19	45	100
≥6.5	19.2*	45*	100*

* These recommended FMs are conservative estimates; FMs for log P values greater than 6.5 may range from the values given to as low as 0.1 for contaminants with very low bioavailability.

Table 3-1. Estimated Food Chain Multipliers (FMs)

Updating Human Health Criteria Using IRIS

EPA recommends that States use the most current risk information in the process of updating human health criteria. The Integrated Risk Information System (IRIS) (Barns and Dourson, 1988; Appendix N) is an electronic data base of the USEPA that provides chemical-specific risk information on the relationship between chemical exposure and estimated human health effects. Risk assessment information contained in IRIS, except as specifically noted, has been reviewed and agreed upon by an interdisciplinary group of scientists representing various Program Offices within the Agency and represent an Agency-wide consensus. Risk assessment information and values are updated on a monthly basis and are approved for Agency-wide use. IRIS is intended to make risk assessment information readily available to those individuals who must perform risk assessments and also to increase consistency among risk assessment/risk management decisions.

IRIS contains two types of quantitative risks values: the oral Reference Dose (RfD) and the carcinogenic potency estimate or slope factor. The RfD (formerly known as the acceptable daily intake or ADI) is the human health hazard assessment for noncarcinogenic (target organ) effects. The carcinogenic potency estimate (formerly known as q_1*) represents the upper bound cancer-causing potential resulting from lifetime exposure to a substance. The RfD or the oral carcinogenic potency estimate is used in the derivation of EPA human health criteria.

EPA periodically updates risk assessment information, including RfDs, cancer potency estimates, and related information on contaminant effects, and reports the current information on IRIS. Since IRIS contains the Agency's most recent quantitative risk assessment values, current IRIS values should be used by States in updating or developing new human health criteria. This means that the 1980 human health criteria should be updated with the latest IRIS values. The procedure for deriving an updated human health water quality criterion would require inserting the current Rfd or carcinogenic potency estimate on IRIS into the equations in Exhibit 3.1 or 3.2, as appropriate.

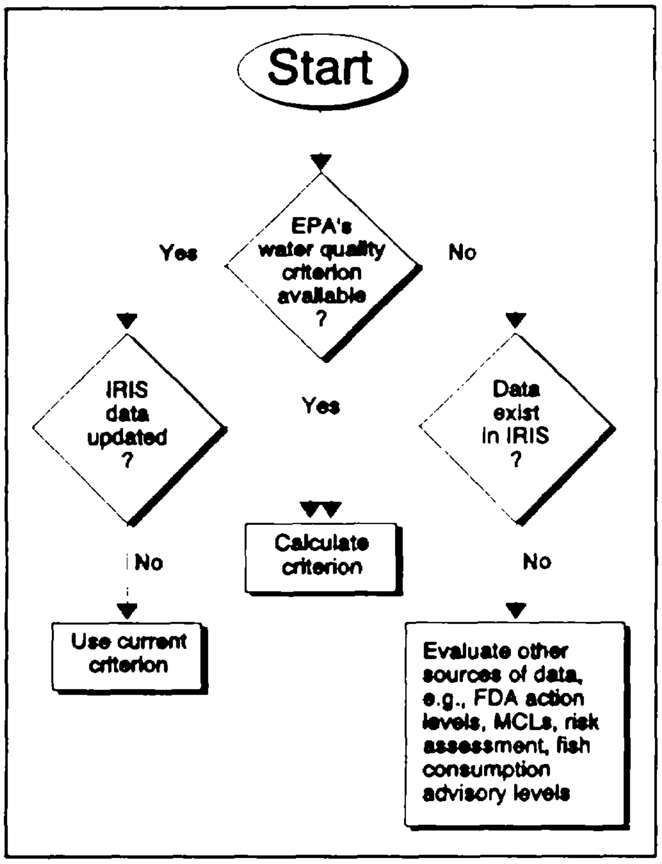


Figure 3-1. Procedure for determining an updated criterion using IRIS data.

Figure 3-1 shows the procedure for determining an updated criterion using IRIS data. If a chemical has both carcinogenic and non-carcinogenic effects, i.e., both a cancer potency estimate and a RfD, both criteria should be calculated. The most stringent criterion applies.

Calculating Criteria for Non-carcinogens

The RfD is an estimate of the daily exposure to the human population that is likely to be without appreciable risk of causing deleterious effects during a lifetime. The RfD is expressed in units of mg toxicant per kg human body weight per day.

RfDs are derived from the "no-observed-adverse-effect level" (NOAEL) or the "lowest-observed-adverse-effect level" (LOAEL) identified from chronic or subchronic human epidemiology studies or animal exposure studies. (Note: "LOAEL" and "NOAEL" refer to animal and human toxicology and are therefore distinct from the aquatic toxicity terms "no-observed-effect concentration" (NOEC) and "lowest-observed-effect concentration" (LOEC).) Uncertainty factors are then applied to the NOAEL or LOAEL to account for uncertainties in the data associated with variability among individuals, extrapolation from nonhuman test species to humans, data on other than long-term exposures, and the use of a LOAEL (USEPA, 1988a). An additional uncertainty factor may be applied to account for significant weakness or gaps in the database.

The RfD is a threshold below which systemic toxic effects are unlikely to occur. While exposures above the RfD increase the probability of adverse effects, they do not produce a certainty of adverse effects. Similarly, while exposure at or below the RfD reduces the probability, it does not guarantee the absence of effects in all persons. The RfDs contained in IRIS are values that represent EPA's consensus (and have uncertainty spanning perhaps an order of magnitude). This means an RfD of 1.0 mg/kg/day could range from 0.3 to 3.0 mg/kg/day.

For noncarcinogenic effects, an updated criterion can be derived using the equation in Exhibit 3-1.

If the receiving water body is not used as a drinking water source, the factor WI can be deleted. Where dietary and/or inhalation exposure values are unknown, these factors may be deleted from the above calculation.

Calculating Criteria for Carcinogens

Any human health criterion for a carcinogen is based on at least three interrelated considerations: cancer potency, exposure, and risk characterization. When developing State criteria, States may make their own judgments on each of these factors within reasonable scientific bounds, but documentation to support their judgments must be clear and in the public record.

Maximum protection of human health from the potential effects of exposure to carcinogens through the consumption of contaminated fish and/or other aquatic life would require a criterion of zero. The zero level is based upon the assumption of non-threshold effects (i.e., no safe level exists below which any increase in exposure does not result in an increased risk of cancer) for carcinogens. However, because a publicly acceptable policy for safety does not require the absence of all risk, a numerical estimate of pollutant concentration (in μg/l) which corresponds to a given level of risk for a population of a specified size is selected instead. A cancer risk level is defined as the number of new cancers that may result in a population of specified size due to an increase in exposure (e.g., 10^{-6} risk level = 1 additional cancer in a population of 1 million). Cancer risk is calculated by multiplying the experimentally derived cancer potency estimate by the concentration of the chemical in the fish and the average daily human consumption of contaminated fish. The risk for a specified population (e.g., 1 million people or 10^{-6}) is then calculated by dividing the risk level by the specific cancer risk. EPA's ambient water quality criteria documents provide risk levels ranging from 10^{-5} to 10^{-7} as examples.

The cancer potency estimate, or slope factor (formerly known as the q_1*), is derived using animal studies. High-dose exposures are extrapolated to low-dose concentrations and adjusted to a lifetime exposure period through the use of a linearized multistage model. The model calculates the upper 95 percent confidence limit of the slope of a straight line which the model postulates to occur at low doses. When based on human (epidemiological) data, the slope factor is based on the observed increase in cancer risk and is not extrapolated. For deriving criteria for carcinogens, the oral cancer potency estimates or slope factors from IRIS are used.

It is important to note that cancer potency factors may overestimate or underestimate the actual risk. Such potency estimates are subject to great uncertainty because of two primary factors:

$$C\ (mg/l) = \frac{(RfD \times WT) - (DT + IN) \times WT}{WI + [FC \times L \times FM \times BCF]}$$

where:

C	=	updated water quality criterion (mg/l)
RfD	=	oral reference dose (mg toxicant/kg human body weight/day)
WT	=	weight of an average human adult (70 kg)
DT	=	dietary exposure (other than fish) (mg toxicant/kg body human weight/day)
IN	=	inhalation exposure (mg toxicant/kg body human weight/day)
WI	=	average human adult water intake (2 l/day)
FC	=	daily fish consumption (kg fish/day)
L	=	ratio of lipid fraction of fish tissue consumed to 3%
FM	=	food chain multiplier (from Table 3-1)
BCF	=	bioconcentration factor (mg toxicant/kg fish divided by mg toxicant/L water) for fish with 3% lipid content

Exhibit 3-1. Equation for Deriving Human Health Criteria Based on Noncarcinogenic Effects

- adequacy of the cancer data base (i.e., human vs. animal data); and
- limited information regarding the mechanism of cancer causation.

Risk levels of 10^{-5}, 10^{-6}, and 10^{-7} are often used by States as minimal risk levels in interpreting their standards. EPA considers risks to be additive, i.e., the risk from individual chemicals is not necessarily the overall risk from exposure to water. For example, an individual risk level of 10^{-6} may yield a higher overall risk level if multiple carcinogenic chemicals are present.

For carcinogenic effects, the criterion can be determined by using the equation in Exhibit 3-2. If the receiving water body is not designated as a drinking water source, the factor WI can be deleted.

Deriving Quantitative Risk Assessments in the Absence of IRIS Values

The RfDs or cancer potency estimates comprise the existing dose-response factors for developing criteria. When IRIS data are unavailable, quantitative risk level information may be developed according to a State's own procedures. Some States have established their own procedures whereby dose-response factors can be developed based upon extrapolation of acute and/or chronic animal data to concentrations of exposure protective of fish consumption by

$$C\ (mg/l) = \frac{(RL \times WT)}{q_1^*\ [WI + FC \times L \times (FM \times BCF)]}$$

where:

C	=	updated water quality criterion (mg/l)
RL	=	risk level (10^{-x}) where x is usually in the range of 4 to 6
WT	=	weight of an average human adult (70 kg)
q_1^*	=	carcinogenic potency factor (kg day/mg)
WI	=	average human adult water intake (2 l/day)
FC	=	daily fish consumption (kg fish/day)
L	=	ratio of lipid fraction of fish tissue consumed to 3% assumed by EPA
FM	=	food chain multiplier (from Table 3-1)
BCF	=	bioconcentration factor (mg toxicant/kg fish divided by mg toxicant/L water) for fish with 3% lipid content

Exhibit 3-2. Equation for Deriving Human Health Criteria Based on Carcinogenic Effects

humans.

3.2 Relationship of Section 304(a) Criteria to State Designated Uses

The section 304(a)(1) criteria published by EPA from time to time can be used to support the designated uses found in State standards. The following sections briefly discuss the relationship between certain criteria and individual use classifications. Additional information on this subject also can be found in the "Green Book" (FWPCA, 1968); the "Blue Book" (NAS/NAE, 1973); the "Red Book" USEPA, 1976); the EPA *Water Quality Criteria Documents* (see Appendix I); the"Gold Book" (USEPA, 1986a); and future EPA section 304(a)(1) water quality criteria publications.

Where a water body is designated for more than one use, criteria necessary to protect the most sensitive use must be applied. The following four sections discuss the major types of use categories.

3.2.1 Recreation

Recreational uses of water include activities such as swimming, wading, boating, and fishing. Often insufficient data exist on the human health effects of physical and chemical pollutants, including most toxics, to make a determination of criteria for recreational uses. However, as a general guideline, recreational waters that contain chemicals in concentrations toxic or otherwise harmful to man if ingested, or irritating to the skin or mucous membranes of the human body upon brief immersion, should be avoided. The section 304(a)(1) human health effects criteria based on direct human drinking water intake and fish consumption might provide useful guidance in these circumstances. Also, section 304(a)(1) criteria based on human health effects may be used to support this designated use where fishing is included in the State definition of "recreation." In this latter situation, only the portion of the criterion based on fish consumption should be used. Section 304(a)(1) criteria to protect recreational uses are also available for certain physical, microbiological, and narrative "free from" aesthetic criteria.

Research regarding bacteriological indicators has resulted in EPA recommending that States use *Escherichia coli* or enterococci as indicators of recreational water quality (USEPA, 1986b) rather than fecal coliform because of the better correlation with gastroenteritis in swimmers.

The "Green Book" and "Blue Book" provide additional information on protecting recreational uses such as pH criteria to prevent eye irritation and microbiological criteria based on aesthetic considerations.

3.2.2 Aquatic Life

The section 304(a)(1) criteria for aquatic life should be used directly to support this designated use. If subcategories of this use are adopted (e.g., to differentiate between coldwater and warmwater fisheries), then appropriate criteria should be set to reflect the varying needs of such subcategories.

3.2.3 Agricultural and Industrial Uses

The "Green Book" (FWPCA, 1968) and "Blue Book" (NAS/NAE, 1973) provide some information on protecting agricultural and industrial uses. Section 304(a)(1) criteria for protecting these uses have not been specifically developed for numerous parameters pertaining to these uses, including most toxics. Where criteria have not been specifically developed for these uses, the criteria developed for human health and aquatic life are usually sufficiently stringent to protect these uses. States may also establish criteria specifically designed to protect these uses.

3.2.4 Public Water Supply

The drinking water exposure component of the section 304(a)(1) criteria based on human health effects can apply directly to this use classification. The criteria also may be appropriately modified depending upon whether the specific water supply system falls within the auspices of the Safe Drinking Water Act's (SDWA) regulatory control and the type and level of treatment imposed upon the supply before delivery to the consumer. The SDWA controls the presence of contaminants in finished ("at-the-tap") drinking water.

A brief description of relevant sections of the SDWA is necessary to explain how the Act will work in conjunction with section 304(a)(1) criteria in protecting human health from the effects of toxics due to consumption of water. Pursuant to section 1412 of the SDWA, EPA has promulgated "National Primary Drinking Water Standards" for certain radionuclide, microbiological, organic, and inorganic substances. These standards establish maximum contaminant levels (MCLs), which specify the maximum permissible level of a contaminant in water that may be delivered to a user of a public water system now defined as serving a minimum of 25 people. MCLs are established based on consideration of a range of factors including not only the health effects of the contaminants but also treatment capability, monitoring availability, and costs. Under section 1401(1)(D)(i) of the SDWA, EPA is also allowed to establish the minimum quality criteria for water that may be taken into a public water supply system.

Section 304(a)(1) criteria provide estimates of pollutant concentrations protective of human health, but do not consider treatment technology, costs, and other feasibility factors. The section

304(a)(1) criteria also include fish bioaccumulation and consumption factors in addition to direct human drinking water intake. These numbers were not developed to serve as "at-the-tap" drinking water standards, and they have no regulatory significance under the SDWA. Drinking water standards are established based on considerations, including technological and economic feasibility, not relevant to section 304(a)(1) criteria. Section 304(a)(1) criteria are more analogous to the maximum contaminant level goals (MCLGs) (previously known as RMCLs) under section 1412(b)(1)(B) of the SDWA in which, based upon a report from the National Academy of Sciences, the Administrator should set target levels for contaminants in drinking water at which "no known or anticipated adverse effects occur and which allow an adequate margin of safety." MCLGs do not take treatment, cost, and other feasibility factors into consideration. Section 304(a)(1) criteria are, in concept, related to the health-based goals specified in the MCLGs.

MCLs of the SDWA, where they exist, control toxic chemicals in finished drinking water. However, because of variations in treatment, ambient water criteria may be used by the States as a supplement to SDWA regulations. When setting water quality criteria for public water supplies, States have the option of applying MCLs, section 304(a)(1) human health effects criteria, modified section 304(a)(1) criteria, or controls more stringent than these three to protect against the effects of contaminants by ingestion from drinking water.

For treated drinking water supplies serving 25 people or greater, States must control contaminants down to levels at least as stringent as MCLs (where they exist for the pollutants of concern) in the finished drinking water. However, States also have the options to control toxics in the ambient water by choosing section 304(a)(1) criteria, adjusted section 304(a)(1) criteria resulting from the reduction of the direct drinking water exposure component in the criteria calculation to the extent that the treatment process reduces the level of pollutants, or a more stringent contaminant level than the former three options.

3.3 State Criteria Requirements

Section 131.11(a)(1) of the Regulation requires States to adopt water quality criteria to protect the designated use(s). The State criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use(s). For waters with multiple use designations, the criteria must support the most sensitive use.

In section 131.11, States are encouraged to adopt both numeric and narrative criteria. Aquatic life criteria should protect against both short-term (acute) and long-term (chronic) effects. Numeric criteria are particularly important where the cause of toxicity is known or for protection against pollutants with potential human health impacts or bioaccumulation potential. Numeric water quality criteria may also be the best way to address nonpoint source pollution problems. Narrative criteria can be the basis for limiting toxicity in waste discharges where a specific pollutant can be identified as causing or contributing to the toxicity but where there are no numeric criteria in the State standards. Narrative criteria also can be used where toxicity cannot be traced to a particular pollutant.

Section 131.11(a)(2) requires States to develop implementation procedures which explain how the State will ensure that narrative toxics criteria are met.

To more fully protect aquatic habitats, it is EPA's policy that States fully integrate chemical-specific, whole-effluent, and biological assessment approaches in State water quality programs (see Appendix R). Specifically, each of these three methods can provide a valid assessment of <u>non-attainment</u> of designated aquatic life uses but can rarely demonstrate use <u>attainment</u> separately. Therefore, EPA supports a policy of independent application of these three water quality assessment approaches. Independent application means that the validity of the results of any one of the approaches does not depend on confirmation by one or both of the other methods. This policy is based on the unique attributes, limitations, and program applications of each of the three approaches. Each method alone can provide valid and independently sufficient evidence of non-attainment of water quality standards, irrespective of any evidence, or lack thereof, derived from the other two approaches. The failure of one method to confirm impacts identified by another method does not negate the results of the initial assessment.

It is also EPA's policy that States should designate aquatic life uses that appropriately address biological integrity and adopt biological criteria necessary to protect those uses (see section 3.5.3 and Appendices C, K, and R).

3.4 Criteria for Toxicants

Applicable requirements for State adoption of water quality criteria for toxicants vary depending upon the toxicant. The reason for this is that the 1983 Water Quality Standards Regulation (Appendix A) and the Water Quality Act of 1987 which amended the Clean Water Act (Public Law 100-4) include more specific requirements for the particular toxicants listed pursuant to CWA section 307(a). For regulatory purposes, EPA has translated the 65 compounds and families of compounds listed pursuant to section 307(a) into 126 more specific substances, which EPA refers to as "priority toxic pollutants." The 126 priority toxic pollutants are listed in the WQS regulation and in Appendix P of this Handbook. Because of the more specific requirements for priority toxic pollutants, it is convenient to organize the requirements applicable to State adoption of criteria for toxicants into three categories:

- requirements applicable to priority toxic pollutants that have been the subject of CWA section 304(a)(1) criteria guidance (see section 3.4.1);
- requirements applicable to priority toxic pollutants that have not been the subject of CWA section 304(a)(1) criteria guidance (see section 3.4.1); and
- requirements applicable to all other toxicants (e.g., non-conventional pollutants like ammonia and chlorine) (see section 3.4.2).

3.4.1 Priority Toxic Pollutant Criteria

The criteria requirements applicable to priority toxic pollutants (i.e., the first two categories above) are specified in CWA section 303(c)(2)(B). Section 303(c)(2)(B), as added by the Water Quality Act of 1987, provides that:

> Whenever a State reviews water quality standards pursuant to paragraph (1) of this subsection, or revises or adopts new standards pursuant to this paragraph, such State shall adopt criteria for all toxic pollutants listed pursuant to section 307(a)(1) of this Act for which criteria have been published under section 304(a), the discharge or presence of which in the affected waters could reasonably be expected to interfere with those designated uses adopted by the State, as necessary to support such designated uses. Such criteria shall be specific numerical criteria for such toxic pollutants. Where such numerical criteria are not available, whenever a State reviews water quality standards pursuant to paragraph (1), or revises or adopts new standards pursuant to this paragraph, such State shall adopt criteria based on biological monitoring or assessment methods consistent with information published pursuant to section 304(a)(8). Nothing in this section shall be construed to limit or delay the use of effluent limitations or other permit conditions based on or involving biological monitoring or assessment

methods or previously adopted numerical criteria.

EPA, in devising guidance for section 303(c)(2)(B), attempted to provide States with the maximum flexibility that complied with the express statutory language but also with the overriding congressional objective: prompt adoption and implementation of numeric toxics criteria. EPA believed that flexibility was important so that each State could comply with section 303(c)(2)(B) and to the extent possible, accommodate its existing water quality standards regulatory approach.

General Requirements

To carry out the requirements of section 303(c)(2)(B), whenever a State revises its water quality standards, it must review all available information and data to first determine whether the discharge or the presence of a toxic pollutant is interfering with or is likely to interfere with the attainment of the designated uses of any water body segment.

If the data indicate that it is reasonable to expect the toxic pollutant to interfere with the use, or it actually is interfering with the use, then the State must adopt a numeric limit for the specific pollutant. If a State is unsure whether a toxic pollutant is interfering with, or is likely to interfere with, the designated use and therefore is unsure that control of the pollutant is necessary to support the designated use, the State should undertake to develop sufficient information upon which to make such a determination. Presence of facilities that manufacture or use the section 307(a) toxic pollutants or other information indicating that such pollutants are discharged or will be discharged strongly suggests that such pollutants could be interfering with attaining designated uses. If a State expects the pollutant not to interfere with the designated use, then section 303(1)(2)(B) does not require a numeric standard for that pollutant.

Section 303(c)(2)(B) addresses only pollutants listed as "toxic" pursuant to section 307(a) of the Act, which are codified at 40 CFR 131.36(b). The section 307(a) list contains 65 compounds and families of compounds, which potentially include thousands of specific compounds. The Agency has interpreted that list to include 126 "priority" toxic pollutants for regulatory purposes. Reference in this guidance to toxic pollutants or section 307(a) toxic pollutants refers to the 126 priority toxic pollutants unless otherwise noted. Both the list of priority toxic pollutants and recommended criteria levels are subject to change.

The national criteria recommendations published by EPA under section 304(a) (see section 3.1, above) of the Act include values for both acute and chronic aquatic life protection; only chronic criteria recommendations have been established to

protect human health. To comply with the statute, a State needs to adopt aquatic life and human health criteria where necessary to support the appropriate designated uses. Criteria for the protection of human health are needed for water bodies designated for public water supply. When fish ingestion is considered an important activity, then the human health-related water quality criteria recommendation developed under section 304(a) of the CWA should be used; that is, the portion of the criteria recommendation based on fish consumption. For those pollutants designated as carcinogens, the recommendation for a human health criterion is generally more stringent than the aquatic life criterion for the same pollutant. In contrast, the aquatic life criteria recommendations for noncarcinogens are generally more stringent than the human health recommendations. When a State adopts a human health criterion for a carcinogen, the State needs to select a risk level. EPA has estimated risk levels of 10^{-5}, 10^{-6}, and 10^{-7} in its criteria documents under one set of exposure assumptions. However, the State is not limited to choosing among the risk levels published in the section 304(a) criteria documents, nor is the State limited to the base case exposure assumptions; it must choose the risk level for its conditions and explain its rationale.

EPA generally regulates pollutants treated as carcinogens in the range of 10^{-6} to 10^{-4} to protect average exposed individuals and more highly exposed populations. However, if a State selects a criterion that represents an upper bound risk level less protective than 1 in 100,000 (e.g., 10^{-5}), the State needs to have substantial support in the record for this level. This support focuses on two distinct issues. First, the record must include documentation that the decision maker considered the public interest of the State in selecting the risk level, including documentation of public participation in the decision making process as required by the Water Quality Standards Regulation at 40 CFR 131.20(b). Second, the record must include an analysis showing that the risk level selected, when combined with other risk assessment variables, is a balanced and reasonable estimate of actual risk posed, based on the best and most representative information available. The importance of the estimated actual risk increases as the degree of conservatism in the selected risk level diminishes. EPA carefully evaluates all assumptions used by a State if the State chose to alter any one of the standard EPA assumption values (57 F.R. 60864, December 22, 1993).

EPA does not intend to propose changes to the current requirements regarding the bases on which a State can adopt numeric criteria (40 CFR 131.11(b)(1)). Under EPA's regulation, in addition to basing numeric criteria on EPA's section 304(a) criteria documents, States may also base numeric criteria on site-specific determinations or other scientifically defensible methods.

EPA expects each State to comply with the new statutory requirements in any section 303(c) water quality standards review initiated after enactment of the Water Quality Act of 1987. The structure of section 303(c) is to require States to review their water quality standards at least once each 3 year period. Section 303(c)(2)(B) instructs States to include reviews for toxics criteria whenever they initiate a triennial review. Therefore, even if a State has complied with section 303(c)(2)(B), the State must review its standards each triennium to ensure that section 303(c)(2)(B) requirements continue to be met, considering that EPA may have published additional section 304(a) criteria documents and that the State will have new information on existing water quality and on pollution sources.

It should be noted that nothing in the Act or in the Water Quality Standards Regulation restricts the right of a State to adopt numeric criteria for any pollutant not listed pursuant to section 307(a)(1), and that such criteria may be expressed as concentration limits for an individual pollutant or for a toxicity parameter itself as measured by whole-effluent toxicity testing. However, neither numeric toxic criteria nor whole-effluent toxicity should be used as a surrogate for, or to supersede the other.

State Options

States may meet the requirements of CWA section 303(c)(2)(B) by choosing one of three scientifically and technically sound options (or some combination thereof):

(1) Adopt statewide numeric criteria in State water quality standards for all section 307(a) toxic pollutants for which EPA has developed criteria guidance, regardless of whether the pollutants are known to be present;

(2) Adopt specific numeric criteria in State water quality standards for section 307(a) toxic pollutants as necessary to support designated uses where such pollutants are discharged or are present in the affected waters and could reasonably be expected to interfere with designated uses;

(3) Adopt a "translator procedure" to be applied to a narrative water quality standard provision that prohibits toxicity in receiving waters. Such a procedure is to be used by the State in calculating derived numeric criteria, which shall be used for all purposes under section 303(c) of the CWA. At a minimum, such criteria need to be developed for section 307(a) toxic pollutants, as necessary to support designated uses, where these pollutants are discharged or present in the affected waters and could reasonably be expected to interfere with designated uses.

Option 1 is consistent with State authority to establish water quality standards. Option 2 most directly reflects the CWA requirements and is the option recommended by EPA. Option 3, while meeting the requirements of the CWA, is best suited to supplement numeric criteria from option 1 or 2. The three options are discussed in more detail below.

OPTION 1

Adopt statewide numeric criteria in State water quality standards for all section 307(a) toxic pollutants for which EPA has developed criteria guidance, regardless of whether the pollutants are known to be present.

Pro:

- simple, straightforward implementation
- ensures that States will satisfy statute
- makes maximum uses of EPA recommendations
- gets specific numbers into State water quality standards fast, at first

Con:

- some priority toxic pollutants may not be discharged in State
- may cause unnecessary monitoring by States
- might result in "paper standards"

Option 1 is within a State's legal authority under the CWA to adopt broad water quality standards. This option is the most comprehensive approach to satisfy the statutory requirements because it would include all of the priority toxic pollutants for which EPA has prepared section 304(a) criteria guidance for either or both aquatic life protection and human health protection. In addition to a simple adoption of EPA's section 304(a) guidance as standards, a State must select a risk level for those toxic pollutants which are carcinogens (i.e., that cause or may cause cancer in humans).

Many States find this option attractive because it ensures comprehensive coverage of the priority toxic pollutants with scientifically defensible criteria without the need to conduct a resource-intensive evaluation of the particular segments and pollutants requiring criteria. This option also would not be more costly to dischargers than other options because permit limits would be based only on the regulation of the particular toxic pollutants in their discharges and not on the total listing in the water quality standards. Thus, actual permit limits should be the same under any of the options.

The State may also exercise its authority to use one or more of the techniques for adjusting water quality standards:

- establish or revise designated stream uses based on use attainability analyses (see section 2.9);
- develop site-specific criteria; or
- allow short-term variances (see section 5.3) when appropriate.

All three of these techniques may apply to standards developed under any of the three options discussed in this guidance. It is likely that States electing to use option 1 will rely more on variances because the other two options are implemented with more site-specific data being available. It should be noted, however, that permits issued pursuant to such water quality variances still must comply with any applicable antidegradation and antibacksliding requirements.

OPTION 2

Adopt specific numeric criteria in State water quality standards for section 307(a) toxic pollutants as necessary to support designated uses where such pollutants are discharged or are present in the affected waters and could reasonably be expected to interfere with designated uses.

Pro:

- directly reflects statutory requirement
- standards based on demonstrated need to control problem pollutants
- State can use EPA's section 304(a) national criteria recommendations or other scientifically acceptable alternative, including site-specific criteria
- State can consider current or potential toxic pollutant problems
- State can go beyond section 307(a) toxics list, as desired

Con:

- may be difficult and time consuming to determine if, and which, pollutants are interfering with the designated use
- adoption of standards can require lengthy debates on correct criteria limit to be included in standards
- successful State toxic control programs based on narrative criteria may be halted or slowed as the State applies its limited resources to developing numeric standards
- difficult to update criteria once adopted as part of standards
- to be absolutely technically defensible, may need site-specific criteria in many situations, leading to a large workload for regulatory agency

EPA recommends that a State use this option to meet the statutory requirement. It directly reflects all the Act's requirements and is flexible, resulting in adoption of numeric water quality standards as needed. To assure that the State is capable of dealing with new problems as they arise, EPA also recommends that States adopt a translator procedure the same as, or similar to, that described in option 3, but applicable to all chemicals causing toxicity and not just priority pollutants as is the case for option 3.

Beginning in 1988, EPA provided States with candidate lists of priority toxic pollutants and water bodies in support of CWA section 304(l) implementation. These lists were developed because States were required to evaluate existing and readily available water-related data to comply with section 304(l), 40 CFR 130.10(d). A similar "strawman" analysis of priority pollutants potentially requiring adoption of numeric criteria under section 303(c)(2)(B) was furnished to most States in September or October of 1990 for their use in ongoing and subsequent triennial reviews. The primary differences between the "strawman" analysis and the section 304(l) candidate lists were that the "strawman" analysis (1) organized the results by chemical rather than by water body, (2) included data for certain STORET monitoring stations that were not used in constructing the candidate lists, (3) included data from the Toxics Release Inventory database, and (4) did not include a number of data sources used in preparing the candidate lists (e.g., those, such as fish kill information, that did not provide chemical-specific information).

