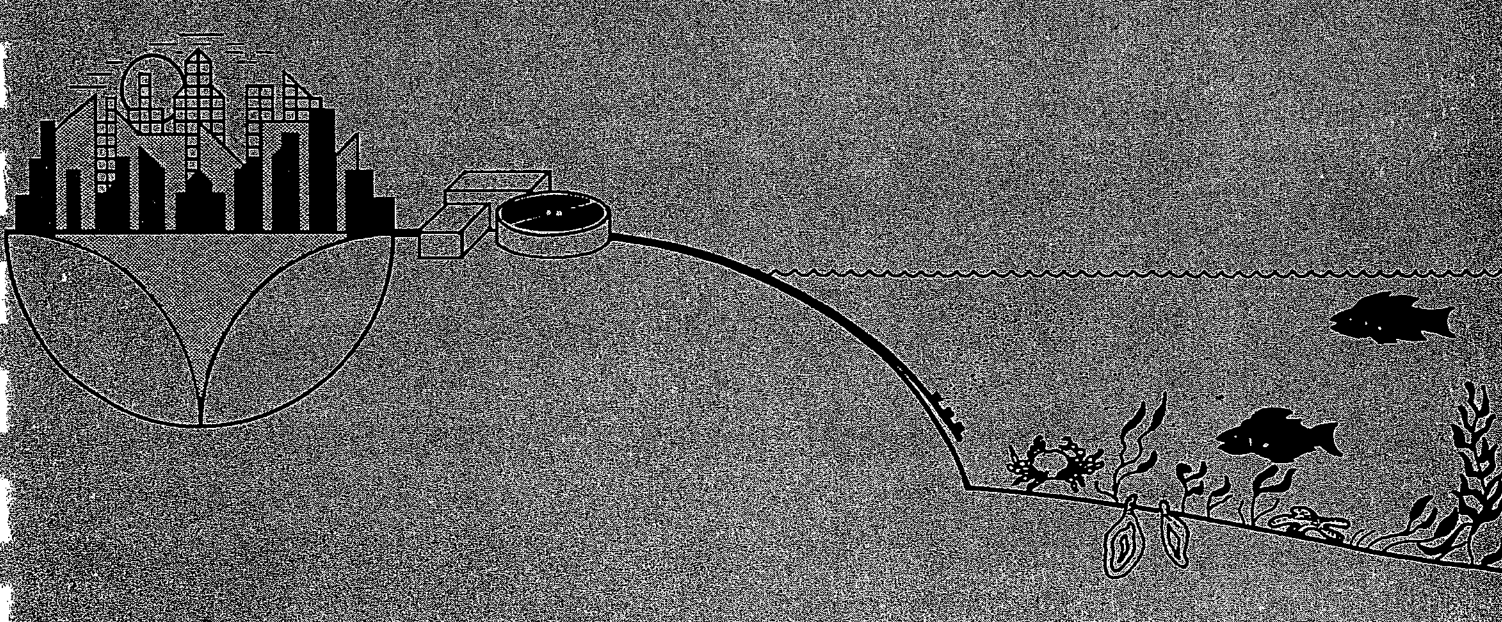
United States
Environmental Protection
Agency

Office of Water
(4504F)

EPA 842-B-94-007
September 1994

EPA

Amended Section 301(h) Technical Support Document



EPA 842-B-94-007
September 1994

Amended Section 301(h) Technical Support Document

Oceans and Coastal Protection Division (4504F)
Office of Wetlands, Oceans and Watersheds
United States Environmental Protection Agency
Washington, DC 20460

CONTENTS

CONTENTS (continued)

CONTENTS (continued)

AGA 2182

CONTENTS (continued)

FIGURES

TABLES

PREFACE

The following is the amended technical support document for the Clean Water Act section 301(h) program. This document completely supersedes and replaces the earlier *Revised Section 301(h) Technical Support Document* and was made available in draft form for comment on January 24, 1991 (56 FR 2814).

This *Amended Section 301(h) Technical Support Document* (TSD) provides municipal dischargers with technical guidance on preparing applications for section 301(h) modified permits and evaluating the effects of 301(h) discharges on water quality. One of the primary purposes for amending the TSD is to add guidance concerning revisions to EPA's section 301(h) regulations (40 CFR Part 125, Subpart G) that the Agency promulgated on August 23, 1994 (59 FR 40642 August 9, 1994). EPA revised the section 301(h) regulations primarily to implement new section 301(h) requirements imposed by the Water Quality Act of 1987.

The guidance provided in this TSD is a general statement of policy. It does not establish or affect legal rights or obligations. It does not establish a binding norm and is not finally determinative of the issues addressed. Agency decisions in any particular case will be made by applying the law and regulations to the specific facts of the case.

ACKNOWLEDGMENTS

This guidance document was prepared by Tetra Tech, Inc. for the U.S. Environmental Protection Agency under the technical support contracts for marine discharge monitoring evaluations and technical support for the Office of Marine and Estuarine Protection data management and Clean Water Act implementation, U.S. EPA Contract Nos. 68-C8-0001 and 68-C1-0008. Ms. Virginia Fox-Norse was the Work Assignment Manager. Major technical contributors were Dr. Gordon Bilyard, Dr. Richard Harris, Dr. John Hochheimer, Dr. William Muellenhoff, Mr. James Pagenkopf, and Dr. A. Mills Soldate.

EXECUTIVE SUMMARY

Section 301(h) of the 1977 Clean Water Act (CWA) allows the U.S. Environmental Protection Agency (EPA), with concurrence of the state, to issue National Pollutant Discharge Elimination System (NPDES) permits to publicly owned treatment works (POTWs) for the discharge of less-than-secondary treated effluent. The statutory deadline for such applications was December 29, 1982.

Although this document addresses all of the 301(h) regulations, one of the primary purposes of this *Amended Section 301(h) Technical Support Document* is to identify changes to the section 301(h) regulations promulgated by EPA in 1994 to implement section 301(h) conditions resulting from the Water Quality Act (WQA) of 1987 and to provide technical guidance for implementing those changes. Guidance is also provided on assessments and data analyses that applicants should perform to satisfy all of the section 301(h) regulatory requirements and on methods to evaluate compliance with those regulatory requirements. This guidance is provided in three forms:

- Explanations of WQA sections 303(a) through 303(g) and resulting changes in the section 301(h) regulations;
- Technical guidance for implementing the new regulations, and updated technical guidance for implementing regulations that have not changed; and
- Guidance on the preparation of applications for reissuance of section 301(h) modified NPDES permits and on the evaluation of those applications to determine compliance with the regulations.

The WQA of 1987 amended CWA section 301(h) in eight respects, as summarized below. References to key affected sections of the amended CWA 301(h) regulations at 40 CFR Part 125, Subpart G, are shown in brackets.

(1) Section 301(h) modified discharges are prohibited from interfering, *alone or in combination with pollutants from other sources*, with the attainment or maintenance of water quality which assures the protection and uses listed in section 301(h)(2). (emphasis added) [§125.62(f)]

(2) The scope of monitoring investigations is limited to only those investigations necessary to study the effects of the modified discharge. [§125.63(a)]

(3) With respect to any toxic pollutant introduced by an industrial source and for which there is no applicable pretreatment requirement in effect, POTWs serving populations of 50,000 or more are required to demonstrate that industrial sources introducing waste into the POTW are in compliance with all applicable pretreatment requirements, that the POTW will enforce those requirements, and that the POTW has in effect a pretreatment program which, in combination with the POTW's own treatment processes, removes at least the same amount of toxic pollutant as would be removed if the POTW were to apply secondary treatment and had no pretreatment program for that pollutant. [§§125.58(g), 125.58(j), 125.58(q), 125.58(w), 125.58(aa), 125.65]

(4) At the time the section 301(h) modified permit becomes effective, the POTW must be discharging effluent that has received at least primary or equivalent treatment [as defined in §125.58(r)], and that meets applicable water quality criteria established under section 304(a)(1) of the CWA after initial mixing in the receiving waters. [§§125.58(r), 125.60, 125.62(a)]

(5) Section 301(h) modified permits may not be issued for discharges into marine waters that contain significant amounts of previously discharged effluent from the POTW. [§125.62]

(6) Section 301(h) modified permits may not be issued for discharges into saline estuarine waters that exhibit stressed conditions, regardless of the applicant's contribution to those stressed conditions. Section 301(h) modified permits may not be issued for discharges into the New York Bight Apex under any conditions. [§§125.59(b)(4), 125.59(b)(5)]

(7) Any POTW that had an agreement before 31 December 1982 to use an outfall operated by another POTW that had applied for or received a section 301(h) modified permit could have applied for its own section 301(h) modified permit within 30 days of enactment of the WQA. [No such application was filed]

(8) Some provisions of the WQA do not apply to applications that received tentative or final approval before enactment of the WQA, but apply to all applications for renewal of section 301(h) modified permits. [§125.59(j)]

Among the changes listed above, changes 1, 3, 4, 5, and 8 are most important to applicants and permittees that are not prohibited from applying for a section 301(h) modified permit under other provisions of the amended regulations. The first change requires POTWs to consider the impacts of their discharge on the receiving environment and biota in combination with pollutants from other sources. Previously, POTWs were required to consider only whether their discharge contributed to such impacts.

Change 3 requires applicants serving a population of 50,000 or more to implement additional toxics control efforts (urban area pretreatment program). This new statutory requirement complements the toxics control program requirements in §125.66 and applies in addition to any applicable pretreatment requirements contained in 40 CFR Part 403. Dischargers may demonstrate compliance with §125.65 by demonstrating that "an applicable pretreatment requirement is in effect" for the toxic pollutant or by demonstrating "secondary removal equivalency."

Applicable pretreatment requirements may be in the form of categorical pretreatment standards promulgated by EPA under CWA section 307, local limits developed in accordance with 40 CFR Part 403, or a combination of both. It is anticipated that most dischargers will be required to use a combination of categorical pretreatment standards and local limits to satisfy §125.65 with respect to toxic pollutants introduced into the treatment works by industrial sources. For any toxic pollutant introduced by an industrial source for which there is no categorical pretreatment standard and it is determined that no local limit is needed, for 301(h) purposes, an applicable pretreatment requirement can also be met by the following: annual monitoring and technical review of industrial discharges, and, where appropriate, implementation of industrial management practices plans, best management practices, and other pollution prevention activities, and determination on an annual basis of the need to revise local limits and/or to demonstrate that there is no need for a local limit for a specific toxic pollutant. When an industrial discharger is subject to both a categorical standard and a numerical local limit for a specific toxic pollutant, the more stringent of the two limits applies.

Alternatively, a discharger may demonstrate that its own treatment processes, in combination with pretreatment by industrial dischargers, achieves "secondary removal equivalency." Dischargers are required to make this demonstration whenever they cannot show that a toxic pollutant introduced by an industrial discharger is subject to an "applicable pretreatment requirement." Although secondary treatment is intended to control conventional pollutants, a certain amount of toxic pollutants in the influent is removed during the process. This part of WQA section 303(c) requires that a section 301(h) discharger remove at least that same amount of a toxic pollutant through industrial pretreatment, plus the applicant's own treatment at less-than-secondary levels, as would be removed if the applicant were to apply secondary treatment and no pretreatment requirements existed for that pollutant. A secondary treatment pilot plant could be used to determine empirically the amount of a toxic pollutant that would be removed from the influent if the applicant were to apply secondary treatment. For each pollutant introduced by an industrial source, the applicant would then demonstrate that industrial pretreatment plus the POTW's own treatment processes removed at least the same amount of pollutant as was removed by the secondary treatment pilot plant. The permit will contain effluent limits based on data from the secondary equivalency demonstration when these values are more stringent than effluent limits required to assure all applicable environmental protection criteria are met. The POTW would then use local limits or perform additional treatment at the POTW, or combine the two to achieve the permit limit.

Change 4 requires all section 301(h) dischargers to achieve a minimum of primary or equivalent treatment, thereby establishing a primary treatment floor for all marine and estuarine POTWs, to demonstrate compliance with §125.60. This section (§125.60) requires at least 30 percent removal of both BOD and SS. Section 301(h) dischargers have always been required to meet state water quality standards that are appropriate for local conditions and that have been approved by EPA. In addition to the primary or equivalent treatment requirements (§125.60), §125.62 implements the new WQA requirement that 301(h) dischargers meet water quality criteria established under CWA section 304(a)(1) after initial mixing in the receiving waters. Under the new provision, dischargers must determine whether there is an EPA-approved state water quality standard that directly corresponds to the CWA section 304(a)(1) water quality criterion for each specific pollutant. If there is, this directly corresponding state standard would apply. In the absence of such a state standard, the section 304(a)(1) water quality criterion would apply. An EPA-approved state water quality standard would be deemed to "directly correspond" if (1) the state water quality standard addresses the same pollutant as EPA's water quality criterion and (2) the state water quality standard specifies a numeric criterion for that pollutant, or an objective methodology for deriving such a pollutant-specific criterion. For example, if a state water quality standard exists only for a group of toxic substances, such as metals, applicants would also be required to demonstrate compliance with the water quality criteria for individual metals (e.g., cadmium, lead, zinc) to demonstrate compliance with §125.62(a).

The section 301(h) regulations were not amended with respect to change 5, recirculation and reentrainment of previously discharged effluent from the POTW. However, POTWs, especially those that discharge into receiving waters where reentrainment is likely, need to address the possible effects of such entrainment when demonstrating compliance with applicable state water quality standards, water quality criteria, and other section 301(h) criteria. Reentrainment is most often of concern where tidal currents predominate, and where previously discharged effluent is likely to be advected into the zone of initial dilution after the tidal currents reverse.

Change 8 in the regulations "grandfathers" applicants that had received tentative or final approval of their section 301(h) modified permits before passage of the WQA. Such applicants are "grandfathered" for changes 3, 4, and 5 above, but only for the term of that section 301(h) modified permit. Applicants for reissuance of section 301(h) modified permits must demonstrate compliance with all applicable section 301(h) criteria to qualify for renewal of the section 301(h) modified permit.

Under §125.59(e), those applicants that have already received tentative or final approvals (including grandfathered applicants) must submit to the EPA Regional Administrator a letter of intent to demonstrate compliance with the primary or equivalent treatment requirements (§125.60) by November 7, 1994. Also, applicants serving a population of 50,000 or more must, under §125.59(e), submit a letter of intent to demonstrate compliance with the urban area pretreatment requirements (§125.65). Those applicants without tentative approval must submit a letter of intent to demonstrate compliance with §§125.60 and 125.65 (if applicable) within 90 days of receiving tentative approval. Applicants that are not grandfathered must, by August 9, 1996, demonstrate compliance with §§125.60 and 125.65. Those applicants that are grandfathered must at the time of permit renewal or by August 9, 1996, whichever is later, meet all of the requirements of §§125.60 and 125.65.

In addition, definitions of *primary or equivalent treatment, pretreatment, categorical pretreatment standard, secondary removal equivalency, water quality criteria, permittee,* and *New York Bight Apex* have been added to the amended section 301(h) regulations, and definitions of industrial source, ocean waters, stressed waters, applications, and applicant questionnaire have been changed.

New technical guidance given in this document primarily addresses major changes 1, 3, 4, and 5 above. Hence, it includes the following:

- Guidance for assessing impacts of the applicant's modified discharge "alone or in combination with pollutants from other sources";

- Guidance on methods for demonstrating compliance with urban area pretreatment requirements;

- Guidance for demonstrating compliance with primary or equivalent treatment;

- Guidance for demonstrating compliance with applicable water quality standards and criteria; and

- Guidance for demonstrating that dilution water does not contain significant amounts of previously discharged effluent.

Updated guidance that reflects technical advances made since publication of the earlier version of this guidance document, the *Revised Section 301(h) Technical Support Document* (1982), is also provided for demonstrating compliance with the section 301(h) regulations. Technical areas that have been updated most extensively include the physical and water quality assessments and the discussion of navigational requirements.

General guidance, new guidance, and updated guidance are provided in the format of the Applicant Questionnaire, with supporting appendices as warranted. General guidance includes discussions of the types of demonstrations that should be included by applicants when responding to each question. Detailed technical explanations of analytical methods that may be used to demonstrate compliance with specific regulatory criteria are provided in six supporting appendices. Methods for calculating initial dilution of the wastefield are provided in Appendix A (Physical Assessment). Detailed descriptions of analytical methods to demonstrate compliance with water quality requirements are presented in Appendix B (Water Quality Assessment). These methods address suspended solids deposition, dissolved oxygen concentrations, sediment oxygen demand, suspended solids concentrations, effluent pH, light transmittance, and other water quality variables. Guidance for biological assessments, as represented by benthic community evaluations, is presented in Appendix C. Navigational considerations for sampling in estuarine and coastal areas are discussed in Appendix D. The new urban area pretreatment requirements and methods for demonstrating compliance with them are described in Appendix E. Finally, additional information on water quality-based toxics control is presented in Appendix F.

Because of the redundancy that existed between the Small and Large Applicant Questionnaires in the 1982 regulations, a single Applicant Questionnaire is included in the amended section 301(h) regulations. It combines relevant questions from the two earlier questionnaires and includes new questions that address the changes in the section 301(h) regulations. In addition to providing technical guidance for responding to questions in the Applicant Questionnaire, this document identifies who must respond to each question (i.e., large dischargers, small dischargers, or both). It also discusses the levels of detail that are appropriate for responses by dischargers of different sizes and into different receiving environments.

Each application for a section 301(h) modified NPDES permit is submitted to, and reviewed by, the appropriate EPA Region. Having reached a decision regarding an application for issuance of a section 301(h) modified permit, the Region may issue or reissue the section 301(h) modified permit with the same or different permit conditions or may deny the section 301(h) modification. In the case of denial, the NPDES permit would then be reissued by EPA (or, in NPDES-delegated states, by the state) with secondary treatment requirements. This document provides guidance on procedures for reapplying for section 301(h) modified permits. However, it does not provide guidance on the preparation of NPDES permits, which has been published in the *Training Manual for NPDES Permit Writers* (U.S. EPA 1986b).

INTRODUCTION

Section 301(h) of the Clean Water Act (CWA) allows the U.S. Environmental Protection Agency (EPA) Administrator, upon application by publicly owned treatment works (POTWs) and with concurrence of the state, to issue National Pollutant Discharge Elimination System (NPDES) permits for the discharge of less-than-secondary treated effluent. POTWs were eligible to apply for such modified permits if they discharged to marine or estuarine waters, and EPA may issue a 301(h) modified permit if the POTW can demonstrate compliance with section 301(h) criteria and all other NPDES permit requirements. The statuatory deadline for 301(h) applications was December 29, 1982. EPA issued regulations and a technical support document (TSD) in 1979.

Section 301(h) was amended in 1981 by the Municipal Wastewater Treatment Construction Grants Amendments. In 1982, revised regulations and the *Revised Section 301(h) Technical Support Document* (U.S. EPA 1982c) were issued. The revised TSD identified the new regulatory requirements of section 301(h) and provided technical guidance on the preparation of section 301(h) applications. A companion document, *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (U.S. EPA 1982a), was also issued in 1982. It provided guidance on the development and implementation of monitoring programs that would meet section 301(h) requirements.

Section 301(h) was amended again by the Water Quality Act (WQA) of 1987. That act did not extend the 1982 application deadline or reopen the application process to POTWs that had not applied by the 1982 deadline. However, it did amend section 301(h) for POTWs already in the program. One of the primary purposes of this technical support document is to identify changes to the regulations promulgated by EPA to implement new section 301(h) conditions resulting from the Water Quality Act of 1987 and to provide technical guidance for implementing those changes. This document also provides guidance on assessments and data analyses that applicants must perform to satisfy all applicable section 301(h) regulatory requirements and general considerations for applicants in preparing section 301(h) applications.

This document supersedes the *Revised Section 301(h) Technical Support Document.* It incorporates relevant guidance from that earlier document and from more recent guidance documents produced under the 301(h) program since 1982. *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* remains relevant to the 301(h) program, although much additional technical guidance is now available (see Question III.F.1 below). These more recent guidance documents provide updated guidance on the collection, analysis, and interpretation of monitoring data, including references for updated laboratory and analytical techniques. This more recent guidance and the general guidance provided in the 1982 document provide a solid technical basis for the design and execution of section 301(h) monitoring programs.

This *Amended Section 301(h) Technical Support Document* is divided into two major sections: a main body of text and six appendices. The main body of text reviews the regulations implementing section 301(h) (i.e., Code of Federal Regulations, Title 40, Part 125, Subpart G, 59 FR 40642, August 9, 1994)* and highlights changes to those regulations made by EPA to reflect the amendments to section 301(h) made by the 1987 WQA. It also provides general technical guidance to dischargers on the preparation of section 301(h) applications for permit reissuance, including general discussions of the types of demonstrations that should be included by applicants when responding to each question in the Applicant Questionnaire. For example, it specifies whether large or small dischargers should respond to a given question and discusses the level of detail that is appropriate for each. Guidance on general considerations for dischargers in preparing section 301(h) applications is also discussed. The appendices contain detailed technical explanations of the analytical methods that may be used to demonstrate compliance with specific regulatory criteria (e.g., formulas to determine dissolved oxygen concentration following initial dilution and detailed discussions of methods to demonstrate compliance with urban area pretreatment requirements).