EPA intends for States, at a minimum, to use the information gathered in support of section 304(l) requirements as a starting point for identifying (1) water segments that will need new and/or revised water quality standards for section 307(a) toxic pollutants, and (2) which priority toxic pollutants require adoption of numeric criteria. In the longer term, EPA expects similar determinations to occur during each triennial review of water quality standards as required by section 303(c).

In identifying the need for numeric criteria, EPA is encouraging States to use information and data such as:

- presence or potential construction of facilities that manufacture or use priority toxic pollutants;
- ambient water monitoring data, including those for sediment and aquatic life (e.g., fish tissue data);
- NPDES permit applications and permittee self-monitoring reports;
- effluent guideline development documents, many of which contain section 307(a)(1) priority pollutant scans;
- pesticide and herbicide application information and other records of pesticide or herbicide inventories;
- public water supply source monitoring data noting pollutants with Maximum Contaminant Levels (MCLs); and
- any other relevant information on toxic pollutants collected by Federal, State, interstate agencies, academic groups, or scientific organizations.

States are also expected to take into account newer information as it became available, such as information in annual reports from the Toxic Chemical Release Inventory requirements of the Emergency Planning and Community Right-To-Know Act of 1986 (Title III, Public Law 99-499).

Where the State's review indicates a reasonable expectation of a problem from the discharge or presence of toxic pollutants, the State should identify the pollutant(s) and the relevant segment(s). In making these determinations, States should use their own EPA-approved criteria or existing EPA water quality criteria for purposes of segment identification. After the review, the State may use other means to establish the final criterion as it revises its standards.

As with option 1, a State using option 2 must follow all its legal and administrative requirements for adoption of water quality standards. Since the resulting numeric criteria are part of a State's water quality standards, they are required to be submitted by the State to EPA for review and either approval or disapproval.

EPA believes this option offers the State optimum flexibility. For section 307(a) toxic pollutants adversely affecting designated uses, numeric criteria are available for permitting purposes. For other situations, the State has the option of defining site-specific criteria.

OPTION 3

Adopt a procedure to be applied to the narrative water quality standard provision that prohibits toxicity in receiving waters. Such a procedure would be used by a State in calculating derived numeric criteria to be used for all purposes of water quality criteria under section 303(c) of the CWA. At a minimum such criteria need to be derived for section 307(a) toxic pollutants where the discharge or presence of such pollutants in the affected waters could reasonably be expected to interfere with designated uses, as necessary to support such designated uses.

Pro:

- allows a State flexibility to control priority toxic pollutants
- reduces time and cost required to adopt specific numeric criteria as water quality standards regulations
- allows immediate use of latest scientific information available at the time a State needs to develop derived numeric criteria
- revisions and additions to derived numeric criteria can be made without need to revise State law
- State can deal more easily with a situation where it did not establish water quality standards for the section 307(a) toxic pollutants during the most recent triennial review
- State can address problems from non-section 307(a) toxic pollutants

Con:

- EPA is currently on notice that a derived numeric criterion may invite legal challenge
- once the necessary procedures are adopted to enhance legal defensibility (e.g., appropriate scientific methods and public participation and review), actual savings in time and costs may be less than expected
- public participation in development of derived numeric criteria may be limited when such criteria are not addressed in a hearing on water quality standards

EPA believes that adoption of a narrative standard along with a translator mechanism as part of a State's water quality standard satisfies the substantive requirements of the statute. These criteria are subject to all the State's legal and administrative requirements for adoption of standards plus review and either approval or disapproval by EPA, and result in the development of derived numeric criteria for specific section 307(a) toxic pollutants. They are also subject to an opportunity for public participation. Nevertheless, EPA believes the most appropriate use of option 3 is as a supplement to either option 1 or 2. Thus, a State would have formally adopted numeric criteria for toxic pollutants that occur frequently; that have general applicability statewide for inclusion in NPDES permits, total maximum daily loads, and waste load allocations; and that also would have a sound and predictable method to develop additional numeric criteria as needed. This combination of options provides a complete regulatory scheme.

Although the approach in option 3 is similar to that currently allowed in the Water Quality Standards Regulation (40 CFR 131.11(a)(2)), this guidance discusses several administrative and scientific requirements that EPA believes are necessary to comply with section 303(c)(2)(B).

(1) The Option 3 Procedure Must Be Used To Calculate Derived Numeric Water Quality Criteria

States must adopt a specific procedure to be applied to a narrative water quality criterion. To satisfy section 303(c)(2)(B), this procedure shall be used by the State in calculating derived numeric criteria, which shall be used for all purposes under section 303(c) of the CWA. Such criteria need to be developed for section 307(a) toxic pollutants as necessary to support designated uses, where these pollutants are discharged or are present in the affected waters and could reasonably be expected to interfere with the designated uses.

To assure protection from short-term exposures, the State procedure should ensure development of derived numeric water quality criteria based on valid acute aquatic toxicity tests that are lethal to half the affected organisms (LC50) for the species representative of or similar to those found in the State. In addition, the State procedure should ensure development of derived numeric water quality criteria for protection from chronic exposure by using an appropriate safety factor applicable to this acute limit. If there are saltwater components to the State's aquatic resources, the State should establish appropriate derived numeric criteria for saltwater in addition to those for freshwater.

The State's documentation of the tests should include a detailed discussion of its quality control and quality assurance procedures. The State should also include a description (or reference existing technical agreements with EPA) of the procedure it will use to calculate derived acute and chronic numeric criteria from the test data, and how these derived criteria will be used as the basis for deriving appropriate TMDLs, WLAs, and NPDES permit limits.

As discussed above, the procedure for calculating derived numeric criteria needs to protect aquatic life from both acute and chronic exposure to specific chemicals. Chronic aquatic life criteria are to be met at the edge of the mixing zone. The acute criteria are to be met (1) at the end-of-pipe if mixing is not rapid and complete and a high rate diffuser is not present; or (2) after mixing if mixing is rapid and complete or a high rate diffuser is present. (See EPA's *Technical Support Document for Water Quality-based Toxics Control*, USEPA 1991a.)

EPA has not established a national policy specifying the point of application in the receiving water to be used with human health criteria. However, EPA has approved State standards that apply human health criteria for fish consumption at the mixing zone boundary and/or apply the criteria for drinking water consumption, at a minimum, at the point of use. EPA has also proposed more stringent requirements for the application of human health criteria for highly bioaccumulative pollutants in the *Water Quality guidance for the Great Lakes System* (50 F.R. 20931, 21035, April 16, 1993) including elimination of mixing zones.

In addition, the State should also include an indication of potential bioconcentration or bioaccumulation by providing for:

- laboratory tests that measure the steady-state bioconcentration rate achieved by a susceptible organism; and/or
- field data in which ambient concentrations and tissue loads are measured to give an appropriate factor.

In developing a procedure to be used in calculating derived numeric criteria for the protection of aquatic life, the State should consider the potential impact that bioconcentration has on aquatic and terrestrial food chains.

The State should also use the derived bioconcentration factor and food chain multiplier to calculate chronically protective numeric criteria for humans that consume aquatic organisms. In calculating this derived numeric criterion, the State should indicate data requirements to be met when dealing with either threshold (toxic) or non-threshold (carcinogenic) compounds. The State should describe the species and the minimum number of tests, which may generally be met by a single mammalian chronic test if it is of good quality and if the weight of evidence indicates that the results are reasonable. The State should provide the method to calculate a derived numeric criterion from the appropriate test result.

Both the threshold and non-threshold criteria for protecting human health should contain exposure assumptions, and the State procedure should be used to calculate derived numeric criteria that address the consumption of water, consumption of fish, and combined consumption of both water and fish. The State should provide the assumptions regarding the amount of fish and the quantity of water consumed per person per day, as well as the rationale used to select the assumptions. It needs to include the number of tests, the species necessary to establish a dose-response relationship, and the procedure to be used to calculate the derived numeric criteria. For non-threshold contaminants, the State should specify the model used to extrapolate to low dose and the risk level. It should also address incidental exposure from other water sources (e.g., swimming). When calculating derived numeric criteria for multiple exposure to pollutants, the State should consider additive effects, especially for carcinogenic substances, and should factor in the contribution to the daily intake of toxicants from other sources (e.g., food, air) when data are available.

(2) The State Must Demonstrate That the Procedure Results in Derived Numeric Criteria Are Protective

The State needs to demonstrate that its procedures for developing criteria, including translator methods, yield fully protective criteria for human health and for aquatic life. EPA's review process will proceed according to EPA's regulation of 40 CFR 131.11, which requires that criteria be based on sound scientific rationale and be protective of all designated uses. EPA will use the expertise and experience it has gained in developing section 304(a) criteria for toxic pollutants by application of its own translator method (USEPA, 1980b; USEPA, 1985b).

Once EPA has approved the State's procedure, the Agency's review of derived numeric criteria, for example, for pollutants other than section 307(a) toxic pollutants resulting from the State's procedure, will focus on the adequacy of the data base rather than the calculation method. EPA also encourages States to apply such a procedure to calculate derived numeric criteria to be used as the basis for deriving permit limitations for nonconventional pollutants that also cause toxicity.

(3) The State Must Provide Full Opportunity for Public Participation in Adoption of the Procedure

The Water Quality Standards Regulation requires States to hold public hearings to review and revise water quality standards in accordance with provisions of State law and EPA's Public Participation Regulation (40 CFR 25). Where a State plans to adopt a procedure to be applied to the narrative criterion, it must provide full opportunity for public participation in the development and adoption of the procedure as part of the State's water quality standards.

While it is not necessary for the State to adopt each derived numeric criterion into its water quality standards and submit it to EPA for review and approval, EPA is very concerned that all affected parties have adequate opportunity to participate in the development of a derived

numeric criterion even though it is not being adopted directly as a water quality standard.

A State can satisfy the need to provide an opportunity for public participation in the development of derived numeric criteria in several ways, including:

- a specific hearing on the derived numeric criterion;
- the opportunity for a public hearing on an NPDES permits as long as public notice is given that a criterion for a toxic pollutant as part of the permit issuance is being contemplated; or
- a hearing coincidental with any other hearing as long as it is made clear that development of a specific criterion is also being undertaken.

For example, as States develop their lists and individual control strategies (ICSs) under section 304(1), they may seek full public participation. NPDES regulations also specify public participation requirements related to State permit issuance. Finally, States have public participation requirements associated with Water Quality Management Plan updates. States may take advantage of any of these public participation requirements to fulfill the requirement for public review of any resulting derived numeric criteria. In such cases, the State must give prior notice that development of such criteria is under consideration.

(4) The Procedure Must Be Formally Adopted and Mandatory

Where a State elects to supplement its narrative criterion with an accompanying implementing procedure, it must formally adopt such a procedure as a part of its water quality standards. The procedure must be used by the State to calculate derived numeric criteria that will be used as the basis for all standards' purposes, including the following: developing TMDLs, WLAs, and limits in NPDES permits; determining whether water use designations are being met; and identifying potential nonpoint source pollution problems.

(5) The Procedure Must Be Approved by EPA as Part of the State's Water Quality Standards Regulation

To be consistent with the requirements of the Act, the State's procedure to be applied to the narrative criterion must be submitted to EPA for review and approval, and will become a part of the State's water quality standards. (See 40 CFR 131.21 for further discussion.) This requirement may be satisfied by a reference in the standards to the procedure, which may be contained in another document, which has legal effect and is binding on the State, and all the requirements for public review, State implementation, and EPA review and approval are satisfied.

Criteria Based on Biological Monitoring

For priority toxic pollutants for which EPA has not issued section 304(a)(1) criteria guidance, CWA section 303(c)(2)(B) requires States to adopt criteria based on biological monitoring or assessment methods. The phrase "biological monitoring or assessment methods" includes:

- whole-effluent toxicity control methods;
- biological criteria methods; or
- other methods based on biological monitoring or assessment.

The phrase "biological monitoring or assessment methods" in its broadest sense also includes criteria developed through translator procedures. This broad interpretation of that phrase is consistent with EPA's policy of applying chemical-specific, biological, and whole-effluent toxicity methods independently in an integrated toxics control program. It is also consistent with the intent of Congress to expand State standards programs beyond chemical-specific approaches.

States should also consider developing protocols to derive and adopt numeric criteria for priority toxic pollutants (or other pollutants) where EPA has not issued section 304(a) criteria guidance. The State should consider available laboratory toxicity test data that may be sufficient to support derivation of chemical-specific criteria. Existing data need not be as comprehensive as that required to meet EPA's 1985 guidelines in order for a State to use its own protocols to derive criteria. EPA has described such protocols in the proposed *Water Quality Guidance for the Great Lakes System* (58 F.R. 20892, at 21016, April 16, 1993.) This is particularly important where other components of a State's narrative criterion implementation procedure (e.g., WET controls or biological criteria) may not ensure full protection of designated uses. For some pollutants, a combination of chemical-specific and other approaches is necessary (e.g., pollutants where bioaccumulation in fish tissue or water consumption by humans is a primary concern).

Biologically based monitoring or assessment methods serve as the basis for control where no specific numeric criteria exist or where calculation or application of pollutant-by-pollutant criteria appears infeasible. Also, these methods may serve as a supplemental measurement of attainment of water quality standards in addition to numeric and narrative criteria. The requirement for both numeric criteria and biologically based methods demonstrates that section 303(c)(2)(B) contemplates that States develop a comprehensive toxics control program regardless of the status of EPA's section 304(a) criteria.

The whole-effluent toxicity (WET) testing procedure is the principal biological monitoring guidance developed by EPA to date. The purpose of the WET procedure is to control point source dischargers of toxic pollutants. The procedure is particularly useful for monitoring and controlling the toxicity of complex effluents that may not be well controlled through chemical-specific numeric criteria. As such, biologically based effluent testing procedures are a necessary component of a State's toxics control program under section 303(c)(2)(B) and a principal means for implementing a State's narrative "free from toxics" standard.

Guidance documents EPA considers to serve the purpose of section 304(a)(8) include the *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a; *Guidelines for Deriving National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses* (Appendix H); *Guidelines and Methodology Used in the Preparation of Health Effect Assessment Chapters of the Consent Decree Water Criteria Documents* (Appendix J); *Methods for Measuring Acute Toxicity of Effluents to Freshwater and Marine Organisms* (USEPA, 1991d); *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms* (USEPA, 1991e); and *Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Marine and Estuarine Organisms* (USEPA, 1991f).

3.4.2 Criteria for Nonconventional Pollutants

Criteria requirements applicable to toxicants that are not priority toxic pollutants (e.g., ammonia and chlorine), are specified in the 1983 Water Quality Standards Regulation (see 40 CFR 131.11). Under these requirements, States must adopt criteria based on sound scientific rationale that cover sufficient parameters to protect designated uses. Both numeric and narrative criteria (discussed in sections 3.5.1 and 3.5.2, below) may be applied to meet these requirements.

3.5 Forms of Criteria

States are required to adopt water quality criteria, based on sound scientific rationale, that contain sufficient parameters or constituents to protect the designated use. EPA believes that an effective State water quality standards program should include both parameter-specific (e.g., ambient numeric criteria) and narrative approaches.

3.5.1 Numeric Criteria

Numeric criteria are required where necessary to protect designated uses. Numeric criteria to protect aquatic life should be developed to address both short-term (acute) and long-term (chronic) effects. Saltwater species, as well as freshwater species, must be adequately protected. Adoption of numeric criteria is particularly important for toxicants known to be impairing surface waters and for toxicants with potential human health impacts (e.g., those with high bioaccumulation potential). Human health should be protected from exposure resulting from consumption of water and fish or other aquatic life (e.g., mussels, crayfish). Numeric water quality criteria also are useful in addressing nonpoint source pollution problems.

In evaluating whether chemical-specific numeric criteria for toxicants that are not priority toxic pollutants are required, States should consider whether other approaches (such as whole-effluent toxicity criteria or biological controls) will ensure full protection of designated uses. As mentioned above, a combination of independent approaches may be required in some cases to support the designated uses and comply with the requirements of the Water Quality Standards Regulation (e.g., pollutants where bioaccumulation in fish tissue or water consumption by humans is a primary concern).

3.5.2 Narrative Criteria

To supplement numeric criteria for toxicants, all States have also adopted narrative criteria for toxicants. Such narrative criteria are statements that describe the desired water quality goal, such as the following:

> All waters, including those within mixing zones, shall be free from substances attributable to wastewater discharges or other pollutant sources that:
>
> (1) Settle to form objectional deposits;
>
> (2) Float as debris, scum, oil, or other matter forming nuisances;
>
> (3) Produce objectionable color, odor, taste, or turbidity;
>
> (4) Cause injury to, or are toxic to, or produce adverse physiological responses in humans, animals, or plants; or
>
> (5) Produce undesirable or nuisance aquatic life (54 F.R. 28627, July 6, 1989).

EPA considers that the narrative criteria apply to all designated uses at all flows and are necessary to meet the statutory requirements of section 303(c)(2)(A) of the CWA.

Narrative toxic criteria (No. 4, above) can be the basis for establishing chemical-specific limits for waste discharges where a specific pollutant can be identified as causing or contributing to the toxicity and the State has not adopted chemical-specific numeric criteria. Narrative toxic criteria are cited as a basis for establishing whole-effluent toxicity controls in EPA permitting regulations at 40 CFR 122.44(d)(1)(v).

To ensure that narrative criteria for toxicants are attained, the Water Quality Standards Regulation requires States to develop implementation procedures (see 40 CFR 131.11(a)(2)). Such implementation procedures (Exhibit 3-3) should address all mechanisms to be used by the State to ensure that narrative criteria are attained. Because implementation of chemical-specific numeric criteria is a key component of State toxics control programs, narrative criteria implementation procedures must describe or reference the State's procedures to implement such chemical-specific numeric criteria (e.g., procedures for establishing chemical-specific permit limits under the NPDES permitting

State implementation procedures for narrative toxics criteria should describe the following:

- Specific, scientifically defensible methods by which the State will implement its narrative toxics standard for all toxicants, including:
  - methods for chemical-specific criteria, including methods for applying chemical-specific criteria in permits, developing or modifying chemical-specific criteria via a "translator procedure" (defined and discussed below), and calculating site-specific criteria based on local water chemistry or biology);
  - methods for developing and implementing whole-effluent toxicity criteria and/or controls; and
  - methods for developing and implementing biological criteria.
- How these methods will be integrated in the State's toxics control program (i.e., how the State will proceed when the specified methods produce conflicting or inconsistent results).
- Application criteria and information needed to apply numerical criteria, for example:
  - methods the State will use to identify those pollutants to be regulated in a specific discharge;
  - an incremental cancer risk level for carcinogens;
  - methods for identifying compliance thresholds in permits where calculated limits are below detection;
  - methods for selecting appropriate hardness, pH, and temperature variables for criteria expressed as functions;
  - methods or policies controlling the size and in-zone quality of mixing zones;
  - design flows to be used in translating chemical-specific numeric criteria for aquatic life and human health into permit limits; and
  - other methods and information needed to apply standards on a case-by-case basis.

Exhibit 3-3. Components of a State Implementation Procedure for Narrative Toxics Criteria

program). Implementation procedures must also address State programs to control whole-effluent toxicity (WET) and may address programs to implement biological criteria, where such programs have been developed by the State. Implementation procedures therefore serve as umbrella documents that describe how the State's various toxics control programs are integrated to ensure adequate protection for aquatic life and human health and attainment of the narrative toxics criterion. In essence, the procedure should apply the "independent application" principle, which provides for independent evaluations of attainment of a designated use based on chemical-specific, whole-effluent toxicity, and biological criteria methods (see section 3.5.3 and Appendices C, K, and R).

EPA encourages, and may ultimately require, State implementation procedures to provide for implementation of biological criteria. However, the regulatory basis for requiring whole-effluent toxicity (WET) controls is clear. EPA regulations at 40 CFR 122.44(d)(1)(v) require NPDES permits to contain WET limits where a permittee has been shown to cause, have the reasonable potential to cause, or contribute to an in-stream excursion of a narrative criterion. Implementation of chemical-specific controls is also required by EPA regulations at 40 CFR 122.44(d)(1). State implementation procedures should, at a minimum, specify or reference methods to be used in implementing chemical-specific and whole-effluent toxicity-based controls, explain how these methods are integrated, and specify needed application criteria.

In addition to EPA's regulation at 40 CFR 131, EPA has regulations at 40 CFR 122.44 that cover the National Surface Water Toxics Control Program. These regulations are intrinsically linked to the requirements to achieve water quality standards, and specifically address the control of pollutants both with and without numeric criteria. For example, section 122.44(d)(1)(vi) provides the permitting authority with several options for establishing effluent limits when a State does not have a chemical-specific numeric criterion for a pollutant present in an effluent at a concentration that causes or contributes to a violation of the State's narrative criteria.

3.5.3 Biological Criteria

The Clean Water Act of 1972 directs EPA to develop programs that will evaluate, restore, and maintain the chemical, physical, and biological integrity of the Nation's waters. In response to this directive, States and EPA have implemented chemically based water quality programs that address significant water pollution problems. However, over the past 20 years, it has become apparent that these programs alone cannot identify and address all surface water pollution problems. To help create a more comprehensive program, EPA is setting a priority for the development of biological criteria as part of State water quality standards. This effort will help States and EPA (1) achieve the biological integrity objective of the CWA set forth in section 101, and (2) comply with the statutory requirements under sections 303 and 304 of the Act (see Appendices C and K).

Regulatory Bases for Biocriteria

The primary statutory basis for EPA's policy that States should develop biocriteria is found in sections 101(a) and 303(c)(2)(B) of the Clean Water Act. Section 101(a) of the CWA gives the general goal of biological criteria. It establishes as the objective of the Act the restoration and maintenance of the chemical, physical, and biological integrity of the Nation's waters. To meet this objective, water quality criteria should address biological integrity. Section 101(a) includes the interim water quality goal for the protection and propagation of fish, shellfish, and wildlife.

Section 304(a) of the Act provides the legal basis for the development of informational criteria, including biological criteria. Specific directives for the development of regulatory biocriteria can be found in section 303(c), which requires EPA to develop criteria based on biological assessment methods when numerical criteria are not established.

Section 304(a) directs EPA to develop and publish water quality criteria and information on methods for measuring water quality and establishing water quality criteria for toxic pollutants on bases other than pollutant-by-pollutant, including biological monitoring and assessment methods that assess:

- the effects of pollutants on aquatic community components (". . . plankton, fish, shellfish, wildlife, plant life . . .") and community attributes (". . . biological community diversity, productivity, and stability . . .") in any body of water; and

- factors necessary " . . . to restore and maintain the chemical, physical, and biological integrity of all navigable waters . . ." for " . . . the protection of shellfish, fish, and wildlife for classes and categories of receiving waters . . . ."

Once biocriteria are formally adopted into State standards, biocriteria and aquatic life use designations serve as direct, legal endpoints for determining aquatic life use attainment/non-attainment. CWA section 303(c)(2)(B) provides that when numeric criteria are not available, States shall adopt criteria for toxics based on biological monitoring or assessment methods; biocriteria can be used to meet this requirement.

Development and Implementation of Biocriteria

Biocriteria are numerical values or narrative expressions that describe the expected reference biological integrity of aquatic communities inhabiting waters of a designated aquatic life use. In the most desirable scenario, these would be waters that are either in pristine condition or minimally impaired. However, in some areas these conditions no longer exist and may not be attainable. In these situations, the reference biological communities represent the best attainable conditions. In either case, the reference conditions then become the basis for developing biocriteria for major surface water types (streams, rivers, lakes, wetlands, estuaries, or marine waters).

Biological criteria support designated aquatic life use classifications for application in State standards (see chapter 2). Each State develops its own designated use classification system based on the generic uses cited in the Act (e.g., protection and propagation of fish, shellfish, and wildlife). Designated uses are intentionally general. However, States may develop subcategories within use designations to refine and clarify the use class. Clarification of the use class is particularly helpful when a variety of surface waters with distinct characteristics fit within the same use class, or do not fit well into any category.

For example, subcategories of aquatic life uses may be on the basis of attainable habitat (e.g., coldwater versus warmwater stream systems as represented by distinctive trout or bass fish communities, respectively). Special uses may also be designated to protect particularly unique, sensitive, or valuable aquatic species, communities, or habitats.

Resident biota integrate multiple impacts over time and can detect impairment from known and unknown causes. Biological criteria can be used to verify improvement in water quality in response to regulatory and other improvement efforts and to detect new or continuing degradation of waters. Biological criteria also provide a framework for developing improved best management practices and management measures for nonpoint source impacts. Numeric biological criteria can provide effective monitoring criteria for more definitive evaluation of the health of an aquatic ecosystem.

The assessment of the biological integrity of a water body should include measures of the structure and function of the aquatic community within a specified habitat. Expert knowledge of the system is required for the selection of appropriate biological components and measurement indices. The development and implementation of biological criteria requires:

- selection of surface waters to use in developing reference conditions for each designated use;
- measurement of the structure and function of aquatic communities in reference surface waters to establish biological criteria;
- measurement of the physical habitat and other environmental characteristics of the water resource; and
- establishment of a protocol to compare the biological criteria to biota in comparable test waters to determine whether impairment has occurred.

These elements serve as an interactive network that is particularly important during early development of biological criteria where rapid accumulation of information is effective for refining both designated uses and developing biological criteria values and the supporting biological monitoring and assessment techniques.

3.5.4 Sediment Criteria

While ambient water quality criteria are playing an important role in assuring a healthy aquatic environment, they alone have not been sufficient to ensure appropriate levels of environmental protection. Sediment contamination, which can involve deposition of toxicants over long periods of time, is responsible for water quality impacts in some areas.

EPA has authority to pursue the development of sediment criteria in streams, lakes and other waters of the United States under sections 104 and 304(a)(1) and (2) of the CWA as follows:

- section 104(n)(1) authorizes the Administrator to establish national programs that study the effects of pollution, including sedimentation, in estuaries on aquatic life;
- section 304(a)(1) directs the Administrator to develop and publish criteria for water quality, including information on the factors affecting rates of organic and inorganic sedimentation for varying types of receiving waters;
- section 304(a)(2) directs the Administrator to develop and publish information on, among other issues, "the factors necessary for the protection and propagation of shellfish, fish, and wildlife for classes and categories of receiving waters. . . ."

To the extent that sediment criteria could be developed that address the concerns of the section 404(b)(1) Guidelines for discharges of dredged or fill material under the CWA or the Marine Protection, Research, and Sanctuaries Act, they could also be incorporated into those regulations.

EPA's current sediment criteria development effort, as described below, focuses on criteria for the protection of aquatic life. EPA anticipates potential future expansion of this effort to include sediment criteria for the protection of human health.

Chemical Approach to Sediment Criteria Development

Over the past several years, sediment criteria development activities have centered on evaluating and developing the Equilibrium Partitioning Approach for generating sediment criteria. The Equilibrium Partitioning Approach focuses on predicting the chemical interaction between sediments and contaminants. Developing an understanding of the principal factors that influence the sediment/contaminant interactions will allow predictions to be made regarding the level of contaminant concentration that benthic and other organisms may be exposed to. Chronic water quality criteria, or possibly other toxicological endpoints, can then be used to predict potential biological effects. In addition to the development of sediment criteria, EPA is also working to develop a standardized sediment toxicity test that could be used with or independently of sediment criteria to assess chronic effects in fresh and marine waters.

> ***Equilibrium Partitioning (EqP) Sediment Quality Criteria (SQC) are the U.S. Environmental Protection Agency's best recommendation of the concentration of a substance in sediment that will not unacceptably affect benthic organisms or their uses.***

Methodologies for deriving effects-based SQC vary for different classes of compounds. For non-ionic organic chemicals, the methodology requires normalization to organic carbon. A methodology for deriving effects-based sediment criteria for metal contaminants is under development and is expected to require normalization to acid volatile sulfide. EqP SQC values can be derived for varying degrees of uncertainty and levels of protection, thus permitting use for ecosystem protection and remedial programs.

Application of Sediment Criteria

SQC would provide a basis for making more informed decisions on the environmental impacts of contaminated sediments. Existing sediment assessment methodologies are limited in their ability to identify chemicals of concern, responsible parties, degree of contamination, and zones of impact. To make the most informed decisions, EPA believes that a comprehensive approach using SQC and biological test methods is preferred.

Sediment criteria will be particularly valuable in site-monitoring applications where sediment contaminant concentrations are gradually approaching a criterion over time or as a preventive tool to ensure that point and nonpoint sources of contamination are controlled and that uncontaminated sediments remain uncontaminated. Also comparison of field measurements to sediment criteria will be a reliable method for providing early warning of a potential problem. An early warning would provide an opportunity to take corrective action before adverse impacts occur. For the reasons mentioned above, it has been identified that SQC are essential to resolving key contaminated sediment and source control issues in the Great Lakes.

Specific Applications

Specific applications of sediment criteria are under development. The primary use of EqP-based sediment criteria will be to assess risks associated with contaminants in sediments. The various offices and programs concerned with contaminated sediment have different regulatory mandates and, thus, have different needs and areas for potential application of sediment criteria. Because each regulatory need is different, EqP-based sediment quality criteria designed specifically to meet the needs of one office or program may have to be implemented in different ways to meet the needs of another office or program.

One mode of application of EqP-based numerical sediment quality criteria would be in a tiered approach. In such an application, when contaminants in sediments exceed the sediment quality criteria the sediments would be considered as causing unacceptable impacts. Further testing may or may not be required depending on site-specific conditions and the degree in which a criterion has been violated. (In locations where contamination significantly exceeds a criterion, no additional testing would be required. Where sediment contaminant levels are close to a criterion, additional testing might be necessary.) Contaminants in a sediment at concentrations less than the sediment criterion would not be of concern. However, in some cases the sediment could not be considered safe because it might contain other contaminants above safe levels for which no sediment criteria exist. In addition, the synergistic, antagonistic, or additive effects of several contaminants in the sediments may be of concern.

Additional testing in other tiers of an evaluation approach, such astoxicity tests, could be required to determine if the sediment is safe. It is likely that such testing would incorporate site-specific considerations. Examples of specific applications of sediment criteria after they are developed include the following:

- Establish permit limits for point sources to ensure that uncontaminated sediments remain uncontaminated or sediments already contaminated have an opportunity to cleanse themselves. Of course, this would occur only after criteria and the means to tie point sources to sediment contamination are developed.

- Establish target levels for nonpoint sources of sediment contamination.

- For remediation activities, SQC would be valuable in identifying:

  - need for remediation,

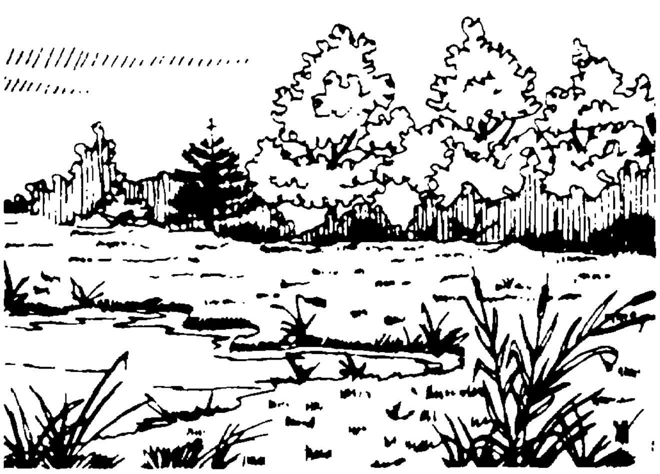
  - spatial extent of remediation area,

  - benefits derived from remediation activities,

  - responsible parties,

  - impacts of depositing contaminated sediments in water environments, and

  - success of remediation activities.



In tiered testing sediment evaluation processes, sediment criteria and biological testing procedures work very well together.

Sediment Criteria Status

Science Advisory Board Review

The Science Advisory Board has completed a second review of the EqP approach to deriving sediment quality criteria for non-ionic contaminants. The November 1992 report (USEPA, 1992c) endorses the EqP approach to deriving criteria as ". . . sufficiently valid to be used in the regulatory process if the uncertainty associated with the method is considered, described, and incorporated," and that "EPA should . . . establish criteria on the basis of present knowledge within the bounds of uncertainty. . . ."

The Science Advisory Board also identified the need for ". . . a better understanding of the uncertainty around the assumptions inherent in the approach, including assumptions of equilibrium, bioavailability, and kinetics, all critical to the application of the EqP."

Sediment Criteria Documents and Application Guidance

EPA efforts at producing sediment criteria documents are being directed first toward phenanthrene, fluoranthene, dieldrin, acenaphthene, and endrin. Efforts are also being directed towards producing a guidance document on the derivation and interpretation of sediment quality criteria. The criteria documents were announced in the *Federal Register* in January 1994; the public comment period ended June 1994. Final documents and implementation guidance should be available in early 1996.

Methodology for Developing Sediment Criteria for Metal Contaminants

EPA is proceeding to develop a methodology for calculating sediment criteria for benthic toxicity to metal contaminants, with key work focused on identifying and understanding the role of acid volatile sulfides (AVS), and other binding factors, in controlling the bioavailability of metal contaminants. A variety of field and laboratory verification studies are under way to add additional support to the methodology. Standard AVS sampling and analytical procedures are under development. Presentation of the metals methodology to the SAB for review is anticipated for Fall 1994.

Biological Approach to Sediment Criteria Development

Under the Contaminated Sediment Management Strategy, EPA programs have committed to using consistent biological methods to determine if sediments are contaminated. In the water program, these biological methods will be used as a complement to the sediment-chemical criteria under development. The biological methods consist of both toxicity and bioaccumulation tests. Freshwater and saltwater benthic species, selected to represent the sensitive range of species' responses to toxicity, are used in toxicity tests to measure sediment toxicity. Insensitive freshwater and saltwater benthic species that form the base of the food chain are used in toxicity tests to measure the bioaccumulation potential of sediment. In FY 1994, acute toxicity tests and bioaccumulation tests selected by all the Agency programs should be standardized and available for use. Training for States and EPA Regions on these methods is expected to begin in FY1995.

In the next few years, research will be conducted to develop standardized chronic toxicity tests for sediment as well as toxicity identification evaluation (TIE) methods. The TIE approach will be used to identify the specific chemicals in a sediment causing acute or chronic toxicity in the test organisms. Under the Contaminated Sediment Management Strategy, EPA's programs have also agreed to incorporate these chronic toxicity and TIE methods into their sediment testing when they are available.

3.5.5 Wildlife Criteria

Terrestrial and avian species are useful as sentinels for the health of the ecosystem as a whole. In many cases, damage to wildlife indicates that the ecosystem itself is damaged. Many wildlife species that are heavily dependent on the aquatic food web reflect the health of aquatic systems. In the case of toxic chemicals, terminal predators such as otter, mink, gulls, terns, eagles, ospreys, and turtles are useful as integrative indicators of the status or health of the ecosystem.

Statutory and Regulatory Authority

Section 101(a)(2) of the CWA sets, as an interim goal of,

> . . . wherever attainable . . . water quality which provides for the protection and propagation of fish, shellfish, and <u>wildlife</u> . . . (emphasis added).

Section 304(a)(1) of the Act also requires EPA to:

> . . . develop and publish . . . criteria for water quality accurately reflecting . . . the kind and extent of all identifiable effects on health and welfare including . . . wildlife.

The Water Quality Standards Regulation reflect the statutory goals and requirements by requiring States to adopt, where attainable, the CWA section 101(a)(2) goal uses of protection and propagation of fish, shellfish, and wildlife (40 CFR 131.10), and to adopt water quality criteria sufficient to protect the designated use (40 CFR 131.11).

Wildlife Protection in Current Aquatic Criteria

Current water quality criteria methodology is designed to protect fish, benthic invertebrates, and zooplankton; however, there is a provision in the current aquatic life criteria guidelines (Appendix H) that is intended to protect wildlife that consume aquatic organisms from the bioaccumulative potential of a compound. The final residue value can be based on either the FDA Action Level or a wildlife feeding study. However, if maximum permissible tissue concentration is not available from a wildlife feeding study, a final residue value cannot be derived and the criteria quantification procedure continues without further consideration of wildlife impacts. Historically, wildlife have been considered only after detrimental effects on wildlife populations have been observed in the environment (this occurred with relationship to DDT, selenium, and PCBs).

Wildlife Criteria Development

EPA's national wildlife criteria effort began following release of a 1987 Government Accounting Office study entitled *Wildlife Management - National Refuge Contamination Is Difficult To Confirm and Clean Up* (GAO, 1987). After waterfowl deformities observed at Kesterson Wildlife Refuge were linked to selenium contamination in the water, Congress requested this study and recommended that "the Administrator of EPA, in close coordination with the Secretary of the Interior, develop water quality criteria for protecting wildlife and their refuge habitat."

In November of 1988, EPA's Environmental Research Laboratory in Corvallis sponsored a workshop entitled *Water Quality Criteria To Protect Wildlife Resources*, (USEPA, 1989g) which was co-chaired by EPA and the Fish and Wildlife Service (FWS). The workshop brought together 26 professionals from a variety of institutions, including EPA, FWS, State governments, academia, and consultants who had expertise in wildlife toxicity, aquatic toxicity, ecology, environmental risk assessment, and conservation. Efforts at he workshop focused on evaluating the need for, and developing a strategy for production of wildlife criteria. Two recommendations came out of that workshop:

(1) The process by which ambient water quality criteria are established should be modified to consider effects on wildlife; and

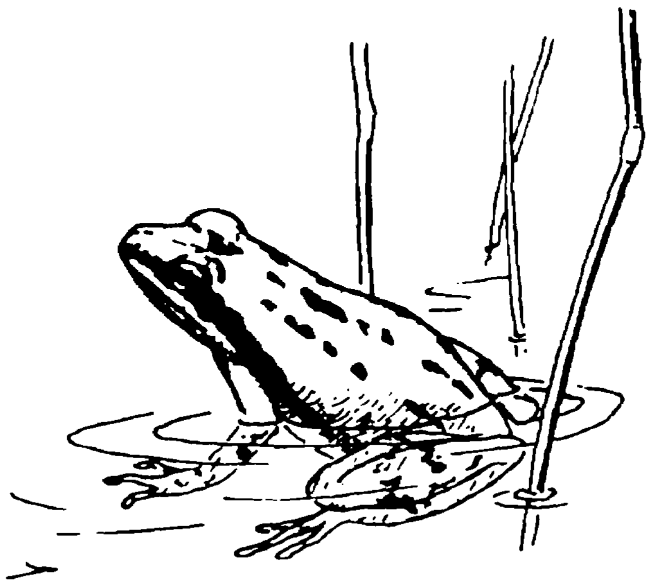
(2) chemicals should be prioritized based on their potential to adversely impact wildlife species.

Based on the workshop recommendations, screening level wildlife criteria (SLWC) were calculated for priority pollutants and chemicals of concern submitted by the FWS to gauge the extent of the problem by:

(1) evaluating whether existing water quality criteria for aquatic life are protective of wildlife, and

(2) prioritizing chemicals for their potential to adversely impact wildlife species.

There were 82 chemicals for which EPA had the necessary toxicity information as well as ambient water quality criteria, advisories, or lowest-observed-adverse-effect levels (LOAELs) to compare with the SLWC values. As would be expected, the majority of chemicals had SLWC larger than existing water quality criteria, advisories, or LOAELs for aquatic life. However, the screen identified classes of compounds for which current ambient water quality criteria may not be adequately protective of wildlife: chlorinated alkanes, benzenes, phenols, metals, DDT, and dioxins. Many of these compounds are produced in very large amounts and have a variety of uses (e.g., solvents, flame retardants, organic syntheses of fungicides and herbicides, and manufacture of plastics and textiles. The manufacture and use of



these materials produce waste byproduct). Also, 5 of the 21 are among the top 25 pollutants identified at Superfund sites in 1985 (3 metals, 2 organics).

Following this initial effort, EPA held a national meeting in April 1992[1] to constructively discuss and evaluate proposed methodologies for deriving wildlife criteria to build consensus among the scientific community as to the most defensible scientifically approach(es) to be pursued by EPA in developing useful and effective wildlife criteria.

The conclusions of this national meeting were as follows:

- wildlife criteria should have a tissue-residue component when appropriate;
- peer-review of wildlife criteria and data sets should be used in their derivation;
- wildlife criteria should incorporate methods to establish site-specific wildlife criteria;
- additional amphibian and reptile toxicity data are needed;
- further development of inter-species toxicological sensitivity factors are needed; and
- criteria methods should measure biomarkers in conjunction with other studies.

On April 16, 1993, EPA proposed wildlife criteria in the *Water Quality Guidance for the Great Lakes System* (58 F.R. 20802). The proposed wildlife criteria are based on the current EPA noncancer human health criteria approach. In this proposal, in addition to requesting comments on the proposed Great Lakes criteria and methods, EPA also requested comments on possible modifications of the proposed Great Lakes approach for consideration in the development of national wildlife criteria.

3.5.6 Numeric Criteria for Wetlands

Extension of the EPA national 304(a) numeric aquatic life criteria to wetlands is recommended as part of a program to develop standards and criteria for wetlands. Appendices D and E provide an overview of the need for standards and criteria for wetlands. The 304(a) numeric aquatic life criteria are designed to be protective of aquatic life for surface waters and are generally applicable to most wetland types. Appendix E provides a possible approach, based on the site-specific guidelines, for detecting wetland types that might not be protected by direct application of national 304(a) criteria. The evaluation can be simple and inexpensive for those wetland types for which sufficient water chemistry and species assemblage data are available, but will be less useful for wetland types for which these data are not readily available. In Appendix E, the site-specific approach is described and recommended for wetlands for which modification of the 304(a) numeric criteria are considered necessary. The results of this type of evaluation, combined with information on local or regional environmental threats, can be used to prioritize wetland types (and individual criteria) for further site-specific evaluations and/or additional data collection. Close coordination among regulatory agencies, wetland scientists, and criteria experts will be required.

3.6 Policy on Aquatic Life Criteria for Metals

It is the policy of the Office of Water that the use of dissolved metal to set and measure compliance with water quality standards is the recommended approach, because dissolved metal more closely approximates the bioavailable fraction of metal in the water column than does total recoverable metal. This conclusion regarding metals bioavailability is supported by a majority of the scientific community within and outside EPA. One reason is that a primary mechanism for water column toxicity is adsorption at the gill surface which requires metals to be in the dissolved form.

Until the scientific uncertainties are better resolved, a range of different risk management decisions can be justified by a State. EPA recommends that State water quality standards be based on dissolved metal--a conversion factor must be used in order to express the EPA criteria articulated as total recoverable as dissolved. (See the paragraph below for technical details on developing dissolved criteria.) EPA will also approve a State risk management decision to adopt standards based on total recoverable metal, if those standards are otherwise approvable as a matter of law. (*Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria* USEPA, 1993f)

3.6.1 Background

The implementation of metals criteria is complex due to the site-specific nature of metals toxicity. This issue covers a number of areas including the expression of aquatic life criteria; total maximum daily loads (TMDLs), permits, effluent monitoring, and compliance; and ambient monitoring. The following Sections, based on the policy memorandum referenced above, provide additional guidance in each of these areas. Included in this Handbook as Appendix J are three guidance documents issued along with the Office of Water policy memorandum with additional technical details. They are: *Guidance Document on Expression of Aquatic Life Criteria as Dissolved Criteria* (Attachment #2), *Guidance Document on Dynamic Modeling and Translators* (Attachment #3), and *Guidance Document on Monitoring* (Attachment #4). These will be supplemented as additional information becomes available.

Since metals toxicity is significantly affected by site-specific factors, it presents a number of programmatic challenges. Factors that must be considered in the management of metals in the aquatic environment include: toxicity specific to effluent chemistry; toxicity specific to ambient water chemistry; different patterns of toxicity for different metals; evolution of the state of the science of metals toxicity, fate, and transport; resource limitations for monitoring, analysis, implementation, and research functions; concerns regarding some of the analytical data currently on record due to possible sampling and analytical contamination; and lack of standardized protocols for clean and ultraclean metals analysis. The States have the key role in the risk management process of balancing these factors in the management of water programs. The site-specific nature of this issue could be perceived as requiring a permit-by-permit approach to implementation. However, EPA believes that this guidance can be effectively implemented on a broader level, across any waters with roughly the same physical and chemical characteristics, and recommends that States work with the EPA with that perspective in mind.

3.6.2 Expression of Aquatic Life Criteria

Dissolved vs. Total Recoverable Metal

A major issue is whether, and how, to use dissolved metal concentrations ("dissolved metal") or total recoverable metal concentrations ("total recoverable metal") in setting State water quality standards. In the past, States have used both approaches when applying the same EPA Section 304(a) criteria guidance. Some older criteria documents may have facilitated these different approaches to interpretation of the criteria because the documents were somewhat equivocal with regards to analytical methods. The May 1992 interim guidance continued the policy that either approach was acceptable.

The position that the dissolved metals approach is more accurate has been questioned because it neglects the possible toxicity of particulate metal. It is true that some studies have indicated that particulate metals appear to contribute to the toxicity of metals, perhaps because of factors such as desorption of metals at the gill surface, but these same studies indicate the toxicity of particulate metal is substantially less than that of dissolved metal.

Furthermore, any error incurred from excluding the contribution of particulate metal will generally be compensated by other factors which make criteria conservative. For example, metals in toxicity tests are added as simple salts to relatively clean water. Due to the likely presence of a significant concentration of metals binding agents in many discharges and ambient waters, metals in toxicity tests would generally be expected to be more bioavailable than metals in discharges or in ambient waters.

If total recoverable metal is used for the purpose of specifying water quality standards, the lower bioavailability of particulate metal and lower bioavailability of sorbed metals as they are discharged may result in an overly conservative water quality standard. The use of dissolved metal in water quality standards gives a more accurate result in the water column. However, total recoverable measurements in ambient water have value, in that exceedences of criteria on a total recoverable basis are an indication that metal loadings could be a stress to the ecosystem, particularly in locations other than the water column (*e.g.*, in the sediments).

The reasons for the potential consideration of total recoverable measurements include risk management considerations not covered by evaluation of water column toxicity alone. The ambient water quality criteria are neither designed nor intended to protect sediments, or to prevent effects in the food webs containing sediment dwelling organisms. A risk manager, however, may consider sediments and food chain effects and may decide to take a conservative approach for metals, considering that metals are very persistent chemicals. This conservative approach could include the use of total recoverable metal in water quality standards. However, since consideration of sediment impacts is not incorporated into the criteria methodology, the degree of conservatism inherent in the total recoverable approach is unknown. The uncertainty of metal impacts in sediments stem from the lack of sediment criteria and an imprecise understanding of the fate and transport of metals. EPA will continue to pursue research and other activities to close these knowledge gaps.

Dissolved Criteria

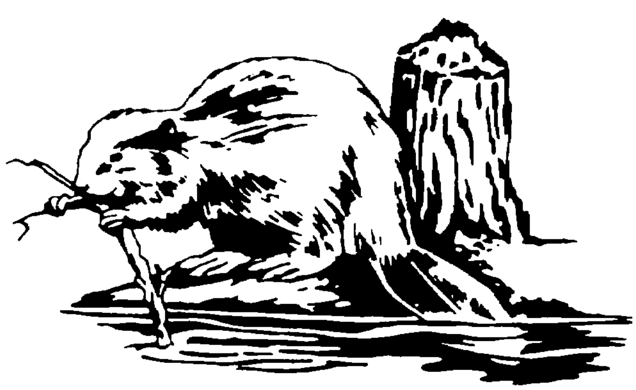
In the toxicity tests used to develop EPA metals criteria for aquatic life, some fraction of the metal is dissolved while some fraction is bound to particulate matter. The present criteria were developed using total recoverable metal measurements or measures expected to give equivalent results in toxicity tests, and are articulated as total recoverable. Therefore, in order to express the EPA criteria as dissolved, a total recoverable to dissolved conversion factor must be used. Attachment #2 in Appendix J provides guidance for calculating EPA dissolved criteria from the published total recoverable criteria. The data expressed as percentage metal dissolved are presented as recommended values and ranges. However, the choice within ranges is a State risk management decision. EPA has recently supplemented the data for copper and is proceeding to further supplement the data for copper and other metals. As testing is completed, EPA will make this information available and this is expected to reduce the magnitude of the ranges for some of the conversion factors provided. EPA also strongly encourages the application of dissolved criteria across a watershed or waterbody, as technically sound and the best use of resources.

Site-Specific Criteria Modifications

While the above methods will correct some site-specific factors affecting metals toxicity, further refinements are possible. EPA has issued guidance for three site-specific criteria development methodologies: recalculation procedure, water-effect ratio (WER) procedure (called the indicator species procedure in previous guidance) and resident species procedure. (See Section 3.7 of this Chapter.)

In the National Toxics Rule (57 FR 60848, December 22, 1992), EPA recommended the WER as an optional method for site-specific criteria development for certain metals. EPA committed in the NTR preamble to provide additional guidance on determining the WERs. The *Interim Guidance on the Determination and Use of Water-Effect Ratios for Metals* was issued by EPA on February 22, 1994 and is intended to fulfill that commitment. This interim guidance supersedes all guidance concerning water-effect ratios and the recalculation procedure previously issued by EPA. This guidance is included as Appendix L to this Handbook.

In order to meet current needs, but allow for changes suggested by protocol users, EPA issued the guidance as "interim." EPA will accept WERs developed using this guidance, as well as by using other scientifically defensible protocols.



3.6.3 Total Maximum Daily Loads (TMDLs) and National Pollutant Discharge Elimination System (NPDES) Permits

Dynamic Water Quality Modeling

Although not specifically part of the reassessment of water quality criteria for metals, dynamic or probabilistic models are another useful tool for implementing water quality criteria, especially for those criteria protecting aquatic life. These models provide another way to incorporate site-specific data. The *Technical Support Document for Water Quality-based Toxics Control* (TSD) (USEPA, 1991a) describes dynamic, as well as static (steady-state) models. Dynamic models make the best use of the specified magnitude, duration, and frequency of water quality criteria and, therefore, provide a more accurate representation of the probability that a water quality standard exceedence will occur. In contrast, steady-state models frequently apply a number of simplifying, worst case assumptions which makes them less complex but also less accurate than dynamic models.

Dynamic models have received increased attention over the last few years as a result of the widespread belief that steady-state modeling is over-conservative due to environmentally conservative dilution assumptions. This belief has led to the misconception that dynamic models will always lead to less stringent regulatory controls (e.g., NPDES effluent limits) than steady-state models, which is not true in every application of dynamic models. EPA considers dynamic models to be a <u>more accurate</u> approach to implementing water quality criteria and continues to recommend their use. Dynamic modeling does require a commitment of resources to develop appropriate data. (See Appendix J, Attachment #3 and the USEPA, 1991a for details on the use of dynamic models.)

Dissolved-Total Metal Translators

Expressing ambient water quality criteria for metals as the dissolved form of a metal poses a need to be able to translate from dissolved metal to total recoverable metal for TMDLs and NPDES permits. TMDLs for metals must be able to calculate: (1) dissolved metal in order to ascertain attainment of water quality standards, and (2) total recoverable metal in order to achieve mass balance necessary for permitting purposes.

EPA's NPDES regulations require that limits of metals in permits be stated as total recoverable in most cases (see 40 CFR §122.45(c)) except when an effluent guideline specifies the limitation in another form of the metal, the approved analytical methods measure only dissolved metal, or the permit writer expresses a metals limit in another form (e.g., dissolved, valent specific, or total) when required to carry out provisions of the Clean Water Act. This is because the chemical conditions in ambient waters frequently differ substantially from those in the effluent, and there is no assurance that effluent particulate metal would not dissolve after discharge. The NPDES rule does not require that State water quality standards be expressed as total recoverable; rather, the rule requires permit writers to translate between different metal forms in the calculation of the permit limit so that a total recoverable limit can be established. Both the TMDL and NPDES uses of water quality criteria require the ability to translate between dissolved metal and total recoverable metal. Appendix J, Attachment #3 provides guidance on this translation.

3.6.4 Guidance on Monitoring

Use of Clean Sampling and Analytical Techniques

In assessing waterbodies to determine the potential for toxicity problems due to metals, the quality of the data used is an important issue. Metals data are used to determine attainment status for water quality standards, discern trends in water quality, estimate background loads for TMDLs, calibrate fate and transport models, estimate effluent concentrations (including effluent variability), assess permit compliance, and conduct research. The quality of trace level metal data, especially below 1 ppb, may be compromised due to contamination of samples during collection, preparation, storage, and analysis. Depending on the level of metal present, the use of "clean" and "ultraclean" techniques for sampling and analysis may be critical to accurate data for implementation of aquatic life criteria for metals.

The significance of the sampling and analysis contamination problem increases as the ambient and effluent metal concentration decreases and, therefore, problems are more likely in ambient measurements. "Clean" techniques refer to those requirements (or practices for sample collection and handling) necessary to produce reliable analytical data in the part per billion (ppb) range. "Ultraclean" techniques refer to those requirements or practices necessary to produce reliable analytical data in the part per trillion (ppt) range. Because typical concentrations of metals in surface waters and effluents vary from one metal to another, the effect of contamination on the quality of metals monitoring data varies appreciably.

EPA plans to develop protocols on the use of clean and ultra-clean techniques and is coordinating with the United States Geological Survey (USGS) on this project, because USGS has been doing work on these techniques for some time, especially the sampling procedures. Draft protocols for clean techniques were presented at the Norfolk, VA analytical methods conference in the Spring of 1994 and final protocols are expected to be available in early 1995. The development of comparable protocols for ultra-clean techniques is underway and are expected to be available in late 1995. In developing these protocols, we will consider the costs of these techniques and will give guidance as to the situations where their use is necessary. Appendix L, pp. 98-108 provide some general guidance on the use of clean analytical techniques. We recommend that this guidance be used by States and Regions as an interim step, while the clean and ultra-clean protocols are being developed.

Use of Historical Data

The concerns about metals sampling and analysis discussed above raise corresponding concerns about the validity of historical data. Data on effluent and ambient metal concentrations are collected by a variety of organizations including Federal agencies (e.g., EPA, USGS), State pollution control agencies and health departments, local government agencies, municipalities, industrial dischargers, researchers, and others. The data are collected for a variety of purposes as discussed above.

Concern about the reliability of the sample collection and analysis procedures is greatest where they have been used to monitor very low level metal concentrations. Specifically, studies have shown data sets with contamination problems during sample collection and laboratory analysis, that have resulted in inaccurate measurements. For example, in developing a TMDL for New York Harbor, some historical ambient data showed extensive metals problems in the harbor, while other historical ambient data showed only limited metals problems. Careful resampling and analysis in 1992/1993 showed the latter view was correct. The key to producing accurate data is appropriate quality assurance (QA) and quality control (QC) procedures. EPA believes that most historical data for metals, collected and analyzed with appropriate QA and QC at levels of 1 ppb or higher, are reliable. The data used in development of EPA criteria are also considered reliable, both because they meet the above test and because the toxicity test solutions are created by adding known amounts of metals.

With respect to effluent monitoring reported by an NPDES permittee, the permittee is responsible for collecting and reporting quality data on a Discharge Monitoring Report (DMR). Permitting authorities should continue to consider the information reported to be true, accurate, and complete as certified by the permittee. Where the permittee becomes aware of new information specific to the effluent discharge that questions the quality of previously submitted DMR data, the permittee must promptly submit that information to the permitting authority. The permitting authority will consider all information submitted by the permittee in determining appropriate enforcement responses to monitoring/reporting and effluent violations. (See Appendix J, Attachment #4 for additional details.)

3.7 Site-Specific Aquatic Life Criteria

The purpose of this section is to provide guidance for the development of site-specific water quality criteria which reflect local environmental conditions. Site-specific criteria are allowed by regulation and are subject to EPA review and approval. The Federal water quality standards regulation at section 131.11(b)(1)(ii) provides States with the opportunity to adopt water quality criteria that are "...modified to reflect site-specific conditions." Site-specific criteria, as with all water quality criteria, must be based on a sound scientific rationale in order to protect the designated use. Existing guidance and practice are that EPA will approve site-specific criteria developed using appropriate procedures.

A site-specific criterion is intended to come closer than the national criterion to providing the intended level of protection to the aquatic life at the site, usually by taking into account the biological and/or chemical conditions (i.e., the species composition and/or water quality characteristics) at the site. The fact that the U.S. EPA has made these procedures available should not be interpreted as implying that the agency advocates that states derive site-specific criteria before setting state standards. Also, derivation of a site-specific criterion does not change the intended level of protection of the aquatic life at the site.

3.7.1 History of Site-Specific Criteria Guidance

National water quality criteria for aquatic life may be under- or over-protective if:

(1) the species at the site are more or less sensitive than those included in the national criteria data set (*e.g.*, the national criteria data set contains data for trout, salmon, penaeid shrimp, and other aquatic species that have been shown to be especially sensitive to some materials), or

(2) physical and/or chemical characteristics of the site alter the biological availability and/or toxicity of the chemical (*e.g.*, alkalinity, hardness, pH, suspended solids and salinity influence the concentration(s) of the toxic form(s) of some heavy metals, ammonia and other chemicals).

Therefore, it is appropriate that site-specific procedures address each of these conditions separately as well as the combination of the two. In the early 1980's, EPA recognized that laboratory-derived water quality criteria might not accurately reflect site-specific conditions and, in response, created three procedures to derive site-specific criteria. This Handbook contains the details of these procedures, referenced below.

1. The Recalculation Procedure is intended to take into account relevant differences between the sensitivities of the aquatic organisms in the national dataset and the sensitivities of organisms that occur at the site (see Appendix L, pp. 90-97).

2. The Water-Effect Ratio Procedure (called the Indicator Species Procedure in USEPA, 1983a; 1984f) provided for the use of a water-effect ratio (WER) that is intended to take into account relevant differences between the toxicities of the chemical in laboratory dilution water and in site water (see Appendix L).

3. The Resident Species Procedure intended to take into account both kinds of differences simultaneously (see Section 3.7.6).

These procedures were first published in the 1983 *Water Quality Standards Handbook* (USEPA, 1983a) and expanded upon in the *Guidelines for Deriving Numerical Aquatic Site-Specific Water Quality Criteria by Modifying National Criteria* (USEPA, 1984f). Interest has increased in recent years as states have devoted more attention to chemical-specific water quality criteria for aquatic life. In addition, interest in water-effect ratios increased when they were integrated into some of the aquatic life criteria for metals that were promulgated for several states in the National Toxics Rule (57 FR 60848, December 22, 1992). The *Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Criteria for Metals* (USEPA, 1993f) (see Section 3.6 of this Handbook) provided further guidance on site-specific criteria for metals by recommending the use of dissolved metals for setting and measuring compliance with water quality standards.

The early guidance concerning WERs (USEPA, 1983a; 1984f) contained few details and needed revision, especially to take into account newer guidance concerning metals. To meet this need, EPA issued *Interim Guidance on the Determination and Use of Water-Effect Ratios for Metals* in 1994 (Appendix L). Metals are specifically addressed in Appendix L because of the National Toxics Rule and because of current interest in aquatic life criteria for metals; although most of this guidance also applies to other pollutants, some obviously applies only to metals. Appendix L supersedes all guidance concerning water-effect ratios and the Indicator Species Procedure given in Chapter 4 of the *Water Quality Standards Handbook* (USEPA, 1983a) and in *Guidelines for Deriving Numerical Aquatic Site-Specific Water Quality Criteria by Modifying National Criteria* (USEPA, 1984f). Appendix L (p. 90-98) also supersedes the guidance in these earlier documents for the Recalculation Procedure for performing site-specific criteria modifications. The Resident Species Procedure remains essentially unchanged since 1983 (except for changes in the averaging periods to conform to the 1985 aquatic life criteria guidelines (USEPA, 1985b) and is presented in Section 3.7.6, below.

The previous guidance concerning site-specific procedures did not allow the Recalculation Procedure and the WER procedure to be used together in the derivation of a site-specific aquatic life criterion; the only way to take into account both species composition and water quality characteristics in the determination of a site-specific criterion was to use the Resident Species Procedure. A specific change contained Appendix L is that, except in jurisdictions that are subject to the National Toxics Rule, the Recalculation Procedure and the WER Procedure may now be used together provided that the recalculation procedure is performed first. Both the Recalculation Procedure and the WER Procedure are based directly on the guidelines for deriving national aquatic life criteria (USEPA 1985) and, when the two are used together, use of the Recalculation Procedure must be performed first because the Recalculation Procedure has specific implications concerning the determination of the WER.