The section 301(h) regulations distinguish between large and small dischargers, and that distinction is maintained throughout this document. Dischargers are considered to be large or small based on their effluent flow and service population. Large dischargers are defined in §125.58(c) as POTWs that "have contributing populations equal to or more than 50,000 people or average dry weather flows of 5.0 MGD (million gallons per day) or more." Small dischargers "have contributing populations of less than 50,000 people and average dry weather flows of less than 5.0 MGD" [§125.58(c)]. The definition further stipulates that estimates of "the contributing population and flows shall be based on projections for the end of the five year permit term. Average dry weather flows shall be the average daily total discharge flows for the maximum month of the dry weather season."

---

* hereinafter referred to as 40 CFR Part 125, Subpart G.

BACKGROUND

Clean Water Act section 301(h) was amended by WQA section 303, entitled "Discharges into Marine Waters." Section 303 includes sections 303(a) through 303(g). The section 301(h) regulations have been changed in response to these statutory amendments, and guidance is now needed to implement the new regulations. As background to providing such guidance, each of the statutory amendments is summarized below, followed by a brief description of the corresponding changes in the section 301(h) regulations. Citations to the 40 CFR Part 125, Subpart G, regulations that appear in the discussion below refer to the section numbers of the regulations as renumbered. (The 1994 regulations added requirements and are therefore numbered differently from the 1982 regulations.)

Section 303(a) amends subsection 301(h)(2) to state that the modified discharge "will not interfere, *alone or in combination with pollutants from other sources*, with the attainment or maintenance of water quality which assures protection of public water supplies and the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife, and allows recreational activities, in and on the water" (emphasis added). In response to WQA section 303(a), language was added to §125.62(f) to clarify that it is not sufficient to demonstrate that the applicant's discharge alone will not interfere with the attainment or maintenance of water quality as specified in the remainder of §125.62. Applicants must also demonstrate compliance with §125.62 based on the combined effects of the applicant's modified discharge and pollutants from other sources. This amendment [WQA section 303(a)] strengthens the existing regulatory requirements of §125.62(f) allowing discharges to stressed waters provided that the discharger can demonstrate (1) that the inability to achieve compliance with the requirements of §125.62(a) through (e) is due to perturbations other than its discharge, (2) that its modified discharge will not contribute to the stressed conditions or further degrade the biota or water quality, and (3) that its discharge will not retard the recovery of biota or water quality if the level of human perturbation from other sources decreases.

Under WQA section 303(b), the scope of a section 301(h) discharger's monitoring program is limited to "those scientific investigations that are necessary to study the effects of the proposed discharge." This limitation is applicable only to modifications and renewals of modifications that are tentatively or finally approved after the date of enactment of the WQA. Although the existing section 301(h) requirements for monitoring programs were already focused on the effects of the applicant's discharge, this limitation was added to §125.63 of the regulations. This limitation does not affect the precedent for developing monitoring programs on a case-by-case basis.

WQA section 303(c) is applicable only to large dischargers that receive toxic pollutants from industrial sources. It mandates that for any toxic pollutant introduced by an industrial source for which there are no applicable pretreatment requirements in effect, the applicant will demonstrate that sources introducing waste into the POTW are in compliance with all applicable pretreatment requirements, the applicant will enforce those requirements, and the applicant has in effect a pretreatment program that, in combination with the POTW's own treatment processes, removes at least the same amount of toxic pollutant as would be removed if the POTW were to apply secondary treatment and had no pretreatment program for the pollutant. Under this provision, each such applicant must demonstrate, for each toxic pollutant introduced by an industrial discharger, either that it has an "applicable pretreatment requirement in effect" or that it has implemented a program that achieves "secondary removal equivalency." In accordance with WQA section 303(c), POTWs are required to demonstrate that industrial sources of toxic pollutants are in compliance with all of their pretreatment requirements, including local limits, and that those standards will be enforced in accordance with Code of Federal Regulations, Title 40, Part 403, 46 FR 9439, 28 January 1981.*

To implement WQA section 303(c), §125.65 was added to the regulations, definitions were added to §125.58, and existing definitions in §125.58 were revised. Section 125.65 requires that an urban area pretreatment program be implemented by applicable POTWs to demonstrate that toxic pollutants are being controlled. It also provides alternative approaches for implementing urban area pretreatment. Definitions that are relevant to the urban area pretreatment program and that have been revised or added to the 301(h) regulations include *categorical pretreatment standard, industrial discharger* or *industrial source, pretreatment, secondary removal equivalency,* and *water quality criteria.*

WQA section 303(d) establishes a minimum of primary treatment (or its equivalent). *Primary or equivalent treatment* is defined in subsection 303(d)(2) as "treatment by screening, sedimentation, and skimming adequate to remove at least 30 percent of the biochemical oxygen demanding material and of the suspended solids in the treatment works influent, and disinfection, where appropriate." This section also mandates compliance with federal water quality criteria (U.S. EPA 1980, 1985f, 1986a) for section 301(h) dischargers.

To implement WQA section 303(d), §125.60, which requires a minimum of primary or equivalent treatment, was added to the regulations, and the definition of primary or equivalent treatment stated in the WQA was incorporated into the section 301(h) regulations at §125.58(r).

---

* hereinafter referred to as 40 CFR Part 403.

Primary or equivalent treatment requires removal of both 30 percent of biochemical oxygen demand (BOD) and 30 percent of suspended solids (SS) [§125.58(r)].

Section 125.62(a) of the regulations was also amended to state that at and beyond the boundary of the zone of initial dilution (ZID), applicants must meet all applicable water quality standards, and all water quality criteria established under section 304(a)(1) of the CWA where no directly corresponding numerical water quality standards exist. Hence, in addition to demonstrating compliance with water quality standards [already required under the 1982 section 301(h) regulations], applicants will need to demonstrate compliance with those water quality criteria (if any) for which no directly corresponding water quality standards exist.

Under WQA section 303(e), section 301(h) modified permits may not be issued for discharges into marine waters where the dilution water contains "significant amounts of previously discharged effluent from such treatment works." Reentrainment of previously discharged effluent is often a potential problem in receiving waters that exhibit poor flushing characteristics, such as semi-enclosed bays or long, narrow estuaries. This section flatly prohibits issuance of section 301(h) modified permits for discharges into the New York Bight Apex, and further prohibits 301(h) modifications for discharges into saline estuarine waters unless those waters meet all of the following conditions:

- Support a balanced indigenous population (BIP) of shellfish, fish, and wildlife;

- Allow for recreational activities; and

- Exhibit ambient water quality characteristics that are adequate to protect public water supplies; protect shellfish, fish, and wildlife; allow for recreational activities; and comply with standards that assure the protection of such uses.

A section 301(h) modified permit for discharges into saline estuarine waters may not be issued if any one of the foregoing conditions is not met, regardless of whether the applicant's discharge contributes to departures from or retards recovery of such conditions.

Section 125.62(a)(1) of the 1982 regulations required the applicant's diffuser to be located and designed to provide initial dilution, dispersion, and transport sufficient to ensure compliance with water quality standards at and beyond the ZID boundary under critical environmental and treatment plant conditions. Because §125.62(a) was viewed to be a sufficient regulatory criterion for ensuring that "significant amounts" of previously discharged effluent are not entrained, this subsection was not modified in response to WQA section 303(e). (However, additional technical guidance is provided herein on how to position monitoring stations to determine compliance with this provision of the WQA.) Section 125.59(b)(4) was modified to include the prohibition of section 301(h) modified discharges into stressed saline estuarine waters, and §125.62(f) was modified so that §125.62(f)(1)-(3) ("stressed water test") applies only to ocean waters, as defined.

WQA section 303(f) applies only to POTWs that had existing agreements (i.e., prior to 31 December 1982) to use outfalls of section 301(h) POTWs. This provision allows those POTWs to apply for their own section 301(h) modified permit within 30 days of enactment of the WQA. Because no POTW applied under this provision, the section 301(h) regulations were not amended to reflect section 303(f).

As stated in WQA section 303(g), sections 303(a), (c), (d), and (e) do not apply to section 301(h) modified permits that were tentatively or finally approved prior to enactment of the WQA. However, section 303(g) further states that those sections will apply to all renewals of section 301(h) modified permits that postdate enactment of the WQA. In response, §125.59(j) was added to the regulations, allowing certain applicants to defer compliance with the specified section of the WQA until permit renewal. Applicants that had been issued tentative denials, or that had withdrawn their section 301(h) applications prior to enactment of the WQA, may not take advantage of this "grandfathering" provision. A requirement was also added to §125.59(e) and (f) stating that "grandfathered" applicants and permittees must, within 90 days of the effective date of the regulatory revisions, submit additional information regarding their intent to demonstrate compliance with the new requirements under §125.60 (primary or equivalent treatment requirements) and §125.65 (urban area pretreatment requirements) within 2 years (non-grandfathered) or upon permit renewal, whichever is later (grandfathered).

The statutory deadline for section 301(h) applications was 29 December 1982. Neither the WQA nor the amended section 301(h) regulations extend that deadline. Hence, the aforementioned statute and changes to the regulations apply only to POTWs presently in the 301(h) program. POTWs currently in the program include those presently holding section 301(h) modified permits and those awaiting a final decision from EPA.

PURPOSE AND SCOPE

The primary purpose of this document is to provide technical support for implementing the section 301(h) regulations that were amended in response to WQA section 303. It does so in the following ways:

- Explains WQA sections 303(a) through 303(g), and resulting changes in the section 301(h) regulations (provided above, in the section entitled "Background," and below, in the section entitled "Statutory Criteria and Regulatory Requirements");

- Provides technical guidance for implementing the new regulations and updates that for existing regulations (provided below, in the chapter entitled "Demonstrations of Compliance by Permittees");

- Provides technical guidance on preparing applications for reissuance of section 301(h) modified permits (provided below, in the chapter entitled "Demonstrations of Compliance by Permittees"); and

- Provides additional technical guidance on preparing applications to demonstrate compliance with the regulations and on the issuance and reissuance of section 301(h) modified permits [provided below, in the chapter entitled "Determinations of Compliance with Section 301(h) Modified Permit Conditions and 301(h) Criteria"].

This document provides the following new technical guidance on how the results of studies and monitoring can be used to demonstrate compliance with the new regulations:

- Guidance for assessing impacts of the applicant's modified discharge "alone or in combination with pollutants from other sources";

- Guidance for demonstrating compliance with at least primary or equivalent treatment;

- Guidance on methods for demonstrating compliance with urban area pretreatment requirements;

- Guidance for demonstrating compliance with applicable water quality standards and criteria; and

- Guidance for demonstrating that dilution water does not contain significant amounts of previously discharged effluent.

This guidance appears in the chapter entitled "Demonstrations of Compliance by Permittees" below and, in some cases, the appendices. Updated guidance is also provided on the calculation of initial dilution, navigation and station positioning methods, analysis of water quality data, assessments of the long-term effects of 301(h) discharges, sedimentation and dispersion models, and the degree of recirculation in the presence of contaminated receiving waters.

Monitoring data collected during the term of the 301(h) modified permit are submitted to the regional jurisdiction of the U.S. EPA (hereinafter referred to as Regions) in accordance with permit procedures. The Regions use these data to determine continuing compliance with the terms and conditions of the permit and with section 301(h) regulations. Although this document was not written to help the Regions evaluate monitoring data during the terms of the modified permits, much of the guidance provided below is applicable to such evaluations.

NPDES permits are issued for 5-year periods. At least 180 days prior to expiration, POTWs holding section 301(h) modified permits must apply for reissuance of their NPDES permits. At the same time, they may apply for reissuance of their section 301(h) modification, as stipulated in §§125.59, 122.21(d),* and 124.3.† In the future, EPA will consider only section 301(h) applications submitted by the deadline (29 December 1982) on which there has not yet been a decision and those applications for reissuance.

According to §125.59(c), "applicants for permit renewal shall support continuation of the modification by supplying to EPA the results of studies and monitoring performed in accordance with §125.63 during the life of the permit." However, neither this section nor other parts of 40 CFR Part 125, Subpart G, provide specific guidance on how the results of studies and monitoring should be used to support the application for permit reissuance. This amended TSD with its appendices generally provides technical guidance to show how to use these results (see the chapter entitled "Determinations of Compliance with Section 301(h) Modified Permit Conditions and 301(h) Criteria").

In the 1982 section 301(h) regulations, EPA recognized the limited financial resources of most small applicants and the lower potential for environmental impacts typically associated with small discharges. Those regulations provided separate questionnaires for large and small

---

* Found in Code of Federal Regulations, Title 40, Part 122, 48 FR 14153, 1 April 1983 (hereinafter referred to as 40 CFR Part 122).

† Found in Code of Federal Regulations, Title 40, Part 124, 48 FR 14264, 1 April 1983 (hereinafter referred to as 40 CFR Part 124).

applicants, with fewer requirements placed on small applicants. To avoid the excessive duplication that existed with the separate questionnaires, the amended section 301(h) regulations, and hence this document, present a single questionnaire. In this document, each question in the combined questionnaire is followed by a statement as to who must respond (i.e., large dischargers, small dischargers, or both) and guidance on how to respond.

As was true under the 1982 regulations, the level of detail expected of most small applicants in their responses is considerably less than that required of large applicants in their responses to the same questions. Because the amended section 301(h) regulations do not provide specific guidance on the required level of detail, the Regions have considerable discretion regarding the level of detail necessary for applicants to demonstrate continued compliance with the 301(h) regulations. This document addresses the levels of detail that may be required of small and large applicants during the permit reissuance process.

This document provides considerations for assessing compliance with section 301(h) regulations. Appropriate uses of monitoring data to assess compliance with regulatory criteria are discussed, including the use of monitoring data to evaluate predictions of conditions that were expected to occur during the term of the section 301(h) modified permit.

Having reached a decision regarding an application for reissuance of a section 301(h) modified permit, the Region may reissue the section 301(h) modified permit with the same or different permit conditions, or may deny the section 301(h) modification. In the case of denial, the NPDES permit would then be reissued by EPA (or, in NPDES-delegated states, by the state) with secondary treatment requirements. This document provides guidance on procedures for reapplying for section 301(h) modified permits. However, it does not provide guidance on the preparation of NPDES permits, which has been published elsewhere (see U.S. EPA, 1986b).

STATUTORY CRITERIA AND REGULATORY REQUIREMENTS

The WQA of 1987 amended CWA section 301(h) in eight respects. Each of these is summarized below, followed by references to key sections of the 301(h) regulations that respond to the statutory criteria of the CWA.

(1) Section 301(h) modified discharges are prohibited from interfering, *alone or in combination with pollutants from other sources*, with the attainment or maintenance of water quality which assures the protection and uses listed in section 301(h)(2) (i.e., assures protection of public water supplies and the

protection and propagation of a balanced, indigenous population of shellfish, fish, and wildlife, and allows recreational activities in and on the water). (emphasis added) [§125.62(f)]

(2) The scope of monitoring investigations is limited to only those investigations necessary to study the effects of the modified discharge. [§125.63(a)]

(3) With respect to any toxic pollutant introduced by an industrial source and for which there is no applicable pretreatment requirement in effect, POTWs serving populations of 50,000 or more are required to demonstrate that industrial sources introducing waste into the POTW are in compliance with all applicable pretreatment requirements, that the POTW will enforce those requirements, and that the POTW has in effect a pretreatment program which, in combination with the POTW's own treatment processes, removes at least the same amount of toxic pollutant as would be removed if the POTW were to apply secondary treatment and had no pretreatment program for that pollutant. [§§125.58(g), 125.58(j), 125.58(q), 125.58(w), 125.58(aa), 125.65]

(4) At the time the section 301(h) modified permit becomes effective, the POTW must be discharging effluent that has received at least primary or equivalent treatment [as defined in §125.58(r)], and that meets the water quality criteria established under section 304(a)(1) of the CWA after initial mixing in the receiving waters. [§§125.58(r), 125.60, 125.62(a)]

(5) Section 301(h) modified permits may not be issued for discharges into waters that contain significant amounts of previously discharged effluent from the POTW. [§125.62]

(6) Section 301(h) modified permits may not be issued for discharges into saline estuarine waters that exhibit stressed conditions, regardless of the applicant's contribution to those stressed conditions. Section 301(h) modified permits may not be issued for discharges into the New York Bight Apex under any conditions. [§§125.59(b)(4), 125.59(b)(5)]

(7) Any POTW that had an agreement before 31 December 1982 to use an outfall operated by another POTW that had applied for or received a section 301(h) modified permit could have applied for its own section 301(h)

AGA 2203

modified permit within 30 days of enactment of the WQA. [No such application was filed.]

(8) Some provisions of the WQA do not apply to applications that received tentative or final approval before enactment of the WQA, but apply to all applications for renewal of section 301(h) modified permits. [§125.59(j)]

Among the changes listed above, changes 1, 3, 4, 5, and 8 are most important to applicants and permittees that are not prohibited from applying for a section 301(h) modified permit under other provisions of the amended regulations. The first change requires POTWs to consider the impacts of their discharge on the receiving water and biota in combination with pollutants from other sources. Previously, POTWs were required to consider only whether their discharge contributed to such impacts.

Change 3 requires applicants serving a population of 50,000 or more to implement additional toxics control efforts (urban area pretreatment program), discussed in detail below under "Demonstrations of Compliance by Permittees" and in Appendix E. This new statutory requirement complements the toxics control program requirements in §125.66 and applies in addition to any applicable pretreatment requirements contained in 40 CFR Part 403. Dischargers may demonstrate compliance with §125.65 by demonstrating that "an applicable pretreatment requirement is in effect" for the toxic pollutant or by demonstrating "secondary removal equivalency."

Applicable pretreatment requirements may be in the form of categorical pretreatment standards promulgated by EPA under CWA section 307, local limits developed in accordance with 40 CFR Part 403, or a combination of both. It is anticipated that most dischargers will be required to use a combination of categorical pretreatment standards and local limits to satisfy §125.65 with respect to toxic pollutants introduced into the treatment works by industrial sources. For any toxic pollutant introduced by an industrial source for which there is no categorical pretreatment standard and it is determined that no local limit is needed, for 301(h) purposes, an applicable pretreatment requirement can also be met by the following: annual monitoring and technical review of industrial discharges, and, where appropriate, implementation of industrial management practices plans (IMPs), best management practices (BMPs), and other pollution prevention activities, and determination on an annual basis of the need to revise local limits and/or to demonstrate that there is no need for a local limit for a specific toxic pollutant. When an industrial discharger is subject to both a categorical standard and a numeric local limit for a specific toxic pollutant, the more stringent of the two limits applies.

Alternatively, a discharger may demonstrate that its own treatment processes, in combination with pretreatment by industrial dischargers, achieves "secondary removal equivalency." Dischargers are required to make this demonstration whenever they cannot show that a toxic pollutant introduced by an industrial discharger is subject to an "applicable pretreatment requirement." Although secondary treatment is intended to control conventional pollutants, a certain amount of toxic pollutants in the influent is removed during the process. This part of WQA section 303(c) requires that a section 301(h) discharger remove at least that same amount of a toxic substance through industrial pretreatment, plus the applicant's own treatment at less-than-secondary levels, as would be removed if the applicant were to apply secondary treatment and no pretreatment requirements existed for that pollutant. A secondary treatment pilot plant could be used to determine empirically the amount of a toxic pollutant that would be removed from the influent if the applicant were to apply secondary treatment. For each pollutant introduced by an industrial source, that applicant would then demonstrate that industrial pretreatment plus the POTW's own treatment processes removed at least the same amount of pollutant as was removed by the secondary treatment pilot plant. The pemit will contain effluent limits based on data from the secondary equivalency demonstration when these values are more stringent than effluent limits required to ensure all applicable environmental protection criteria are met. The POTW would then use local limits or perform additional treatment at the POTW, or combine the two to achieve the permit limit.

Change 4 requires all section 301(h) dischargers to achieve a minimum of primary or equivalent treatment, thereby establishing a primary treatment floor for all marine and estuarine POTWs, to demonstrate compliance with §125.60. This section (§125.60) requires at least 30 percent removal of both BOD and SS. Section 301(h) dischargers have always been required to meet state water quality standards that are appropriate for local conditions and that have been approved by EPA. In addition to the primary or equivalent treatment requirements (§125.60), (§125.62) implements the new WQA requirement that 301(h) dischargers meet water quality criteria established under CWA section 304(a)(1) after initial mixing in the receiving waters. Under the new provision, dischargers must determine whether there is an EPA-approved state water quality standard that directly corresponds to the CWA section 304(a)(1) water quality criterion for each specific pollutant. If there is, this directly corresponding state standard would apply. In the absence of such a state standard, the section 304(a)(1) water quality criterion would apply. An EPA-approved state water quality standard would be deemed to "directly correspond" if (1) the state water quality standard addresses the same pollutant as EPA's water quality criterion and (2) the state water quality standard specifies a numeric criterion for that pollutant, or an objective methodology for deriving such a pollutant-specific criterion. For example, if a state water quality standard exists only for a group of toxic substances, such as metals, applicants would also be required to demonstrate compliance with the water quality criteria for individual metals (e.g., cadmium, lead, zinc) to demonstrate compliance with §125.62(a).