3.7.2 Preparing to Calculate Site-Specific Criteria

Adopting site-specific criteria in water quality standards is a State option--not a requirement. Moreover, EPA is not advocating that States use site-specific criteria development procedures for setting all aquatic life criteria as opposed to using the National Section 304(a) criteria recommendations. Site-specific criteria are not needed in all situations. When a State considers the possibility of developing site-specific criteria, it is essential to involve the appropriate EPA Regional office at the start of the project.

This early planning is also essential if it appears that data generation and testing may be conducted by a party other than the State or EPA. The State and EPA need to apply the procedures judiciously and must consider the complexity of the problem and the extent of knowledge available concerning the fate and effect of the pollutant under consideration. If site-specific criteria are developed without early EPA involvement in the planning and design of the task, the State may expect EPA to take additional time to closely scrutinize the results before granting any approval to the formally adopted standards.

The following sequence of decisions need to be made before any of the procedures are initiated:

- verify that site-specific criteria are actually needed (*e.g.*, that the use of clean sampling and/or analytical techniques, especially for metals, do not result in attainment of standards.)
- Define the site boundaries.
- Determine from the national criterion document and other sources if physical and/or chemical characteristics are known to affect the biological availability and/or toxicity of a material of interest.
- If data in the national criterion document and/or from other sources indicate that the range of sensitivity of the selected resident species to the material of interest is different from the range for the species in the national criterion document, and variation in physical and/or chemical characteristics of the site water is not expected to be a factor, use the *Recalculation Procedure* (Section 3.7.4).

- If data in the national criterion document and/or from other sources indicate that physical and/or chemical characteristics of the site water may affect the biological availability and/or toxicity of the material of interest, and the selected resident species range of sensitivity is similar to that for the species in the national criterion document, use the *Water-Effect Ratio Procedure* (Section 3.7.5).

- If data in the national criterion document and/or from other sources indicated that physical and/or chemical characteristics of the site water may affect the biological availability and/or toxicity of the material of interest, and the selected resident species range of sensitivity is different from that for the species in the national criterion document, and if both these differences are to be taken into account, use the *Recalculation Procedure in conjunction with the Water-Effect Ratio Procedure* or use the *Resident Species Procedure* (Section 3.7.6).

3.7.3 Definition of a Site

Since the rationales for site-specific criteria are usually based on potential differences in species sensitivity, physical and chemical characteristics of the water, or a combination of the two, the concept of site must be consistent with this rationale.

In the general context of site-specific criteria, a "site" may be a state, region, watershed, waterbody, or segment of a waterbody. The site-specific criterion is to be derived to provide adequate protection for the entire site, however the site is defined.

If water quality effects on toxicity are not a consideration, the site can be as large as a generally consistent biogeographic zone permits. For example, large portions of the Chesapeake Bay, Lake Michigan, or the Ohio River may be considered as one site if their respective aquatic communities do not vary substantially. However, when a site-specific criterion is derived using the Recalculation Procedure, all species that "occur at the site" need to be taken into account when deciding what species, if any, are to be deleted from the dataset. Unique populations or less sensitive uses within sites may justify a designation as a distinct site.

If the species of a site are toxicologically comparable to those in the national criteria data set for a material of interest, and physical and/or chemical water characteristics are the only factors supporting modification of the national criteria, then the site can be defined on the basis of expected changes in the material's biological availability and/or toxicity due to physical and chemical variability of the site water. However, when a site-specific criterion is derived using a WER, the WER is to be adequately protective of the entire site. If, for example, a site-specific criterion is being derived for an estuary, WERs could be determined using samples of the surface water obtained from various sampling stations, which, to avoid confusion, should not be called "sites". If all the WERs were sufficiently similar, one site-specific criterion could be derived to apply to the whole estuary. If the WERs were sufficiently different, either the lowest WER could be used to derive a site-specific criterion for the whole estuary, or the data might indicate that the estuary should be divided into two or more sites, each with its own criterion.

3.7.4 The Recalculation Procedure

The Recalculation Procedure is intended to cause a site-specific criterion to appropriately differ from a national aquatic life criterion if justified by demonstrated pertinent toxicological differences between the aquatic species that occur at the site and those that were used in the derivation of the national criterion. There are at least three reasons why such differences might exist between the two sets of species.

- First, the national dataset contains aquatic species that are sensitive to many pollutants, but these and comparably sensitive species might not occur at the site.

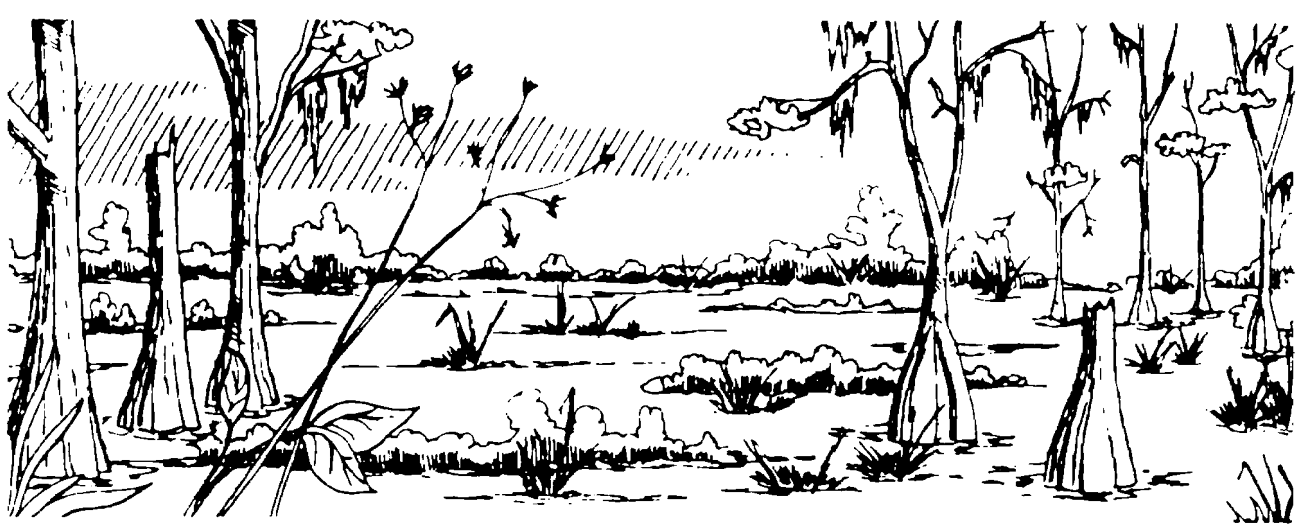
- Second, a species that is critical at the site might be sensitive to the pollutant and require a lower criterion. (A critical species is a species that is commercially or recreationally important at the site, a species that exists at the site and is listed as threatened or endangered under section 4 of the Endangered Species Act, or a species for which there is evidence that the loss of the species from the site is likely to cause an unacceptable impact on a commercially or recreationally important species, a threatened or endangered species, the abundances of a variety of other species, or the structure or function of the community.)

- Third, the species that occur at the site might represent a narrower mix of species than those in the national dataset due to a limited range of natural environmental conditions.

The procedure presented in Appendix L, pp. 90-98 is structured so that corrections and additions can be made to the national dataset without the deletion process being used to take into account taxa that do not occur at the site; in effect, this procedure makes it possible to update the national aquatic life criterion. All corrections and additions that have been approved by EPA are required, whereas use of the deletion process is optional. The deletion process may not be used to remove species from the criterion calculation that are not currently present at a site due to degraded conditions.

The Recalculation Procedure is more likely to result in lowering a criterion if the net result of addition and deletion is to decrease the number of genera in the dataset, whereas the procedure is more likely to result in raising a criterion if the net result of addition and deletion is to increase the number of genera in the dataset.

For the lipid soluble chemicals whose national Final Residue Values are based on Food and Drug Administration (FDA) action levels, adjustments in those values based on the percent lipid content of resident aquatic species is appropriate for the derivation of site-specific Final Residue Values. For lipid-soluble materials, the national Final Residue Value is based on an average 11 percent lipid content for edible portions for the freshwater chinook salmon and lake trout and an average of 10 percent lipids for the edible portion for saltwater Atlantic herring. Resident species of concern may have higher (e.g., Lake Superior siscowet, a race of lake trout) or lower (e.g., many sport fish) percent lipid content than used for the national Final Residue Value.



For some lipid-soluble materials such as polychlorinated biphenyls (PCB) and DDT, the national Final Residue Value is based on wildlife consumers of fish and aquatic invertebrate species rather than an FDA action level because the former provides a more stringent residue level. See the National Guidelines (USEPA, 1985b) for details.

For the lipid-soluble materials whose national Final Residue Values are based on wildlife effects, the limiting wildlife species (mink for PCB and brown pelican for DDT) are considered acceptable surrogates for resident avian and mammalian species (e.g., herons, gulls, terns, otter, etc.) Conservatism is appropriate for those two chemicals, and no less restrictive modification of the national Final Residue Value is appropriate. The site-specific Final Residue Value would be the same as the national value.

3.7.5 The Water-Effect Ratio (WER) Procedure

The guidance on the Water-Effect Ratio Procedure presented in Appendix L is intended to produce WERs that may be used to derive site-specific aquatic life criteria from most national and state aquatic life criteria that were derived from laboratory toxicity data.

As indicated in Appendix L, the determination of a water-effect ratio may require substantial resources. A discharger should consider cost-effective, preliminary measures described in this Appendix L (e.g., use of "clean" sampling and chemical analytical techniques especially for metals, or in non-NTR States, a recalculated criterion) to determine if an indicator species site-specific criterion is really needed. In many instances, use of these other measures may eliminate the need for deriving water-effect ratios. The methods described in the 1994 interim guidance (Appendix L) should be sufficient to develop site-specific criteria that resolve concerns of dischargers when there appears to be no instream toxicity but, where (a) a discharge appears to exceed existing or proposed water quality-based permit limits, or (b) an instream concentration appears to exceed an existing or proposed water quality criterion.

<u>WERs obtained using the methods described in Appendix L should only be used to adjust aquatic life criteria that were derived using laboratory toxicity tests.</u> WERs determined using the methods described herein cannot be used to adjust the residue-based mercury Criterion Continuous Concentration (CCC) or the field-based selenium freshwater criterion.

Except in jurisdictions that are subject to the NTR, the WERs may also be used with site-specific aquatic life criteria that are derived using the Recalculation Procedure described in Appendix L (p.90).

Water-Effect Ratios in the Derivation of Site-Specific Criteria

A central question concerning WERs is whether their use by a State results in a site-specific criterion subject to EPA review and approval under Section 303(c) of the Clean Water Act?

Derivation of a water-effect ratio by a State is a site-specific criterion adjustment subject to EPA review and approval/disapproval under Section 303(c). There are two options by which this review can be accomplished.

Option 1:

A State may derive and submit each individual water-effect ratio determination to EPA for review and approval. This would be accomplished through the normal review and revision process used by a State.

Option 2:

A State can amend its water quality standards to provide a formal procedure which includes derivation of water-effect ratios, appropriate definition of sites, and enforceable monitoring provisions to assure that designated uses are protected. Both this procedure and the resulting criteria would be subject to full public participation requirements. EPA would review and approve/disapprove this protocol as a revised standard as part of the State's triennial review/revision. After adoption of the procedure, public review of a site-specific criterion could be accomplished in conjunction with the public review required for permit issuance. For public information, EPA recommends that once a year the State publish a list of site-specific criteria.

An exception to this policy applies to the waters of the jurisdictions included in the National Toxics Rule. The EPA review is not required for the jurisdictions included in the National Toxics Rule where EPA established the procedure for the State for application to the criteria promulgated. The National Toxics Rule was a formal rulemaking process (with notice and comment) in which EPA pre-authorized the use of a correctly applied water-effect ratio. That same process has not yet taken place in States not included in the National Toxics Rule.

However, the National Toxics Rule does not affect State authority to establish scientifically defensible procedures to determine Federally authorized WERs, to certify those WERs in NPDES permit proceedings, or to deny their application based on the State's risk management analysis.

As described in Section 131.36(b)(iii) of the water quality standards regulation (the official regulatory reference to the National Toxics Rule), the water-effect ratio is a site-specific calculation. As indicated on page 60866 of the preamble to the National Toxics Rule, the rule was constructed as a rebuttable presumption. The water-effect ratio is assigned a value of 1.0 until a different water-effect ratio is derived from suitable tests representative of conditions in the affected waterbody. It is the responsibility of the State to determine whether to rebut the assumed value of 1.0 in the National Toxics Rule and apply another value of the water-effect ratio in order to establish a site-specific criterion. The site-specific criterion is then used to develop appropriate NPDES permit limits. The rule thus provides a State with the flexibility to derive an appropriate site-specific criterion for specific waterbodies.

As a point of emphasis, although a water-effect ratio affects permit limits for individual dischargers, it is the State in all cases that determines if derivation of a site-specific criterion based on the water-effect ratio is allowed and it is the State that ensures that the calculations and data analysis are done completely and correctly.

3.7.6 The Resident Species Procedure

The resident Species Procedure for the derivation of a site-specific criterion accounts for differences in resident species sensitivity and differences in biological availability and/or toxicity of a material due to variability in physical and chemical characteristics of a site water. Derivation of the site-specific criterion maximum concentration (CMC) and site-specific criterion continuous concentration (CCC) are accomplished after the complete acute toxicity minimum data set requirements have been met by conducting tests with resident species in site water. Chronic tests may also be necessary. This procedure is designed to compensate concurrently for any real differences between the sensitivity range of species represented in the national data set and for site water which may markedly affect the biological availability and/or toxicity of the material of interest.

Certain families of organisms have been specified in the National Guidelines acute toxicity minimum data set (e.g., Salmonidae in fresh water and Penaeidae or Mysidae in salt water); if this or any other requirement cannot be met because the family or other group (e.g., insect or benthic crustacean) in fresh water is not represented by resident species, select a substitute(s) from a sensitive family represented by one or more resident species and meet the 8 family minimum data set requirement. If all the families at the site have been tested and the minimum data set requirements have not been met, use the most sensitive resident family mean acute value as the site-specific Final Acute Value.

To derive the criterion maximum concentration divide the site-specific Final Acute Value by two. The site-specific Final Chronic Value can be obtained as described in the Appendix L. The lower of the site-specific Final Chronic Value (as described in the recalculation procedure - Appendix L, p. 90) and the recalculated site-specific Final Residue Value becomes the site-specific criterion continuous concentration unless plant or other data (including data obtained from the site-specific tests) indicates a lower value is appropriate. If a problem is identified, judgment should be used in establishing the site-specific criterion.

The frequency of testing (e.g., the need for seasonal testing) will be related to the variability of the physical and chemical characteristics of site water as it is expected to affect the biological availability and/or toxicity of the material of interest. As the variability increases, the frequency of testing will increase. Many of the limitations discussed for the previous two procedures would also apply to this procedure.

Endnotes

1. Proceedings in production.

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CHAPTER 4

ANTIDEGRADATION

(40 CFR 131.12)

Table of Contents

CHAPTER 4
ANTIDEGRADATION

This chapter provides guidance on the antidegradation component of water quality standards, its application in conjunction with the other parts of the water quality standards regulation, and its implementation by the States. Antidegradation implementation by the States is based on a set of procedures to be followed when evaluating activities that may impact the quality of the waters of the United States. Antidegradation implementation is an integral component of a comprehensive approach to protecting and enhancing water quality.

4.1 History of Antidegradation

The first antidegradation policy statement was released on February 8, 1968, by the Secretary of the U.S. Department of the Interior. It was included in EPA's first Water Quality Standards Regulation (40 CFR 130.17, 40 F.R. 55340-41, November 28, 1975), and was slightly refined and re-promulgated as part of the current program regulation published on November 8, 1983 (48 F.R. 51400, 40 CFR 131.12). Antidegradation requirements and methods for implementing those requirements are minimum conditions to be included in a State's water quality standards. Antidegradation was originally based on the spirit, intent, and goals of the Act, especially the clause ". . . restore and maintain the chemical, physical and biological integrity of the Nation's waters" (101(a)) and the provision of 303(a) that made water quality standards under prior law the "starting point" for CWA water quality requirements. Antidegradation was explicitly incorporated in the CWA through:

- a 1987 amendment codified in section 303(d)(4)(B) requiring satisfaction of antidegradation requirements before making certain changes in NPDES permits; and
- the 1990 Great Lakes Critical Programs Act codified in CWA section 118(c)(2) requiring EPA to publish Great Lakes water quality guidance including antidegradation policies and implementation procedures.

4.2 Summary of the Antidegradation Policy

Section 131.12(a)(1), or "Tier 1," protecting "existing uses," provides the absolute floor of water quality in all waters of the United States. This paragraph applies a minimum level of protection to all waters.

Section 131.12(a)(2), or "Tier 2," applies to waters whose quality exceeds that necessary to protect the section 101(a)(2) goals of the Act. In this case, water quality may not be lowered to less than the level necessary to fully protect the "fishable/swimmable" uses and other existing uses and may be lowered even to those levels only after following all the provisions described in section 131.12(a)(2).

Section 131.12(a)(3), or "Tier 3," applies to Outstanding National Resource Waters (ONRW) where the ordinary use classifications and supporting criteria may not be sufficient or appropriate. As described in the preamble to the Water Quality Standards Regulation, "States may allow some limited activities which result in temporary and short-term changes in water quality," but such changes in water quality should not impact existing uses or alter the essential character or special use that makes the water an ONRW.

The requirement for potential water quality impairment associated with thermal discharges contained in section 131.12 (a)(4) of the regulation is intended to coordinate the requirements and procedures of the antidegradation policy with those established in the Act for setting thermal discharge limitations. Regulations implementing section 316 may be found at 40 CFR 124.66. The statutory scheme and legislative history indicate that limitations developed under section 316 take precedence over other requirements of the Act.

As the States began to focus more attention on implementing their antidegradation policies, an additional concept was developed by the States, which EPA has accepted even though not directly mentioned in previous EPA guidance or in the regulation. This concept, commonly known as "Tier 2½," is an application of the antidegradation policy that has implementation requirements that are more stringent than for "Tier 2" (high-quality waters), but somewhat less stringent than the prohibition against any lowering of water quality in "Tier 3" (ONRWs). EPA accepts this additional tier in State antidegradation policies because it is clearly a more stringent application of the Tier 2 provisions of the antidegradation policy and, therefore, permissible under section 510 of the CWA.

The supporting rationale that led to the development of the Tier 2½ concept was a concern by the States that the Tier 3 ONRW provision was so stringent that its application would likely prevent States from taking actions in the future that were consistent with important social and economic development on, or upstream of, ONRWs. This concern is a major reason that relatively few water bodies are designated as ONRWs. The Tier 2½ approach allows States to provide a very high level of water quality protection without precluding unforeseen future economic and social development considerations.

4.3 State Antidegradation Requirements

Each State must develop, adopt, and retain a statewide antidegradation policy regarding water quality standards and establish procedures for its implementation through the water quality management process. The State antidegradation policy and implementation procedures must be consistent with the components detailed in 40 CFR 131.12. If not included in the standards regulation of a State, the policy must be specifically referenced in the water quality standards so that the functional relationship between the policy and the standards is clear. Regardless of the location of the policy, it must meet all applicable requirements. States may adopt antidegradation statements more protective than the Federal requirement. The antidegradation implementation procedures specify how the State will determine on a case-by-case basis whether, and to what extent, water quality may be lowered.

State antidegradation polices and implementation procedures are subject to review by the Regional Administrator. EPA has clear authority to review and approve or disapprove and promulgate an antidegradation policy for a State. EPA's review of the implementation procedures is limited to ensuring that procedures are included that describe how the State will implement the required elements of the antidegradation review. EPA may disapprove and federally promulgate all or part of an implementation process for antidegradation if, in the judgment of the Administrator, the State's process (or certain provisions thereof) can be implemented in such a way as to circumvent the intent and purpose of the antidegradation policy. EPA encourages submittal of any amendments to the statement and implementing procedures to the Regional Administrator for pre-adoption review so that the State may take EPA comments into account prior to final action.

If a State's antidegradation policy does not meet the Federal regulatory requirements, either through State action to revise its policy or through revised Federal requirements, the State would be given the opportunity to make its policy consistent with the regulation. If this is not done, EPA has the authority to promulgate the policy for the State pursuant to section 303(c)(4) of the Clean Water Act (see section 6.3, this Handbook).

4.4 Protection of Existing Uses - 40 CFR 131.12(a)(1)

This section requires the protection of existing uses and the level of water quality to protect those uses. An "existing use" can be established by demonstrating that:

- fishing, swimming, or other uses have actually occurred since November 28, 1975; or
- that the water quality is suitable to allow the use to be attained—unless there are physical problems, such as substrate or flow, that prevent the use from being attained.

An example of the latter is an area where shellfish are propagating and surviving in a biologically suitable habitat and are available and suitable for harvesting although, to date, no one has attempted to harvest them. Such facts clearly establish that shellfish harvesting is an "existing" use, not one dependent on improvements in water quality. To argue otherwise would be to say that the only time an aquatic protection use "exists" is if someone succeeds in catching fish.

Full protection of the existing use requires protection of the entire water body with a few limited exceptions such as certain physical modifications that may so alter a water body that species composition cannot be maintained (see section 4.4.3, this Handbook), and mixing zones (see section 4.4.4, this Handbook). For example, an activity that lowers water quality such that a buffer zone must be established within a previous shellfish harvesting area is inconsistent with the antidegradation policy.

Section 131.12(a)(1) provides the absolute floor of water quality in all waters of the United States. This paragraph applies a minimum level of protection to all waters. However, it is most pertinent to waters having beneficial uses that are less than the section 101(a)(2) goals of the Act. If it can be proven, in that situation, that water quality exceeds that necessary to fully protect the existing use(s) and exceeds water quality standards but is not of sufficient quality to cause a better use to be achieved, then that water quality may be lowered to the level required to fully protect the existing use as long as existing water quality standards and downstream water quality standards are not affected. If this does not involve a change in standards, no public hearing would be required under section 303(c). However, public participation would still be provided in connection with the issuance of a NPDES permit or amendment of a section 208 plan or section 319 program. If, however, analysis indicates that the higher water quality does result in a better use, even if not up to the section 101(a)(2) goals, then the water quality standards must be upgraded to reflect the uses presently being attained (131.10(i)).

If a planned activity will foreseeably lower water quality to the extent that it no longer is sufficient to protect and maintain the existing

uses in that water body, such an activity is inconsistent with EPA's antidegradation policy, which requires that existing uses are to be maintained. In such a circumstance, the planned activity must be avoided or adequate mitigation or preventive measures must be taken to ensure that the existing uses and the water quality to protect them will be maintained.

Section 4.4.1, this Handbook, discusses the determination and protection of recreational "existing" uses, and section 4.4.2, this Handbook, discusses aquatic life protection "existing" uses (of course, many other types of existing uses may occur in a water body).

4.4.1 Recreational Uses

Recreational uses traditionally are divided into primary contact and secondary contact recreation (e.g., swimming vs. boating; that is, recreation "in" or "on" the water.) However, these two broad uses can logically be subdivided into a variety of subcategories (e.g., wading, sailing, power boating, rafting). The water quality standards regulation does not establish a level of specificity that each State must apply in determining what recreational "uses" exist. However, the following principles apply.

- The State selects the level of specificity it desires for identifying recreational existing uses (that is, whether to treat secondary contact recreation as a single use or to define subcategories of secondary recreation). The State has two limitations:
    - the State must be at least as specific as the uses listed in sections 101(a) and 303(c) of the Clean Water Act; and
    - the State must be at least as specific as the written description of the designated use classifications adopted by the State.
- If the State designated use classification system is very specific in describing subcategories of a use, then such specifically defined uses, if they exist, must be protected fully under antidegradation. A State with a broadly written use classification system may, as a matter of policy, interpret its classifications more specifically for determining existing uses—as long as it is done consistently. A State may also redefine its use classification system, subject to the constraints in 40 CFR 131.10, to more adequately reflect existing uses.
- If the use classification system in a State is defined in broad terms such as primary contact recreation, secondary contact recreation, or boating, then it is a State determination whether to allow changes in the type of primary or secondary contact recreation or boating activity that would occur on a specific water body as long as the basic use classification is met. For example, if a State defines a use simply as "boating," it is the State's decision whether to allow something to occur that would change the type of boating from canoeing to power boating as long as the resulting water quality allows the "boating" use to be met. (The public record used originally to establish the use may provide a clearer indication of the use intended to be attained and protected by the State.)

The rationale is that the required water quality will allow a boating use to continue and that use meets the goal of the Act. Water quality is the key. This interpretation may allow a State to change activities within a specific use category but it does not create a mechanism to remove use classifications; this latter action is governed solely by the provisions of the standards regulation (CWA section 131.10(g)).

One situation where EPA might conceivably be called upon to decide what constitutes an existing use is where EPA is writing an NPDES permit. EPA has the responsibility under CWA section 301(b)(1)(C) to determine what is needed to protect existing uses under the State's antidegradation requirement, and accordingly may define "existing uses" or interpret the State's definition to write that permit if the State has not done so. Of course, EPA's determination would be subject to State section 401 certification in such a case.

4.4.2 Aquatic Life/Wildlife Uses

No activity is allowable under the antidegradation policy which would partially or completely eliminate any existing use whether or not that use is designated in a State's water quality standards. The aquatic protection use is a broad category requiring further explanation. Non-aberrational resident species must be protected, even if not prevalent in number or importance. Water quality should be such that it results in no mortality and no significant growth or reproductive impairment of resident species. Any lowering of water quality below this full level of protection is not allowed.

A State may develop subcategories of aquatic protection uses but cannot choose different levels of protection for like uses. The fact that sport or commercial fish are not present does not mean that the water may not be supporting an aquatic life protection function. An existing aquatic community composed entirely of invertebrates and plants, such as may be found in a pristine alpine tributary stream, should still be protected whether or not such a stream supports a fishery.

Even though the shorthand expression "fishable/swimmable" is often used, the actual objective of the Act is to "restore and maintain the chemical, physical, and biological integrity of our Nation's waters" (section 101(a)). The term "aquatic life" would more accurately reflect the protection of the aquatic community that was intended in section 101(a)(2) of the Act.

Section 131.12(a)(1) states, "Existing instream water uses and level of water quality necessary to protect the existing uses shall be maintained and protected." For example, while sustaining a small coldwater fish population, a stream does not support an existing use of a "coldwater fishery." The existing stream temperatures are unsuitable for a thriving coldwater fishery. The small marginal population is an artifact and should not be employed to mandate a more stringent use (true coldwater fishery) where natural conditions are not suitable for that use.

A use attainability analysis or other scientific assessment should be used to determine whether the aquatic life population is in fact an artifact or is a stable population requiring water quality protection. Where species appear in areas not normally expected, some adaptation may have occurred and site-specific criteria may be appropriately developed. Should the coldwater fish population consist of a threatened or endangered species, it may require protection under the Endangered Species Act. Otherwise, the stream need only be protected as a warmwater fishery.

4.4.3 Existing Uses and Physical Modifications

A literal interpretation of 40 CFR 131.12(a)(1) could prevent certain physical modifications to a water body that are clearly allowed by the Clean Water Act, such as wetland fill operations permitted under section 404 of the Clean Water Act. EPA interprets section 131.12(a)(l) of the antidegradation policy to be satisfied with regard to fills in wetlands if the discharge did not result in "significant degradation" to the aquatic ecosystem as defined under section 230.10(c) of the section 404(b)(l) Guidelines.

The section 404(b)(1) Guidelines state that the following effects contribute to significant degradation, either individually or collectively:

> . . . significant adverse effects on (1) human health or welfare, including effects on municipal water supplies, plankton, fish, shellfish, wildlife, and special aquatic sites (e.g., wetlands); (2) on the life stages of aquatic life and other wildlife dependent on aquatic ecosystems, including the transfer, concentration, or spread of pollutants or their byproducts beyond the site through biological, physical, or chemical process; (3) on ecosystem diversity, productivity, and stability, including loss of fish and wildlife habitat or loss of the capacity of a wetland to assimilate nutrients, purify water, or reduce wave energy; or (4) on recreational, aesthetic, and economic values.

These Guidelines may be used by States to determine "significant degradation" for wetland fills. Of course, the States are free to adopt stricter requirements for wetland fills in their own antidegradation polices, just as they may adopt any other requirement more stringent than Federal law requires. For additional information on the linkage between water quality standards and the section 404 program, see Appendix D.

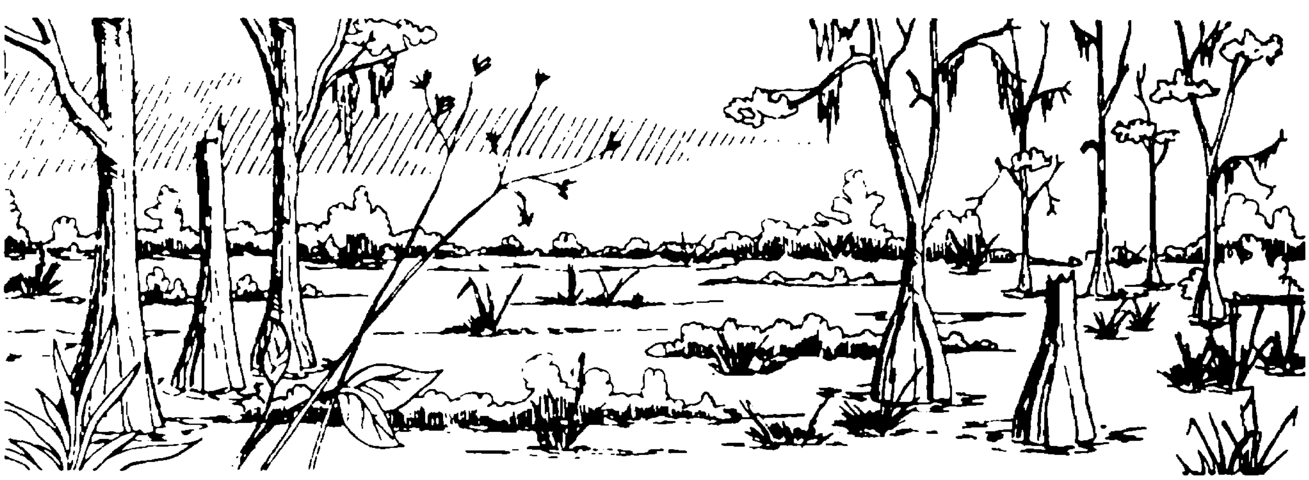
If any wetlands were found to have better water quality than "fishable/swimmable," the State would be allowed to lower water quality to the no significant degradation level as long as the requirements of section 131.12(a)(2) were followed. As for the ONRW provision of antidegradation (131.12(a)(3)), there is no difference in the way it applies to wetlands and other water bodies.

4.4.4 Existing Uses and Mixing Zones

Mixing zones are another instance when the entire extent of the water body is not required to be given full existing use protection. The area within a properly designated mixing zone (see section 5.1) may have altered benthic habitat and a subsequent alteration of the portions of the aquatic community. Any effect on the existing use must be limited to the area of the regulatory mixing zone.

4.5 Protection of Water Quality in High-Quality Waters - 40 CFR 131.12(a)(2)

This section provides general program guidance in the development of procedures for the maintenance and protection of water quality where the quality of the water exceeds levels necessary to support propagation of fish, shellfish, and wildlife and recreation in and on the water. Water quality in "high-quality waters" must be maintained and protected as prescribed in section 131.12(a)(2) of the WQS regulation.



High-quality waters are those whose quality exceeds that necessary to protect the section 101(a)(2) goals of the Act, regardless of use designation. All parameters do not need to be better quality than the State's ambient criteria for the water to be deemed a "high-quality water." EPA believes that it is best to apply antidegradation on a parameter-by-parameter basis. Otherwise, there is potential for a large number of waters not to receive antidegradation protection, which is important to attaining the goals of the Clean Water Act to restore and maintain the integrity of the Nation's waters. However, if a State has an official interpretation that differs from this interpretation, EPA will evaluate the State interpretation for conformance with the statutory and regulatory intent of the antidegradation policy. EPA has accepted approaches that do not use a strict pollutant-by-pollutant basis (USEPA, 1989c).

In "high-quality waters," under 131.12(a)(2), before any lowering of water quality occurs, there must be an antidegradation review consisting of:

- a finding that it is necessary to accommodate important economical or social development in the area in which the waters are located (this phrase is intended to convey a general concept regarding what level of social and economic development could be used to justify a change in high-quality waters);

- full satisfaction of all intergovernmental coordination and public participation provisions (the intent here is to ensure that no activity that will cause water quality to decline in existing high-quality waters is undertaken without adequate public review and intergovernmental coordination); and

- assurance that the highest statutory and regulatory requirements for point sources, including new source performance standards, and best management practices for nonpoint source pollutant controls are achieved (this requirement ensures that the limited provision for lowering water quality of high-quality waters down to "fishable/swimmable" levels will not be used to undercut the Clean Water Act requirements for point source and nonpoint source pollution control; furthermore, by ensuring compliance with such statutory and regulatory controls, there is less chance that a lowering of water quality will be sought to accommodate new economic and social development).

In addition, water quality may not be lowered to less than the level necessary to fully protect the "fishable/swimmable" uses and other existing uses. This provision is intended to provide relief only in a few extraordinary circumstances where the economic and social need for the activity clearly outweighs the benefit of maintaining water quality above that required for "fishable/swimmable" water, and both cannot be achieved. The burden of demonstration on the individual proposing such activity will be very high. In any case, moreover, the existing use must be maintained and the activity shall not preclude the maintenance of a "fishable/swimmable" level of water quality protection.

The antidegradation review requirements of this provision of the antidegradation policy are triggered by any action that would result in the lowering of water quality in a high-quality water. Such activities as new discharges or expansion of existing facilities would presumably lower water quality and would not be permissible unless the State conducts a review consistent with the previous paragraph. In addition, no permit may be issued, without an antidegradation review, to a discharger to high-quality waters with effluent limits greater than actual current loadings if such loadings will cause a lowering of water quality (USEPA, 1989c).

Antidegradation is not a "no growth" rule and was never designed or intended to be such. It is a policy that allows public decisions to be made on important environmental actions. Where the State intends to provide for development, it may decide under this section, after satisfying the requirements for intergovernmental coordination and public participation, that some lowering of water quality in "high-quality waters" is necessary to accommodate important economic or social development. Any such lower water quality must protect existing uses fully, and the State must assure that the highest statutory and regulatory requirement for all new and existing point sources and all cost-effective and reasonable BMPs for nonpoint source control are being achieved on the water body.

Section 131.12(a)(2) does not REQUIRE a State to establish BMPs for nonpoint sources where such BMP requirements do not exist. We interpret Section 131.12(a)(2) as REQUIRING States to adopt an antidegradation policy that includes a provision that will assure that all cost-effective and reasonable BMPs established under State authority are implemented for nonpoint sources before the State authorizes degradation of high quality waters by point sources (see USEPA, 1994a.)

Section 131.12(a)(2) does not mandate that States establish controls on nonpoint sources. The Act leaves it to the States to determine what, if any, controls on nonpoint sources are needed to provide for attainment of State water quality standards (See CWA Section 319.) States may adopt enforceable requirements, or voluntary programs to address nonpoint source pollution. Section 40 CFR 131.12(a)(2) does not require that States adopt or implement best management practices for nonpoint sources prior to allowing point source degradation of a high quality water. However, States that have adopted nonpoint source controls must assure that such controls are properly implemented before authorization is granted to allow point source degradation of water quality.

The rationale behind the antidegradation regulatory statement regarding achievement of statutory requirements for point sources and all cost effective and reasonable BMPs for nonpoint sources is to assure that, in high quality waters, where there are existing point or nonpoint source control compliance problems, proposed new or expanded point sources are not allowed to contribute additional pollutants that could result in degradation. Where such compliance problems exist, it would be inconsistent with the philosophy of the antidegradation policy to authorize the discharge of additional pollutants in the absence of adequate assurance that any existing compliance problems will be resolved.

EPA's regulation also requires maintenance of high quality waters except where the State finds that degradation is "necessary to accommodate important economic and social development in the area in which the waters are located." (40 CFR Part 131.12(a) (Emphasis added)). We believe this phrase should be interpreted to prohibit point source degradation as unnecessary to accommodate important economic and social development if it could be partially or completely prevented through implementation of existing State-required BMPs.

EPA believes that its antidegradation policy should be interpreted on a pollutant-by-pollutant and waterbody-by-waterbody basis. For example, degradation of a high quality waterbody by a proposed new BOD source prior to implementation of required BMPs on the same waterbody that are related to BOD loading should not be allowed. However, degradation by the new point source of BOD should not be barred solely on the basis that BMPs unrelated to BOD loadings, or which relate to other waterbodies, have not been implemented.

We recommend that States explain in their antidegradation polices or procedures how, and to what extent, the State will require implementation of otherwise non-enforceable (voluntary) BMPs before allowing point source degradation of high quality waters. EPA understands this recommendation exceeds the Federal requirements discussed in this guidance. For example, nonpoint source management plans being developed under section 319 of the Clean Water Act are likely to identify potential problems and certain voluntary means to correct those problems. The State should consider how these provisions will be implemented in conjunction with the water quality standards program.

4.6 Applicability of Water Quality Standards to Nonpoint Sources Versus Enforceability of Controls

The requirement in Section 131.21(a)(2) to implement existing nonpoint source controls before allowing degradation of a high quality water, is a subset of the broader issue of the applicability of water quality standards versus the enforceability of controls designed to implement standards. A discussion of the broader issue is included here with the intent of further clarifying the nonpoint source antidegradation question. In the following discussion, the central message is that water quality standards apply broadly and it is inappropriate to exempt whole classes of activities from standards and thereby invalidate that broader, intended purpose of adopted State water quality standards.

Water quality standards serve the dual function of establishing water quality goals for a specific waterbody and providing the basis for regulatory controls. Water quality standards apply to both point and nonpoint sources. There is a direct Federal implementation mechanism to regulate point sources of pollution but no parallel Federal regulatory process for nonpoint sources. Under State law, however, States can and do adopt mandatory nonpoint source controls.

State water quality standards play the central role in a State's water quality management program, which identifies the overall mechanism States use to integrate the various Clean Water Act water quality control elements into a coherent management framework. This includes, for example: (1) setting and revising water quality standards for all surface waterbodies, (2) monitoring water quality to provide information upon which water quality-based decisions will be made, progress evaluated, and success measured, (3) preparing a water quality inventory report under section 305(b) which documents the status of the States's water quality, (4) developing a water quality management plan which lists the standards, and prescribes the regulatory and construction activities necessary to meet the standards, (5) calculating total maximum daily loads and wasteload allocations for point sources of pollution and load allocations for nonpoint sources of pollution in the implementation of standards,(6) implementing the section 319 management plan which outlines the State's control strategy for nonpoint sources of pollution, and (7) developing permits under Section 402.

Water quality standards describe the desired condition of the aquatic environment, and, as such, reflect any activity that affects water quality. Water quality standards have broad application and use in evaluating potential impacts of water quality from a broad range of causes and sources and are not limited to evaluation of effects caused by the discharge of pollutants from point sources. In this regard, States should have in place methods by which the State can determine whether or not their standards have been achieved (including uses, criteria, and implementation of an antidegradation policy). Evaluating attainment of standards is basic to successful application of a State's water quality standards program. In the broad application of standards, these evaluations are not limited to those activities which are directly controlled through a mandatory process. Rather, these evaluations are an important component of a State's water quality management program regardless of whether or not an enforcement procedure is in place for the activity under review.

Water quality standards are implemented through State or EPA-issued water quality-based permits and through State nonpoint source control programs. Water quality standards are implemented through enforceable NPDES permits for point sources and through the installation and maintenance of BMPs for nonpoint sources. Water quality standards usually are not considered self-enforcing except where they are established as enforceable under State law. Application of water quality standards in the overall context of a water quality management program, however, is not limited to activities for which there are enforceable implementation mechanisms.

In simple terms, applicability and enforceability are two distinctly separate functions in the water quality standards program. Water quality standards are applicable to all waters and in all situations, regardless of activity or source of degradation. Implementation of those standards may not be possible in all circumstances; in such cases, the use attainability analysis may be employed. In describing the desired condition of the environment, standards establish a benchmark against which all activities which might affect that desired condition are, at a minimum, evaluated. Standards serve as the basis for water quality monitoring and there is value in identifying the source and cause of a exceedance even if, at present, those sources of impact are not regulated otherwise controlled.

It is acceptable for a State to specify particular classes of activities for which no control requirements have been established in State law. It is not acceptable, however, to specify that standards do not apply to particular classes of activities (e.g. for purposes of monitoring and assessment). To do so would abrogate one of the primary functions of water quality standards.

4.7 Outstanding National Resource Waters (ONRW) - 40 CFR 131.12(a)(3)

Outstanding National Resource Waters (ONRWs) are provided the highest level of protection under the antidegradation policy. The policy provides for protection of water quality in high-quality waters that constitute an ONRW by prohibiting the lowering of water quality. ONRWs are often regarded as highest quality waters of the United States: That is clearly the thrust of 131.12(a)(3). However, ONRW designation also offers special protection for waters of "exceptional ecological significance." These are water bodies that are important, unique, or sensitive ecologically, but whose water quality, as measured by the traditional parameters such as dissolved oxygen or pH, may not be particularly high or whose characteristics cannot be adequately described by these parameters (such as wetlands).

The regulation requires water quality to be maintained and protected in ONRWs. EPA interprets this provision to mean no new or increased discharges to ONRWs and no new or increased discharge to tributaries to ONRWs that would result in lower water quality in the ONRWs. The only exception to this prohibition, as discussed in the preamble to the Water Quality Standards Regulation (48 F.R. 51402), permits States to allow some limited activities that result in temporary and short-term changes in the water quality of ONRW. Such activities must not permanently degrade water quality or result in water quality lower than that necessary to protect the existing uses in the ONRW. It is difficult to give an exact definition of "temporary" and "short-term" because of the variety of activities that might be considered. However, in rather broad terms, EPA's view of temporary is weeks and months, not years. The intent of EPA's provision clearly is to limit water quality degradation to the shortest possible time. If a construction activity is involved, for example, temporary is defined as the length of time necessary to construct the facility and make it operational. During any period of time when, after opportunity for public participation in the decision, the State allows temporary degradation, all practical means of minimizing such degradation shall be implemented. Examples of situations in which flexibility is appropriate are listed in Exhibit 4-1.

4.8 Antidegradation Application and Implementation

Any one or a combination of several activities may trigger the antidegradation policy analysis. Such activities include a scheduled water quality standards review, the establishment of new or revised load allocations, waste load allocations, total maximum daily loads, issuance of NPDES permits, and the demonstration of need for

Example 1 ***A national park wishes to replace a defective septic tank-drainfield system in a campground. The campground is located immediately adjacent to a small stream with the ONRW use designation.***

Under the regulation, the construction could occur if best management practices were scrupulously followed to minimize any disturbance of water quality or aquatic habitat.

Example 2 ***Same situation except the campground is served by a small sewage treatment plant already discharging to the ONRW. It is desired to enlarge the treatment system and provide higher levels of treatment.***

Under the regulation, this water-quality-enhancing action would be permitted if there was only temporary increase in sediment and, perhaps, in organic loading, which would occur during the actual construction phase.

Example 3 ***A National forest with a mature, second growth of trees which are suitable for harvesting, with associated road repair and re-stabilization. Streams in the area are designated as ONRW and support trout fishing.***

The regulation intends that best management practices for timber harvesting be followed and might include preventive measures more stringent than for similar logging in less environmentally sensitive areas. Of course, if the lands were being considered for designation as wilderness areas or other similar designations, EPA's regulation should not be construed as encouraging or condoning timbering operations. The regulation allows only temporary and short-term water quality degradation while maintaining existing uses or new uses consistent with the purpose of the management of the ONRW area.

Other examples of these types of activities include maintenance and/or repair of existing boat ramps or boat docks, restoration of existing sea walls, repair of existing stormwater pipes, and replacement or repair of existing bridges.

Exhibit 4-1. Examples of Allowable Temporary Lowering of Water Quality in Outstanding National Resource Waters

advanced treatment or request by private or public agencies or individuals for a special study of the water body.

Nonpoint source activities are not exempt from the provisions of the antidegradation policy. The language of section 131.12 (a)(2) of the regulation: "Further, the State shall assure that there shall be achieved the highest statutory and regulatory requirements for all new and existing point sources and all cost-effective and reasonable best management practices for nonpoint source control . . . " reflects statutory provisions of the Clean Water Act. While it is true that the Act does not establish a federally enforceable program for nonpoint sources, it clearly intends that the BMPs developed and approved under sections 205(j), 208, 303(e), and 319 be aggressively implemented by the States.

4.8.1 Antidegradation, Load Allocation, Waste Load Allocation, Total Maximum Daily Load, and Permits

In developing or revising a load allocation (LA), waste load allocation (WLA), or total maximum daily load (TMDL) to reflect new information or to provide for seasonal variation, the antidegradation policy, as an integral part of the State water quality standards, must be applied as discussed in this section.

The TMDL/WLA/LA process distributes the allowable pollutant loadings to a water body. Such allocations also consider the contribution to pollutant loadings from nonpoint sources. This process must reflect applicable State water quality standards including the antidegradation policy. No waste load allocation can be developed or NPDES permit issued that would result in standards being violated. With respect to antidegradation, that means existing uses must be protected, water quality may not be lowered in ONRWs, and in the case of waters whose quality exceeds that necessary for the section 101(a)(2) goals of the Act, an activity cannot result in a lowering of water quality unless the applicable public participation, intergovernmental review, and baseline control requirements of the antidegradation policy have been met. Once the LA, WLA, or TMDL revision is completed, the resulting permits must incorporate discharge limitations based on this revision.

When a pollutant discharge ceases for any reason, the waste load allocations for the other dischargers in the area may be adjusted to reflect the additional loading available consistent with the antidegradation policy under two circumstances:

- In "high-quality waters" where after the full satisfaction of all public participation and intergovernmental review requirements, such adjustments are considered necessary to accommodate important economic or social development, and the "threshold" level requirements (required point and nonpoint source controls) are met.

- In less than "high-quality waters," when the expected improvement in water quality (from the ceased discharge) would not cause a better use to be achieved.

The adjusted loads still must meet water quality standards, and the new waste load allocations must be at least as stringent as technology-based limitations. Of course, all applicable requirements of the section 402 NPDES permit regulations would have to be satisfied before a permittee could increase its discharge.

If a permit is being renewed, reissued or modified to include less stringent limitations based on the revised LA/WLA/TMDL, the same antidegradation analysis applied during the LA/WLA/TMDL stage would apply during the permitting stage. It would be reasonable to allow the showing made during the LA/WLA/TMDL stage to satisfy the antidegradation showing at the permit stage. Any restrictions to less stringent limits based on antibacksliding would also apply.

If a State issues an NPDES permit that violates the required antidegradation policy, it would be subject to a discretionary EPA veto under section

402(d) or to a citizen challenge. In addition to actions on permits, any waste load allocations and total maximum daily loads violating the antidegradation policy are subject to EPA disapproval and EPA promulgation of a new waste load allocation/total maximum daily load under section 303(d) of the Act. If a significant pattern of violation was evident, EPA could constrain the award of grants or possibly revoke any Federal permitting capability that had been delegated to the State. Where EPA issues an NPDES permit, EPA will, consistent with its NPDES regulations, add any additional or more stringent effluent limitations required to ensure compliance with the State antidegradation policy incorporated into the State water quality standards. If a State fails to require compliance with its antidegradation policy through section 401 certification related to permits issued by other Federal agencies (e.g., a Corps of Engineers section 404 permit), EPA could comment unfavorably upon permit issuance. The public, of course, could bring pressure upon the permit issuing agency.

For example applications of antidegradation in the WLA and permitting process, see Exhibit 4-2.

4.8.2 Antidegradation and the Public Participation Process

Antidegradation, as with other water quality standards activities, requires public participation and intergovernmental coordination to be an effective tool in the water quality management process. 40 CFR 131.12(a)(2) contains explicit requirements for public participation and intergovernmental coordination when determining whether to allow lower water quality in high-quality waters. Nothing in either the water quality standards or the waste load allocation regulations requires the same degree of public participation or intergovernmental coordination for such non-high-quality waters as is required for high-quality waters. However public participation would still be provided in connection with the issuance of a NPDES permit or amendment of a 208 plan. Also, if the action that causes reconsideration of the existing waste loads (such as dischargers withdrawing from the area) will result in an improvement in water quality that makes a better use attainable, even if not up to the "fishable/swimmable" goal, then the water quality standards must be upgraded and full public review is required for any action affecting changes in standards. Although not specifically required by the standards regulation between the triennial reviews, we recommend that the State conduct a use attainability analysis to determine if water quality improvement will result in attaining higher uses than currently designated in situations where significant changes in waste loads are expected.

The antidegradation public participation requirement may be satisfied in several ways. The State may hold a public hearing or hearings. The State may also satisfy the requirement by providing public notice and the opportunity for the public to request a hearing. Activities that may affect several water bodies in a river basin or sub-basin may be considered in a single hearing. To ease the resource burden on both the State and public, standards issues may be combined with hearings on environmental impact statements, water management plans, or permits. However, if this is done, the public must be clearly informed that possible changes in water quality standards are being considered along with other activities. It is inconsistent with the water quality standards regulation to "back-door" changes in standards through actions on EIS's, waste load allocations, plans, or permits.

Example 1

Several facilities on a stream segment discharge phosphorus-containing wastes. Ambient phosphorus concentrations meet the designated class B (non-fishable/swimmable) standards, but barely. Three dischargers achieve elimination by developing land treatment systems. As a result, actual water quality improves (i.e., phosphorus levels decline) but not quite to the level needed to meet class A (fishable/swimmable) standards. Can the remaining dischargers now be allowed to increase their phosphorus discharge without an antidegradation analysis with the result that water quality declines (phosphorus levels increase) to previous levels?

Nothing in the water quality standards regulation explicitly prohibits this. Of course, changes in their NPDES permit limits may be subject to non-water quality constraints, such as BPT, BAT, or the NPDES antibacksliding provisions, which may restrict the increased loads.

Example 2

Suppose, in the above situation, water quality improves to the point that actual water quality now meets class A requirements. Is the answer different?

Yes. The standards must be upgraded (see section 2.8).

Example 3

As an alternative case, suppose phosphorus loadings go down and water quality improves because of a change in farming practices (e.g., initiation of a successful nonpoint source program.) Are the above answers the same?

Yes. Whether the improvement results from a change in point or nonpoint source activity is immaterial to how any aspect of the standards regulation operates. Section 131.10(d) clearly indicates that uses are deemed attainable if they can be achieved by "... cost-effective and reasonable best management practices for nonpoint source control." Section 131.12(a)(2) of the antidegradation policy contains essentially the same wording.

Exhibit 4-2. Examples of the Application of Antidegradation in the Waste Load/Load Allocation and NPDES Permitting Process

CHAPTER 5

GENERAL POLICIES

(40 CFR 131.13)

Table of Contents

CHAPTER 5
GENERAL POLICIES

States may, at their discretion, adopt certain policies in their standards affecting the application and implementation of standards. For example, policies concerning mixing zones, water quality standards variances, and critical flows for water quality-based permit limits may be adopted. Although these are areas of State discretion, EPA retains authority to review and approve or disapprove such policies (see 40 CFR 131.13).

5.1 Mixing Zones

It is not always necessary to meet all water quality criteria within the discharge pipe to protect the integrity of the water body as a whole. Sometimes it is appropriate to allow for ambient concentrations above the criteria in small areas near outfalls. These areas are called mixing zones. Whether to establish a mixing zone policy is a matter of State discretion, but any State policy allowing for mixing zones must be consistent with the Clean Water Act and is subject to approval of the Regional Administrator.

A series of guidance documents issued by EPA and its predecessor agencies have addressed the concept of a mixing zone as a limited area or volume of water where initial dilution of a discharge takes place. Mixing zones have been applied in the water quality standards program since its inception. The present water quality standards regulation allows States' to adopt mixing zones as a matter of States discretion. Guidance on defining mixing zones previously has been provided in several EPA documents, including FWPCA (1968); NAS/NAE (1972); USEPA (1976); and USEPA (1983a).

EPA's current mixing zone guidance, contained in this Handbook and the *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a), evolved from and supersedes these sources.

Allowable mixing zone characteristics should be established to ensure that:

- mixing zones do not impair the integrity of the water body as a whole,
- there is no lethality to organisms passing through the mixing zone (see section 5.1.2, this Handbook); and
- there are no significant health risks, considering likely pathways of exposure (see section 5.1.3, this Handbook).

EPA recommends that mixing zone characteristics be defined on a case-by-case basis after it has been determined that the assimilative capacity of the receiving system can safely accommodate the discharge. This assessment should take into consideration the physical, chemical, and biological characteristics of the discharge and the receiving system; the life history and behavior of organisms in the receiving system; and the desired uses of the waters. Mixing zones should not be permitted where they may endanger critical areas (e.g., drinking water supplies, recreational areas, breeding grounds, areas with sensitive biota).

EPA has developed a holistic approach to determine whether a mixing zone is tolerable (Brungs, 1986). The method considers all the impacts to the water body and all the impacts that the drop in water quality will have on the surrounding ecosystem and water body uses. It is a multistep data collection and analysis procedure that is particularly sensitive to overlapping mixing zones. This method includes the identification of all upstream and downstream water bodies and the ecological and cultural data pertaining to them; the collection of data on all present and future discharges to the water body; the assessment of relative environmental value and level of protection needed for the water body; and, finally, the allocation of environmental impact for a discharge applicant. Because of the difficulty in collecting the data necessary for this procedure and the general lack of agreement concerning relative values, this method will be difficult to implement in full. However, the method does serve as a guide on how to proceed in allocating a mixing zone.

Mixing zone allowances will increase the mass loadings of the pollutant to the water body and decrease treatment requirements. They adversely impact immobile species, such as benthic communities, in the immediate vicinity of the outfall. Because of these and other factors, mixing zones must be applied carefully, so as not to impede progress toward the Clean Water Act goals of maintaining and improving water quality. EPA recommendations for allowances for mixing zones, and appropriate cautions about their use, are contained in this section.

MIXING ZONES

A limited area or volume of water where initial dilution of a discharge takes place and where numeric water quality criteria can be exceeded but acutely toxic conditions are prevented.

The *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a, sections 2.2, 4.3, 4.4) discusses mixing zone analyses for situations in which the discharge does not mix completely with the receiving water within a short distance. Included are discussions of outfall designs that maximize initial dilution in the mixing zone, critical design periods for mixing zone analyses, and methods to analyze and model nearfield and farfield mixing.

5.1.1 State Mixing Zone Methodologies

EPA recommends that States have a definitive statement in their standards on whether or not mixing zones are allowed. Where mixing zones provisions are part of the State standards, the State should describe the procedures for defining mixing zones. Since these areas of impact, if disproportionally large, could potentially adversely impact the productivity of the water body and have unanticipated ecological consequences, they should be carefully evaluated and appropriately limited in size. As our understanding of pollutant impacts on ecological systems evolves, cases could be identified where no mixing zone is appropriate.

State water quality standards should describe the State's methodology for determining the location, size, shape, outfall design, and in-zone quality of mixing zones. The methodology should be sufficiently precise to support regulatory actions, issuance of permits, and determination of BMPs for nonpoint sources. EPA recommends the following:

- **Location**

Biologically important areas are to be identified and protected. Where necessary to preserve a zone of passage for migrating fish or other organisms in a water course, the standards should specifically identify the portions of the waters to be kept free from mixing zones.

Where a mixing zone is allowed, water quality standards are met at the edge of that regulatory mixing zone during design flow conditions and generally provide:

- a continuous zone of passage that meets water quality criteria for free-swimming and drifting organisms; and
- prevention of impairment of critical resource areas.

Individual State mixing zone dimensions are designed to limit the impact of a mixing zone on the water body. Furthermore, EPA's review of State waste load allocations (WLAs) should evaluate whether assumptions of complete or incomplete mixing are appropriate based on available data.

In river systems, reservoirs, lakes, estuaries, and coastal waters, zones of passage are defined as continuous water routes of such volume, area, and quality as to allow passage of free-swimming and drifting organisms so that no significant effects are produced on their populations. Transport of a variety of organisms in river water and by tidal movements in estuaries is biologically important for a number of reasons:

- food is carried to the sessile filter feeders and other nonmotile organisms;
- spatial distribution of organisms and reinforcement of weakened populations are enhanced; and
- embryos and larvae of some fish species develop while drifting.

Anadromous and catadromous species must be able to reach suitable spawning areas. Their young (and in some cases the adults) must be assured a return route to their growing and living areas. Many species make migrations for spawning and other purposes. Barriers or blocks that prevent or interfere with these types of essential transport and movement can be created by water with inadequate chemical or physical quality.

Size

Various methods and techniques for defining the surface area and volume of mixing zones for various types of waters have been formulated. Methods that result in quantitative measures sufficient for permit actions and that protect designated uses of a water body as a whole are acceptable. The area or volume of an individual zone or group of zones must be limited to an area or volume as small as practicable that will not interfere with the designated uses or with the established community of aquatic life in the segment for which the uses are designated.

To ensure that mixing zones do not impair the integrity of the water body, it should be determined that the mixing zone will not cause lethality to passing organisms and that, considering likely pathways of exposure, no significant human health risks exist. One means to achieve these objectives is to limit the size of the area affected by the mixing zones.

In the general case, where a State has both acute and chronic aquatic life criteria, as well as human health criteria, independently established mixing zone specifications may apply to each of the three types of criteria. For application of two-number aquatic life criteria, there may be up to two types of mixing zones (see Figure 5-1). In the zone immediately surrounding the outfall, neither the acute nor the chronic criteria are met. The acute criteria are met at the edge of this zone. In the next mixing zone, the acute, but not the chronic, criteria are met. The chronic criteria are met at the edge of the second mixing zone. The acute mixing zone may be sized to prevent lethality to passing organisms, the chronic mixing zone sized to protect the ecology of the water body as a whole, and the health criteria mixing zone sized to prevent significant human risks. For any particular pollutant from any

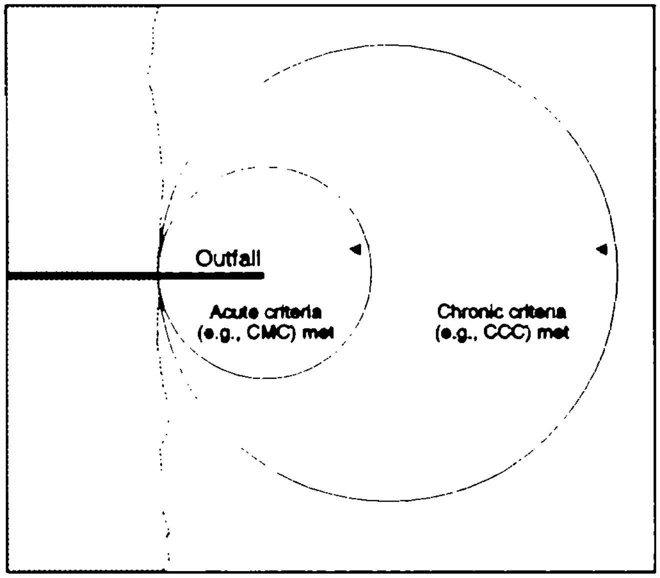


Figure 5-1. Diagram of the Two Parts of the Aquatic Life Mixing Zone

particular discharge, the magnitude, duration, frequency, and mixing zone associated with each of the three types of criteria (acute and chronic aquatic life, and human health) will determine which one most limits the allowable discharge.

Concentrations above the chronic criteria are likely to prevent sensitive taxa from taking up long-term residence in the mixing zone. In this regard, benthic organisms and territorial organisms are likely to be of greatest concern. The higher the concentrations occurring within certain isopleths, the more taxa are likely to be excluded, thereby affecting the structure and function of the ecological community. It is thus important to minimize the overall size of the mixing zone and the size of elevated concentration isopleths within the mixing zone.

To determine that, for aquatic life protection, a mixing zone is appropriately sized, water quality conditions within the mixing zone may be compared to laboratory-measured or predicted toxicity benchmarks as follows:

- It is not necessary to meet chronic criteria within the mixing zone, only at the edge of the mixing zone. Conditions within the mixing zone would thus not be adequate to assure survival, growth, and reproduction of all organisms that might otherwise attempt to reside continuously within the mixing zone.

- If acute criteria (criterion maximum concentration, or CMC, derived from 48- to 96-hour exposure tests) are met throughout the mixing zone, no lethality should result from temporary passage through the mixing zone. If acute criteria are exceeded no more than a few minutes in a parcel of water leaving an outfall (as assumed in deriving the section 5.1.2 options for an outfall velocity of 3 m/sec, and a size of 50 times the discharge length scale), this likewise assures no lethality to passing organisms.