The section 301(h) regulations were not amended with respect to change 5, recirculation and reentrainment of previously discharged effluent from the POTW. However, POTWs, especially those that discharge into receiving waters where reentrainment is likely, need to address the possible effects of such entrainment when demonstrating compliance with applicable state water quality standards, water quality criteria, and other section 301(h) criteria. Reentrainment is most often of concern where tidal currents predominate, and where previously discharged effluent is likely to be advected into the ZID after the tidal currents reverse. Technical guidance is provided herein to assist applicants in demonstrating compliance with this new requirement.

Finally, change 8 in the regulations "grandfathers" applicants that had received tentative or final approval of their section 301(h) modified permits before passage of the WQA. Such applicants are "grandfathered" for changes 3, 4, and 5 above, but only for the term of that section 301(h) modified permit. Applicants for reissuance of section 301(h) modified permits must demonstrate compliance with all applicable section 301(h) criteria to qualify for renewal of the section 301(h) modified permit.

Under §125.59(e), those applicants that have already received tentative or final approvals (including grandfathered applicants) must submit to the EPA Regional Administrator a letter of intent to demonstrate compliance with the primary or equivalent treatment requirements (§125.60) by November 7, 1994. Also, applicants serving a population of 50,000 or more must, under §125.59(e), submit a letter of intent to demonstrate compliance with the urban area pretreatment requirements (§125.65). Those applicants without tentative approval must submit a letter of intent to demonstrate compliance with §§125.60 and 125.65 (if applicable) within 90 days of receiving tentative approval. Applicants that are not grandfathered must, by August 9, 1996, demonstrate compliance with §§125.60 and 125.65. Those applicants that are grandfathered must at the time of permit renewal or by August 9, 1996, whichever is later, meet all of the requirements of §§125.60 and 125.65.

All but one (change 7) of these eight statutory changes have been integrated into the amended section 301(h) regulations and must be satisfied by all 301(h) applicants, including those for reissuance of section 301(h) modified permits. Regulations applicable to such applications include NPDES permit regulations (40 CFR Part 122) and the amended section 301(h) regulations (40 CFR Part 125, Subpart G). These regulations, including the changes that resulted from the WQA, are discussed below in detail. As previously noted, this document does not provide guidance on the preparation of NPDES permits. Guidance on 40 CFR Part 122 can be found in U.S. EPA (1986b). For convenience, a portion is briefly discussed below.

40 CFR Part 122. U.S. EPA Administered Programs: The National Pollutant Discharge Elimination System

Section 122.21(d). Duty to Reapply--

Under this section, POTWs with an existing NPDES permit must submit an application for a new NPDES permit a minimum of 180 days before the existing permit expires. The applicant may ask to submit the new application after this due date, and the Region may grant such a request. The Region may extend the due date up to the expiration date of the existing permit. Upon review of an application, the Region may determine that additional information is needed to determine compliance with 301(h) regulations and permit conditions. Such information may be requested at any time (including after the application deadline has passed) in accordance with §122.41(h).

It is strongly recommended that POTWs submit their applications for reissuance of section 301(h) modified permits as early as possible, and no later than 180 days prior to expiration of the existing permit. This early submittal is particularly important because of the need to establish compliance with the recent statutory amendments to section 301(h). As discussed below, early submittal gives the Regions time to review applications for completeness and to request any information needed to complete applications before existing permits expire. Timely submittal of a completed application is required to qualify for the continuation described below.

Section 122.6. Continuation of Expiring Permits--

A permittee may have submitted a complete, timely application to the Region, but through no fault of the permittee, the Region may not have issued a new permit with an effective date on or before the expiration of the previous permit. This section provides that in those cases, the previous permit will remain fully effective and enforceable, pursuant to the Administrative Procedure Act.

40 CFR Part 125, Subpart G

Section 125.56. Scope and Purpose--

40 CFR Part 125, Subpart G, establishes the criteria by which EPA evaluates requests for section 301(h) modified permits. It also establishes special permit conditions that must be included in section 301(h) modified permits.

Section 125.57. Law Governing Issuance of Section 301(h) Modified Permit--

All applicants for section 301(h) modified permits must demonstrate satisfactorily to EPA that the modified discharge will meet all of the following nine requirements to qualify for a section 301(h) modified permit:

(1) An applicant must demonstrate that an applicable water quality standard exists for each pollutant for which the modification is requested. Details of this requirement are given in §125.61. Demonstrations that applicable water quality standards exist will be superfluous for reissuance of section 301(h) modified permits because the original section 301(h) modified permit was based, in part, on successful demonstrations that such standards exist. However, as specified in §125.61, an applicant must demonstrate that the modified discharge will comply with applicable water quality standards. An applicant must also provide a determination signed by an authorized state or interstate agency, stating that the modified discharge will comply with state law. Both the demonstration of compliance with applicable water quality standards and the state's determination are required of applicants for reissuance of section 301(h) modified permits.

(2) An applicant must demonstrate that the modified discharge, alone or in combination with pollutants from other sources, will not interfere with the attainment or maintenance of water quality that assures the protection of public water supplies; assures the protection and propagation of a balanced indigenous population of fish, shellfish, and wildlife; and allows for recreational activities. Specific demonstrations that must be performed by an applicant are stated in §125.62. All are required of applicants for reissuance of section 301(h) modified permits.

(3) An applicant must demonstrate that a monitoring program has been established to monitor the impact of the modified discharge on a representative sample of aquatic biota. The scope of that monitoring program should include only those investigations necessary to study the effects of the modified discharge. General requirements of monitoring program design and specific requirements of the biological, water quality, and effluent monitoring components are specified in §125.63. Demonstrating that an effective monitoring program has been established will be simple for most POTWs that apply for reissuance of section 301(h) modified permits because monitoring data will have been collected over the life of the existing permit. However, EPA may require an applicant to demonstrate the effectiveness of an established monitoring program if the quality of the data is suspect, if incomplete data have been submitted to EPA, or if when the data are analyzed it is evident that additional data collection is needed to adequately characterize and detect the effects of the discharge.

(4) An applicant must demonstrate that the modified discharge will not result in additional requirements on other point or nonpoint sources of pollutants. Section 125.64 requires an applicant to provide a determination signed by an authorized state or interstate agency indicating whether the modified discharge will result in any such additional requirements. The foregoing demonstration and determination of compliance are required of applicants for reissuance of section 301(h) modified permits.

(5) An applicant with a treatment works that serves a population of 50,000 or more and that receives toxic pollutants introduced into the treatment works by one or more industrial dischargers must demonstrate that it has an urban area pretreatment program in effect at the time of final permit approval (§125.65). This requirement can be met in one of two ways. An applicant may demonstrate that applicable pretreatment requirements, as defined in §125.65(c), will be in effect for each toxic pollutant introduced by an industrial source into the treatment works. Alternatively, an applicant may demonstrate that it has a program in effect that achieves "secondary removal equivalency," as defined in §125.58(w) and explained in §125.65(d).

(6) An applicant must demonstrate that pretreatment requirements for sources that introduce wastes into the treatment works will be enforced. This demonstration includes chemical analyses of the discharge for all toxic

pollutants and pesticides; identification of sources of toxic pollutants and pesticides; and development of, implementation of, and compliance with an approved industrial pretreatment program, as specified in §§125.65 and 125.66. However, these requirements are waived for small applicants that certify that there are no known or suspected sources of toxic pollutants and pesticides, and that document the certification with an industrial waste survey as described by 40 CFR 403.8(f). Most small applicants for reissuance of section 301(h) modified permits will be required to provide only an updated certification that there are no known or suspected sources of toxic pollutants or pesticides. Because industrial sources of pollutants may have changed over the term of the original section 301(h) modified permit, both large and small applicants should review updated information on industrial sources of pollutants before performing the required demonstration or certifying that there are no known industrial sources of toxic pollutants or pesticides.

(7) An applicant must demonstrate that a schedule of activities has been established to eliminate the introduction of toxic substances from nonindustrial sources into the treatment works. Just as was required in the original section 301(h) application, applicants must comply with the specific requirements of §125.66(d). These requirements are that a public education program be developed, submitted with the application, and implemented; that nonindustrial source control programs be developed and implemented in accordance with schedules submitted with the application; and that the foregoing program may be revised by EPA before issuance or reissuance of a section 301(h) modified permit, or during the term of that permit. However, for small applicants certifying that there are no known or suspected problems related to toxic pollutants or pesticides in the discharge, only a public education program is required. As was true for the original section 301(h) applications, most small applicants should be able to provide the foregoing certification. However, the small applicant should review updated information on water quality, sediment quality, and biological conditions before certifying that there are no known or suspected water quality, sediment accumulation, or biological problems that are related to the discharge of toxic pollutants or pesticides.

(8) An applicant must demonstrate that the modified discharge will not result in new or substantially increased discharges of the pollutant for which a section 301(h) modification is being requested above the discharge specified in the

section 301(h) modified permit. Details of this requirement are given in §125.67, which states that where pollutant discharges are attributable, in part, to combined sewer overflows, an applicant must minimize such overflows and prevent increased discharges of pollutants. An applicant must also project effluent volumes and mass emission rates for pollutants to which the modification applies. These projections must be provided in 5-year increments for the design life of the facility. This demonstration applies to applicants for reissuance of section 301(h) modified permits.

(9) An applicant must demonstrate that the modified discharge will have received at least primary or equivalent treatment, as required under §125.60 and defined in §125.58(r). An applicant must also meet the criteria established under CWA section 304(a)(1) in accordance with §125.62(a). Section 301(h) modified discharges are prohibited into waters that contain "significant amounts of previously discharged effluent from such treatment works" and into saline estuarine waters that at the time of application do not support a balanced indigenous population of shellfish, fish, and wildlife, do not allow recreation in or on the waters, or exhibit ambient water quality that does not meet specified standards. "A significant amount of previously discharged effluent" is that amount which would cause the discharge plume to violate water quality standards or water quality criteria beyond the zone of initial dilution.

Section 125.58. Definitions--

This section defines terms applicable to the 40 CFR Part 125, Subpart G, regulations. Definitions of *primary or equivalent treatment, pretreatment, categorical pretreatment standard, secondary removal equivalency, water quality criteria, permittee,* and *New York Bight Apex* have been added to the amended section 301(h) regulations, and definitions of *industrial source, ocean waters, stressed waters, applications,* and *applicant questionnaire* have been changed.

Section 125.59. General--

This section establishes general criteria and requirements that must be met by applicants for section 301(h) modified permits. Also specified are several regulatory options that may be exercised by EPA during the application process. As indicated below, some of the general regulations are not relevant to applications for reissuance of section 301(h) modified permits.

According to §125.59(a), an application may be based on a current, improved, or altered discharge into ocean waters or saline estuarine waters. This requirement remains relevant to applications for reissuance of section 301(h) modified permits.

No section 301(h) modified permits may be issued for the following discharges:

- Discharges that would not assure compliance with 40 CFR Part 122 and 40 CFR Part 125, Subpart G;
- Discharges of sewage sludge;
- Discharges that would not be in compliance with applicable provisions of state, local, or other federal laws and Executive orders;
- Applicants that have not met at least primary or equivalent treatment requirements;
- Discharges entering saline estuarine waters that are stressed in the manner set forth in §125.59(b)(4); and
- Discharges that enter the New York Bight Apex.

These prohibitions are relevant to applications for reissuance of section 301(h) modified permits.

Section 125.59(c) specifies that all applications for section 301(h) modified permits must contain a signed, completed NPDES application; a completed Applicant Questionnaire; and a certification of completeness and accuracy. This provision remains valid for applications for reissuance of section 301(h) modified permits. Applicants for permit renewal should support continuation of their modification with results of studies and monitoring performed during the life of the permit. As was the case for original section 301(h) applications, the level of detail required of applicants responding to questions in the Applicant Questionnaire will vary according to the volume, composition, and characteristics of the discharge, as well as the characteristics of the receiving water and biota. Applicants should consult with the EPA Region about permit reissuance well in advance of the application deadline. Timely consultation will help ensure that each applicant is informed of the appropriate level of detail required to complete the Applicant Questionnaire and that all data necessary for completing the questionnaire have been collected and are adequate to demonstrate compliance with 301(h) criteria and regulations.

Revisions to original section 301(h) applications that were submitted under the 1979 and 1982 application deadlines are discussed in §125.59(d). Such revisions are not relevant to applications for reissuance of section 301(h) modified permits. Also as noted above, a discharger holding an existing section 301(h) modified permit must submit an application for a new section 301(h) modified permit at least 180 days before the existing permit expires if the section 301(h) modification is to be renewed. [See §125.59(f)(1).]

Deadlines for submittal of applications for reissuance of section 301(h) modified permits are specified in §122.21(d) and are discussed above. The distribution of such applications is not specified in 40 CFR Part 124 or 40 CFR Part 125, Subpart G. However, applicants should adhere to the distribution schedule required for original section 301(h) applications, as indicated in §125.59(f)(1): one original and one copy to the appropriate U.S. EPA Regional Administrator, and one copy to state and interstate agencies authorized to provide certification or concurrence in accordance with §§124.53-124.55. Deadlines for applicants desiring to submit revised applications following the issuance of a tentative decision are stated in §125.59(f)(2).

Under §125.59(e), applicants or permittees are required to submit additional information regarding their intent to demonstrate compliance with §125.60 (primary or equivalent treatment requirements) and §125.65 (urban area pretreatment requirements) by November 7, 1994. Section 125.59(e) specifies the additional information required and the conditions under which the submittal of this information may be delayed until the time of permit renewal. Deadlines for providing additional information to demonstrate compliance with §§125.60 and 125.65 are specified in §125.59(f)(3).

A favorable state determination is required before the Region reviews an application. Under §125.59(f)(4), state determinations are due to the Regions no more than 90 days after an application is submitted to EPA. The Regions may extend this 90-day deadline upon request by the state. However, extensions may decrease the amount of time remaining until expiration of the existing modified permit and the amount of time available for an applicant to respond to concerns of the state.

Under §125.59(g), the Regions may authorize or request an applicant to submit additional data after the application deadline. Such information must be submitted within 1 year of the date of the authorization or request.

Options that the Regions and states may exercise in granting or denying a section 301(h) modified permit are specified in §125.59(i). All remain relevant to applications for reissuance of section 301(h) modified permits. For the Administrator to grant a section 301(h) modified permit, an applicant must have demonstrated compliance with §§125.59 through 125.68. State certification (concurrence) is also required, with the state director cosigning the section 301(h) modified permit if an intent to do so was indicated in the written concurrence. Section 301(h) modified permits must be issued in accordance with procedures in 40 CFR Part 124 and must contain all applicable terms and conditions specified in 40 CFR Part 122 and §125.68. Appeals of section 301(h) determinations may be made in accordance with procedures in 40 CFR Part 124. Under §125.59(h), the Administrator may grant a tentative decision on a section 301(h) modified permit if the applicant can demonstrate that the modified discharge will comply with the provisions of 40 CFR Part 125, Subpart G, based on a schedule submitted by the applicant.

Section 125.68. Special Conditions for Section 301(h) Modified Permits--

Section 125.68 sets forth special conditions that must be included in section 301(h) modified permits, in addition to those specified in 40 CFR Part 122. All remain valid for reissued section 301(h) modified permits. The special conditions are as follows:

- That effluent limitations and mass loadings assure compliance with 301(h) regulations;

- That schedules of compliance, if needed (e.g., if a permittee had been a small applicant but became a large applicant and would need to develop a pretreatment program) be included for the required industrial pretreatment program [§125.66(c)], the nonindustrial source control program [§125.66(d)], and control of combined sewer overflows [§125.67].

- That the proposed monitoring program include provisions for monitoring biota [§125.63(b)], water quality [§125.63(c)], and effluent [§§125.60(b) and 125.63(d)]; and

- That the monitoring data be reported at the frequency prescribed in the approved monitoring program.

DEMONSTRATIONS OF COMPLIANCE BY PERMITTEES

The 1994 amendments to 40 CFR Part 125, Subpart G, have been integrated into the section 301(h) Applicant Questionnaire, which must be completed and included with all applications for renewal of section 301(h) modified permits. Explanations of the demonstrations that are required of applicants are given below following each question, and in the appendices to this document, as appropriate.

All applicants for new or reissued section 301(h) modified permits are required to demonstrate compliance with the new regulatory criteria. However, §125.59 establishes special procedures and deadlines for demonstrating compliance with §125.60 (i.e., primary or equivalent treatment requirements) and §125.65 (i.e., urban area pretreatment requirements). Compliance with §125.62(a)(1) (i.e., water quality standards and criteria, as applicable) is not included in the special procedures and deadlines established under §125.59.

Under §125.59(e), applicants for new or reissued section 301(h) modified permits must submit a letter of intent to demonstrate compliance with §§125.60 and 125.65. For compliance with §125.60, the letter of intent must include a description of the proposed treatment system and a project plan for achieving compliance (including a schedule for data collection; dates for design and construction of necessary facilities; submittal of influent, effluent, and receiving water quality data; and any other information necessary for determining compliance with §125.60). For compliance with §125.65, the letter of intent must include a description of the approach that will be used to achieve compliance and a project plan for achieving compliance (including necessary data collection activities, submittal of additional information, and the development of any appropriate pretreatment limits). Applicants that submit additional information must modify their NPDES form and Applicant Questionnaire as needed to ensure that the information in their application is complete and correct, must obtain new state determinations as specified in §§125.61(b)(2) and 125.64(b), and must provide the certification required under §122.22(d).

Section 125.59(f) requires permittees and applicants with tentative or final approval of section 301(h) modifications to submit a letter of intent that contains the information required under §125.59(e)(1). This letter must be submitted by November 7, 1994. Applicants that have not yet received tentative approval of a section 301(h) modification must submit a letter of intent within 90 days of receipt of that tentative approval. Applicants that are not "grandfathered" under §125.59(j) must demonstrate compliance with §§125.60 and 125.65 by August 9, 1996. Applicants grandfathered under the aforementioned subsection must demonstrate compliance with these subsections at the time of permit renewal or by August 9, 1996, whichever is later.

APPLICATION FORMAT

As specified in §125.59(c), a full, completed application for a section 301(h) modified permit contains a certification of completeness and accuracy; a signed, completed NPDES application [Short Form A or Standard Form A in accordance with §§122.21(d) and 124.3]; and a completed Applicant Questionnaire. The order in which these parts are to be assembled is not specified in the 301(h) regulations.

To facilitate review by the Region and appropriate state agencies, it is recommended that the application be assembled in the following sequence:

- A cover letter signed by the responsible official for the POTW;
- The statement of completeness and accuracy mandated in §122.22(d), signed by the responsible official for the POTW [§125.59(c)(3)];
- A table of contents for the application, including any appendices;
- A list of figures for the application;
- A list of tables for the application;
- A signed, completed NPDES application Short Form A or Standard Form A;
- A completed Applicant Questionnaire; and
- Any accessory documents (e.g., technical reports) considered necessary for an independent review of the application.

The Applicant Questionnaire given as Appendix A of 40 CFR Part 125, Subpart G, is designed to provide EPA with all information necessary to determine whether an applicant meets the statutory criteria and regulations of 40 CFR Part 125, Subpart G. Guidance provided in this document and in *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (U.S. EPA 1982a) complements the questionnaire. Although applicants are required to respond to applicable questions, the Regions may determine the appropriate level of response to each question for each applicant. The Region may also allow an applicant to incorporate data by reference to previous submittals.

Applicants/permittees should consult with the appropriate EPA Region in a timely manner so the Region can assist in determining the level of response needed. This will help the permittee to submit the appropriate information on time. EPA encourages applicants to work closely with the Region, particularly during the end of the existing permit term. This will help to ensure that all data necessary for completion of the Applicant Questionnaire are available well in advance of the application deadline, and that the applicant understands the level of detail appropriate for each response. Such discussions should result in more concise responses to the questions and should help avoid unnecessary effort and expense by the applicant during the application process.

REQUIRED DATA

Applicants "shall support continuation of the modification by supplying to EPA the results of studies and monitoring performed in accordance with §125.63 during the life of the permit" [§125.59(c)]. For many dischargers, data collected during these studies and monitoring programs will be relevant to many, or all, of the questions in the Applicant Questionnaire. Additional relevant data may be found in publications and technical reports produced by other agencies, institutions, and companies working in nearby areas of the receiving waters. Data from such surveys could be used to better define environmental factors, such as the critical density profile for initial dilution calculations or biological conditions in a reference area. However, for some applicants, no new data [i.e., data collected after issuance of the original section 301(h) modified permit] will be available to respond to some of the questions in the Applicant Questionnaire.

Although the Regions may be of assistance in clarifying the appropriate application requirements, it is the permittee's responsibility to contact the Region well in advance of the application deadline. Once informed of information deficiencies, permittees must collect, analyze, and interpret the necessary information for incorporation into the application for permit reissuance. Failure to supply necessary information could result in permit denial, based on the grounds that a complete application was not submitted. After an application has been received, however, the Region may determine that additional information is needed to determine compliance with 301(h) regulations and permit conditions. Such information may be requested at any time (including after the application deadline has passed) in accordance with §§122.41(h) and 125.59(f).

INTEGRATION OF DATA WITH EPA DATABASES

Many EPA databases are available for the storage, retrieval, and analysis of water quality, sediment, and biological sampling data. Although the use of these systems is not mandated by current legislation, they are useful tools for both the regulated community and the various federal, state, and regional regulatory authorities. EPA is modernizing its water information systems, which include ODES (Ocean Data Evaluation System), STORET (Water Quality Information System), and BIOS (Biological Information System). The systems are used extensively because of their unique functionality: to manage and analyze water quality and biological monitoring data. The major objective of the modernization program is to move ODES, STORET, and BIOS into a relational database environment, facilitating data integration and sharing while accommodating emerging informational needs. Applicants for 301(h) permit waivers are encouraged to use these systems for storing and analyzing data required for the application, as well as for ongoing monitoring programs.

PREPARATION OF THE APPLICANT QUESTIONNAIRE FOR MODIFICATION OF SECONDARY TREATMENT REQUIREMENTS

I. INTRODUCTION

The Applicant Questionnaire is to be submitted by both small and large applicants for modification of secondary treatment requirements under CWA section 301(h). A small applicant is defined as a POTW that has a population contributing to its wastewater treatment facility of less than 50,000 and a projected average dry-weather flow of less than 5.0 MGD (0.22 cubic meters/sec) [§125.58(c)]. A large applicant is defined as a POTW that has a population contributing to its wastewater treatment facility of at least 50,000 or a projected average dry-weather flow of its discharge of at least 5.0 MGD [§125.58(c)]. The questionnaire is in two sections, a general information and basic requirements section (Part II) and a technical evaluation section (Part III). Satisfactory completion by small and large dischargers of the appropriate questions is necessary to enable EPA to determine whether the applicant's modified discharge meets the criteria of section 301(h) and EPA regulations (40 CFR Part 125, Subpart G).

Most small applicants should be able to complete the questionnaire using available information. However, small POTWs having low initial dilution, discharging into shallow waters or waters with poor dispersion and transport characteristics, discharging near distinctive and susceptible biological habitats, or discharging substantial quantities of toxics should anticipate the need to collect additional information and/or conduct additional analyses to demonstrate compliance with section 301(h) criteria. If there are questions in this regard, applicants should contact the appropriate EPA Regional Office for guidance.

Guidance for preparing a complete application for reissuance of a section 301(h) modified permit is provided below. Special instructions and exceptions for small applicants are also provided. The sequence in which the application parts are discussed corresponds to that recommended in the "Application Format" section of this document. Accessory doucments (e.g., data reports) should be appended to the application.

Just as original section 301(h) applications were based on the most recent, appropriate, and technically correct data available at the time the application was prepared, applications for reissuance of section 301(h) modified permits should consider monitoring data collected over the term of the existing modified permit, as required under §125.59(c)(4). When monitoring data and other information, collected over the term of the existing permit, confirm that all the values used in analyses provided in the original application have not changed and are not expected to change over the term of the new modified permit, the applicant may summarize the available data and provide evidence demonstrating the basis for determining that no change in information has been realized or expected. In cases where the values of one or more parameters have changed, however, or where new monitoring data are useful for supporting a given demonstration, those data should be included in the required response.

Under section 301(h)(2) and §§125.57(a)(2) and 125.62(f), all demonstrations of compliance with applicable statutes and regulations must consider the effects of the discharge singly and in combination with pollutants from other sources, if any other sources exist. When demonstrating such compliance, the level of detail required of small applicants is considerably less than that required of large applicants for the same demonstration. Applicants should consult with the appropriate EPA Region before submitting an application to determine the level of detail that is appropriate for their discharge. POTWs that have been classified as small dischargers, but that no longer meet the conditions of the definition of small discharger [§125.58(c)] or that are not expected to meet those small discharger conditions during the next permit term, must apply for reissuance of this section 301(h) modified permit as large dischargers.

II. GENERAL INFORMATION AND BASIC DATA REQUIREMENTS

II.A. Treatment System Description

II.A.1. On which of the following are you basing your application: a current discharge, improved discharge, or altered discharge, as defined in 40 CFR 125.58? [40 CFR 125.59(a)]

****** Large and small dischargers must respond.***

Applicants should consider "current discharge" to mean the actual volume, composition, and location of a 301(h) permittee's discharge at the time of permit reapplication. Use of the latest 12 months of data would be most appropriate in the application.

An "improved discharge" may result from any of the following changes:

- Improvements to the collection system, treatment plant, or outfall (including outfall relocations);
- Improvements to treatment levels or discharge characteristics;
- Improvements in the operation or maintenance of the treatment system; or
- Measures to control the introduction of pollutants into the treatment works.

For improved discharges, applicants should briefly describe the changes to the treatment system or its operation on which the application is based.

Discharge alterations include all changes that result in a treatment level less than that currently achieved, including changes in effluent volume or composition. All changes that result in the downgrading of effluent characteristics, regardless of whether the outfall was previously improved or relocated to compensate for lower effluent quality, are considered altered discharges. An applicant that proposes downgrading treatment levels and/or changes outfall and diffuser location and design must justify the proposal on the basis of substantial changes in circumstances beyond the applicant's control since the time of application submission and must comply with applicable state antidegradation policy. Applicants that propose altered discharges based on changed circumstances and that propose improvements in treatment levels must comply with the applicable state's antidegradation policy and should briefly describe the changes to the treatment system or its operation on which the application is based.

II.A.2. Description of the Treatment/Outfall System [40 CFR 125.62(a) and 125.62(e)]

*a. **Provide detailed descriptions and diagrams of the treatment system and outfall configuration which you propose to satisfy the requirements of section 301(h) and 40 CFR Part 125, Subpart G. What is the total discharge design flow upon which this application is based?***

b. Provide a map showing the geographic location of the proposed outfall(s) (i.e., discharge). What is the latitude and longitude of the proposed outfall(s)?

c. For a modification based on an improved or altered discharge, provide a description and diagram of your current treatment system and outfall configuration. Include the current outfall's latitude and longitude, if different from the proposed outfall.

**** Large and small dischargers must respond.*

Most of the above information can be found in sections 1-13 of the NPDES Standard Form A. Past experience in the 301(h) program has shown that applicants often neglect to describe the treatment and outfall system in sufficient detail to allow evaluation of the technical merit of the application. Applicants should provide a detailed description of this system such that the reader will have a complete picture of the physical aspects of the treatment and outfall system and will be able to understand the treatment processes that occur therein. Information on diffuser dimensions used to determine the port flow distribution achieved by the outfall is especially important (see Question II.A.8 below) and should be specified as accurately as possible. Figures and drawings with dimensions should be included if possible. In those descriptions, applicants should emphasize any changes in the service area, treatment system, or outfall system that were implemented during the term of the existing permit. Water depths and navigational coordinates of the outfalls as they exist should be correctly specified. Water depth of the outfall should be specified as the water depth at the midpoint of the diffuser, referenced to mean sea level or mean lower low water. Water depths and navigational coordinates found in engineering design documents are often incorrect because of changes in the lengths and routes of the outfalls made during construction. Hence, drawings of as-built conditions should be used.

II.A.3. Primary or equivalent treatment requirements [40 CFR 125.60]

a. Provide data to demonstrate that your effluent meets at least primary or equivalent treatment requirements as defined in 40 CFR 125.58 (r). [40 CFR 125.60]

b. If your effluent does not meet primary or equivalent treatment requirements, when do you plan to meet them? Provide a detailed schedule, including design, construction, start-up and full operation, with *your application. This requirement must be met by the effective data of the new section 301(h) modified permit.*

*** *Large and small dischargers must respond.*

Applicants must demonstrate that the treatment works will discharge, at a minimum, primary treated effluent (or its equivalent) at the time their modification becomes effective, as mandated by §§125.57 and 125.60. Applicants are advised that "primary or equivalent treatment" is defined in §125.58(r) as "treatment by screening, sedimentation, and skimming adequate to remove at least 30 percent of the biochemical oxygen demanding material and of the suspended solids in the treatment works influent, and disinfection, where appropriate." To support this demonstration, the applicant should supply monthly averaged data for influent and effluent BOD, suspended solids, and flow for the last 1-year period. The averaging period (e.g., weekly) for such data should be specified precisely for each parameter.

EPA believes that the monthly period for averaging monitoring results to determine compliance with the 30 percent BOD removal requirement will be appropriate for most applicants. However, as noted in the preamble discussion of primary treatment in the 1994 regulations, EPA also recognizes that the 30 percent removal rate for BOD may be difficult to achieve on a monthly average basis in certain cases, e.g., where there is dilute wastewater or proportionately low concentrations of insoluble BOD. Because of this, §125.60(c) provides flexibility in achieving 30 percent removal of BOD, in certain instances, by allowing compliance monitoring data to be averaged for a period longer than monthly, up to annually.

EPA anticipates that compliance requirements established for longer-than-monthly averaging periods for BOD removal will be the exception, not the general practice. An applicant that has demonstrated a consistent ability to achieve 30 percent removal of BOD on a monthly average basis over the year preceding the promulgation of these regulations (or another time period established by the Regional Administrator when this time period is not applicable) will not be eligible for the longer-than-monthly averaging period. Eligibility for the longer period is limited to those POTWs that, based on circumstances listed below, and subject to the qualifications listed below, truly cannot achieve 30 percent removal on a monthly average.

Eligibility for longer-than-monthly averaging periods will be determined by the Regional Administrator on a case-by case basis. The Regional Administrator will judge each eligible case, taking into account climatic, seasonal, or other factors causing significant fluctuations in influent characteristics that could affect BOD removal efficiencies. Appropriate circumstances may include:

- Seasonally dilute influent BOD concentrations due to relatively high (although nonexcessive) inflow and infiltration;

- Relatively high soluble-to-insoluble BOD ratios on a fluctuating basis; or

- Cold climates resulting in cold influent.

The longer period must be requested by the applicant, and the burden of justifying a longer averaging period will be on the applicant. In addition to justifying the application on the basis of the conditions listed above, to qualify for the longer averaging period the applicant must demonstrate to the satisfaction of the Regional Administrator that the treatment facility is properly designed and operated; that the applicant will be able to meet all section 301(h) requirements with the longer averaging basis; and, because of circumstances beyond the applicant's control (listed above), the applicant cannot achieve the 30 percent removal requirement for BOD on a monthly averaging basis. Section 125.60(c)(2) of the new regulations also requires that inflow and infiltration (I&I) be nonexcessive to ensure that applicants have corrected, as feasible, deficiencies in their collection system that result in extremely dilute wastewater. The determination of whether the I&I is excessive will be based on the definition of excessive I&I in 40 CFR 35.2005(b)(16),[*] plus the additional criterion that inflow is nonexcessive if the total flow to the primary treatment plant is less than 275 gallons per capita per day, consistent with 40 CFR 133.103(d)[†] of the secondary treatment regulations.

If the applicant has received the Regional Administrator's approval to demonstrate compliance with the 30 percent BOD removal requirement on other than a monthly average basis [§125.60(c)(1)], monitoring data for determining compliance based on the approved compliance period should be submitted. The Regional Administrator has discretion to establish averaging periods up to yearly (e.g., quarterly or semi-annually).

The applicant must maintain the sampling and reporting frequencies for all parameters, as specified in its permit (e.g., weekly averages, monthly averages). The modified time period used to calculate compliance with the 30 percent removal requirements applies only to BOD, not to other measured parameters. For BOD, the goal for whichever averaging period is approved,

---

[*] As found in Code of Federal Regulations, Title 40, Part 35, 47 FR 44954, 12 October 1982 (hereinafter referred to as 40 CFR Part 35).

[†] As found in Code of Federal Regulations Title 40, Part 133, 49 FR 37006, 20 September 1984 (hereinafter referred to as 40 CFR Part 133).

up to annually, is to achieve at least 30 percent removal. If the problem is seasonal, a separate averaging period can be established for that season. However, the POTW will still need to achieve a 30 percent removal rate for that period. This type of averaging period may require bracketing the season with monthly average removals greater than 30 percent to achieve the seasonal 30 percent removal rate. The Regional Administrator may require 30 percent removal on a monthly average basis for other times of the year.

In the event the averaging period is lengthened to a year, the permit may be written to provide for timely and effective enforcement of the specified 30 percent removal of BOD and suspended solids and, at the discretion of the permit writer, set interim monthly minimums. These monthly minimums would be set on a case-by-case basis so that compliance with the 30 percent removal on the basis of an alternative averaging period would be maintained. Historical performance levels pertaining to the percent removal of BOD and suspended solids and seasonal fluctuations from month to month, accounting for changes in I&I, could be a factor in determining the minimum levels. This information could also help to ensure that POTWs maintain or surpass their historical operating performance. These minimum values, *based on past removal performance*, could be set as high as practicable for the applicant to maintain operating efficiency, which depends on the particular situation and conditions. In addition, permits would still incorporate daily, 7-day average, and monthly average concentrations, as well as mass emission rate (MER)-based limits according to the limits on BOD and suspended solids proposed in waiver applications.

Additional provisions address the primary treatment compliance time frame [§125.59(f)(3)]. Under §125.59(f)(3), by August 9, 1996 applicants that are not grandfathered have to comply and applicants that are grandfathered have until permit renewal or by August 9, 1996, whichever is later, to comply with the primary treatment requirements. This 2-year time period is designed to allow 1 year for plant construction and another year to demonstrate compliance with the primary treatment requirements. If approved by the Regional Administrator, compliance demonstration may be based on less than 1 year's worth of data. The period to determine compliance may be less than 1 year if there are sufficient data to determine compliance, the plant is well designed and there are no operational or maintenance problems, and the applicant has been complying with the 30 percent removal rate for at least 3 months.

II.A.4. Effluent Limitations and Characteristics [40 CFR 125.61(b) and 125.62(e)(2)]

a. *Identify the final effluent limitations for five-day biochemical oxygen demand (BOD_5), suspended solids, and pH upon which your application for a modification is based:*

- *BOD_5 _____ mg/L*
- *Suspended solids _____ mg/L*
- *pH _____ (range)*

b. *Provide data on the following effluent characteristics for your current discharge as well as for the modified discharge if different from the current discharge:*

Flow (m^3/sec):

- *minimum*
- *average dry weather*
- *average wet weather*
- *maximum*
- *annual average*

BOD_5 (mg/L) for the following plant flows:

- *minimum*
- *average dry weather*
- *average wet weather*
- *maximum*
- *annual average*

Suspended solids (mg/L) for the following plant flows:

- *minimum*
- *average dry weather*
- *average wet weather*
- *maximum*
- *annual average*

Toxic pollutants and pesticides (ug/L):

- *list each toxic pollutant and pesticide*

- *list each 304(a)(1) criteria and toxic pollutant and pesticides*

pH:

- *minimum*
- *maximum*

Dissolved oxygen (mg/L, prior to chlorination) for the following plant flows:

- *minimum*
- *average dry weather*
- *average wet weather*
- *maximum*
- *annual average*

Immediate dissolved oxygen demand (mg/L)

*** *Large and small dischargers must respond.*

Applicants should specify the effluent limitations requested for their section 301(h) modified permits and the basis (e.g., monthly average values) for those limits. Applicants must request specific limitations. Except for pH, ranges of values or a list of alternatives is not acceptable. The remaining information on effluent characteristics can usually be found by analyzing plant operating records.

II.A.5. Effluent Volume and Mass Emissions [40 CFR 125.62(e)(2) and 125.67]

a. Provide detailed analyses showing projections of effluent volume (annual average, m^3/sec) and mass loadings (mt/yr) of BOD_5 and suspended solids for the design life of your treatment facility in five-year increments. If the application is based upon an improved or altered discharge, the projections must be provided with and without the proposed improvements or alterations.

b. Provide projections for the end of your five-year permit term for 1) the treatment facility contributing population and 2) the average daily total discharge flow for the maximum month of the dry weather season.

*** *Large and small dischargers must respond.*

Applicants should project effluent flows and mass emissions for the term of the modified permit being requested, and for subsequent years at 5-year intervals. Projections should be based on the annual average flows and annual average effluent characteristics. Projections should reflect expected changes in the service area and population over the term of the modified permit being requested, and over the subsequent periods of time being considered. Projections for the new end-of-permit year must be given, including the average daily flow for the maximum month of the dry-weather season and the average effluent characteristics for that month.

II.A.6. Average Daily Industrial Flow (m^3/sec). Provide or estimate the average daily industrial inflow to your treatment facility for the same time increments as in question II.A.5 above. [40 CFR 125.66]

*** *Large and small dischargers must respond.*

Annual average flow data will generally be sufficient for nonseasonal (i.e., continuous operation) industries. For seasonal industries, average daily flows for the periods of operation should be provided. Supporting information (e.g., lists of industries and products manufactured) may be required.

II.A.7. Combined Sewer Overflows [40 CFR 125.67(b)]

a. Does (will) your treatment and collection system include combined sewer overflows?

b. If yes, provide a description of your plan for minimizing combined sewer overflows to the receiving water.

*** *Large and small dischargers must respond.*

Locations, flow quantities, and frequency of overflows should be specified. Data on total effluent flow and on effluent suspended solids and BOD_5 concentrations should be provided for times when overflows occur. The effect of increased infiltration during the rainy season should be discussed. Applicants should also provide a plan, including a narrative description and implementation schedule for minimizing the discharge of combined sewer overflows to the receiving water.

II.A.8. Outfall/Diffuser Design. Provide the following data for your current discharge as well as for the modified discharge, if different from the current discharge: [40 CFR 125.62(a)(1)]

- *Diameter and length of the outfall(s) (meters)*
- *Diameter and length of the diffuser(s) (meters)*
- *Angle(s) of port orientation(s) from horizontal (degrees)*
- *Port diameter(s) (meters)*
- *Orifice contraction coefficient(s), if known*
- *Vertical distance from mean lower low water (or mean low water) surface and outfall port(s) centerline (meters)*
- *Number of ports*
- *Port spacing (meters)*
- *Design flow rate for each port, if multiple ports are used (m^3/sec)*

*** *Large and small dischargers must respond.*

The information requested above should be available from the engineering drawings for the treatment plant outfall and diffuser system. If risers are used, information sufficient to compute the riser discharge coefficient by using the method of Koh (1973) should also be provided. For example, if the riser consists of a vertical pipe, the following details should be specified: length and inside diameter of the pipe, material from which it is made, and diameter of the port orifice. Missing information should be so indicated in the responses to the foregoing questions. Because outfalls and diffusers are often built somewhat differently than specified in the engineering design drawings, applicants are advised to provide as-built information.

In addition to the foregoing information, applicants should provide information on the slope of the diffuser and the slope of the port centerlines if they differ from that of the diffuser. If the diffuser ports discharge to opposite sides of the diffuser, that information should be noted. The depths of the ports below mean lower low water (or mean low water) should be provided, as should any variations in port depths along the length of the diffuser.

The information provided in this section is routinely used in the review process to determine whether the diffuser is well-designed hydraulically for the range of flow (daily minimum to daily maximum) expected during the requested permit term. Among the characteristics of a well-designed diffuser are uniform port flows and individual port densimetric Froude numbers that are always greater than 1. Methods for computing the port flow distribution from a multiport diffuser are described by Grace (1978). Discharge coefficients for risers can be computed using methods provided by Koh (1973). The effect of the bottom slope must be included in the diffuser hydraulics computations because some diffusers behave properly on a horizontal seafloor but poorly on a sloping bottom, especially at low flow rates.

II.B. <u>*Receiving Water Description*</u>

II.B.1. Are you applying for a modification based on a discharge to the ocean [40 CFR 125.58(n)] or to a saline estuary [40 CFR 125.58(v)]? [40 CFR 125.59(a)]

*** ***Large and small dischargers must respond.***

Ocean waters are defined in §125.58(n) as coastal waters, other than saline estuarine waters (defined below), landward of the baseline of the territorial seas, the deep waters of the territorial seas, or the waters of the contiguous zone. Territorial seas extend 3 miles outward from the baseline, and the contiguous zone extends an additional 9 miles.