- If a full analysis of concentrations and hydraulic residence times within the mixing zone indicates that organisms drifting through the centerline of the plume along the path of maximum exposure would not be exposed to concentrations exceeding the acute criteria when averaged over the 1-hour (or appropriate site-specific) averaging period for acute criteria, then lethality to swimming or drifting organisms should ordinarily not be expected, even for rather fast-acting toxicants. In many situations, travel time through the acute mixing zone must be less than roughly 15 minutes if a 1-hour average exposure is not to exceed the acute criterion.

Where mixing zone toxicity is evaluated using the probit approach described in the water quality criteria "Blue Book" (NAS/NAE, 1973), or using models of toxicant accumulation and action in organisms (such as described by Mancini, 1983, or Erickson et al., 1989), the phenomenon of delayed mortality should be taken into account before judging the mixing zone concentrations to be safe.

The above recommendations assume that the effluent is repulsive, such that free-swimming organisms would avoid the mixing zones. While most toxic effluents are repulsive, caution is necessary in evaluating attractive mixing zones of known effluent toxicity, and denial of such mixing zones may well be appropriate. It is also important to assure that concentration isopleths within any plume will not extend to restrict passage of swimming organisms into tributary streams.

In all cases, the size of the mixing zone and the area within certain concentration isopleths should be evaluated for their effect on the overall biological integrity of the water body. If the total area affected by elevated concentrations within all mixing zones combined is small compared with the total area of a water body (such as a river segment), then mixing zones are likely to have little effect on the integrity of the water body as a whole, provided that they do not impinge on unique or critical habitats. EPA has developed a multistep procedure for evaluating the overall acceptability of mixing zones (Brungs, 1986).

Shape

The shape of a mixing zone should be a simple configuration that is easy to locate in a body of water and that avoids impingement on biologically important areas. In lakes, a circle with a specified radius is generally preferable, but other shapes may be specified in the case of unusual site requirements. Most States allow mixing zones as a policy issue but provide spatial dimensions to limit the areal extent of the mixing zones. The mixing zones are then allowed (or not allowed) after case-by-case determinations. State regulations dealing with streams and rivers generally limit mixing zone widths, cross-sectional areas, and flow volumes, and allow lengths to be determined on a case-by-case basis. For lakes, estuaries, and coastal waters, dimensions are usually specified by surface area, width, cross-sectional area, and volume. "Shore-hugging" plumes should be avoided in all water bodies.

Outfall Design

Before designating any mixing zone, the State should ensure that the best practicable engineering design is used and that the location of the existing or proposed outfall will avoid significant adverse aquatic resource and water quality impacts of the wastewater discharge.

In-Zone Quality

Mixing zones are areas where an effluent discharge undergoes initial dilution and are extended to cover the secondary mixing in the ambient water body. A mixing zone is an allocated impact zone where acute and chronic water quality criteria can be exceeded as long as a number of protections are maintained, including freedom from the following:

(1) materials in concentrations that will cause acutely toxic conditions to aquatic life;

(2) materials in concentrations that settle to form objectionable deposits;

(3) floating debris, oil, scum, and other material in concentrations that form nuisances;

(4) substances in concentrations that produce objectionable color, odor, taste, or turbidity; and

(5) substances in concentrations that produce undesirable aquatic life or result in a dominance of nuisance species.

Acutely toxic conditions are defined as those lethal to aquatic organisms that may pass through the mixing zone. As discussed in section 5.1.2 below, the underlying assumption for allowing a mixing zone is that a small area of concentrations in excess of acute and chronic criteria but below acutely toxic releases can exist without causing adverse effects to the overall water body. The State regulatory agency can decide to allow or deny a mixing zone on a site-specific basis. For a mixing zone to be permitted, the discharger should prove to the State regulatory agency that all State requirements for a mixing zone are met.

5.1.2 Prevention of Lethality to Passing Organisms

Lethality is a function of the magnitude of pollutant concentrations and the duration an organism is exposed to those concentrations. Requirements for wastewater plumes that tend to attract aquatic life should incorporate measures to reduce the toxicity (e.g., via pretreatment, dilution) to minimize lethality or any irreversible toxic effects on aquatic life.

EPA's water quality criteria provide guidance on the magnitude and duration of pollutant concentrations causing lethality. The CMC is used as a means to prevent lethality or other acute effects. As explained in Appendix D to the *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a), the CMC is a toxicity level and should not be confused with an LC_{50} level. The CMC is defined as one-half of the final acute value (FAV) for specific toxicants and 0.3 acute toxicity unit (TU_a) for effluent toxicity (USEPA, 1991a. chap. 2). The CMC describes the condition under which lethality will not occur if the duration of the exposure to the CMC level is less than 1 hour. The CMC for whole-effluent toxicity is intended to prevent lethality or acute effects in the aquatic biota. The CMC for individual toxicants prevents acute effects in all but a small percentage of the tested species. Thus, the areal extent and concentration isopleths of the mixing zone must be such that the 1-hour average exposure of organisms passing through the mixing zone is less than the CMC. The organism must be able to pass through quickly or flee the high-concentration area. The objective of mixing zone water quality recommendations is to provide time-exposure histories that produce negligible or no measurable effects on populations of critical species in the receiving system.

Lethality to passing organisms can be prevented in the mixing zone in one of four ways. The first method is to prohibit concentrations in excess of the CMC in the pipe itself, as measured directly at the end of the pipe. As an example, the CMC should be met in the pipe whenever a continuous discharge is made to an intermittent stream. The second approach is to require that the CMC be met within a very short distance from the outfall during chronic design flow conditions for receiving waters (see section 5.2, this Handbook).

If the second alternative is selected, hydraulic investigations and calculations indicate that the use of a high-velocity discharge with an initial velocity of 3 m/sec, or greater, together with a mixing zone spatial limitation of 50 times the discharge length scale in any direction, should ensure that the CMC is met within a few minutes under practically all conditions.

The discharge length scale is defined as the square root of the cross-sectional area of any discharge pipe.

A third alternative (applicable to any water body) is not to use a high-velocity discharge.

Rather the discharger should provide data to the State regulatory agency showing that the most restrictive of the following conditions are met for each outfall:

- The CMC should be met within 10 percent of the distance from the edge of the outfall structure to the edge of the regulatory mixing zone in any spatial direction.

- The CMC should be met within a distance of 50 times the discharge length scale in any spatial direction. In the case of a multiport diffuser, this requirement must be met for each port using the appropriate discharge length scale of that port. This restriction will ensure a dilution factor of at least 10 within this distance under all possible circumstances, including situations of severe bottom interaction, surface interaction, or lateral merging.

- The CMC should be met within a distance of 5 times the local water depth in any horizontal direction from any discharge outlet. The local water depth is defined as the natural water depth (existing prior to the installation of the discharge outlet) prevailing under mixing-zone design conditions (e.g., low-flow for rivers). This restriction will prevent locating the discharge in very shallow environments or very close to shore, which would result in significant surface and bottom concentrations.

A fourth alternative (applicable to any water body) is for the discharger to provide data to the State regulatory agency showing that a drifting organism would not be exposed to 1-hour average concentrations exceeding the CMC, or would not receive harmful exposure when evaluated by other valid toxicological analysis (USEPA, 1991a, chap. 2). Such data should be collected during environmental conditions that replicate critical conditions.

For the third and fourth alternatives, examples of such data include monitoring studies, except for those situations where collecting chemical samples to develop monitoring data would be impractical, such as at deep outfalls in oceans, lakes, or embayments. Other types of data could include field tracer studies using dye, current meters, other tracer materials, or detailed analytical calculations, such as modeling estimations of concentration or dilution isopleths.

The following outlines a method, applicable to the fourth alternative, to determine whether a mixing zone is tolerable for a free-swimming or drifting organism. The method incorporates mortality rates (based on toxicity studies for the pollutant of concern and a representative organism) along with the concentration isopleths of the mixing zone and the length of time the organism may spend in each isopleth. The intent of the method is to prevent the actual time of exposure from exceeding the exposure time required to elicit an effect:

$$\sum \left(\frac{T(n)}{ET(X) \text{ at } C_{(n)}} \right) \leq 1$$

where T(n) is the exposure time an organism is in isopleth n, and ET(X) is the "effect time." That is, ET(X) is the exposure time required to produce an effect (including a delayed effect) in X percent of organisms exposed to a concentration equal to $C_{(n)}$, the concentration in isopleth n. ET(X) is experimentally determined; the effect is usually mortality. If the summation of ratios of exposure time to effect time is less than 1, then the percent effect will not occur.

5.1.3 Human Health Protection

For protection of human health, the presence of mixing zones should not result in significant health risks when evaluated using reasonable assumptions about exposure pathways. Thus, where drinking water contaminants are a concern, mixing zones should not encroach on drinking water intakes. Where fish tissue residues are a concern (either because of measured or predicted residues), mixing zones should not be projected to result in significant health risks to average consumers of fish and shellfish, after considering exposure duration of the affected aquatic organisms in the mixing zone and the patterns of fisheries use in the area.

While fish tissue contamination tends to be a far-field problem affecting entire water bodies rather than a narrow-scale problem confined to mixing zones, restricting or eliminating mixing zones for bioaccumulative pollutants may be appropriate under conditions such as the following:

- Mixing zones should be restricted such that they do not encroach on areas often used for fish harvesting particularly of stationary species such as shellfish.

- Mixing zones might be denied (see section 5.1.4) where such denial is used as a device to compensate for uncertainties in the protectiveness of the water quality criteria or uncertainties in the assimilative capacity of the water body.

5.1.4 Where Mixing Zones Are Not Appropriate

States are not required to allow mixing zones and, if mixing zones are allowed, a State regulatory agency may decide to deny a mixing zone in a site-specific case. Careful consideration must be given to the appropriateness of a mixing zone where a substance discharged is bioaccumulative, persistent, carcinogenic, mutagenic, or teratogenic.

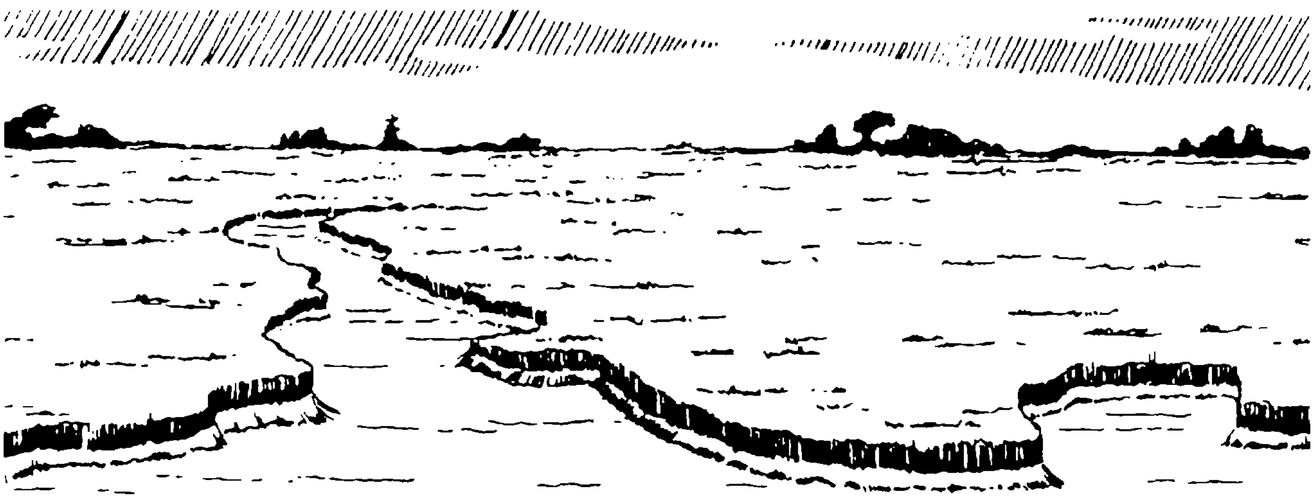
Denial should be considered when bioaccumulative pollutants are in the discharge. The potential for a pollutant to bioaccumulate in living organisms is measured by:

- the bioconcentration factor (BCF), which is chemical-specific and describes the degree to which an organism or tissue can acquire a higher contaminant concentration than its environment (e.g., surface water);

- the duration of exposure; and

- the concentration of the chemical of interest.

While any BCF value greater than 1 indicates that bioaccumulation potential exists, bioaccumulation potential is generally not considered to be significant unless the BCF exceeds 100 or more. Thus, a chemical that is discharged to a receiving stream resulting in



low concentrations and has a low BCF value will not result in a bioaccumulation hazard. Conversely, a chemical that is discharged to a receiving stream resulting in a low concentration but having a high BCF value may result in a bioaccumulation hazard. Also, some chemicals of relatively low toxicity, such as zinc, will bioconcentrate in fish without harmful effects resulting from human consumption.

Factors such as size of zone, concentration gradient within the zone, physical habitat, and attraction of aquatic life are important in this evaluation. Where unsafe fish tissue levels or other evidence indicates a lack of assimilative capacity in a particular water body for a bioaccumulative pollutant, care should be taken in calculating discharge limits for this pollutant or the additivity of multiple pollutants. In such instances, the ecological or human health effects may be so adverse that a mixing zone is not appropriate.

Another example of when a regulator should consider prohibiting a mixing zone is in situations where an effluent is known to attract biota. In such cases, provision of a continuous zone of passage around the mixing area will not serve the purpose of protecting aquatic life. A review of the technical literature on avoidance/attraction behavior revealed that the majority of toxicants elicited an avoidance or neutral response at low concentrations (Versar, 1984). However, some chemicals did elicit an attractive response, but the data were not sufficient to support any predictive methods. Temperature can be an attractive force and may counter an avoidance response to a pollutant, resulting in attraction to the toxicant discharge. Innate behavior such as migration may also supersede an avoidance response and cause a fish to incur a significant exposure.

5.1.5 Mixing Zones for the Discharge of Dredged or Fill Material

EPA, in conjunction with the Department of the Army, has developed guidelines to be applied in evaluating the discharge of dredged or fill material in navigable waters (see 40 CFR 230). The guidelines include provisions for determining the acceptability of mixing discharge zones (section 230.11(f)). The particular pollutant involved should be evaluated carefully in establishing dredging mixing zones. Dredged spoil discharges generally result in temporary short-term disruption and do not represent continuous discharge that will affect beneficial uses over a long term. Disruption of beneficial uses should be the primary consideration in establishing mixing zones for dredge and fill activities. State water quality standards should reflect these principles if mixing zones for dredging activities are referenced.

5.1.6 Mixing Zones for Aquaculture Projects

The Administrator is authorized, after public hearings, to permit certain discharges associated with approved aquaculture projects (section 318 of the Act). The regulations relating to aquaculture (40 CFR 122.56 and 125.11) provide that the aquaculture project area and project approval must not result in the enlargement of any previously approved mixing zone. In addition, aquaculture regulations provide that designated project areas must not include so large a portion of the body of water that a substantial portion of the indigenous biota will be exposed to conditions within the designated projects area (section 125.11(d)). Areas designated for approved aquaculture projects should be treated in the same manner as other mixing zones. Special allowances should not be made for these areas.

5.2 Critical Low-Flows

Water quality standards should protect water quality for designated uses in critical low-flow situations. In establishing water quality standards, States may designate a critical low-flow below which numerical water quality criteria do not apply. At all times, waters shall be free from substances that settle to form objectionable deposits; float as debris, scum, oil, or other matter; produce objectionable color, odor, taste, or turbidity; cause acutely toxic conditions; or produce undesirable or nuisance aquatic life.

To do steady-state waste load allocation analyses, these low-flow values become design flows for sizing treatment plants, developing waste load allocations, and developing water quality-based effluent limits. Historically, these so-called "design" flows were selected for the purposes of waste load allocation analyses that focused on instream dissolved oxygen concentrations and protection of aquatic life. EPA introduced hydrologically and biologically based analyses for the protection of aquatic life and human health with the publication of the *Technical Support Document for Water Quality-based Toxics Control.* These concepts have been expanded subsequently in guidance entitled *Technical Guidance Manual for Performing Wasteload Allocations, Book 6, Design Conditions*, (USEPA, 1986c). These new developments are included in Appendix D of the 1991 *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a). The discussion here is greatly simplified; it is provided to support EPA's recommendation for baseline application values for instream flows and thereby maintain the intended stringency of the criteria for priority toxic pollutants. EPA recommended either of two methods for calculating acceptable low-flows, the traditional hydrologic method developed by the U.S. Geological Survey and a biologically based method developed by EPA.

Most States have adopted specific low-flow requirements for streams and rivers to protect designated uses against the effects of toxics. Generally, these have followed the guidance in the TSD. EPA believes it is essential that States adopt design flows for steady-state analyses so that criteria are implemented appropriately. The TSD also recommends the use of three dynamic models to perform waste load allocations. Because dynamic waste load models do not generally use specific steady-state design flows but accomplish the same effect by factoring in the probability of occurrence of stream flows based on the historical flow record, only steady-state conditions will be discussed here. Clearly, if the criteria are implemented using inadequate design flows, the resulting toxics controls would not be fully effective because the resulting ambient concentrations would exceed EPA's criteria.

In the case of aquatic life, more frequent violations than the assumed exceedences once in 3 years would result in diminished vitality of stream ecosystems characteristics by the loss of desired species such as sport fish. Numeric water quality criteria should apply at all flows that are equal to or greater than flows specified in Exhibit 5-1.

EPA is recommending the harmonic mean flow to be applied with human health criteria for carcinogens. The concept of a harmonic mean is a standard statistical data analysis technique. EPA's model for human health effects assumes that such effects occur because of a long-term exposure to low concentration of a toxic pollutant (for example, 2 liters of water per day for 70 years). To estimate the concentrations of the toxic pollutant in those 2 liters per day by withdrawal from streams with a high daily variation in flow, EPA believes the harmonic mean flow is the correct statistic to use in computing such design flows rather than other averaging techniques. For a description of harmonic means, refer to Rossman (1990).

AQUATIC LIFE

Acute criteria (CMC)	1Q10 or 1B3
Chronic criteria (CCC)	7Q10 or 4B3

HUMAN HEALTH

Non-carcinogens	30Q5
Carcinogens	Harmonic mean flow

Where:

1Q10 is the lowest one day flow with an average recurrence frequency of once in 10 years determined hydrologically;

1B3 is biologically based and indicates an allowable exceedence of once every 3 years. It is determined by EPA's computerized method (DFLOW model);

7Q10 is the lowest average 7 consecutive day low flow with an average recurrence frequency of once in 10 years determined hydrologically;

4B3 is biologically based and indicates an allowable exceedence for 4 consecutive days once every 3 years. It is determined by EPA's computerized method (DFLOW model);

30Q5 is the lowest average 30 consecutive day low flow with an average recurrence frequency of once in 5 years determined hydrologically; and

harmonic mean flow is a long term mean flow value calculated by dividing the number of daily flows analyzed by the sum of the reciprocals of those daily flows.

Exhibit 5-1. EPA recommendations for design flows

EPA has produced guidance on flow considerations (USEPA, 1986d) which calculates design flows based on steady-state modeling. Two design flows are calculated, one for the criterion continuous concentration (CCC) and one for the criterion maximum concentration (CMC). The CCC is the 4-day average concentration of a pollutant in ambient water that should not be exceeded more than once every 3 years on average. The CCC is therefore, a chronic concentration. The CMC is a 1-hour average concentration in ambient waters that should not be exceeded more than once every 3 years on average. The CMC is an acute concentration. Note that when a criterion specifies a 4-day average concentration that should not be exceeded more than once every 3 years, this should not be interpreted as implying that a 4Q3 low-flow is appropriate for use as the design flow.

EPA had recommended interim use of the 1Q5 and 1Q10 low-flow as the CMC design flow and the 7Q5 and 7Q10 low-flows as the CCC design flow for unstressed and stressed systems, respectively. Further consideration of stress placed on aquatic ecosystems resulting from exceedences of water quality criteria indicates that there is little justification for different design flows for unstressed and stressed systems. All ecosystems have been changed and, therefore, stressed as a result of human activities. Therefore, the recommended design flow for CMC is 1Q10 and for CCC is 7Q10. States may designate other design or low-flows but such flows, must be scientifically justified. That many streams within a State have no flow at 7Q10 is not adequate justification for designating alternative flows.

5.3 Variances From Water Quality Standards

EPA first formally indicated allowability of State WQS variance provisions in Decision of the General Counsel No. 44, dated June 22, 1976, which specifically considered an Illinois variance provision, and expanded upon the acceptability of State WQS variance procedures in Decision of the General Counsel No. 58 (OGC No. 58) dated March 29, 1977 (published, in part, at 44 F.R. 39508 (July 6, 1979)). Subsequent guidance has elaborated on or clarified the policy over the years. For example, the Director of EPA's Criteria and Standards Division transmitted EPA's definition of a WQS variance to the Regional WQS Coordinators on July 3, 1979, and on March 15, 1985, the Director of the Office of Water Regulations and Standards, responding to questions raised on WQS variances, issued a reinterpretation of the factors that could be considered when granting variances.

Variance procedures involve the same substantive and procedural requirements as removing a designated use (see section 2.7, this Handbook), but unlike use removal, variances are both discharger and pollutant specific, are time-limited, and do not forego the currently designated use.

A variance should be used instead of removal of a use where the State believes the standard can ultimately be attained. By maintaining the standard rather than changing it, the State will assure that further progress is made in improving water quality and attaining the standard. With a variance, NPDES permits may be written such that reasonable progress is made toward attaining the standards without violating section 402(a)(1) of the Act, which requires that NPDES permits must meet the applicable water quality standards.

State variance procedures, as part of State water quality standards, must be consistent with the substantive requirements of 40 CFR 131. EPA has approved State-adopted variances in the past and will continue to do so if:

- each individual variance is included as part of the water quality standard;
- the State demonstrates that meeting the standard is unattainable based on one or more of the grounds outlined in 40 CFR 131.10(g) for removing a designated use;
- the justification submitted by the State includes documentation that treatment more advanced than that required by sections 303(c)(2)(A) and (B) has been carefully considered, and that alternative effluent control strategies have been evaluated;
- the more stringent State criterion is maintained and is binding upon all other dischargers on the stream or stream segment;
- the discharger who is given a variance for one particular constituent is required to meet the applicable criteria for other constituents;
- the variance is granted for a specific period of time and must be rejustified upon expiration but at least every 3 years (Note: the 3-year limit is derived from the triennial review requirements of section 303(c) of the Act.);
- the discharger either must meet the standard upon the expiration of this time period or must make a new demonstration of "unattainability";
- reasonable progress is being made toward meeting the standards; and
- the variance was subjected to public notice, opportunity for comment, and public hearing. (See section 303(c)(1) and 40 CFR 131.20.) The public notice should contain a clear description of the impact of the variance upon achieving water quality standards in the affected stream segment.

CHAPTER 6

PROCEDURES FOR REVIEW AND REVISION OF WATER QUALITY STANDARDS

(40 CFR 131 - Subpart C)

Table of Contents

CHAPTER 6
PROCEDURES FOR REVIEW AND REVISION OF WATER QUALITY STANDARDS

State review and revision of water quality standards are discussed in section 6.1. of this chapter. Guidance is provided on the administrative and regulatory requirements and procedures that should be followed in the State review and submittal process as well as the implication of a State's failure to submit standards. EPA review and approval procedures are discussed in section 6.2, and the procedures for promulgation of Federal standards are described in section 6.3.

6.1 State Review and Revision

Section 303(c)(1) of the Clean Water Act requires that a State shall, from time to time, but at least once every 3 years, hold public hearings to review applicable water quality standards and, as appropriate, to modify and adopt standards. The 3-year period is measured from the date of the letter in which the State informs EPA that revised or new standards have been adopted for the affected waters and are being submitted for EPA review or, if no changes were made in the standards for those waters, from the date of the letter in which the State informs EPA that the standards were reviewed and no changes were made.

States identify additions or revisions necessary to existing standards based on their 305(b) reports, other available water quality monitoring data, previous water quality standards reviews, or requests from industry, environmental groups, or the public. Water quality standards reviews and revisions may take many forms, including additions to and modifications in uses, in criteria, in the antidegradation policy, in the antidegradation implementation procedures, or in other general policies.

6.1.1 Consultation with EPA

State consultation with EPA regional offices should occur when States begin activities to revise or adopt new water quality standards and long before the State standards are formally submitted for EPA review. Reasons for early consultation with EPA include the following:

- States will benefit from early identification of potential areas of disagreement between EPA and the States, and EPA can determine where assistance may be provided;
- EPA must be in a position to respond to litigation and to congressional and other inquiries relating to actions on the revised State water quality standards;
- Headquarters must be ready to support promulgation actions when State standards have been disapproved;
- early consultation with EPA allows issues to be discussed well before a formal review request is received from the State; and
- EPA actions related to State standards should receive as comprehensive a review as possible.

6.1.2 Public Notice Soliciting Suggestions for Additions or Revisions to Standards

An important component of the water quality standards setting and review process is a

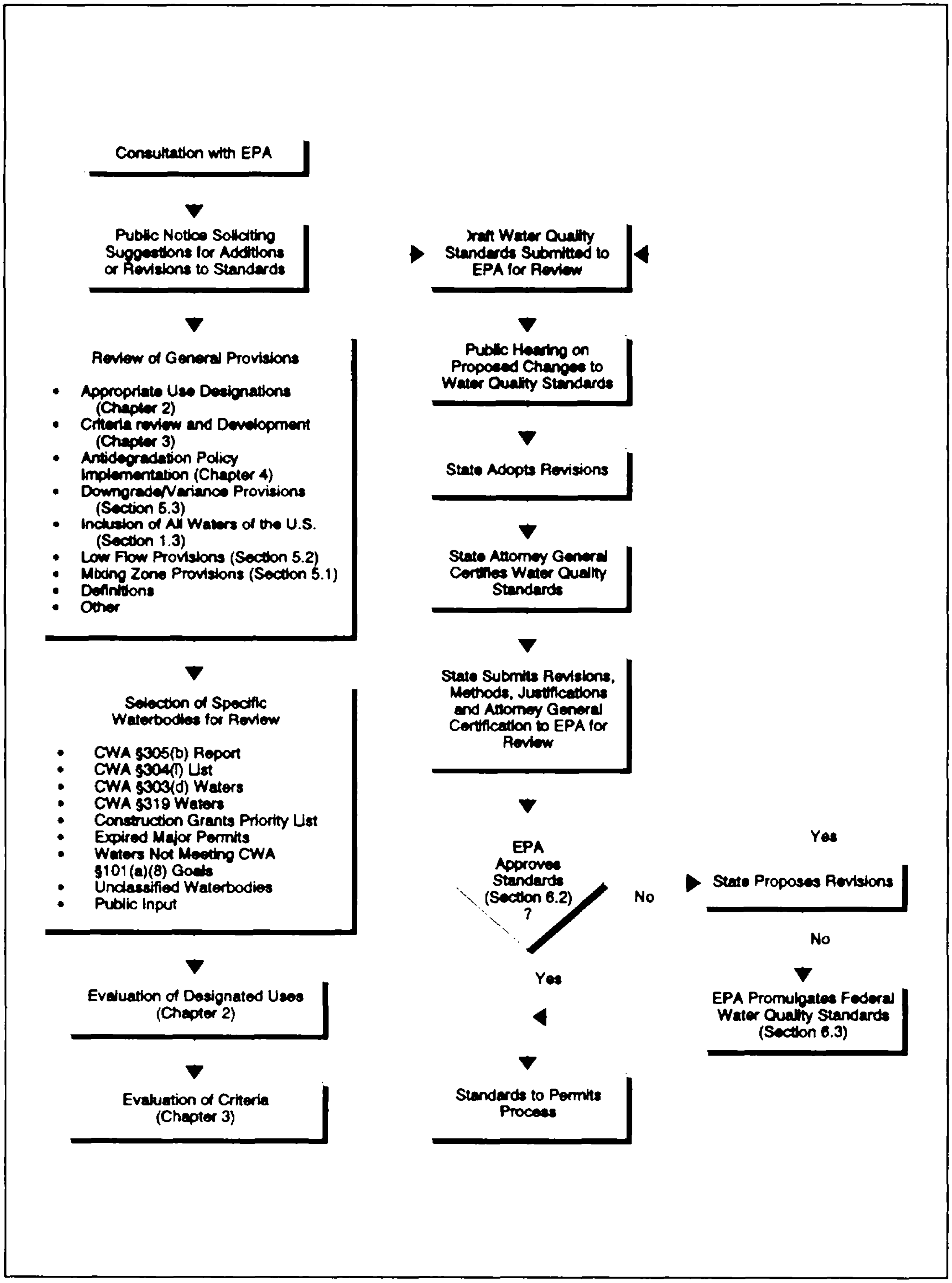


Figure 6-1. Simplified Flow Chart of a Typical State Water Quality Standards Review Process

meaningful involvement of those affected by the standards decisions. At a minimum, section 303(c) of the Clean Water Act requires States to hold a public hearing in reviewing and revising water quality standards. (State law may require more than one hearing.) However, States are urged to involve the public more actively in the review process. Involvement of the public includes the involvement of citizens affected by standards decisions, the regulated community (municipalities and industry), and inter-governmental coordination with local, State, and Federal agencies, and Indian Tribes with an interest in water quality issues. This partnership will ensure the sharing of ideas, data, and information, which will increase the effectiveness of the total water quality management process.

Public involvement is beneficial at several points in the water quality standards decision making process. Enlisting the support of municipalities, industries, environmentalists, universities, other agencies, and the affected public in collecting and evaluating information for the decision making process should assist the State in improving the scientific basis for, and in building support for, standards decisions. The more that people and groups are involved early in the process of setting appropriate standards, the more support the State will have in implementing the standards.

6.1.3 Review of General Provisions

In each 3-year water quality standards review cycle, States review the general provisions of the standards for adequacy taking into consideration:

- new Federal or State statutes, regulations, or guidance;
- legal decisions involving application of standards; or
- other necessary clarifications or revisions.

Inclusion of All Waters of the United States

Water quality standards are needed for all "waters of the United States," defined in the National Pollution Discharge Elimination System Regulations at 40 CFR 122.2 to include all interstate waters, including wetlands, and all intrastate lakes, rivers, streams (including intermittent streams), wetlands, natural ponds, etc., the use, degradation or destruction of which would affect or could affect interstate or foreign commerce. The term "waters of the United States" should be read broadly during the standards review process. States should ensure that all waters under this definition are included in the States' water quality standards, are assigned designated uses, and have protective criteria.