Saline estuarine waters are defined in §125.58(v) as coastal waters inside the baseline from which the territorial seas are measured which have a free connection to the territorial sea in which the salinity is diluted by freshwater inflows, undergo net seaward exchange with ocean waters, and have salinities comparable to those of the ocean. Generally, these waters are near the mouth of estuaries and have cross-sectional, annual mean salinities greater than 25 parts per thousand (ppt). It should be noted, however, that 25 ppt is used as a general test in §125.58(v). The failure of the receiving water to meet this salinity concentration does not absolutely preclude eligibility for consideration under section 301(h). However, where salinities fall substantially below this concentration, applicants should be careful to document that the waters into which they discharge meet the other requirements of §125.58(v) (i.e., inside the baseline from which the territorial seas are measured, free connection to the territorial sea in which the salinity is diluted by freshwater inflows, and net seaward exchange with ocean waters).

Estuarine dischargers are advised that according to §§125.57(a)(9) and 125.59(b)(4), section 301(h) modified permits may not be issued for discharges into saline estuarine waters unless those waters meet all of the following conditions:

- Support a balanced indigenous population of shellfish, fish, and wildlife;

- Allow for recreational activities in and on the waters; and

- Exhibit ambient water quality that meets applicable water quality standards adopted for the protection of public water supplies, shellfish, fish, and wildlife, or recreational activities, or such other standards necessary to assure support and protection of such uses.

These conditions must be met, regardless of whether the applicant's discharge contributes to departures from such conditions. According to section 301(h) and §125.57(e), the foregoing prohibition does not apply to discharges with section 301(h) modified permits that were tentatively or finally approved prior to the enactment of the Water Quality Act of 1987. However, the foregoing prohibitions are in force for all renewals of section 301(h) modified permits that postdate enactment of the Water Quality Act of 1987. Thus, all estuarine dischargers must demonstrate that the receiving waters exhibit the above characteristics (i.e., that they are not stressed) at the time of permit reissuance, regardless of whether such conditions existed at the time the existing section 301(h) modified permit was issued.

II.B.2. Is your current discharge or modified discharge to stressed waters as defined in 40 CFR 125.58(z)? If yes, what are the pollution sources contributing to the stress? [40 CFR 125.59(b)(4) and 125.62(f)]

*** ***Large and small dischargers must respond.***

Stressed waters are defined in §125.58(z) as those ocean waters in which the absence of a balanced indigenous population of shellfish, fish, and wildlife is caused solely by human perturbations other than the applicant's modified discharge. Section 125.57(a) prohibits reissuance of section 301(h) modified permits if the discharge alone or in combination with pollutants from other sources adversely impacts the balanced indigenous population, water quality, or recreational activities. In addition, dischargers to estuaries are advised that under section 301(h)(9) and §§125.57(a)(9) and 125.59(b)(4), permits may not be reissued for discharges to stressed saline estuarine waters.

Guidance for establishing monitoring programs to determine whether receiving waters should be characterized as stressed waters is found in section III.F of this document. Detailed guidance on the design of section 301(h) monitoring programs is provided in *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Water* (U.S. EPA 1982a) and *Framework for 301(h) Monitoring Program* (U.S. EPA 1987e).

Sections (a) through (e) of §125.62 address the attainment and maintenance of water quality, assuring the protection of public water supplies and the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife and allowing recreational activities. In accordance with §125.62(f), stressed waters, if an applicant that discharges into ocean waters believes that its failure to meet the requirements of §125.62(a) through (e) is entirely attributable to conditions resulting from human perturbations other than its modified discharge (including, without limitation, other municipal or industrial dischargers, nonpoint source runoff, and the applicant's previous discharges), the applicant need not demonstrate compliance if it demonstrates to the satisfaction of the Administrator that its modified discharge does not or will not (1) contribute to, increase, or perpetuate stressed conditions; (2) contribute to further degradation of the biota or water quality if the level of human perturbation from other sources increases; and/or (3) retard the recovery of the biota or water quality if the level of human perturbation from other sources decreases.

Applicants that respond "no" to this question should explain the basis for their conclusion.

II.B.3. Provide a description and data on the seasonal circulation patterns in the vicinity of your current and modified discharge(s). [40 CFR 125.62(a)]

*** ***Large and small dischargers must respond.***

The applicant should provide sufficient information on current speed and direction in the vicinity of the discharge to predict the dispersion and transport of diluted effluent. This information should include a description of current patterns and general density structure on a seasonal basis, as well as the variation over a tidal cycle. Estimates of near-surface and near-bottom lowest 10 percentile current speeds, as well as the locations of the current meters and the time span over which data were collected, should also be provided. Hydraulic residence times and flushing characteristics should be described for discharges into estuaries and semi-enclosed bodies of water. Any periods of net drift stagnation and natural upwelling should be described, including changes in the current patterns and stratification.

The applicant should also discuss the occurrence of onshore surface currents. Because onshore winds induce onshore currents, wind speed and direction statistics that are appropriate for the diffuser location should also be provided. Useful sources of information include data collected during execution of the monitoring program for the existing modified permit, data collected in the vicinity of the discharge by other researchers, and U.S. Department of Commerce tidal current tables (e.g., National Ocean Survey 1988a, 1988b).

Section 125.57(a)(9) prohibits section 301(h) modified permits for discharges where the dilution water contains "significant amounts of previously discharged effluent from such treatment works." In responding to Question II.B.3, applicants should discuss the potential for reentrainment of previously discharged effluent or the presence of nuisance materials (e.g., floatables, scum, oil sheen) in and around the discharge area. Reentrainment is a potential problem primarily in receiving waters that exhibit poor flushing characteristics. Such conditions can also occur, however, in open coastal areas during periods of tidal or wind-driven current reversals, or temporary stagnation of longshore coastal currents.

II.B.4. Oceanographic conditions in the vicinity of the current and proposed modified discharge(s). Provide data on the following: [40 CFR 125.62(a)]

- ***Lowest ten percentile current speed (m/sec)***
- ***Predominant current speed (m/sec) and direction (true)* during the four seasons***
- ***Period(s) of maximum stratification (months)***
- ***Period(s) of natural upwelling events (duration and frequency, months)***
- ***Density profiles during period(s) of maximum stratification***

*** ***Only large dischargers must respond.***

The vertical and areal distribution of currents and water density in both the nearfield and farfield are needed to evaluate plume dilution, wastefield transport, and potential reentrainment of previously discharged effluent. Data collected from previous studies or nearby similar areas will often be appropriate.

The number and location of sampling stations needed to provide sufficient data will depend on the bathymetric and hydrographic environment. For open coastal sites with uniform bathymetry and minimal freshwater inflows, as few as five stations may be adequate. For an estuary with significant freshwater inflow and highly variable bathymetry, however, as many as 50 stations may be necessary.

For existing discharges, the measurements should be made in the vicinity of the outfall but outside the region directly influenced by the discharge. For relocated outfalls, measurements should be made in the vicinity of the proposed discharge location. Current data should be

---

* The direction is specified in terms of true north (T).

obtained near the surface, at the approximate depth of the wastefield, and in the bottom 2 meters (6.6 feet) of the water column. Water depths at the stations should be similar to the water depth at the site of the existing and relocated outfalls (if present).

The duration of time within which these measurements should be obtained is dependent on the current regime and the variability of the density structure. If the currents are predominantly tidal (which could be the case for both open coastal and estuary sites), the current measurements should be at approximately 30-minute intervals for not less than 29 days. If seasonal changes in oceanographic conditions (e.g., low or variable longshore current speeds or directions, upwelling, shoreward transport, high and low runoff) are significant, then information should be obtained for each season. The question is based on the presumption that periods of maximum stratification will be important for calculating critical initial dilutions. Field data on other potentially critical periods (e.g., periods of longshore current stagnation) may be necessary for determining whether this presumption is true.

Reduction and presentation of data should be of sufficient detail to support the interpretation and analyses performed in the application. The following forms of data reduction and presentation are recommended:

- Current persistence tables—Summary of the frequency and duration of specific current speed and direction events. For example, currents with speeds between 10 and 15 cm/sec (0.33 and 0.49 ft/sec), directions between 260 and 280 degrees (T), and durations of at least 1 hour occurred for 18 percent of the data record.

- Current speed and direction frequency tables—Frequency of specific current speed and direction intervals. For example, currents with speeds between 5 and 10 cm/sec (0.16 to 0.33 ft/sec) occurred for 20 percent of the data record, and currents with directions between 80 and 90 degrees (T) occurred for 23 percent of the data record.

- Net coastal orthogonal component analysis—By determining the predominant directions of current flow, a primary axis for orthogonal component decomposition of each current vector can be selected. The net component relative to each axis can then be determined. If the currents do not exhibit predominant flow directions, an axis parallel to the local bathymetry or in the direction of an area of significance can be selected.

- Current mean and variance—For the predominant directions of current flow or the selected primary axis, the mean and variance of the current speed can be determined.

Guidance on instrumentation and methods for oceanographic data collection is provided in *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (U.S. EPA 1982a).

II.B.5. Do the receiving waters for your discharge contain significant amounts of effluent previously discharged from the treatment works for which you are applying for a section 301(h) modified permit? [40 CFR 125.57(a)(9)]

*** ***Large and small dischargers must respond.***

Applicants should explain the basis for their response to this question. Explanations should consider the hydrographic characteristics of the receiving water and the behavior of the effluent plume through time. Applicants that respond negatively to this question should demonstrate that little or no previously discharged effluent will be carried into the ZID (after having been transported out of the ZID) to become entrained in the effluent plume. This demonstration will be relatively simple for applicants that discharge to open coastal areas where currents are unidirectional most of the time. Those applicants should be able to plot effluent transport through time and thereby demonstrate that little or no effluent reenters the ZID. The demonstration will be much more complicated for dischargers into estuarine environments where tidal currents oscillate. In estuaries, effluent transported away from the ZID during the first half of a tidal cycle may be transported back into the ZID on the second half of that cycle. If effluent is likely to be transported back into the ZID, the applicant should estimate the quantities of effluent that would be entrained.

In responding to this question, applicants should demonstrate that all applicable water quality standards and water quality criteria are met at and beyond the ZID boundary. If the dilution water contained significant quantities of previously discharged effluent, it is unlikely that an applicant would be able to meet all applicable water quality standards and water quality criteria. Responses given for Questions II.D.1, II.D.2, and II.D.3 of the Applicant Questionnaire may be cited to support this demonstration.

II.B.6. Ambient water quality conditions during the period(s) of maximum stratification: at the zone of initial dilution (ZID) boundary, at other areas of potential impact, and at control stations. [40 CFR 125.62(a)]

a. Provide profiles (with depth) on the following for the current discharge location and for the modified discharge location, if different from the current discharge:

- *BOD_5 (mg/L)*
- *Dissolved oxygen (mg/L)*
- *Suspended solids (mg/L)*
- *pH*
- *Temperature (°C)*
- *Salinity (ppt)*
- *Transparency (turbidity, percent light transmittance)*
- *Other significant variables (e.g., nutrients, 304(a)(1) criteria and toxic pollutants and pesticides, fecal coliform bacteria)*

b. Provide available data on the following in the vicinity of the current discharge location and for the modified discharge location, if different from the current discharge: [40 CFR 125.61(b)(1)]

- *Dissolved oxygen (mg/L)*
- *Suspended solids (mg/L)*
- *pH*
- *Temperature (°C)*
- *Salinity (ppt)*
- *Transparency (turbidity, percent light transmittance)*
- *Other significant variables (e.g., nutrients, 304(a)(1) criteria and toxic pollutants and pesticides, fecal coliform bacteria)*

c. Are there other periods when receiving water quality conditions may be more critical than the period(s) of maximum stratification? If so, describe these and other critical periods and data requested in 6.a. for the other critical period(s). [40 CFR 125.62(a)(1)]

**** Small dischargers must respond to parts b and c.*
**** Large dischargers must respond to parts a and c.*

To document the periods of maximum stratification, temperature and salinity profiles that are sufficient to determine the most stratified and the typical conditions should be provided for each oceanographic season. The "most stratified" temperature and salinity profile with depth is the profile that will produce the lowest initial dilution (see Question III.A.1 for definition). In some locations, such a profile has the steepest gradients of temperature or salinity near mid-depth. Both temperature (expressed in degrees Celsius) and salinity (expressed in parts per thousand, ppt) should be measured accurately to two decimal places so that density (expressed in grams per cubic centimeter, gm/cm^3) can be computed accurately to five decimal places. Also, only measured profiles should be provided. Averages of measured profiles or "representative" profiles should never be substituted. Density profiles should exhibit a stable water column over the plume height-of-rise (i.e., no higher-density water should overlie lower-density water). The minimum period of time over which oceanographic data must be collected to establish typical and most stratified conditions is 1 year. Because oceanographic conditions vary among years, it is recommended that data collected over 5 years be provided.

Sampling for nutrients, coliform or other indicator bacteria, and other major parameters may be conducted at selected depths and should be measured in terms that can be compared with water quality standards. The evaluation of light transmittance may require the measurement of one or more water clarity parameters and a comparison of values recorded in the vicinity of the outfall with those recorded in control areas. Parameters that are widely measured to assess light transmittance include turbidity, Secchi disc depth, beam transmittance, and downward irradiance. The applicant should review Chapter B-VII in Appendix B for more information on the selection of sampling methods appropriate for various waterbody conditions (e.g., the presence of submerged plumes). The applicant should state the reason(s) for the light transmittance method(s) selected. In addition, because sunlight greatly increases die-off rates of enteric bacteria (Crane and Moore 1986, Elliot and Colwell 1985), bacteriological sampling should be conducted during early morning or at night. Ambient water quality data collection procedures and requirements are different for existing and for proposed or relocated discharge locations, as discussed in *Design of 301(h) Monitoring Program for Municipal Wastewater Discharges to Marine Waters* (U.S. EPA 1982a) and summarized below.

For existing discharges, station locations should include sampling at the ZID boundaries (both upcurrent and downcurrent), at control (i.e., background ambient) stations, along the primary axis of the longshore component of the current (both upcurrent and downcurrent), at intermediate upcurrent stations located between the ZID boundary and the upcurrent control station, and in potential impact areas (e.g., in the nearshore zone and close to areas with distinctive habitats). The applicant should use information on local currents and wastefield dispersion patterns to select sampling station locations in potentially impacted areas. Sampling stations located at the ZID boundary, at control stations along the primary axis of current, and at intermediate upcurrent stations should be in waters of approximately the same depth. Control (i.e., background ambient) stations should be located in areas not influenced by the applicant's discharge. The intermediate upcurrent stations are intended to represent the approximate residual wastefield concentrations (i.e., affected ambient) upcurrent of the discharge location to account for potential recirculation of previously discharged effluent (by reversing tidal currents, upwelling, or stagnant net circulation). Data should be collected at the intermediate and ZID stations at least twice during the day (e.g., high and low slack tides) to allow evaluation of short-term conditions. The duration of the longshore current in relation to the time of sampling is an important factor in determining whether the intermediate upcurrent stations are representative of persistent conditions or of only a temporary plume reversal. For discharges involving outfall relocation, monitoring stations must be located at the current discharge site until cessation of that discharge, and at the relocation site.

For each survey, the following information should be submitted along with the data: a chart showing exact locations of the stations, the depth at which the measurements were taken, and the sampling dates and times. For existing discharges, the applicant should state whether effluent was discharging from the outfall at the time of the survey and should provide the flow rate, BOD_5 concentration, pH, and suspended solids concentration of the effluent, if available. Any unusual meteorological or oceanographic conditions (e.g., storms, onshore transport, low or stagnant longshore currents) should be discussed. Current data or other oceanographic information should be collected (e.g., deploy drogues) at the time of the survey in order to determine the direction of movement of the wastefield.

Other periods when water quality conditions may be more critical include periods of maximum hydraulic loading from the POTW, exceptional biological activity, poor background water quality, minimum stratification, low net circulation, and low effective net flushing or low intertidal mixing. The frequency and duration of each of these observed conditions should be provided. Any unusual meteorological, oceanographic, or POTW operating conditions should also be described. The last three cases represent the potential for recirculation or reentrainment of previously discharged effluent or the presence of nuisance materials (e.g., floatables, scum, oil sheen) in and around the discharge area. The degree of recirculation would become significant if the discharge caused a violation in water quality standards or water quality criteria, as appropriate, at the ZID boundary, when under normal circulation conditions it would meet the standards or criteria at the ZID boundary.

II.B.7. Provide data on steady state sediment dissolved oxygen demand and dissolved oxygen demand due to resuspension of sediments in the vicinity of your current and modified discharge(s) (mg/L/day).

*** ***Only large dischargers must respond.***

Dissolved oxygen depletion due to steady sediment demand and sediment resuspension depends on sediment composition (e.g., grain size distribution and organic content), sediment accumulation rates, current speeds, and circulation patterns. Field or laboratory measurements can be used to determine oxygen consumption rates. The results of these measurements and the procedures used should be described.

II.C. Biological Conditions

In the section 301(h) process, the determination of adverse biological effects involves assessing whether a balanced indigenous population (BIP) of shellfish, fish, and wildlife exists in the vicinity of the discharge and in other areas potentially affected by the discharge. Since the BIP concept forms an integral part of the applicant's biological assessment, it is important to establish the meaning and interpretation of the term in the context of a section 301(h) biological demonstration.

The term *population* does not mean a reproductive unit of a single species but rather all biological communities existing in the receiving water body. Similarly, the terms *shellfish, fish,* and *wildlife* should be interpreted to include any and all biological communities that might be affected adversely by a marine POTW discharge [§125.58(y)].

A BIP is defined in the section 301(h) regulations [§125.58(f)] as "an ecological community which: (1) exhibits characteristics similar to those of nearby, healthy communities existing under comparable but unpolluted environmental conditions; or (2) may reasonably be expected to become re-established in the polluted water body segment from adjacent waters if sources of pollution were removed." Balanced indigenous populations generally occur in unpolluted waters. The second part of the definition concerning the re-establishment of communities is included because of its relevance to proposed, improved discharges and to discharges into waters that are stressed by sources of pollution other than the applicant's modified discharge.

The biological community characteristics that might be examined in an evaluation of a BIP include (but are not limited to) species composition, abundance, biomass, dominance, and diversity; spatial and temporal distributions; growth and reproduction of populations; disease frequency; trophic structure and productivity patterns; presence or absence of certain indicator species; bioaccumulation of toxic materials; and the occurrence of mass mortalities of fish and invertebrates.

The first step in an applicant's BIP demonstration is to define the "indigenous population" and establish the natural variability of the "balanced population." Because EPA has determined that these are observable characteristics of natural communities that exist in the absence of human disturbance, a comparative strategy is found throughout the section 301(h) regulations. Biological parameters of concern within and beyond the ZID should be compared to the range of natural variability found in comparable but unpolluted habitats.

The extent of documentation provided by the applicant in the marine biological assessment should reflect the quality and quantity of the effluent and the sensitivity of the receiving water. Data requirements will probably be least for applicants without substantial industrial waste sources whose discharges into ocean waters do not potentially affect distinctive habitats of limited distribution or important fishery resources.

> ***II.C.1. Provide a detailed description of representative biological communities (e.g., plankton, macrobenthos, demersal fish, etc.) in the vicinity of your current and modified discharge(s): within the ZID, at the ZID boundary, at other areas of potential discharge-related impact, and at reference (control) sites. Community characteristics to be described shall include (but not be limited to) species composition; abundance; dominance and diversity; spatial/temporal distribution; growth and reproduction; disease frequency; trophic structure and productivity patterns; presence of opportunistic species; bioaccumulation of toxic materials; and the occurrence of mass mortalities.***

*** ***Only large dischargers must respond.***

Of the marine communities that may be affected by POTW discharges, benthic communities or other communities that depend on the benthos as a food source (i.e., bottom-dwelling or bottom-feeding organisms) are usually the most sensitive to pollutants. The rate of accumulation of discharged solids and associated toxic substances near a POTW outfall affects the magnitude and extent of impacts to benthic communities. Based on the review of biological conditions near both large and small discharges in a variety of marine and estuarine environments, it is apparent that the effects of POTW discharges on the benthos are determined primarily by the influence of the local hydrographic regimes on solids deposition and accumulation. Observed biological effects in areas of solids accumulation are generally associated with decreased abundances of suspension-feeding animals and increased abundances of deposit-feeding animals. Such effects would be expected to occur in sediments enriched with organic matter (e.g., from POTWs).

The biological information must be used to describe existing conditions near the discharge and to determine whether a BIP exists (or will exist) near the existing and modified discharges. This descriptive information must be used as the basis for the applicant's response to Question III.D.1. The applicant should design the monitoring program to collect data on biological conditions and habitat characteristics within and at the ZID-boundary, nearfield, farfield, and reference sites, ensuring that conditions near the discharge and shoreward are not excluded.

Applicants must submit descriptions of representative biological communities (typically benthic infauna and demersal fishes) in the receiving water body. These descriptions will form the basis for the comparative BIP demonstrations. It is important that the applicant assess biological community characteristics at a minimum of four sites: within the ZID, at or immediately beyond the ZID boundary, within the expected discharge impact area outside the ZID, and at appropriate reference sites.

Benthic data should be adequate to perform valid statistical and community analyses for the purposes of determining whether the following conditions exist:

- Benthic community structure in the discharge area differs from that in the control area.
- Benthic biomass in the discharge area differs from that in the control area.
- Opportunistic or pollution-tolerant species dominate benthic communities in the discharge area.
- Anoxic sediment conditions occur in the discharge area.
- Distinctive habitats of limited distribution (when present) are adversely affected by the applicant's discharge.

- The discharge contributes to or perpetuates ambient stresses in the receiving water (stressed water discharges only).

When the applicant's discharge is located in an area of soft substrates, sediment data should also be collected simultaneously with the benthic community at each sampling station. These data should include grain size composition and a measure of organic content. Data on Kjeldahl nitrogen, sediment BOD_5, and other sediment parameters may also be collected. Sediment data will be used to identify correlations between benthic community structure and attributes of the sedimentary environment in the receiving waters. Detailed guidance for evaluating benthic community conditions in the vicinity of an outfall is given in Appendix C.

II.C.2. a. Are distinctive habitats of limited distribution (such as kelp beds or coral reefs) located in areas potentially affected by the modified discharge? [40 CFR 125.62(c)]

b. If yes, provide information on type, extent, and location of habitats.

*** ***Large and small dischargers must respond.***

"Distinctive habitats of limited distribution" include marine environments whose protection is of special concern because of their ecological significance or value to humans. These habitats include, but are not limited to, coral reefs, kelp beds, seagrass meadows, salt marshes, spawning or nursery areas for commercial species, sites of aesthetic appeal, and rocky intertidal habitats (where they are uncommon). Distinctive habitats of limited distribution may be highly susceptible to the potential effects of discharged suspended solids and nutrients on the unique floral (e.g., kelp, seagrass) or faunal (e.g., coral) components of the communities. The potential for adverse effects of bioaccumulation of toxic substances is also relatively high because sessile floral and faunal organisms may constitute important trophic pathways within these communities. These attached communities are also susceptible because of the potential for continuous exposure to the effluent plume.

The applicant should describe distinctive habitats of limited distribution within the receiving water environment, as follows:

- Kinds of distinctive habitats that occur in the general vicinity of the discharge;

- Areal extent and location of the habitats in the region (shown on a map);

- Approximate distance from the discharge to sensitive habitats;
- Physical characteristics of each distinctive habitat (water column and substrate);
- Species composition of the flora and fauna;
- Abundance or percent cover (as applicable) of resident species; and
- Spatial and temporal variations in the biotic and abiotic components of each distinctive habitat present.

The basic information supplied by the applicant is expected to be descriptive in nature and should not require field surveys. Possible sources for information on distinctive habitats include contacts with local offices of state conservation agencies, and literature and resource maps, which are available for many areas.

II.C.3. a. Are commercial or recreational fisheries located in areas potentially affected by the discharge? [40 CFR 125.62(c) and (d)]

b. If yes, provide information on types, location, and value of fisheries.

*** ***Large and small dischargers must respond.***

Assessment of impacts on fisheries is important because of their economic significance, their recreational potential, and the potential for human consumption of contaminated organisms. The applicant should provide information on all fishery resources, both harvested and unharvested, near the outfall and in other areas potentially influenced by the discharge. Emphasis should be placed on regulatory or health-related factors that prevent utilization of the resource, especially if such factors are related to contamination. Information pertaining to water quality criteria and the associated human health risk levels is discussed under Question III.F.1. Additionally, Question III.F.1 discusses the possibilities of adverse effects due to the current discharge and references the guidance needed to effectively assess the levels of toxic accumulation in any contaminated organisms. Sources of information include natural resource agencies, public health agencies, local anglers, and academic institutions. For this assessment, the applicant should specify where species of recreational or commercial importance occur (i.e., in the immediate vicinity of the discharge, in the general region of the discharge, as migrants through the region).

The immediate vicinity of a discharge includes the outfall structure and the area associated with the discharge plume or clearly impacted by the deposition of discharged sediment. The spatial extent of the fisheries data will depend on the size and potential effects of the discharge and on the characteristics of the data. Many state fish and game agencies have established statistical areas for recording fisheries data. In these cases, an applicant can consider regional fisheries as those occurring in the statistical block that includes the outfall. If the outfall is located within an embayment or estuary where fisheries occur, the applicant should address commercial and recreational fisheries throughout the embayment or estuary.

Distances of the various fishery resources from the discharge should be provided. The following information should be provided:

- Magnitude of the fisheries:
  - Effort levels (e.g., number of vessels or number of fishermen) and
  - Economic value of commercial landings or sport fishery;
- Temporal pattern of the fisheries.

II.D. *<u>State and Federal Laws [40 CFR 125.61 and 125.62(a)(1)]</u>*

II.D.1. Are there water quality standards applicable to the following pollutants for which a modification is requested:

- ***Biochemical oxygen demand or dissolved oxygen?***
- ***Suspended solids, turbidity, light transmission, light scattering, or maintenance of the euphotic zone?***
- ***pH of the receiving water?***

****** *Large and small dischargers must respond.*

Applicants should contact the state water quality agency for an answer to this question.

II.D.2. If yes, what is the water use classification for your discharge area? What are the applicable standards for your discharge area for each of the parameters for which a modification is requested? Provide a copy of all applicable water quality standards or a citation to where they can be found.

*** *Large and small dischargers must respond.*

In response to Question II.D, applicants should demonstrate compliance with state water quality standards [§125.61(b)]. Individual states often have water quality standards that must be met independently from federal water quality criteria. State standards that are applicable to the discharge must be provided in this response, and determinations of compliance with those standards must be provided in the response to Questions III.B.6 and III.B.7. Occasionally, state water quality standards are dependent on the location of the outfall diffuser. If the effluent wastefield is transported to a location having standards different from those of the diffuser location, then both sets of standards apply [§125.62(a)(1)].

II.D.3. Will the modified discharge: [40 CFR 125.59(b)(3)]

- *Be consistent with applicable State coastal zone management program(s) approved under the Coastal Zone Management Act as amended, 16 U.S.C. 1451 et seq.? [See 16 U.S.C. 1456(c)(3)(A)]*

- *Be located in a marine sanctuary designated under Title III of the Marine Protection, Research, and Sanctuaries Act (MPRSA) as amended, 16 U.S.C. 1431 et seq., or in an estuarine sanctuary designated under the Coastal Zone Management Act as amended, 16 U.S.C. 1461? If located in a marine sanctuary designated under Title III of the MPRSA, attach a copy of any certification or permit required under regulations governing such marine sanctuary. [See 16 U.S.C. 1432(f)(2)]*

- *Be consistent with the Endangered Species Act as amended, 16 U.S.C. 1531 et seq.? Provide the names of any threatened or endangered species that inhabit or obtain nutrients from waters that may be affected by the modified discharge. Identify any critical habitat that may be affected by the modified discharge and evaluate whether the modified discharge will affect threatened or endangered species or modify a critical habitat. [See 16 U.S.C. 1536(a)(2)]*

*** *Large and small dischargers must respond.*

Applicants should contact the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS), and applicable state coastal zone management agency for answers to this question.

II.D.4. Are you aware of any State or Federal laws or regulations (other than the Clean Water Act or the three statutes identified in item 3 above) or an Executive order which is applicable to your discharge? If yes, provide sufficient information to demonstrate that your modified discharge will comply with such law(s), regulation(s), or order(s). [40 CFR 125.59 (b)(3)]

**** Large and small dischargers must respond.*

Because each application for permit reissuance is considered to be an application for a new NPDES permit, applicants are required to provide new determinations of compliance with all applicable local, state, and federal laws and regulations, as indicated above.

III. TECHNICAL EVALUATION

III.A. Physical Characteristics of Discharge [40 CFR 125.62(a)]

III.A.1. What is the critical initial dilution for your current and modified discharge(s) during 1) the period(s) of maximum stratification? and 2) any other critical period(s) of discharge volume/composition, water quality, biological seasons, or oceanographic conditions?

**** Large and small dischargers must respond.*

POTW effluents are normally discharged into marine waters through outfalls that range from open-ended pipes to extensive diffusers. The characteristics of the effluent and the receiving water, the diffuser design, and the depth of discharge will determine the amount of effluent dilution achieved. As shown in Figure 1, the lower-density (nonsaline) discharged effluent creates a buoyant plume that rises rapidly toward the water surface, entraining significant amounts of ambient saline water. The momentum and buoyancy of the discharged effluent are primarily responsible for the entrainment of dilution water (i.e., mixing of ambient saline water with effluent). As the plume rises and entrains ambient saline water, its density increases and its momentum and buoyancy decrease accordingly. If a sufficient ambient vertical density gradient or zone of stratification (like a pycnocline or thermocline) is present, the plume will spread horizontally at the level of neutral buoyancy (i.e., where the plume density equals ambient water density). If a sufficient density gradient is not present, the diluted effluent will reach the water surface and flow horizontally. The vertical distance from the discharge points to the centerline of the plume when it reaches the level of neutral buoyancy or the water surface is

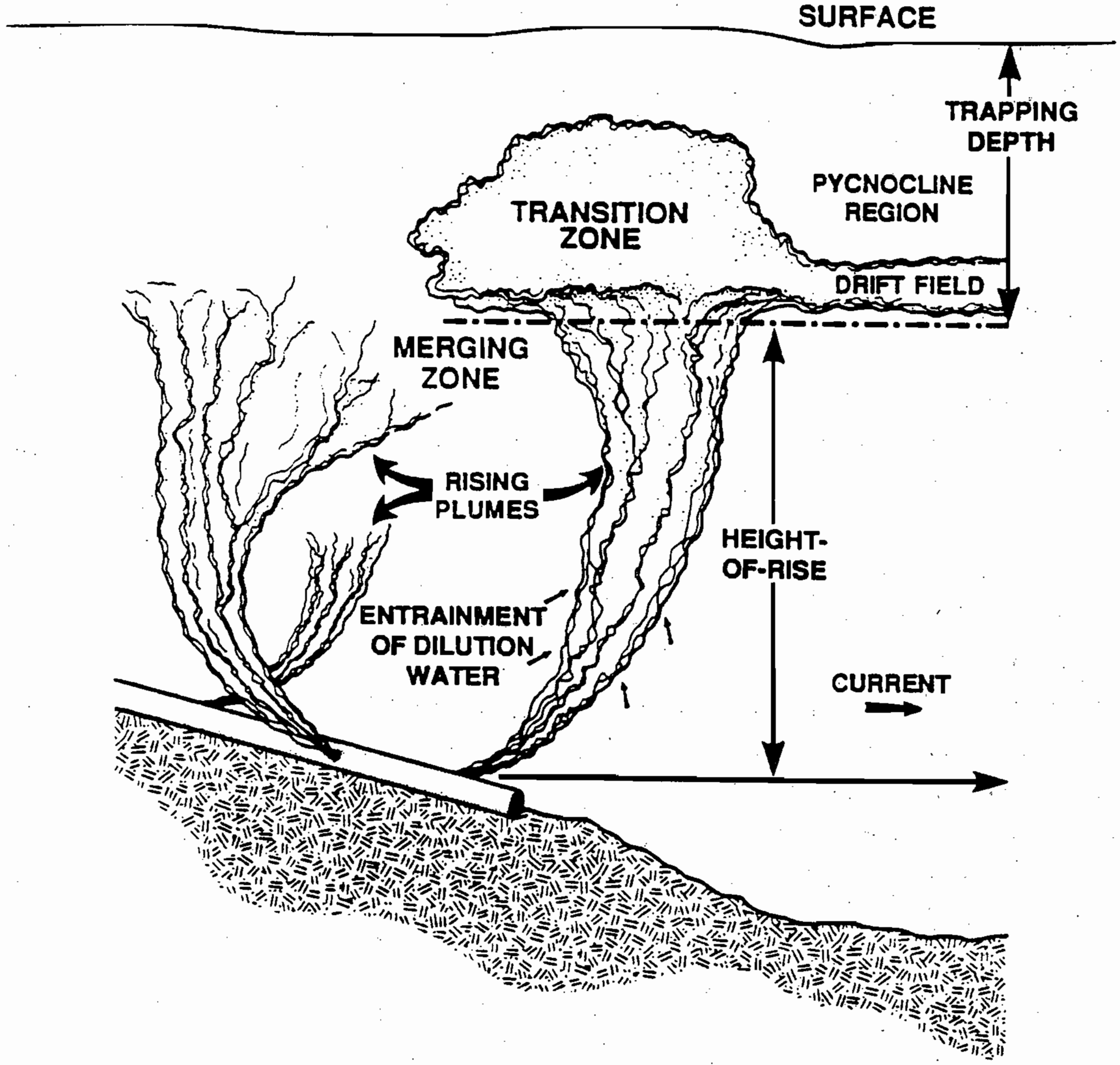


Figure 1. Wastefield generated by a simple ocean outfall.

AGA 2243

called the "height-of-rise" (sometimes referred to as the height to "trapping" or "equilibrium" level).

The dilution achieved at the completion of this process is called the "initial dilution." Dilution is the ratio of the total volume of a sample (ambient water plus effluent) to the volume of effluent in the sample. A dilution of 100 is, therefore, a mixture composed of 99 parts of ambient water to 1 part of effluent. The initial dilution is a critical parameter relative to compliance with water quality standards and is thus discussed in some detail in the evaluation of both large and small applications. The magnitude of initial dilution achieved is dependent on ambient density gradients and diffuser design.

The lowest (i.e., critical) initial dilution must be computed for each of the critical environmental seasons. The predicted peak 2- to 3-hour effluent flow for the new end-of-permit year and a current speed no higher than the lowest 10 percentile current speed must be used. A simplified procedure for computing initial dilution is described in Appendix A. Five EPA-supported computer models (i.e., UPLUME, UOUTPLM, UMERGE, UDKHDEN, ULINE) and several analytical formulas for computing initial dilution are described by Muellenhoff et al. (1985a, 1985b). These five models were designed for submerged discharges in oceans. All but one can be used on rivers, lakes, and estuaries with appropriate input modifications; UPLUME is restricted to stagnant water environments where ambient water current velocity is zero (e.g., lakes, reservoirs). Also available through EPA is CORMIX, an expert system that guides the user in selecting an appropriate modeling strategy for rivers or estuaries (U.S. EPA 1991b). ASCII files containing FORTRAN code for these models are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4650. These files are on either nine-track tape or floppy diskettes that can be read by an IBM-compatible personal computer. Muellenhoff et al. (1985a) discuss guidelines for use of the models.

The method described in Appendix A to calculate initial dilution is most applicable to situations where ample dilution waters are available. Three assumptions are made when using the simplified method: (1) the discharge is submerged; (2) the submergence depth of the port is more than 10 times the diameter of the port; and (3) the hydraulic pressure within the port is greater than ambient water pressure (i.e., there is a constant flow out of the outfall).

Care should be taken when using this method of calculation in situations where ample dilution waters are not available. Using these calculations for discharges into shallow waters or estuarine areas may result in overconservative or invalid results. Additional information for modeling of estuarine areas can be found in *Technical Guidance Manual for Performing Waste Load Allocations, Book III: Estuaries, Part 3 Use of Mixing Zone Models in Estuarine Waste Load Allocations* (Ambrose et al. 1992).

The method presented Appendix A is for use in the absence of site-specific information. Where site-specific information is available, or where site-specific circumstances make the calculation of the initial dilution ratio suspect, the numerical model UPLUME or UMERGE can be used to provide a better estimate of initial dilution. Case-by-case assessments of the accuracy of calculations made using the Appendix A method may be necessary in such instances. Site-specific information on topography, density profile, type of outfall, current measurements, physical circulation patterns, and temperature is needed to obtain an accurate calculation of initial dilution. Recalculation with site-specific information using the methods in *Mixing in Inland and Estuarine Waters* (Fischer et al. 1979) could be conducted.

During computation of initial dilution by one of these methods, the flow from each of the ports modeled should be approximately constant within a section of the diffuser. The initial dilution and trapping depth for each section should be a flow rate averaged to obtain the initial dilution and trapping depth, respectively, for the entire diffuser. The depth of the discharge is determined as the depth of section below mean lower low water (or mean low water) or as the average for the diffuser. If the adjacent ports discharge on opposite sides of the diffuser, the port spacing should be equal to the distance between ports discharging on the same side of the diffuser. (This stipulation is applicable to UMERGE and UDKHDEN, but not ULINE.) Sufficient documentation of the methods and parameters used by the applicant to calculate initial dilution must be provided so that the results obtained can be duplicated independently.

When monitoring data and other information, collected over the term of the existing permit, confirm that all the values used in analyses provided in the original application have not changed and are not expected to change over the term of the new modified permit, the applicant may summarize the available data and provide evidence demonstrating the basis for determining that no change in information has been realized or expected. In cases where the values of one or more parameters have changed, however, or where new monitoring data are useful for supporting a given demonstration, those data should be included in the required response.

Under section 301(h)(2) and §§125.57(a)(2) and 125.62(f), all demonstrations of compliance with applicable statutes and regulations must consider the effects of the discharge singly and in combination with pollutants from other sources, if any other sources exist. Some applicants will find, however, that monitoring data or other information collected during the term of the original modified permit requires that new calculations be performed. For example, new calculations will be required where the water column density profile is better defined, effluent flows have changed or are expected to change, or the number of open ports has changed.

III.A.2. What are the dimensions of the zone of initial dilution for your modified discharge(s)?

****** Large and small dischargers must respond.***

The zone of initial dilution (ZID) is the region of initial mixing surrounding or adjacent to the end of the outfall pipe or diffuser ports and includes the underlying seabed. The ZID describes an area in which inhabitants, including the benthos, may be chronically exposed to concentrations of pollutants in violation of water quality standards and criteria or at least to concentrations more severe than those predicted for critical conditions. The ZID is not intended to describe the area bounding the entire mixing process for all conditions or the total area impacted by the sedimentation of settleable material.

In general, the ZID can be considered to include that bottom area and the water column above that area circumscribed by distance d from any point of the diffuser, where d is equal to the water depth. Several different diffuser configurations and corresponding ZID dimensions are shown in Figure 2. The water depth used should be the maximum water depth along the diffuser axes with respect to mean lower low water (or mean low water) and may not be larger than allowed by mixing zone restrictions in applicable water quality standards [§125.58(dd)].

Unless changes to the outfall system have been made or are anticipated, or unless incorrect water depths or outfall characteristics were used in the original section 301(h) application, the calculation presented here should be identical to that presented in the original application. Repetition of the calculation in the application for reissuance of the section 301(h) modified permit is necessary to confirm that all values used in the original application were correct and that the outfall system has not changed and will not change over the term of the new permit.

III.A.3. What are the effects of ambient currents and stratification on dispersion and transport of the discharge plume/wastefield?

****** Only large dischargers must respond.***

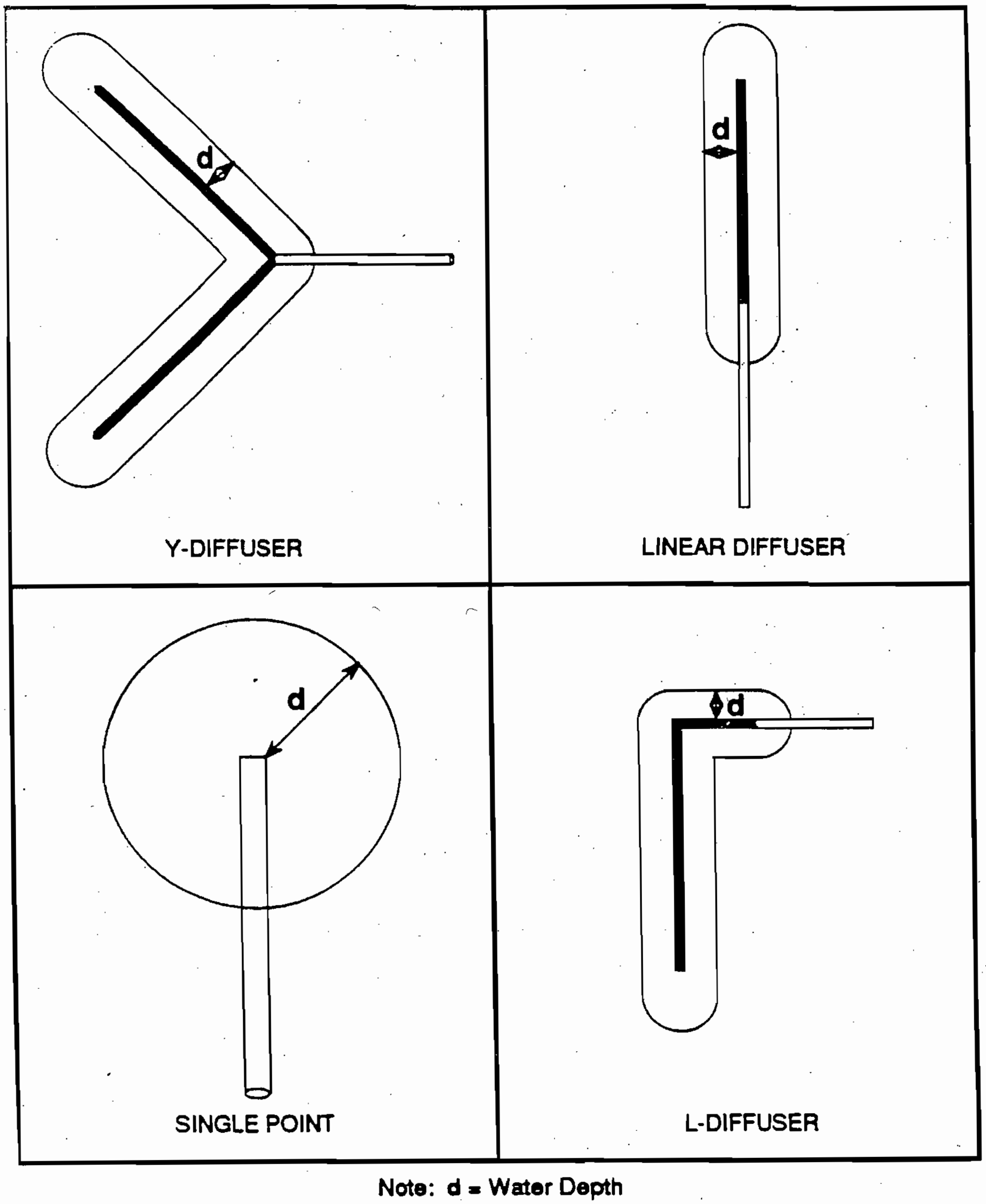


Figure 2. Diffuser types and corresponding ZID configurations.