Definitions

Terms used in the Water Quality Standards Regulation are defined in 40 CFR 131.3. The glossary of this document contains these and other water quality standards-related terms defined by the Clean Water Act, EPA regulation, or guidance. States, when reviewing their water quality standards, should at a minimum define those terms included in the Definitions section of the regulation to be synonymous with the EPA definitions.

6.1.4 Selection of Specific Water Bodies for Review

The Water Quality Standards Regulation allows States to establish procedures for identifying and reviewing the standards on specific water bodies in detail. Any procedures States establish to revise standards should be articulated in the continuing planning process consistent with the water quality management regulation. Water bodies receiving a detailed standards review are most likely to be those where:

- combined sewer overflow (CSO) funding decisions are pending;

- water quality-based permits are scheduled to be issued or reissued;

- CWA goal uses are not being met;

- toxics have been identified and are suspected of precluding a use or may be posing an unreasonable risk to human health; or

- there may be potential impacts on threatened or endangered species.

States may have other reasons for wishing to examine a water body in detail, such as human health problems, court orders, or costs or economic and social impacts of implementing the existing water quality standards. States must reexamine any water body with standards not consistent with the section 101(a)(2) goals of the Act every 3 years, and if new information indicates that section 101(a)(2) goal uses are attainable, revise its standards to reflect those uses.

States are encouraged to review standards for a large enough area to consider the interaction between both point and nonpoint source discharges. In carrying out standards reviews, the States and EPA should ensure proper coordination of all water quality programs.

6.1.5 Evaluation of Designated Uses

Once priority water bodies have been selected for review, the designated uses must be evaluated. This may involve some level of data collection up to and including a full water body survey and assessment; however, an intensive survey of the water body is not necessary if adequate data are available. The purpose of the evaluation is to pinpoint problems and to characterize present uses, attainable uses (uses that could exist in the absence of anthropogenic effects), uses impaired or precluded, and the reasons why uses are impaired or precluded. Information generated in the survey also can be used to establish the basis for seasonal uses and subcategories of uses.

Included in section 2.9 of this Handbook are examples of a range of physical, chemical, and biological characteristics of the water body that may be surveyed when evaluating aquatic protection uses. This information is then used in determining the existing species in the water body and the health of those species, as well as what species could be in the water body given the physical characteristics of the water body, or what species might be in the water if the quality of the water were improved.

Review of the Cause of Uses Not Being Met

If the survey indicates that designated uses are impaired, the next step is to determine the cause. In many situations, physical conditions and/or the presence of pollutants prevent the water body from meeting its designated use. Physical limitations refer to such factors as depth, flow, habitat, turbulence, or structures such as dams that might make a use unsuitable or impossible to achieve regardless of water quality.

If uses are precluded because of physical limitations of the water body, the State may wish to examine modifications that might allow a habitat suitable for a species to thrive where it could not before. Some of the techniques which have been used include bank stabilization, current deflectors, construction of oxbows, or installation of spawning beds. A State also might wish to consider improving the access to the water body, improving facilities nearby so that it can be used for recreational purposes, or establishing seasonal uses or subcategories of a use.

If uses are not being met because of water pollution problems, the first step in the process is to determine the cause. If the standards review process is well coordinated with the total maximum daily load (TMDL) determination and the permit process, permitees may be required to conduct some of the analyses necessary to determine why uses are not attained (For more information on the TMDL process, see chapter 7, this Handbook.) When background levels of pollutants are irreversible and criteria cannot be met, States should evaluate other more appropriate uses and revise the water quality standards appropriately.

Determination of Attainable Uses

Consideration of the suitability of the water body to attain a use is an integral part of the water quality standards review and revision process. The data and information collected from the water body survey provide a firm basis for evaluating whether the water body is suitable for the particular use. Suitability depends on the physical, chemical, and biological characteristics of the water body, its geographic setting and scenic qualities, and the socioeconomic and cultural characteristics of the surrounding area. Suitability must be assessed through the professional judgment of the evaluators. It is their task to provide sufficient information to the public and the State decision makers.

In some instances, physical factors may preclude the attainment of uses regardless of improvements in the chemistry of the receiving water. This is particularly true for fish and wildlife protection uses where the lack of a proper substrate may preclude certain forms of aquatic life from using the stream for propagation, or the lack of cover, depth, flow, pools, riffles, or impacts from channelization, dams, or diversions may preclude particular forms of aquatic life from the stream altogether. While physical factors may influence a State's decision regarding designation of uses for a water body, States need to give consideration to the incidental uses that may be made of the water body notwithstanding the use designation. For example, even though it may not make sense to encourage use of a stream for swimming because of the flow, depth, or velocity of the water, the States and EPA must recognize that swimming and/or wading may, in fact, occur. To protect public health, States must set criteria to reflect swimming if it appears that primary contact recreation will, in fact, occur in the stream.

While physical factors are important in evaluating whether a use is attainable, physical limitations of the stream may not be an overriding factor. Common sense and good judgment play an important role in setting appropriate uses and criteria. In setting criteria and uses, States must assure the attainment of downstream standards. The downstream uses may not be affected by the same physical limitations as the upstream uses.

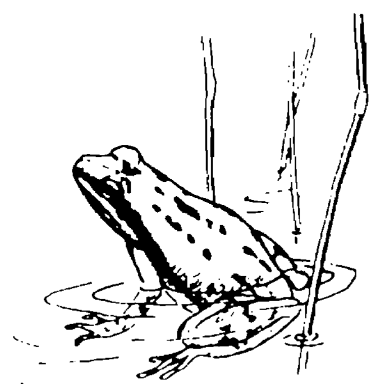
If a change in the designated use is warranted based on a use attainability analysis, States may modify the uses currently assigned. In doing so, the State should designate uses that can be supported given the physical, chemical, or biological limitations of the water body. Or, a State may designate uses on a seasonal basis. Seasonal use designations may be appropriate for streams that lack adequate water volume to support aquatic life year round, but can be used for fish spawning, etc., during higher flow periods. In setting seasonal uses, care must be taken not to allow the creation of conditions instream that preclude uses in another season. EPA encourages the designation of seasonal uses as an alternative to completely downgrading the use of a water body.

Economic Impact Assessment

The Water Quality Standards Regulation allows States to establish uses that are inconsistent with the section 101(a)(2) goals of the Act if the more stringent technology required to meet the goals will cause substantial and widespread economic and social impact. These are impacts resulting specifically from imposition of the pollution controls and reflect such factors as unemployment, plant closures, and changes in the governmental fiscal base. The analysis should address the incremental effects of water quality standards beyond technology-based or other State requirements. If the requirements are not demonstrated to have an incremental, substantial, and widespread impact on the affected community, the standard must be maintained or made compatible with the goals of the Act.

6.1.6 Evaluation of Criteria

Changes in use designations also must be accompanied by consideration of the need for a change in criteria. If a use is removed, the criteria to protect that use may be deleted or revised to assure protection of the remaining uses. If a use is added, there must be adequate water quality criteria to protect the use. Regardless of whether changes or modifications in uses are made, criteria protective of the use must be adopted. Certain criteria are deemed essential for inclusion in all State standards, and criteria for section 307(a) toxic pollutants must be addressed consistent with section 303(c)(2)(B) (see chapter 3, this Handbook). All State standards should contain the "free froms" narrative statements (see section 3.5.2) in addition to numerical limits that can be used as a basis for regulating discharges into surface waters. Also, water quality parameters such as temperature, dissolved oxygen, pH, and bacteriological requirements are basic to all State standards.



EPA's laboratory-derived criteria may not always accurately reflect the bioavailability and/or toxicity of a pollutant because of the effect of local physical and chemical characteristics or varying sensitivities of local aquatic communities. Similarly, certain compounds may be more or less toxic in some waters because of differences in temperature, hardness, or other conditions. Setting site-specific criteria is appropriate where:

- background water quality parameters, such as pH, hardness, temperature, color, appear to differ significantly from the laboratory water used in developing the section 304(a) criteria; or

- the types of local aquatic organisms differ significantly from those actually tested in developing the section 304(a) criteria.

Developing site-specific criteria is a method of taking local conditions into account so that criteria are adequate to protect the designated use without being more or less stringent than needed. A three-phase testing program that includes water quality sampling and analysis, a biological survey, and acute bioassays provides an approach for developing site-specific criteria. Much of the data and information for the water quality sampling and analysis and the biological survey can be obtained while conducting the assessment of the water body. Included in section 3.10 of this Handbook are scientifically acceptable procedures for setting site-specific pollutant concentrations that will protect designated uses. EPA believes that setting site-specific criteria will occur on only a limited number of stream segments because of the resources required to conduct the analyses and the basic soundness of the section 304(a) recommendations.

6.1.7 Draft Water Quality Standards Submitted to EPA for Review

While not a regulatory requirement, prudence dictates that draft State water quality standards be submitted to EPA for review. The EPA regional office and Headquarters will conduct concurrent reviews of draft standards and make comments on proposed revisions to assist the State in producing standards that are approvable by the Regional Administrator. Continuing cooperation between the State and EPA is essential to timely approval of State standards.

6.1.8 Public Hearing on Proposed Changes to Standards

Before removing or modifying any use or changing criteria, the Clean Water Act requires the State to hold a public hearing. More than one hearing may be required depending on State regulations. It may be appropriate to have EPA review the adequacy of justifications including the data and the suitability and appropriateness of the analyses and how the analyses were applied prior to the public hearing. In cases where the analyses are judged to be inadequate, EPA will identify how the analyses could be improved and suggest the additional types of evaluations or data needed. By consulting with EPA frequently throughout the review process, States can be better assured that EPA will be able to expeditiously review State submissions and make the determination that the standards meet the requirements of the Act.

The analyses and supporting documentation prepared in conjunction with the proposed water quality standards revision should be made available to the interested public prior to the hearing. Open discussion of the scientific evidence and analysis supporting proposed revisions in the water quality standards will assist the State in making its decision.

6.1.9 State Adopts Revisions; Submits Standards Package to EPA for Review

Within 30 days of their final administrative action, States submit to EPA water quality standards revisions, supporting analyses, and State Attorney General certification that the standards were duly adopted pursuant to State law. Final administrative action is meant to be the last action a State must take before its revision becomes a rule under State law and it can officially transmit State-adopted standards to EPA for review. This last action might be a signature, a review by a legislative committee or

State Board, or a delay mandated by a State administrative procedures act.

In reviewing changes in uses that are inconsistent with the section 101(a)(2) goals of the Act or changes in criteria, EPA will carefully consider the adequacy of the analyses and the public comments received during the hearing process. Standards are to meet the goals of the Act unless the State can clearly demonstrate that the uses reflected in the goals are unattainable.

6.2 EPA Review and Approval

When States adopt new or revised water quality standards, the State is required under CWA Section 303(c) to submit such standards to EPA for review and approval/disapproval. Section 131.20(c) of the Water Quality Standards Regulation requires the submittal to EPA to occur within 30 days of the final State action. Figure 6.2 outlines EPA's review process. EPA reviews and approves/disapproves the standards based on whether the standards meet the requirements of the CWA and the Water Quality Standards Regulation. States are encouraged to provide early drafts to the EPA Regional Office so that issues can be resolved during the water quality standards review process, prior to formal State proposal or adoption of revised or new standards.

When reviewing State water quality standards, EPA ensures that the standards meet the minimum requirements of the Act and Water Quality Standards Regulation. Pursuant to section 510 of the Act, State water quality standards may be more stringent than EPA's minimum requirements.

The general elements of an EPA review include, but are not limited to, the following:

- EPA determines whether "fishable/ swimmable" designated uses have been assigned to all State waters or a use attainability analysis (UAA) is available to support the designation of other uses. Other uses may satisfy the CWA section 101(a)(2) goal if properly supported by a UAA. EPA reviews the adequacy of the analyses.

- EPA determines whether the State's water quality criteria are sufficient to protect the designated uses by ensuring that all numeric criteria are based on CWA Section 304(a) guidance, 304(a) guidance modified to reflect site-specific conditions, or other scientifically defensible methods. EPA's decision to accept criteria based on site-specific calculations or alternative scientific procedures is based on a determination of the validity and adequacy of the supporting scientific procedures and assumptions and not on whether the resulting criterion is more or less stringent than the EPA guideline.

- EPA ensures that uses and/or criteria are consistent throughout the water body and that downstream standards are protected. A review to determine compliance with downstream standards is most likely to involve bodies of water on, or crossing, interstate and international boundaries.

- Where the analyses supporting any changes in the standards are inadequate, EPA identifies how the analyses need to be improved and suggests the type of information or analyses needed.

- For waters where uses have not been designated in support of the fishable/ swimmable goal of the CWA, EPA determines whether the alternative uses are based on an acceptable UAA and whether such UAAs have been reviewed every 3 years as required by 40 CFR 131.20(a).

- EPA ensures that general "free from" narrative criteria are included that protect all waters at all flows from substances that

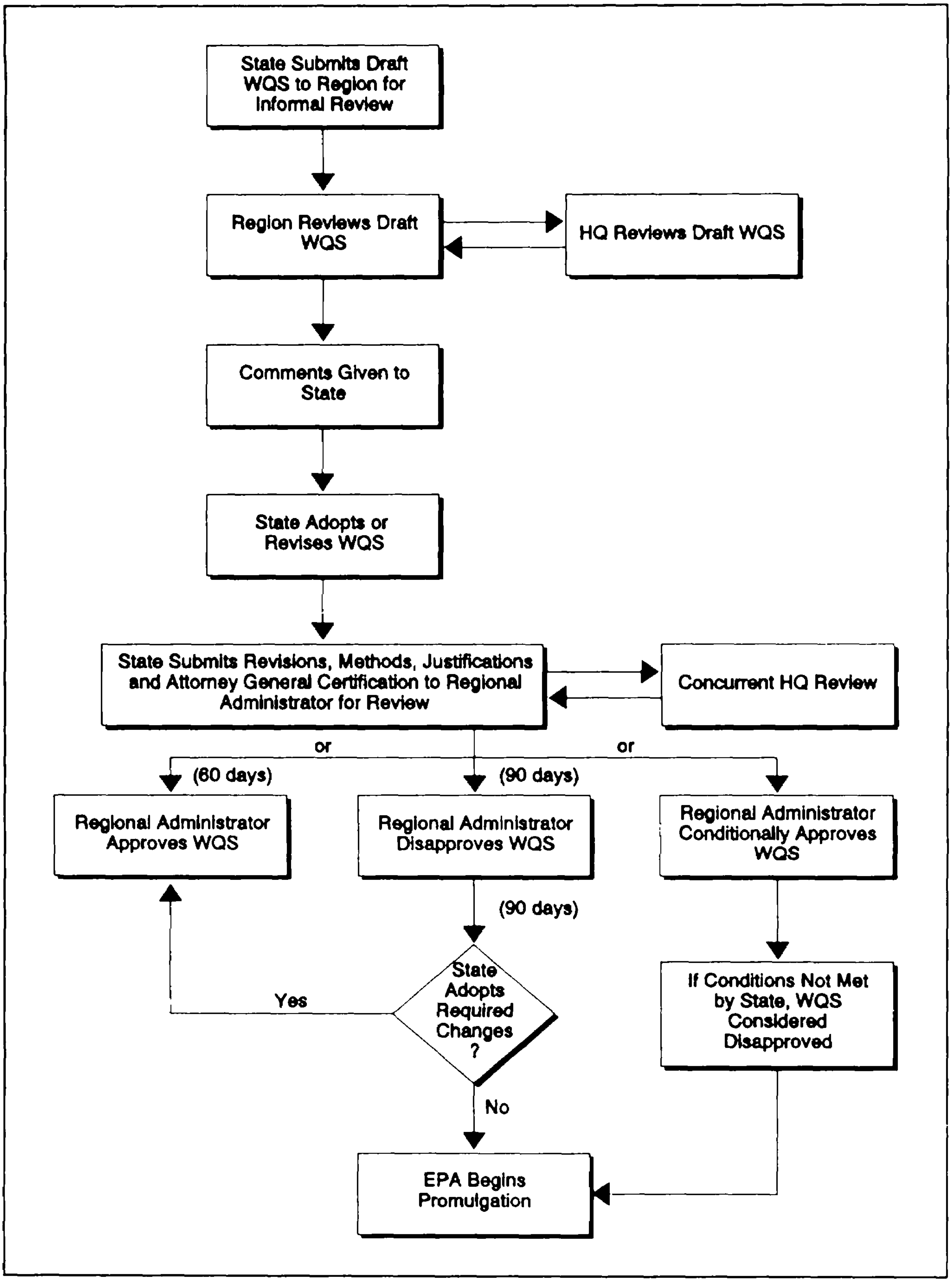


Figure 6-2. Overview of EPA Water Quality Standards Review Process

settle to form objectionable deposits; float as debris, scum, oil, or other matter; produce objectionable color, odor, taste, or turbidity; are acutely toxic; or produce undesirable or nuisance aquatic life.

- EPA determines whether the State has included criteria for CWA section 307(a) "priority" pollutants sufficient to satisfy the requirements of CWA section 303(c)(2)(B).

- For toxic pollutants where EPA has not issued guidance or it is not known which toxicant or toxicants are causing the problem, EPA ensures that the State standards include or reference a method for implementing the narrative toxics "free from" criterion.

- EPA ensures that the State's antidegradation policy meets the requirements of section 131.12 of the Water Quality Standards Regulation.

- EPA reviews whether the State has provided or referenced a procedure for implementing the antidegradation policy.

- Where (optional) general policies are included in the State water quality standards (e.g., mixing zone provisions, variance policies, low-flow exemption policies), EPA reviews whether the policies are consistent with the latest EPA guidance.

- EPA reviews comments and suggestions on previous State water quality standards to ensure that any areas for improvement or conditions attached to previous approvals have been acted upon satisfactorily.

- EPA reviews whether the policies are consistent with the latest EPA guidance and regulatory requirements.

- EPA ensures that the State has met the minimum requirements for a standards submission as outlined in section 131.6 of the Water Quality Standards Regulation.

- EPA reviews whether the State has complied with the procedural requirements (e.g., public participation) for conducting water quality standards reviews.

Since 1972, EPA review and approval/ disapproval includes concurrent reviews by the Regions and Headquarters. However, because the EPA regional Administrator has the responsibility for approving/disapproving water quality standards and because of the decentralized structure of EPA, the regional offices are the primary point of contact with the States. The EPA regional offices, not the States, are responsible for providing copies of State water quality standards to EPA Headquarters for review and for acting as liaison between States and EPA Headquarters on most matters affecting the water quality standards program. The basic internal EPA review procedures have been described in various guidance documents over the years; the most was a memorandum dated December 17, 1984. This memorandum also made one minor change to the process. It required that Headquarters be consulted immediately for possible advice and assistance when the Regional Office learns that a State:

- is proposing to lower designated water uses below the section 101(a)(2) goals of the Act;

- is not raising water uses to meet the section 101(a)(2) goals of the Act; or

- is considering adopting a water quality criterion less stringent than currently included in a State's standard.

To expedite Headquarters review, copies of State water quality standards revisions (draft and final) must be provided to the Director, Standards and Applied Science Division, at the time they are received by the Region. The Standards and Applied Science Division will involve other EPA offices in the review as appropriate, and provide comments and suggestions, if any, to regional offices for consideration in State-EPA negotiations and final standards decisions. Their review will be expeditiously accomplished so as not to slow regional approval/disapproval. Neither the regional nor Headquarters review need be limited only to revisions to existing standards or to new standards.

In general, three outcomes are possible:

- EPA approval, in whole or in part, of the submitted State water quality standards;
- EPA disapproval, in whole or in part, of the submitted State water quality standards; and
- EPA conditional approval, in whole or in part, of the submitted State water quality standards.

Unconditional approval or disapproval of State-adopted water quality standards within the statutory time limits is the preferred approach. Conditional approvals should be used only as a limited exception to this general policy for correcting minor deficiencies in State standards and only if a State provides assurance that it will submit corrections on a specified, written schedule. Failure of a State to respond in a timely manner to the conditions expressed in the letter means that the standards are disapproved and the Region must promptly request Headquarters to initiate a promulgation action. Where this occurs, the Region should formally notify the State in writing that their failure to meet the conditions previously specified results in the standards now being disapproved as of the original date of the conditional approval letter.

6.2.1 Policies and Procedures Related to Approvals

Authority to approve or disapprove State water quality standards is delegated by the Administrator to each Regional Administrator. The Administrator retains the authority to promulgate standards. Revisions to State water quality standards that meet the requirements of the Act and the Water Quality Standards Regulation are approved by the appropriate EPA Regional Administrator. The Regional Administrator must, within 60 days, notify the Governor or his designee by letter of the approval and forward a copy of the letter to the appropriate State agency. The letter should contain any information that might be helpful in understanding the scope of the approval action. If particular events (e.g., State implementation decisions, pending Federal legislation pertaining to water quality standards requirements) could result in a failure of the approved standards to continue to meet the requirements of the Act, these events should be identified in the approval letter. Such events should be identified for the record to guide future review and revision activities.

When only a portion of the revisions submitted meet the requirements of the Act and the Water Quality Standards Regulation, the Regional Administrator may approve only that portion. If only a partial approval is made, the Region must, in notifying the State, be as specific as possible in identifying what is disapproved and why. The Regional Administrator must also clearly indicate what action the State could take to make the disapproved item acceptable.

6.2.2 Policies and Procedures Related to Disapprovals

If the Regional Administrator determines that the revisions submitted are not consistent with or do not meet the requirements of the Act or the Water Quality Standards Regulation, the Regional Administrator must disapprove such standards within 90 days. Such disapproval must be via written notification to the Governor of the State or his designee. The letter must state why the revisions are not consistent with the Act or the Water Quality Standards

Regulation and specify the revisions that must be adopted to obtain full approval. The letter must also notify the Governor that the Administrator will initiate promulgation proceedings if the State fails to adopt and submit the necessary revisions within 90 days after notification.

A State water quality standard remains in effect, even though disapproved by EPA, until the State revises it or EPA promulgates a rule that supersedes the State water quality standard. This is because water quality standards are State laws, not Federal laws, and once the law is amended by the State, the previously adopted and EPA-approved standards no longer legally exist.

6.2.3 Policies and Procedures Related to Conditional Approvals

Conditional approvals are EPA approvals contingent on the performance of specified actions on the part of a State in a timely manner. There is an implicit or explicit statement in the letter to the State that failure to satisfy the identified conditions will nullify the conditional approval and lead to Federal promulgation action. Problems have arisen with inconsistent use of conditional approvals among the regions and with followup actions to ensure that a State is responding to the conditions in a timely manner.

Because promulgation of Federal standards is inherently a lengthy process, the use of conditional approvals evolved over the years as another mechanism to maintain the State-Federal relationship in establishing standards. When used properly, conditional approvals can result in standards that fully meet the requirements of the Act without undue Federal intervention and promote smooth operation of the national program.

If used improperly, conditional approvals can be an unacceptable delaying tactic to establishing standards and can be construed as EPA failing to properly exercise its duty to review and either approve or disapprove and promptly initiate promulgation action after the allotted 90-day period for State action. This improper use of conditional approvals must be avoided.

It is incumbent on a Region that uses a conditional approval to ensure that State action is timely. When a State fails to meet the agreed-upon schedule, EPA should initiate promulgation action. Conditional approvals are to be used only to correct minor deficiencies and should be the exception, not the rule, governing regional responses to State standards. Note that requests for clarification or additional information are not approval actions of any type.

This policy is modeled after that applied to EPA approval of State implementation plans

(SIPs) in the air program. (See 44 F.R. 38583, July 2, 1979. See also *Mississippi Commission on Natural Resources* v. *Costle*, 625 F. 2d 1269 (5th Cir.) 1980.)

Necessary Elements of Conditional Approvals

First, conditional approvals are appropriate only for "minor deficiencies." Blatant disregard of Federal statutory or regulatory requirements or changes that will affect major permit issuance or reissuance are not minor deficiencies. In addition, the State's standards submission as a whole must be in substantial compliance with EPA's regulation. Major deficiencies must be disapproved to allow prompt Federal promulgation action.

Second, the State must commit, in writing, to a mutually satisfactory, negotiated schedule to correct the identified regulatory deficiencies in as short a time period as possible. The time allowed should bear a reasonable relationship to the required action. However, in consideration of the first element above, it is expected that the time period for compliance will be limited to a few months. It is definitely not expected that a year or more will be required. If that is the case, disapproval would be more appropriate. Headquarters concurrence in the schedule is required if it extends for more than 3 months.

6.3 EPA Promulgation

As a matter of policy, EPA prefers that States adopt their own standards. However, under section 303(c)(4) of the Act, EPA may promulgate Federal standards:

- if a revised or new water quality standard submitted by a State is determined by the Administrator not to be consistent with the requirements of the Clean Water Act, or
- in any case where the Administrator determines that a new or revised standard is necessary to meet the requirements of the Act.

Under the latter provision of the statute, EPA would be able to promulgate standards for a State, or States, that failed to conduct a triennial review and submit new or revised standards to EPA for review so long as the Administrator determined new standards were necessary. Where one of these conditions is met, the Administrator has the authority to publish proposed revisions to the State(s) standards in the *Federal Register*. Generally, a public hearing will be held on the proposed standards. Final standards are promulgated after giving due consideration to written comments received and statements made at any public hearings on the proposed revisions.

Although only the Administrator may promulgate State standards, the Regional Office has a major role in the promulgation process. The Regional Office provides the necessary background information and conducts the public hearings. The Regional Office prepares drafts of the rationale supporting EPA's action included in the proposed and final rulemakings. The rationale should clearly state the reason for the disapproval of the State standard.

If conditions warrant (e.g.,a State remedies the deficiencies in its water quality standards prior to promulgation), the Administrator may terminate the rulemaking proceeding at any time. However, if a proposed rulemaking has been published in the *Federal Register*, then the Regional Administrator must not approve the State's changes without obtaining concurrence from Headquarters.

Whenever promulgation proceedings are terminated, a notice of withdrawal of the proposed rulemaking will be published in the *Federal Register*. The Regional Offices are responsible for initiating such action and furnishing a rationale for use in preparing the notice for the Administrator's signature.

An EPA-promulgated standard will be withdrawn when revisions to State water quality standards are made that meet the requirements of the Act. In such a situation, the Regional Office should initiate the withdrawal action by notifying the Standards and Applied Science Division (WH-585) that it is requesting the withdrawal, specifying the rationale for the withdrawal, and obtaining Headquarters concurrence on the acceptability of the State's water quality standards. EPA's action to withdraw a federally promulgated standard requires both a proposed and final rulemaking if the State-adopted standards are less stringent than federally promulgated standards but, in the Agency's judgment, fully meet the requirements of the Act. EPA will withdraw the Federal rule without a notice and comment rulemaking when the State standards are no less stringent than the Federal rule (i.e., standards that provide, at least, equivalent environmental and human health protection).

Withdrawal of a Federal promulgation is based on a determination that State-adopted water quality standards meet the requirements of the Clean Water Act. Such State-adopted standards may be the same as, more stringent than, or less stringent than the Federal rule.

CHAPTER 7

THE WATER QUALITY-BASED APPROACH TO POLLUTION CONTROL

Table of Contents

CHAPTER 7
THE WATER QUALITY-BASED APPROACH TO POLLUTION CONTROL

This chapter briefly describes the overall water quality-based approach and its relationship to the water quality standards program. The water quality-based approach emphasizes the overall quality of water within a water body and provides a mechanism through which the amount of pollution entering a water body is controlled based on the intrinsic conditions of that body of water and the standards set to protect it.

As shown in Figure 7.1, the water quality-based approach contains eight stages. These stages each represent a major Clean Water Act program with specific regulatory requirements and guidance. The presentations in this chapter summarize how the different programs fit into the overall water quality control scheme and are not intended as implementation guidance. Implementation of these programs should be consistent with the specific programmatic regulations and guidance documents provided by the appropriate program office, many of which are cited herein.

The first stage, "Determining Protection Level," involves State development of water quality standards, the subject of the preceding chapters of this Handbook.

In the second stage, "Monitoring and Assessing Water Quality," States identify impaired waters, determine if water quality standards are being met, and detect pollution trends. Sections of the Clean Water Act require States to compile data, assess, and report on the status of their water bodies. States generally use existing information and new data collected from ongoing monitoring programs to assess their waters. This stage is discussed in section 7.2. of this Handbook.

In the third stage, "Establishing Priorities," States rank water bodies according to the severity of the pollution, the uses to be made of the waters, and other social-economic considerations, and determine how best to utilize available resources to solve problems. Section 7.3 of this Handbook discusses the ranking and targeting of water bodies.

In the fourth stage, "Evaluating WQS for Targeted Waters," the appropriateness of the water quality standards for specific waters is evaluated. States may revise or reaffirm their water quality standards. A State may choose, for example, to develop site-specific criteria for a particular stream because a particular species needs to be protected. This stage is discussed in section 7.4 of this Handbook.

In the fifth stage "Defining and Allocating Control Responsibilities," the level of control needed to meet water quality standards is established, and control responsibilities are defined and allocated. States use mathematical models and/or monitoring to determine total maximum daily loads (TMDLs) for water bodies; the TMDLs include waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, and a margin of safety. The TMDL is the amount of a pollutant that may be discharged into a water body and still maintain water quality standards. Pollutant loadings above this amount generally will result in waters exceeding the standards. Allocations for pollution limits for point and nonpoint sources are calculated to ensure that water quality standards are not exceeded. Section 7.5 discusses the TMDL process in greater detail.

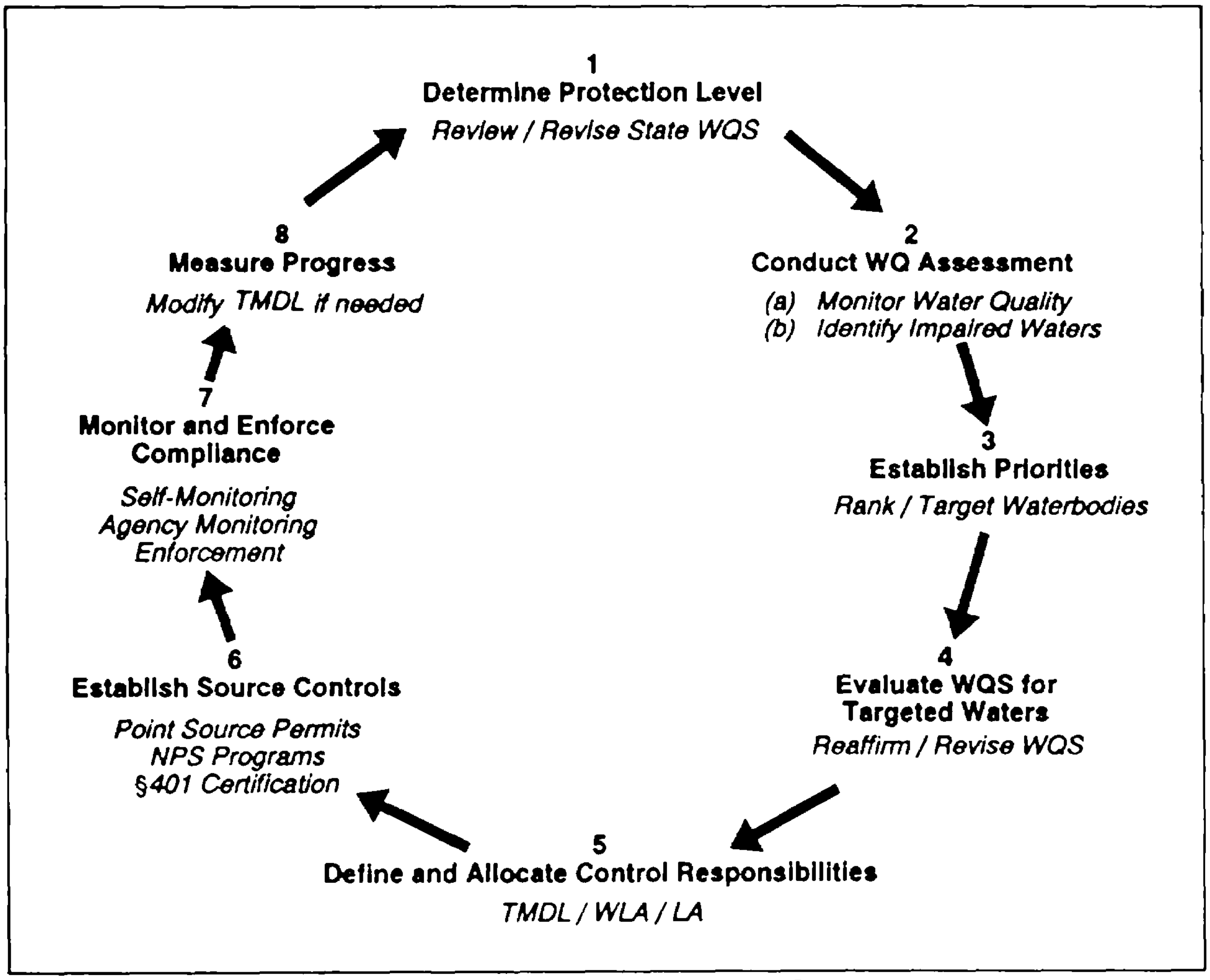


Figure 7-1. Water Quality-Based Approach to Pollution Control

In the sixth stage, "Establishing Source Control," States and EPA implement point source controls through NPDES permits, State and local governments implement nonpoint source management programs through State laws and local ordinances, and States assure attainment of water quality standards through the CWA section 401 certification process. Control actions are discussed in Section 7.6.

In the seventh stage, "Monitoring and Enforcing Compliance," States (or EPA) evaluate self-monitoring data reported by dischargers to see that the conditions of the NPDES permit are being met and take actions against any violators. Dischargers are monitored to determine whether or not they meet permit conditions and to ensure that expected water quality improvements are achieved. State nonpoint source programs are monitored and enforced under State law and to the extent provided by State law.

In the final stage, "Measuring Progress," the States (and EPA) assess the effectiveness of the controls and determine whether water quality standards have been attained, water quality standards need to be revised, or more stringent controls should be applied.

7.1 Determine Protection Level

The water quality-based approach to pollution control begins with the identification of problem water bodies. State water quality standards form the basis and "yardstick" by which States can assess the water body status and implement needed pollution controls. A water quality standard defines the water quality goals of a water body, or portion thereof, by designating the use or uses to be made of the water, by setting criteria necessary to protect the uses, and by preventing degradation of water quality through antidegradation provisions. States adopt water quality standards to protect public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act. "Serve the purposes of the Act" (as defined in sections 101(a), 101(a)(2), and 303(d) of the Act) means that water quality standards should (1) include provisions for restoring and maintaining chemical, physical, and biological integrity of State waters; (2) provide, wherever attainable, water quality for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water ("fishable/swimmable"); and (3) consider the use and value of State waters for public water supplies, propagation of fish and wildlife, recreation, agricultural and industrial purposes, and navigation. The preceding chapters of this Handbook provide EPA's guidance on the water quality standards program.

7.2 Conduct Water Quality Assessment

Once State water quality standards have determined the appropriate levels of protection to be afforded to State water bodies, States conduct water quality monitoring and identify those waters that are "water quality limited," or not meeting the standards.

7.2.1 Monitor Water Quality

Monitoring is an important element throughout the water quality-based decision making process. In this step, monitoring provides data for identifying impaired waters. The Clean Water Act specifies that States and Interstate Agencies, in cooperation with EPA, establish water quality monitoring systems necessary to review and revise water quality standards, assess designated use attainment, calculate TMDLs, assess compliance with permits, and report on conditions and trends in ambient waters. EPA issued guidance in 1985 for *State Water Monitoring and Waste load Allocation* (USEPA, 1985d). Guidance for preparing CWA section 305(b) reports is contained in the *Guidelines for the Preparation of the 1994 State Water Quality Assessments (305(b) Reports)* (USEPA, 1993a). Both of these documents discuss monitoring as an information collection tool for many program needs. The Intergovernmental Task Force on Monitoring Water Quality report (ITFM, 1992) proposes actions to improve ambient water quality monitoring in the United States to allow better management of water resources.

Sections 208(b)(2)(F) through (K) of the CWA require the development of a State process to identify, if appropriate, agricultural, silvicultural, and other nonpoint sources of pollution. NPS monitoring concerns are discussed in several NPS guidance documents along with methods to monitor and evaluate nonpoint sources (*Watershed Monitoring and Reporting Requirements for Section 319 National Monitoring Program Projects* (USEPA, 1991g) and *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (USEPA, 1993b).

7.2.2 Identify Impaired (Water Quality-Limited) Waters

EPA's Water Quality Planning and Management Regulation (40 CFR Part 130) establishes the process for identifying water quality-limited water still requiring total maximum daily loads (TMDLs). Waters require TMDLs when certain pollution control requirements (see Exhibit 7.1) are not stringent enough to maintain water quality standards for such waters.

The most widely applied water pollution controls are the technology-based effluent limitations required by sections 301(b) and 306 of the Clean Water Act. In some cases, a State

(b)(1) Each State shall identify those water quality segments still requiring WLAs/LAs and TMDLs within its boundaries for which:

> **(i) Technology-based effluent limitations required by sections 301(b), 306, 307, or other section of the Act;**
>
> **(ii) More stringent effluent limitations (including prohibitions) required by either State or local authority preserved by section 510 of the Act, of Federal authority (*e.g.*, law, regulation, or treaty); and**
>
> **(iii) Other pollution control requirements (*e.g.*, best management practices) required by local, State, or Federal authority**

are not stringent enough to implement any water quality standard applicable to such waters.

Exhibit 7-1. Identifying Waters Still Requiring TMDLs: 40 CFR 130.7(b)

or local authority may establish enforceable requirements beyond technology-based controls. Examples of such requirements may be those that (1) provide more stringent NPDES permit limitations to protect a valuable water resource, or (2) provide for the management of certain types of nonpoint source pollution.

Identification of good quality waters that are threatened is an important part of this approach. Adequate control of new discharges from either point or nonpoint sources should be a high priority for States to maintain the existing use or uses of these water bodies. In the identification of threatened waters, it is important that the 303(d) process consider all parts of the State water quality standards program to ensure that a State's antidegradation policy and narrative provisions, as well as parameter-specific criteria, are maintained.

Section 303(d) requires States to identify those water quality-limited waters needing TMDLs. States must regularly update their lists of waters as assessments are made and report these lists to EPA once every 2 years. In their biennial submission, States should identify the water quality-limited waters targeted for TMDL development in the next 2 years, and the pollutants or stressors for which the water is water quality-limited.

Each State may have different methods for identifying and compiling information on the status of its water bodies, depending on its specific programmatic or cross-programmatic needs and organizational arrangements. Typically, States utilize both existing information and new data collected from ongoing monitoring programs to assess whether water quality standards are being met, and to detect trends.

States assess their waters for a variety of purposes, including targeting cleanup activities, assessing the extent of contamination at potential Superfund sites, and meeting federally mandated reporting requirements. While the identification of water quality-limited waters may appear to be a major task for the States, a significant amount of this work has already begun or has been completed under sections 305(b), 304(l), 314(a), and 319(a) of the Clean Water Act as amended in 1987.

Section 305(b) requires States to prepare a water quality inventory every 2 years to document the status of water bodies that have been assessed. Under section 304(l), States identified all surface waters adversely affected by toxic (65 classes of compounds), conventional (such as BOD, total suspended solids, fecal coliform, and oil and grease), and nonconventional (such as ammonia, chlorine, and iron) pollutants from both point and nonpoint sources. Under section 314(a), States identify publicly owned lakes for which uses are known to be impaired by point and nonpoint sources, and report those identified in their

305(b) reports. Section 319 of the CWA requires each State to develop an NPS assessment report. Guidance on the submission and approval process for Section 319 reports is contained in *Nonpoint Source Guidance* (USEPA, 1987c).

Lists prepared to satisfy requirements under section 305(b), 304(l), 314(a) and 319 should be very useful in preparing 303(d) lists. Appendix B of *Guidance for Water Quality-based Decisions: The TMDL Process* (USEPA, 1991c) provides a summary of these supporting CWA programs.

7.3 Establish Priorities

Once waters needing additional controls have been identified, a State prioritizes its list of waters using established ranking processes that should consider all water pollution control activities within the State. Priority ranking has traditionally been a process defined by the State and may vary in complexity and design. A priority ranking should enable the State to make efficient use of its available resources and meet the objectives of the Clean Water Act.

The Clean Water Act states that the priority ranking for such waters must take into account the severity of the pollution and the uses to be made of such waters. Several documents (USEPA, 1987e, 1988c,d, 1989d, 1990c, 1993c) are available from EPA to assist States in priority setting.

According to EPA's State Clean Water Strategy document: "Where all water quality problems cannot be addressed immediately, EPA and the States will, using multi-year approaches, set priorities and direct efforts and resources to maximize environmental benefits by dealing with the most serious water quality problems and the most valuable and threatened resources first."

Targeting high-priority waters for TMDL development should reflect an evaluation of the relative value and benefit of water bodies within the State and take into consideration the following:

- risk to human health, aquatic life, and wildlife;
- degree of public interest and support;
- recreational, economic, and aesthetic importance of a particular water body;
- vulnerability or fragility of a particular water body as an aquatic habitat;
- immediate programmatic needs such as waste load allocations needed for permits that are coming up for revisions or for new or expanding discharges, or load allocations for needed BMPs;
- waters and pollution problems identified during the development of the section 304(l) "long list";
- court orders and decisions relating to water quality; and
- national policies and priorities such as those identified in EPA's Annual Operating Guidance.

States are required to submit their priority rankings to EPA for review. EPA expects all waters needing TMDLs to be ranked, with "high" priority waters — targeted for initiation

of *TMDL development within 2 years following* the listing process — identified. (See USEPA (1991c) for further details on submission of priorities to EPA.)

To effectively develop and implement TMDLs for all waters identified, States should establish multi-year schedules that take into consideration the immediate TMDL development for targeted water bodies and the long-range planning for addressing all water quality-limited waters still requiring TMDLs.

While the CWA section 319 NPS assessment report identifies the overall dimensions of the State's NPS water quality problems and States are to develop statewide program approaches for specific categories of pollution to address NPS problems, States are also encouraged to target subsets of waters for concerted action on a watershed-by-watershed basis. EPA has issued guidance on NPS targeting (USEPA, 1987e).

7.4 Evaluate Water Quality Standards for Targeted Waters

At this point in the water quality management process, States have identified and targeted priority water quality-limited water bodies. It is often appropriate, to re-evaluate the appropriateness of the water quality standards for the targeted waters for several reasons including, but not limited to, the following.

First, many States have not conducted in-depth analyses of appropriate uses and criteria for all water bodies but have designated general fishable/swimmable use classifications and statewide criteria on a "best professional judgment" basis to many waters. *In addition*, many States make general assumptions about the antidegradation status of State waters (e.g., all waters not specifically assigned to an antidegradation category will be considered tier 2 or high-quality waters). It is possible that these generally applied standards, although meeting the minimum requirements of the CWA and WQS regulation, may be inappropriate (either over- or under-protective) for a specific water body that has not had an in-depth standards analysis. For example, if a water body was classified as a coldwater fishery based solely on its proximity to other coldwater fisheries, a water body-specific analysis may show that only a warmwater fishery use is existing or attainable. If the listing of the water body was based on exceedences of criteria that are more stringent for coldwater fish (such as ammonia or dissolved oxygen), changing the designated use through a use attainability analysis and applying appropriate criteria may allow standards to be met without further water quality controls.

Second, even if an in-depth analysis has been done in the past, changes in the uses of the water body since that time may have made *different standards more appropriate or* generated an additional "existing use" which must be protected. For example, a water body designated for fish, aquatic life, and recreation in the past may now be used as a public water supply, without that use and protective criteria ever being formally adopted in the standards. Another example might be a designated warmwater fishery that, due to the removal of a thermal discharge, now supports a coldwater fishery as the existing use.

Third, monitoring data used to identify the water body as impaired may be historical, and subsequent water quality improvements have allowed standards to be met. And fourth, site-specific criteria may be appropriate because of specific local environmental conditions. For example, the species capable of living at the site are more or less sensitive than those included in the national criteria data set, or physical and/or chemical characteristics of the site alter the biological availability and/or toxicity of the chemical.

7.5 Define and Allocate Control Responsibilities

For a water quality-limited water that still requires a TMDL, a State must establish a TMDL that quantifies pollutant sources, and a margin of safety, and allocates allowable loads to the contributing point and nonpoint source discharges so that the water quality standards are attained. The development of TMDLs should be accomplished by setting priorities, considering the geographic area impacted by the pollution problem, and in some cases where there are uncertainties from lack of adequate data, using a *phased approach to establishing control measures* based on the TMDL.

Many water pollution concerns are areawide phenomena caused by multiple dischargers, multiple pollutants (with potential synergistic and additive effects), or nonpoint sources. Atmospheric deposition and ground water discharge may also result in significant pollutant loadings to surface waters. As a result, EPA recommends that States develop TMDLs on a watershed basis to efficiently and effectively manage the quality of surface waters.

The TMDL process is a rational method for weighing the competing pollution concerns and developing an integrated pollution reduction strategy for point and nonpoint sources. The TMDL process allows States to take a holistic view of their water quality problems from the perspective of instream conditions. Although States may define a water body to correspond with their current programs, it is expected that States will consider the extent of pollution problems and sources when defining the geographic area for developing TMDLs. In general, the geographical approach for TMDL development supports sound environmental management and efficient use of limited water quality program resources. In cases where TMDLs are developed on watershed levels, States should consider organizing permitting cycles so that all permits in a given watershed expire at the same time.

Mathematical modeling is a valuable tool for assessment of all types of water pollution problems. Dissolved oxygen depletion and nutrient enrichment from point sources are the traditional modeling problems of the past. They continue to be problems and are joined by such new challenges as nonpoint source loadings, urban stormwater runoff, toxics, and pollutants involving sediment and bioaccumulative pathways. These new pollutants and pathways require the use of new models.

All models are simplifications of reality that express our scientific understanding of the important processes. Where we don't fully understand the process(es), or cannot collect the data that would be required to set parameters in a model that would simulate the process(es), we make simplifying assumptions. All of these

simplifications increase the uncertainty of our ability to predict responses of already highly-variable systems. While the use of conservative assumptions does reduce the possibility of underestimating pollutants effects on the waterbody, the use of conservative assumptions does not reduce the uncertainty. Calibration of a model to given waterbody does more to reduce uncertainty surrounding the system's response to reduced pollutant loadings. Sensitivity analyses can further this process.

For TMDLs involving both traditional and nontraditional problems, the margins of safety can be increased and additional monitoring required to verify attainment of water quality standards, and provide data needed to recalculate the TMDL if necessary (the phased approach).

EPA regulations provide that load allocations for nonpoint sources and natural background "are best estimates of the loading which may range from reasonably accurate estimates to gross allotments . . ." (40 CFR 130.2(g)). A phased approach to developing TMDLs may be appropriate where nonpoint sources are involved and where estimates are based on limited information. Under the phased approach, TMDL includes monitoring requirements and a schedule for reassessing TMDL allocations to ensure attainment of water quality standards. Uncertainties that cannot be quantified may also exist for certain pollutants discharged primarily by point sources. In such situations a large margin of safety and follow-up monitoring are appropriate.

By pursuing the phased approach where applicable, a State can move forward to implement water quality-based control measures and adopt an explicit schedule for implementation and assessment. States can also use the phased approach to address a greater number of water bodies including threatened waters or watersheds that would otherwise not be managed. Specific requirements relating to the phased approach are discussed in *Guidance for Water Quality-based Decisions: The TMDL Process* (USEPA 1991c).

7.6 Establish Source Controls

Once a TMDL has been established for a water body (or watershed) and the appropriate source loads developed, implementation of control actions should proceed. The State or EPA is responsible for implementation, the first step being to update the water quality management plan. Next, point and nonpoint source controls should be implemented to meet waste load allocations and load allocations, respectively. Various pollution allocation schemes (i.e., determination of allowable loading from different pollution sources in the same water body) can be employed by States to optimize alternative point and nonpoint source management strategies.

The NPDES permitting process is used to limit effluent from point sources. Section 7.6.1 provides a more complete description of the NPDES process and how it fits into the water quality-based approach to permitting. Construction decisions regarding publicly owned treatment works (POTWs), including advanced treatment facilities, must also be based on the more stringent of technology-based or water quality-based limitations. These decisions should be coordinated so that the facility plan for the discharge is consistent with the limitations in the permit.

In the case of nonpoint sources, both State and local laws may authorize the implementation of nonpoint source controls such as the installation of best management practices (BMPs) or other management measures. CWA section 319 and Coastal Zone Act Reauthorization Amendments of 1990 (CZARA) section 6217 State management programs may also be utilized to implement nonpoint source control measures and practices to ensure improved water quality. Many BMPs may be implemented through section 319 programs even where State regulatory programs do not exist. In such cases, a State needs to document the coordination that may be necessary among State and local agencies, landowners, operators, and managers and then evaluate BMP implementation, maintenance, and overall effectiveness to ensure that load allocations are achieved. Section 7.6.2 discusses some of the programs associated with implementation of nonpoint source control measures.

States may also grant, condition, or deny "certification" for a federally permitted or licensed activity that may result in a discharge to the waters of the United States, if it is the State where the discharge will originate. The State decision is based on a State's determination of whether the proposed activity will comply with the requirements of certain sections of the Clean Water Act, including water quality standards under section 303. Section 7.6.3 of this Handbook contains further discussion of section 401 certification.

7.6.1 Point Source Control - the NPDES Process

Both technology-based and water quality-based controls are implemented through the National Pollutant Discharge Elimination System (NPDES) permitting process. Permit limits based on TMDLs are called water quality-based limits.

Waste load allocations establish the level of effluent quality necessary to protect water quality in the receiving water and to ensure attainment of water quality standards. Once allowable loadings have been developed through WLAs for specific pollution sources, limits are incorporated into NPDES permits. It is important to ensure that the WLA accounts for the fact that effluent quality is often highly variable. The WLA and permit limit should be calculated to prevent water quality standards impairment at all times. The reader is referred to the *Technical Support Document for Water Quality-based Toxics Control* (USEPA, 1991a) for additional information on deriving permit limits.

As a result of the 1987 Amendments to the Act, Individual Control Strategies (ICSs) were established under section 304(l)(1) for certain point source discharges of priority toxic pollutants. ICSs consist of NPDES permit limits and schedules for achieving such limits, along with documentation showing that the control measures selected are appropriate and adequate (e.g., fact sheets including information on how water quality-based limits were developed, such as total maximum daily loads and waste load allocations). Point sources with approved ICSs are to be in compliance with those ICSs as soon as possible or in no case later than 3 years from the establishment of the ICS (typically by 1992 or 1993).

When establishing WLAs for point sources in a watershed, the TMDL record should show that, in the case of any credit for future nonpoint source reductions (1) there is reasonable assurance that nonpoint source controls will be implemented and maintained, or (2) that nonpoint source reductions are demonstrated through an effective monitoring program. Assurances may include the application or utilization of local ordinances, grant conditions, or other enforcement authorities. For example, it may be appropriate to provide that a permit may be reopened when a WLA requiring more stringent limits is necessary because attainment of a nonpoint source load allocation was not demonstrated.

Some compliance implementation time may, in certain situations, be necessary and appropriate for permittees to meet new permit limits based on new standards. Under the Administrator's April 16, 1990 decision in an NPDES appeal (Star-Kist Caribe Inc., NPDES Appeal No. 88-5), the Administrator stated that the only basis in which a permittee may delay compliance after July 1, 1977 (for a post July 1977 standard), is pursuant to a schedule of compliance established in the permit which is authorized by the State in the water quality standard itself or in other State implementing regulations. Standards are made applicable to individual dischargers through NPDES permits which reflects the applicable Federal or State water quality standards. When a permit is issued, a schedule of compliance for water quality-based limitations may be included, as necessary.

7.6.2 Nonpoint Source Controls

In addition to permits for point sources, nonpoint sources controls such as management measures or best management practices (BMPs) are also to be implemented so that surface water quality objectives are met. To fully address water bodies impaired or threatened by nonpoint source pollution, States should implement their nonpoint source management programs and ensure adoption of control measures or practices by all contributors of nonpoint source pollution to the targeted watersheds.

Best management practices are the primary mechanism in section 319 of the CWA to enable achievement of water quality standards. Section 319 requires each State, in addition to developing the assessment reports discussed in section 7.2.1 of this Handbook, to adopt NPS management programs to control NPS pollution.

Sections 208(b)(2)(F) through (K) of the CWA also require States to set forth procedures and methods including land use requirements, to control to the extent feasible nonpoint sources of pollution reports.

Section 6217 of the Coastal Zone Reauthorization Amendments of 1990 (CZARA) requires that States with federally approved coastal zone management programs develop Coastal Nonpoint Pollution Control Programs to be approved by EPA and NOAA. EPA and NOAA have issued *Coastal Nonpoint Pollution Control Program; Program Development and Approval Guidance* (NOAA/EPA, 1993), which describes the program development and approval process and requirements. State programs are to employ an initial technology-based approach generally throughout the coastal management area, to be followed by a more stringent water quality-based approach to address known water quality problems. The Management Measures generally implemented throughout the coastal management area are described in *Guidance Specifying Management Measures for Sources of Nonpoint Pollution in Coastal Waters* (USEPA, 1993b).

7.6.3 CWA Section 401 Certification

States may grant, condition, or deny "certification" for a federally permitted or licensed activity that may result in a discharge to the waters of the United States, if it is the State where the discharge will originate. The language of section 401(a)(1) is very broad with respect to the activities it covers:

> [A]ny activity, including, but not limited to, the construction or operation of facilities, which may result in any discharge . . .

requires water quality certification.

EPA has identified five Federal permits and/or licenses that authorize activities that may result in a discharge to the waters: permits for point source discharge under section 402 and discharge of dredged and fill material under section 404 of the Clean Water Act; permits for activities in navigable waters that may affect navigation under sections 9 and 10 of the Rivers and Harbors Act (RHA); and licenses required for hydroelectric projects issued under the Federal Power Act. There are likely other Federal permits and licenses, such as permits for activities on public lands, and Nuclear Regulatory Commission licenses, which may result in a discharge and thus require 401 certification. Each State should work with EPA and the Federal agencies active in its State to determine whether 401 certification is in fact applicable.

Congress intended for the States to use the water quality certification process to ensure that no Federal license or permits would be issued that would violate State standards or become a source of pollution in the future. Also, because the States' certification of a construction permit or license also operates as certification for an operating permit (except in certain instances specified in section 401(a)(3)), it is imperative for a State review to consider all potential water quality impacts of the project, both direct and indirect, over the life of the project.

In addition, when an activity requiring 401 certification in one State (i.e. the State in which the discharge originates) will have an impact on the water quality of another State, the statute provides that after receiving notice of application from a Federal permitting or licensing agency, EPA will notify any States whose water quality may be affected. Such States have the right to submit their objections and request a hearing. EPA may also submit its evaluation and recommendations. If the use of conditions cannot ensure compliance with the affected State's water quality requirements, the Federal permitting or licensing agency shall not issue such permit or license.

The decision to grant, condition, or deny certification is based on a State's determination from data submitted by an applicant (and any other information available to the State) whether the proposed activity will comply with the requirements of certain sections of the Clean Water Act enumerated in section 401(a)(1). These requirements address effluent limitations for conventional and nonconventional pollutants, water quality standards, new source performance standards, and toxic pollutants (sections 301, 302, 303, 306, and 307). Also included are *requirements of State law or regulation more* stringent than those sections or their Federal implementing regulations.

States adopt surface water quality standards pursuant to section 303 of the Clean Water Act and have broad authority to base those standards *on the waters' use and value for ". . . public* water supplies, propagation of fish and wildlife, recreational purposes, and . . . other purposes" (33 U.S.C. section 1313 (c)(2)(A)). All permits must include effluent limitations at least as stringent as needed to maintain established beneficial uses and to attain the quality of water designated by States for their waters. Thus, the States' water quality standards are a critical concern of the 401 certification process.

If a State grants water quality certification to an applicant for a Federal license or permit, it is in effect saying that the proposed activity <u>will</u> comply with State water quality standards (and the other CWA and State law provisions enumerated above). The State may thus deny certification because the applicant has not demonstrated that the project will comply with those requirements. Or it may place whatever limitations or conditions on the certification it determines are necessary to ensure compliance with those provisions, and with any other "appropriate" requirements of State law.

If a State denies certification, the Federal permitting or licensing agency is prohibited from issuing a permit or license. While the procedure varies from State to State, a State's decision to grant or deny certification is ordinarily subject to an administrative appeal, with review in the State courts designated for appeals of agency decisions. Court review is typically limited to the question of whether the State agency's decision is supported by the record and is not arbitrary or capricious. The courts generally presume regularity in agency procedures and defer to agency expertise in their review. (If the applicant is a Federal agency, however, at least one Federal court has ruled that the State's certification decision may be reviewed by the Federal courts.)

States may also waive water quality certification, either affirmatively or involuntarily. Under section 401(a)(1), if the State fails to act on a certification request "within a reasonable time (which shall not exceed one year)" after the receipt of an application, it forfeits its authority to grant conditionally or to deny certification.

The most important regulatory tools for the implementation of 401 certification are the States' water quality standards regulations and their 401 certification implementing regulations and guidelines. Most Tribes do not yet have water quality standards, and developing them would be a first step prior to having the authority to conduct water quality certification. Also, many States have not adopted regulations implementing their authority to grant, deny, and condition water quality certification. *Wetland and 401 Certification: Opportunities and Guidelines for States and Eligible Indian Tribes* (USEPA, 1989a) discusses specific approaches, and elements of water quality standards and 401 certification regulations that EPA views as effective to implement the States' water quality certification authority.

7.7 Monitor and Enforce Compliance

As noted throughout the previous sections, monitoring is a crucial element of water quality-based decision making. Monitoring provides data for assessing compliance with water quality-based controls and for evaluating whether the TMDL and control actions that are based on the TMDL protect water quality standards.

With point sources, dischargers are required to provide reports on compliance with NPDES permit limits. Their discharge monitoring reports (DMR) provide a key source of effluent quality data. In some instances, dischargers may also be required in the permit to assess the impact of their discharge on the receiving water. A monitoring requirement can be put into the permit as a special condition as long as the information is collected for purposes of writing a permit limit.

States should also ensure that effective monitoring programs are in place for evaluating nonpoint source control measures. EPA recognizes monitoring as a high-priority activity in a State's nonpoint source management program (55 F.R. 35262, August 28, 1990). To facilitate the implementation and evaluation of NPS controls, States should consult current guidance (USEPA, 1991g); (USEPA, 1993b). States are also encouraged to use innovative monitoring programs (e.g., rapid bioassessments (USEPA, 1989e), and volunteer monitoring (USEPA, 1990b) to provide for adequate point and nonpoint source monitoring coverage.

Dischargers are monitored to determine whether or not they are meeting their permit conditions and to ensure that expected water quality improvements are achieved. If a State has not been delegated authority for the NPDES permit program, compliance reviews of all permittees in that State are the responsibility of EPA. EPA retains oversight responsibility for State compliance programs in NPDES-delegated States. NPDES permits also contain self-monitoring requirements that are the responsibility of the individual discharger. Data obtained through self-monitoring are reported to the appropriate regulatory agency.

Based on a review of data, EPA or a State regulatory agency determines whether or not a NPDES permittee has complied with the requirements of the NPDES permit. If a facility has been identified as having apparent violations, EPA or the State will review the facility's compliance history. This review focuses on the magnitude, frequency, and duration of violations. A determination of the appropriate enforcement response is then made. EPA and States are authorized to bring civil or criminal action against facilities that violate their NPDES permits. State nonpoint source programs are enforced under State law and to the extent provided by State law.

Once control measures have been implemented, the impaired waters should be assessed to determine if water quality standards have been attained or are no longer threatened. The monitoring program used to gather the data for this assessment should be designed based on the specific pollution problems or sources. For example, it is difficult to ensure, *a priori*, that implementing nonpoint source controls will achieve expected load reductions due to inadequate selection of practices or measures, inadequate design or implementation, or lack of full participation by all contributing nonpoint sources (USEPA, 1987e). As a result, long-term monitoring efforts must be consistent over time to develop a data base adequate for analysis of control actions.

7.8 Measure Progress

If the water body achieves the applicable State water quality standards, the water body may be removed from the 303(d) list of waters still needing TMDLs. If the water quality standards are not met, the TMDL and allocations of load and waste loads must be modified. This modification should be based on the additional data and information gathered as required by the phased approach for developing a TMDL, where appropriate; as part of routine monitoring activities; and when assessing the water body for water quality standards attainment.

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