A general description of the ambient currents expected within the influence of the diffuser site is required by EPA. Since this description is primarily of use in determining where the effluent wastefield is likely to be transported during several days' time, the response to this subsection should be of sufficient detail for this purpose. Knowledge of the subsequent movement of the wastefield is also needed to address the potential for reentrainment of previously discharged effluent, which could effectively increase wastefield concentrations at the boundary of the ZID. The applicant should take into account that dilution water is entrained into the effluent plume throughout the depth over which the plume rises. The diluted wastefield may be transported by either surface currents or subpycnocline currents at different times during a tidal cycle. In a region where currents are predominantly tidal, current persistence and the mean current speed and its variance with respect to the primary directions of water flow should be given. If the currents have large components unrelated to tidal influences (e.g., wind-induced currents), then a more detailed analysis should be performed. The mean, variance, and direction of the tidal component should be determined, and a synopsis of the nontidal current speed, direction, and persistence should be provided. Vertical variations in currents are important at depths where the effluent wastefield is trapped.

The basis for the current estimates should be provided. Acceptable sources of information are site-specific measurements and published measurements or predictions. The Tidal Current Tables published annually by the U.S. Department of Commerce (see National Ocean Survey 1988a, 1988b) provide tidal current information for a large number of locations. Information from other published documents is usable if the documents are made available to EPA on request.

Expected or measured effluent dilutions at important shoreline stations should be included. Chapters B-II, Dissolved Oxygen Concentration Following Initial Dilution, and B-III, Farfield Dissolved Oxygen Depression, in Appendix B of this document provide further guidance on computing farfield dilutions for water quality parameters.

Under certain circumstances, such as low nontidal currents or reversing tidal currents, the affected "ambient" water quality concentrations of the dilution water for the plume may be temporarily higher than the normal background concentration. Thus, higher concentrations of pollutants may occur within the ZID. This issue is of primary concern for discharges located in estuaries or semi-enclosed water bodies but may also be of concern for open coastal sites. To ensure that the discharge meets all applicable water quality criteria during these other critical conditions, the applicant should evaluate the recirculation potential of the existing or proposed discharge through an analysis of currents, dye or field mixing studies (for existing discharges only), numerical modeling analyses (for relocated or proposed new discharges), or evaluation of water quality data collected during the existing discharge monitoring program. A monitoring strategy is described below in guidance for questions in III.F (Establishment of a Monitoring Program).

Dye studies are particularly useful to evaluate the recirculation potential under short-term tidal cycle influences for existing discharges. Current-meter data should be made available to evaluate both the high-frequency (tidal) and low-frequency (nontidal) current regimes that exist at the time of the dye study.

For relocated or proposed new discharges, numerical circulation and transport models are the most useful methods for assessing the effects of ambient currents and stratification on dispersion and transport of the wastefield and for estimating the potential for recirculation of previously discharged effluent. There are two general approaches. The first is to simulate a conservative substance (i.e., no decay) as a tracer for the wastefield to estimate numerical dilution factors surrounding the discharge. These dilution factors can be used to estimate the affected ambient concentration of any water quality parameter as input to the initial and subsequent dilution techniques presented elsewhere in this document. The second approach, which is more complex, is to simulate directly the water quality parameters and the kinetic processes that govern their fate (e.g., BOD decay, suspected solids settling).

Several specific guidelines can be offered to applicants in the use of numerical models. Typically, the most critical conditions for recirculation and build-up of previously discharged effluent would occur when the water column is density-stratified in the presence of tidally reversing currents and low nontidal currents and the wastefield remains submerged below the pycnocline following initial dilution. If such conditions occur at the applicant's outfall site, the numerical model should be layered vertically, with a minimum of two layers. The plume should be discharged into the bottom layer to simulate the submerged discharge. The applicant should set up the grid system for the numerical model such that the smallest segments are located in the vicinity of the diffuser and the segments gradually increase in size with distance from the diffuser. The applicant might choose to experiment with grid configuration by starting with a coarse grid and then decreasing the grid size until the model results do not change greatly.

A variety of numerical circulation and transport models exist with various levels of detail, user documentation, and applicability. Examples of potentially applicable models include CAFE/DISPER (Wang and Connor 1975; Christodoulou, Connor, et al. 1976; Christodoulou, Pagenkopf, et al. 1976; Pagenkopf et al. 1976); TEA/ELA (Baptista et al. 1984, Westerink et al. 1985); Spaulding and Pavish (1984); and Sheng and Butler (1982). The applicant must use a model that is supported by a fully documented computer program so that EPA and other interested parties can conduct analyses (i.e., run simulations) on generally available computer systems.

III.A.4. Will there be significant sedimentation of suspended solids in the vicinity of the modified discharge?

****** Only small dischargers must respond.***

The accumulation of suspended solids from municipal wastewater discharges may lower dissolved oxygen concentrations in near-bottom waters and cause changes in benthic communities. Accumulation of suspended solids in the vicinity of a discharge is influenced by the amount of solids discharged, the settling velocity distribution of the particles in the discharge, the plume height-of-rise, and current velocities. Hence, sedimentation of suspended solids is generally of little concern for small discharges into well-flushed receiving waters.

In response to this question, the applicant must predict the seabed accumulation that results from the discharge of suspended solids into the receiving water. The applicant may use any applicable well-documented sedimentation model. A simplified approach for small dischargers is provided in Chapter B-I of Appendix B. A simplified sedimentation model for large dischargers, or small dischargers for whom the simplified approach is not appropriate, is also described in Chapter B-I of Appendix B. The sedimentation model DECAL (a simplified Deposition Calculation) is available as an Ocean Data Evaluation System (ODES) tool.

III.A.5. Sedimentation of suspended solids.

- ***a. What fraction of the modified discharge's suspended solids will accumulate within the vicinity of the modified discharge?***
- ***b. What are the calculated area(s) and rate(s) of sediment accumulation within the vicinity of the modified discharge(s) ($g/m^2/yr$)?***
- ***c. What is the fate of settleable solids transported beyond the calculated sediment accumulation area?***

****** Only large dischargers must respond.***

Information on the fate of suspended solids is needed to calculate oxygen consumption rates and interpret biological data. Settling velocity distributions of the effluent should be provided, if available. Graphs showing the settling velocity (cm/sec) and percent of solids that settle at that velocity or less are preferred. The suspended solids concentration (mg/L), test conditions, and laboratory procedures that are used should be described.

The applicant should calculate whether substantial sedimentation of suspended solids occurs. These calculations should be made for the annual period and for the critical 90-day period (i.e., the 90-day period during which the highest sedimentation rate occurs). The average plume height-of-rise with respect to the seafloor should be used in these calculations. A simplified procedure for calculating the effect of sedimentation is described in Chapter B-I of Appendix B.

III.B. *<u>Compliance with Applicable Water Quality Standards and CWA §304(a)(1) water quality criteria [40 CFR 125.61(b) and 125.62(a)]</u>*

III.B.1. What is the concentration of dissolved oxygen immediately following initial dilution for the period(s) of maximum stratification and any other critical period(s) of discharge volume/composition, water quality, biological seasons, or oceanographic conditions?

*** ***Large and small dischargers must respond.***

Dissolved oxygen in the receiving water is diminished by the low oxygen content and immediate dissolved oxygen demand (IDOD) of the effluent within the ZID and by oxidation of organic material in the diluted effluent beyond the ZID. A simplified procedure for calculating the dissolved oxygen concentration immediately following initial dilution is explained in Chapter B-II of Appendix B. Note that some states limit the maximum allowable depression in dissolved oxygen concentration and that the maximum dissolved oxygen depression may not occur during the season that has the lowest initial dilution.

III.B.2. What is the farfield dissolved oxygen depression and resulting concentration due to BOD exertion of the wastefield during the period(s) of maximum stratification and any other critical period(s)?

*** ***Large and small dischargers must respond.***

A simplified procedure for calculating the farfield dissolved oxygen depression is given in Chapter B-III of Appendix B.

III.B.3. What are the dissolved oxygen depressions and resulting concentrations near the bottom due to steady sediment demand and resuspension of sediments?

*** ***Only large dischargers must respond.***

Suspended solids that accumulate on the seabed can exert a dissolved oxygen demand due to continuous oxidation of organic material at the sediment surface and occasional rapid oxidation of resuspended sediments. Estimates of dissolved oxygen depressions that result from steady state sediment demand and resuspension of solids should be made using the methods described in Chapter B-IV of Appendix B. If field or laboratory measurements are available, the results can be used in these analyses.

III.B.4. What is the increase in receiving water suspended solids concentration immediately following initial dilution of the modified discharge(s)?

*** ***Large and small dischargers must respond.***

Suspended solids in the water column can reduce light transmittance and thus water clarity. Reduction of the depth to which sunlight penetrates can also affect biological communities within the water column. The suspended solids concentration following initial dilution can be estimated by a simple mass balance calculation.

The formula provided in Chapter B-V of Appendix B should be used to calculate the receiving water suspended solids concentration following critical initial dilution. In cases where the initial dilution or the concentration of suspended solids in the effluent has not changed since the original application was submitted, and is not expected to change over the term of the new permit, it will be necessary only to reproduce the calculation provided in the original application. However, changes in either parameter will necessitate recalculating the receiving water suspended solids concentration.

III.B.5. What is the change in receiving water pH immediately following initial dilution of the modified discharge(s)?

*** ***Only large dischargers must respond.***

The pH of the receiving water can be affected by the discharge of highly acidic or highly alkaline wastes. Final pH values after initial dilution can be estimated from field measurements or calculated from carbonate system alkalinity relationships.

In most settings, the influence of a municipal waste discharge on the receiving water pH is small. This section provides a method to calculate the pH change of receiving waters due to a waste discharge and to determine whether standards are violated.

The pH at completion of initial dilution can be estimated from Table 1. The values shown in this table were generated by a pH-alkalinity model (based on the carbonate system) that simulates the mixing of effluent and seawater. The methods used to calculate the values in this table are explained in Chapter B-VI of Appendix B. Because waste plumes are usually submerged during initial dilution, no exchange with the atmosphere is included. The results are

TABLE 1. ESTIMATED pH VALUES AFTER INITIAL DILUTION

Seawater Temp.	5 °C					15 °C					25 °C				
	Initial Dilution														
Seawater pH	10	25	50	75	100	10	25	50	75	100	10	25	50	75	100
Effluent pH = 6.0 Alk = 0.1															
7.00	6.97	6.98	6.99	6.99	6.99	6.97	6.99	6.99	6.99	6.99	6.97	6.99	6.99	6.99	6.99
7.50	7.40	7.46	7.48	7.48	7.49	7.42	7.47	7.48	7.49	7.49	7.43	7.47	7.48	7.49	7.49
7.70	7.58	7.65	7.67	7.68	7.68	7.61	7.66	7.68	7.69	7.69	7.63	7.67	7.68	7.69	7.69
8.00	7.89	7.96	7.98	7.98	7.99	7.93	7.97	7.99	7.99	7.99	7.96	7.98	7.99	7.99	7.99
8.30	8.23	8.27	8.28	8.29	8.29	8.27	8.29	8.29	8.29	8.29	8.28	8.29	8.29	8.29	8.29
8.50	8.46	8.48	8.49	8.49	8.49	8.48	8.49	8.49	8.49	8.49	8.49	8.49	8.49	8.49	8.49
Effluent pH = 6.0 Alk = 0.6															
7.00	6.80	6.91	6.95	6.96	6.97	6.80	6.91	6.95	6.96	6.97	6.80	6.91	6.95	6.97	6.97
7.50	7.05	7.28	7.38	7.42	7.43	7.07	7.30	7.39	7.42	7.44	7.09	7.32	7.40	7.43	7.45
7.70	7.13	7.42	7.55	7.60	7.62	7.18	7.46	7.58	7.62	7.64	7.22	7.50	7.60	7.63	7.65
8.00	7.29	7.69	7.85	7.90	7.92	7.40	7.78	7.90	7.93	7.95	7.53	7.84	7.92	7.95	7.96
8.30	7.57	8.06	8.19	8.23	8.24	7.82	8.15	8.23	8.25	8.26	7.98	8.19	8.25	8.26	8.27
8.50	7.90	8.32	8.41	8.44	8.46	8.15	8.38	8.44	8.46	8.47	8.25	8.41	8.46	8.47	8.48
Effluent pH = 6.0 Alk = 1.0															
7.00	6.70	6.85	6.92	6.94	6.96	6.70	6.86	6.92	6.94	6.96	6.71	6.86	6.92	6.95	6.96
7.50	6.89	7.17	7.31	7.37	7.40	6.90	7.19	7.33	7.38	7.41	6.92	7.21	7.34	7.39	7.42
7.70	6.94	7.28	7.46	7.54	7.57	6.97	7.33	7.50	7.56	7.60	7.01	7.38	7.53	7.59	7.62
8.00	7.04	7.50	7.74	7.83	7.87	7.12	7.62	7.82	7.88	7.91	7.22	7.71	7.87	7.91	7.93
8.30	7.20	7.86	8.11	8.18	8.21	7.40	8.02	8.17	8.22	8.24	7.65	8.10	8.21	8.24	8.25
8.50	7.39	8.17	8.35	8.40	8.43	7.77	8.29	8.40	8.43	8.45	8.01	8.34	8.42	8.45	8.46
Effluent pH = 6.0 Alk = 2.0															
7.00	6.53	6.75	6.85	6.90	6.92	6.53	6.75	6.86	6.90	6.92	6.54	6.75	6.86	6.90	6.92
7.50	6.64	6.97	7.17	7.26	7.31	6.65	6.99	7.19	7.28	7.33	6.67	7.01	7.21	7.30	7.34
7.70	6.67	7.04	7.28	7.40	7.46	6.69	7.08	7.33	7.44	7.50	6.71	7.12	7.38	7.48	7.53
8.00	6.72	7.17	7.50	7.66	7.74	6.76	7.27	7.62	7.75	7.82	6.81	7.39	7.71	7.82	7.86
8.30	6.79	7.39	7.87	8.03	8.11	6.88	7.64	8.02	8.12	8.17	6.99	7.84	8.10	8.17	8.20
8.50	6.86	7.67	8.17	8.29	8.35	7.01	8.00	8.28	8.36	8.40	7.23	8.15	8.34	8.39	8.42
Effluent pH = 6.5 Alk = 0.5															
7.00	6.95	6.98	6.99	6.99	6.99	6.95	6.98	6.99	6.99	6.99	6.95	6.98	6.99	6.99	6.99
7.50	7.35	7.44	7.47	7.48	7.48	7.37	7.45	7.47	7.48	7.48	7.39	7.45	7.47	7.48	7.48
7.70	7.52	7.62	7.66	7.67	7.68	7.55	7.64	7.67	7.68	7.68	7.58	7.65	7.67	7.68	7.69
8.00	7.81	7.93	7.96	7.97	7.98	7.87	7.95	7.97	7.98	7.98	7.91	7.97	7.98	7.99	7.99
8.30	8.16	8.25	8.27	8.28	8.28	8.22	8.27	8.28	8.29	8.29	8.24	8.28	8.29	8.29	8.29
8.50	8.40	8.46	8.48	8.48	8.49	8.44	8.47	8.49	8.49	8.49	8.46	8.48	8.49	8.49	8.49
Effluent pH = 6.5 Alk = 1.0															
7.00	6.90	6.95	6.97	6.98	6.98	6.90	6.96	6.98	6.98	6.98	6.90	6.96	6.98	6.98	6.99
7.50	7.23	7.38	7.43	7.45	7.46	7.25	7.39	7.44	7.46	7.47	7.27	7.40	7.45	7.46	7.47
7.70	7.35	7.55	7.62	7.65	7.66	7.40	7.58	7.64	7.66	7.67	7.44	7.60	7.65	7.66	7.67
8.00	7.59	7.84	7.92	7.95	7.96	7.70	7.89	7.95	7.96	7.97	7.78	7.92	7.96	7.97	7.98
8.30	7.96	8.18	8.24	8.26	8.27	8.09	8.22	8.26	8.27	8.28	8.15	8.24	8.27	8.28	8.28
8.50	8.24	8.41	8.45	8.47	8.48	8.33	8.44	8.47	8.48	8.48	8.38	8.45	8.47	8.48	8.48

TABLE 1. (Continued)

Seawater Temp.	5 °C					15 °C					25 °C				
	Initial Dilution														
Seawater pH	10	25	50	75	100	10	25	50	75	100	10	25	50	75	100
Effluent pH = 6.5 Alk = 2.0															
7.00	6.82	6.91	6.95	6.97	6.97	6.82	6.91	6.95	6.97	6.97	6.82	6.92	6.95	6.97	6.97
7.50	7.06	7.28	7.38	7.41	7.43	7.08	7.29	7.39	7.42	7.44	7.10	7.31	7.40	7.43	7.45
7.70	7.14	7.42	7.55	7.59	7.62	7.18	7.46	7.57	7.61	7.63	7.22	7.49	7.60	7.63	7.65
8.00	7.28	7.68	7.84	7.89	7.92	7.39	7.76	7.89	7.92	7.94	7.50	7.82	7.91	7.94	7.96
8.30	7.54	8.04	8.18	8.22	8.24	7.78	8.13	8.22	8.24	8.26	7.93	8.17	8.24	8.26	8.27
8.50	7.85	8.30	8.40	8.44	8.45	8.10	8.36	8.43	8.45	8.46	8.21	8.39	8.45	8.46	8.47
Effluent pH = 9.0 Alk = 2.0															
7.00	7.06	7.02	7.01	7.00	7.00	7.06	7.02	7.01	7.00	7.00	7.07	7.02	7.01	7.00	7.00
7.50	7.56	7.52	7.51	7.50	7.50	7.56	7.52	7.51	7.50	7.50	7.56	7.52	7.51	7.50	7.50
7.70	7.75	7.72	7.70	7.70	7.70	7.75	7.72	7.71	7.70	7.70	7.75	7.72	7.71	7.70	7.70
8.00	8.03	8.01	8.00	8.00	8.00	8.03	8.01	8.00	8.00	8.00	8.03	8.01	8.00	8.00	8.00
8.30	8.31	8.30	8.30	8.30	8.30	8.31	8.30	8.30	8.30	8.30	8.31	8.30	8.30	8.30	8.30
8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.49	8.49
Effluent pH = 9.0 Alk = 4.0															
7.00	7.10	7.04	7.02	7.01	7.00	7.10	7.04	7.02	7.01	7.01	7.11	7.04	7.02	7.01	7.01
7.50	7.59	7.53	7.51	7.51	7.50	7.59	7.53	7.51	7.51	7.50	7.59	7.53	7.51	7.51	7.50
7.70	7.76	7.72	7.71	7.70	7.70	7.76	7.72	7.71	7.70	7.70	7.76	7.72	7.71	7.70	7.70
8.00	8.02	8.01	8.00	8.00	8.00	8.02	8.00	8.00	8.00	8.00	8.02	8.00	8.00	8.00	8.00
8.30	8.29	8.29	8.29	8.29	8.29	8.28	8.29	8.29	8.29	8.29	8.28	8.29	8.29	8.29	8.29
8.50	8.47	8.48	8.49	8.49	8.49	8.46	8.48	8.49	8.49	8.49	8.46	8.48	8.49	8.49	8.49
Effluent pH = 9.0 Alk = 6.0															
7.00	7.14	7.05	7.02	7.01	7.01	7.14	7.05	7.02	7.01	7.01	7.15	7.06	7.03	7.02	7.01
7.50	7.61	7.54	7.52	7.51	7.51	7.61	7.54	7.52	7.51	7.51	7.61	7.54	7.52	7.51	7.51
7.70	7.78	7.73	7.71	7.71	7.70	7.77	7.73	7.71	7.71	7.70	7.77	7.73	7.71	7.71	7.70
8.00	8.02	8.00	8.00	8.00	8.00	8.01	8.00	8.00	8.00	8.00	8.01	8.00	8.00	8.00	8.00
8.30	8.27	8.28	8.29	8.29	8.29	8.26	8.28	8.29	8.29	8.29	8.26	8.28	8.29	8.29	8.29
8.50	8.44	8.47	8.48	8.49	8.49	8.43	8.47	8.48	8.49	8.49	8.43	8.47	8.48	8.48	8.49

based on a seawater alkalinity of 2.3 meq/L (Stumm and Morgan 1981) and dissociation constants from Stumm and Morgan (1981) and Dickson and Riley (1979).

Effluent alkalinity depends on the alkalinity of the source water and any infiltrating water, the type of treatment process, and the volume and type of industrial waste that enters the treatment plant. Effluent alkalinity can range from 0 to 6.0 meq/L. A typical value for effluent alkalinity is 2 meq/L or higher (Metcalf and Eddy 1979). Because alkalinity data are scarce, final pH values calculated for a range of alkalinities are provided in Table 1. If significant industrial waste is present in an effluent, or if pure oxygen or nitrification-denitrification treatment processes are used, effluent pH and alkalinity should be measured. For cases of weak primary effluents with no industrial waste components, an alkalinity value of 0.1 meq/L with an effluent pH of 6.0 can be used to estimate the final pH. If the lowest effluent pH is 6.5 or higher, an alkalinity value of 0.5 meq/L with an effluent pH of 6.5 can be used to estimate the final pH.

The applicant should first estimate the pH at completion of initial dilution for the case when the effluent pH is 6.0 and the ambient pH is equal to the minimum ambient pH in the vicinity of the discharge. The estimated value should be compared with the appropriate state standard to determine whether the standard is met.

The applicant may also perform laboratory tests when the predicted pH values in Table 1 indicate that contraventions of pH standards are possible. Some of the buffering constituents in municipal effluents are not readily quantified (e.g., organic acid ligands) and have not been included in the calculations used to produce the table. The laboratory test would include measuring the pH of effluent-receiving water mixtures as discussed below.

If the effluent pH drops below 6.0, the applicant should indicate the number of times per year effluent pH values fell below 6.0 and the suspected causes of those low values. If effluent pH values below 6.0 occur frequently, a laboratory test of pH after mixing the effluent and receiving water should be performed for the critical conditions. The sample mixture should not be allowed to equilibrate with the atmosphere. The pH should be measured at close intervals until no further change in pH is observed. The applicant should describe conditions of the test, including temperature, pH, and alkalinity of the effluent and receiving water; initial dilution; and the measured values after mixing. The measured values should then be compared with the applicable standard to determine whether a violation is likely. The frequency of violations should be estimated.

III.B.6. Does (will) the modified discharge comply with applicable water quality standards for:

- *Dissolved oxygen?*
- *Suspended solids or surrogate standards?*
- *pH?*

*** ***Large and small dischargers must respond.***

The applicant must demonstrate compliance with applicable receiving water quality standards. Typically, standards exist for dissolved oxygen, suspended solids, and pH, in which case the results of previous sections may be used. If a quantitative state standard exists for turbidity expressed in a given turbidity unit, then turbidity of the effluent and the receiving water (expressed in turbidity units as a function of concentration) should be measured to demonstrate that the standard will be met. Methods to determine compliance with water quality standards for DO, TSS, pH, and turbidity are discussed in Appendix B, Chapters B-I to B-VII.

According to §125.57(a)(9), permits may not be issued if the dilution water for the discharge contains significant amounts of previously discharged effluent. In general, this criterion will be met if all water quality standards and/or water quality criteria established under section 304(a)(1) of the Clean Water Act, as noted in Question III.B.7 below, are met.

> ***III.B.7. Provide data to demonstrate that all applicable State water quality standards, and all applicable water quality criteria established under Section 304(a)(1) of the Clean Water Act for which there are no directly corresponding numerical applicable water quality standards approved by EPA, are met at and beyond the boundary of the ZID under critical environmental and treatment plant conditions in the waters surrounding or adjacent to the point at which your effluent is discharged. [40 CFR 125.62(a)(1)]***

*** ***Large and small dischargers must respond.***

At the time the 301(h) modification becomes effective, the applicant's outfall and diffuser must be located and designed to provide adequate dilution, dispersion, and transport of wastewater to meet, at and beyond the ZID, all applicable water quality standards and all applicable water quality criteria for which there are no directly corresponding approved water quality standards. A state water quality standard is considered to "directly correspond" to an EPA water quality criterion only if (1) the state water quality standard addresses the same pollutant as that addressed by the EPA water quality criterion and (2) the state water quality standard specifies a numeric criterion for that pollutant or a state objective methodology for deriving such a numeric criterion [§125.62(a)]. Compliance with criteria and standards other than those discussed in Question III.B.6, such as standards for nutrients, toxic pollutants, and coliform bacteria concentrations at the edge of the ZID, is necessary.

To support this demonstration, applicants should submit pollutant concentration data in a form that satisfies state water quality regulations and all applicable EPA water quality criteria. Where average values are given (e.g., average dry-weather flow), applicants should specify how they were calculated. Applicants should also submit data on the predicted maximum 2- to 3-hour flow for the end-of-permit year (U.S. EPA 1985e). Monitoring data collected during the term of the original section 301(h) permit may be useful for demonstrating compliance with applicable receiving water standards and criteria, and for verifying predictions made in the original application [§125.59(c)(4)]. Detailed guidance for assessing compliance with some specific water quality standards is provided in Appendix B, Chapter B-VIII. Also note that according to §125.57(a)(9), permits may not be issued if the dilution water for the discharge contains significant amounts of previously discharged effluent. In general, demonstrated compliance with this criterion can be shown if all water quality standards and 304(a)(1) water quality criteria are met.

Under the CWA, states may develop water quality standards based on the 304(a)(1) criteria, as modified to reflect site-specific conditions, or they may use other scientifically defensible methods for developing water quality standards. State water quality standards are developed, by states, to protect the types of biota in and beneficial uses of their local waters and thus represent scientifically appropriate standards for each state's specific situation. State standards are subject to EPA review and approval. In the absence of an EPA-approved state water quality standard that directly corresponds to the section 304(a)(1) water quality criteria for a given pollutant, EPA requires compliance with the section 304(a)(1) water quality criteria.

To demonstrate compliance with state water quality standards and water quality criteria, applicants must show that the applicable numerical criteria are not exceeded after critical initial dilution. For most cases, either analytical or computer models can be used to evaluate the water quality impacts. The dilution achieved during the initial mixing process is dependent on ambient and discharge conditions and is, therefore, highly variable. In evaluating a discharge's effect on water quality, the appropriate conditions to consider are those which result in the "lowest" dilution and those which occur at times when the environment is most sensitive. For example, minimum dilution can be predicted using a combination of maximum vertical density stratification, minimum initial density difference between the effluent and the ambient seawater, maximum waste flow rate, and minimum currents for a particular site. Other situations may be more critical depending on the ambient water quality and applicable criteria.

To determine initial dilutions, it is necessary to know specific characteristics of the discharge, the outfall, and the receiving waters. The discharge volumetric flow rate and density are required. Alternately, the effluent temperature and salinity (major inorganic ions contributing to density) can be used to estimate density based on known relationships to seawater. Municipal effluent densities typically range from 0.9970 to 1.0003 g/cm^3, and salinities range to 5 ppt. The highest 2- to 3-hour flow rate during a period of concern should be used to calculate the minimum initial dilution for that period. The principal environmental quantities to consider in dilution prediction are the ambient density stratification and local currents. These parameters should be considered for periods of maximum wastewater flow; any other periods of maximum loadings; and times of seasonal maximum and minimum stratification, low ambient water quality, low net circulation or flushing, or exceptional biological activity. The quantities selected to represent these periods should reflect lowest 10 percentile conditions (U.S. EPA 1985e).

The critical initial dilution factor can be calculated with any or all of the following data: (1) effluent monitoring, (2) ambient water quality monitoring, or (3) modeling. A list of toxic pollutants [as defined in §125.58(p) and (aa)] is found in Table 2, and corresponding marine water quality criteria are summarized in Table 3. Guidance on sampling and analytical methods for 301(h) monitoring programs is found in EPA guidance (U.S. EPA 1982a, 1987c, 1987e) and 40 CFR Part 136. Remember, in addition to factoring in reentrainment of previously discharged effluent, section 301(h) of the Clean Water Act requires an applicant to demonstrate that the 301(h) modified discharge will not interfere, alone or in combination with pollutants from other sources, with the attainment or maintenance of water quality. Hence, data on pollutant loadings in the ambient receiving waters may be required to calculate values of water quality parameters after initial dilution. Furthermore, the modified discharge must not result in any additional requirements on any other point or nonpoint sources of pollution [§125.64].

Compliance with water quality standards and the 304(a)(1) water quality criteria in marine waters can be determined by the applicant's documenting water quality in the vicinity of the ZID boundary, at control or reference stations, and at areas beyond the ZID where discharge impacts might reasonably be expected. Monitoring should reflect conditions during all critical environmental periods as identified in the 301(h) application (e.g., dry-weather flow or maximum 2- to 3-hour flow conditions). Selection of specific sampling station locations depends on the monitoring requirements. For example, when determining compliance with water quality standards at the edge of the ZID, sampling stations should be located at various points around the ZID boundary. Sampling in estuaries should be conducted at slack water. Where tidal effects are to be discriminated, sampling should be done at several times over a tidal cycle for both spring and neap tides. To verify continuing compliance with 301(h) requirements, the ZID boundary stations should be sampled during those times of the year when the discharge is least diluted (U.S. EPA 1982a).

Applicants should be aware that EPA promulgated the National Toxics Rule (Code of Federal Regulations, Title 40, Part 131, 57 FR 60848, 22 December 1992),* which establishes chemical-specific, numeric criteria for the priority toxic pollutants necessary to bring all states

*hereinafter referred to as 40 CFR Part 131.

TABLE 2. LIST OF PESTICIDES AND TOXIC POLLUTANTS
(as defined in §125.58(p) and (aa))

Pesticides

Demeton
Guthion
Malathion
Methoxychlor
Mirex
Parathion

Toxic Pollutants[a]

Chlorinated Benzenes
- Chlorobenzene
- 1,2-Dichlorobenzene
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- 1,2,4-Trichlorobenzene
- Hexachlorobenzene

Chlorinated Ethanes
- Chloroethane
- 1,1-Dichloroethane
- 1,2-Dichloroethane
- 1,1,1-Trichloroethane
- 1,1,2-Trichloroethane
- 1,1,2,2-Tetrachloroethane
- Hexachloroethane

Chlorinated Phenols
- 2-Chlorophenol
- 2,4-Dichlorophenol
- 2,4,6-Trichlorophenol
- 4-Chloro-3-methyl phenol

Other Chlorinated Organics
- Chloroform (trichloromethane)
- Carbon tetrachloride (tetrachloromethane)
- bis(2-Chloroethoxy)methane
- bis(2-Chloroethyl)ether
- 2-Chloroethyl vinyl ether (mixed)
- 2-Chloronaphthalene
- 3,3-Dichlorobenzidine
- 1,1-Dichloroethylene
- trans-1,2-Dichloroethylene
- 1,2-Dichloropropane
- 1,2-Dichloropropylene (1,3-dichloropropene)
- Tetrachloroethylene
- Trichloroethylene
- Vinyl chloride (chloroethylene)
- Hexachlorobutadiene
- 2,3,7,8-Tetrachloro-dibenzo-p-dioxin (TCDD)

Haloethers
- 4-Chlorophenyl phenyl ether
- 2-Bromophenyl phenyl ether
- bis(2-Chloroisopropyl) ether

Halomethanes
- Methylene chloride (dichloromethane)
- Methyl chloride (chloromethane)
- Methyl bromide (bromomethane)
- Bromoform (tribromomethane)
- Dichlorobromomethane
- Chlorodibromomethane

Nitrosamines
- N-Nitrosodimethylamine
- N-Nitrosodiphenylamine
- N-Nitrosodi-n-propylamine

Phenols (other than chlorinated)
- 2-Nitrophenol
- 4-Nitrophenol
- 2,4-Dinitrophenol
- 4,6-Dinitro-o-cresol (4,6-dinitro-2-methylphenol)
- Pentachlorophenol
- Phenol
- 2,4-dimethylphenol

Phthalate Esters
- bis(2-Ethylhexyl)phthalate
- Butyl benzyl phthalate
- Di-n-butyl phthalate
- Di-n-octyl phthalate
- Diethyl phthalate
- Dimethyl phthalate

Polynuclear Aromatic Hydrocarbons (PAHs)
- Acenaphthene
- 1,2-Benzanthracene (benzo(a)anthracene)
- 3,4-Benzo(a)pyrene (benzo(a)pyrene)

PAHs (continued)
- 3,4-Benzofluoranthene (benzo(b)fluoranthene)
- 11,12-Benzofluoranthene (benzo(k) fluoranthene)
- Chrysene
- Acenaphthalene
- Anthracene
- 1,12-Benzoperylene (benzo(g,h,i)perylene)
- Fluorene
- Fluoranthene
- Phenanthrene
- 1,2,5,6-Dibenzanthracene (dibenzo(a,h) anthracene)
- Indeno(1,2,3-cd)pyrene (2,3-o-phenylene pyrene)
- Pyrene

Pesticides and Metabolites
- Aldrin
- Dieldrin
- Chlordane (technical mixture and metabolites)
- alpha-Endosulfan
- beta-Endosulfan
- Endosulfan sulfate
- Endrin
- Endrin aldehyde
- Heptachlor
- Heptachlor epoxide (BHC-hexachlorocyclohexane)
- alpha-BHC
- beta-BHC
- gamma-BHC (Lindane)
- delta-BHC
- Toxaphene

DDT and Metabolites
- 4,4-DDT
- 4,4-DDE (p,p-DDX)
- 4,4-DDD (p,p-TDE)

Polychlorinated Biphenyls (PCBs)
- PCB-1242 (Arochlor 1242)
- PCB-1254 (Arochlor 1254)
- PCB-1221 (Arochlor 1221)
- PCB-1232 (Arochlor 1232)
- PCB-1248 (Arochlor 1248)
- PCB-1260 (Arochlor 1260)
- PCB-1016 (Arochlor 1016)

Other Organics
- Acrolein
- Acrylonitrile
- Benzene
- Benzidine
- 2,4-Dinitrotoluene
- 2,6-Dinitrotoluene
- 1,2-Diphenylhydrazine
- Ethylbenzene
- Isophorone
- Naphthalene
- Nitrobenzene
- Toluene

Inorganics
- Antimony
- Arsenic
- Asbestos
- Beryllium
- Cadmium
- Chromium
- Copper
- Cyanide, total
- Lead
- Mercury
- Nickel
- Selenium
- Silver
- Thallium
- Zinc

[a]Source: U.S. EPA 1993b.

TABLE 3. SUMMARY OF U.S. EPA MARINE WATER QUALITY CRITERIA

(NOTE: This summary should be used only as estimates for the criteria. These values are subject to change. Refer to the appropriate criteria source (e.g., the current *Quality Criteria for Water*) for up-to-date criteria values.)

Pollutant	Saltwater Acute Criteria (μg/L)	Saltwater Chronic Criteria (μg/L)	Human Health[g] (μg/L)
Pollutants with numeric criteria:			
Acenaphthene	970[a]	710[a]	2,700[k]
Acrolein	55[a]	-[b]	780[i]
Acrylonitrile	-[b]	-[b]	0.66[h]
Aldrin	1.3[c]	-[b]	0.00014[h]
Anthracene	-[b]	-[b]	10,000[h]
Antimony	-[b]	-[b]	4,300[h]
Arsenic	69[l]	36[l]	0.14[m]
Benzene	5,100[a]	700[a]	71[h]
Benzidine	-[b]	-[b]	0.00054[h]
Benzofluoranthene 3,4	-[b]	-[b]	0.031[h]
Benzofluoranthene 11,12	-[b]	-[b]	0.031[h]
Benzoanthrancene 1,2	-[b]	-[b]	0.031[h]
Benzopyrene 3,4	-[b]	-[b]	0.031[h]
BHC	0.34[a]	-[b]	-[j]
BHC - alpha	-[b]	-[b]	0.013[h]
BHC - beta	-[b]	-[b]	0.046[h]
BHC - gamma	0.16[c]	-[b]	0.063[h]
Bromoform	-[b]	-[b]	360[h]
Cadmium	43[l]	9.3[l]	-[n]
Carbon tetrachloride	50,000[a]	-[b]	4.4[h]
Chlordane	0.09[c]	0.004[f]	0.00059[h]
Chlorinated benzenes	160[a]	129[a]	-[j]
Chlorobenzene	-[b]	-[b]	21,000[h]
Dichlorobenzenes	1,970[a]	-[b]	2,600[i]
Dichlorobenzene 1,2	-[b]	-[b]	17,000[h]
Dichlorobenzene 1,3	-[b]	-[b]	2,600[h]
Dichlorobenzene 1,4	-[b]	-[b]	2,600[h]
Hexachlorobenzene	-[b]	-[b]	0.00077[h]
Pentachlorobenzene	-[b]	-[b]	85[i]
Tetrachlorobenzene 1,2,4,5	-[b]	-[b]	48[i]
Chlorinated ethanes			
Dichloroethane 1,2	113,000[a]	-[b]	99[h]
Hexachloroethane	940[a]	-[b]	8.9[h]
Pentachloroethane	390[a]	281[a]	-[j]
Tetrachloroethane 1,1,2,2	9,020a	-[b]	11.0[h]
Trichloroethane 1,1,1	31,200[a]	-[b]	-[n]
Trichloroethane 1,1,2	-[b]	-[b]	42[h]
Chlorinated ethylenes			
Dichloroethylenes	224,000[a]	-[b]	-[j]

TABLE 3. (Continued)

Pollutant	Saltwater Acute Criteria (μg/L)	Saltwater Chronic Criteria (μg/L)	Human Health[g] (μg/L)
Dichloroethylene 1,1	-[b]	-[b]	3.2[h]
Tetrachloroethylene	10,200[d]	450[a]	8.85[i]
Trichloroethylene	2,000[a]	-[b]	81[h]
Chlorodibromomethane	-[b]	-[b]	34[h]
Chloronaphthalene 2	7.5[a]	-[b]	4,300[k]
Chlorinated phenols			
Chlorophenol 2	-[b]	-[b]	400[k]
Chlorophenol 4	29,700[a]	-[b]	-[j]
Dichlorophenol 2,4	-[b]	-[b]	790[h]
Pentachlorophenol (penta)	13[d]	7.9[e]	8.2[h]
Tetrachlorophenol 2,3,5,6	440[a]	-[b]	-[j]
Trichlorophenol 2,4,6	-[b]	-[b]	6.5[h]
Chlorine	13[d]	7.5[e]	-[j]
Chloroethyl ether 2	-[b]	-[b]	1.4[h]
Chloroisopropyl ether 2	-[b]	-[b]	170,000[h]
Chloromethyl ether	-[b]	-[b]	0.00184[i]
Chloroform	-[b]	-[b]	470[h]
Chlorpyrifos	0.011[o]	0.0056[p]	-[j]
Chromium			
Hexavalent	1,100[l]	50[l]	-[n]
Trivalent	10,300[a]	-[b]	-[n]
Chrysene	-[b]	-[b]	0.0311[h]
Copper[k]	2.9[l]	2.9[l]	-[j]
Cyanide	1.0[d]	1.0[e]	220,000[h]
DDT	0.13[c]	0.001[f]	0.00059[h]
DDT Metabolites			
DDD (TDE)	3.6[a]	-[b]	0.00084[h]
DDE	14[a]	-[b]	0.00059[h]
Demeton	-[b]	0.1[e]	-[j]
Dibenzo(a,h)anthrancene	-[b]	-[b]	0.0311[h]
Dichlorobenzidine 3,3	-[b]	-[b]	0.077[h]
Dichlorobromomethane	-[b]	-[b]	22[h]
Dichloropropane	10,300[a]	3,040[a]	-[j]
Dichloropropane 1,2	10,300[a]	3,040[a]	39[k]
Dichloropropene	790[a]	-[b]	14,100[i]
Dichloropropylene 1,3	-[b]	-[b]	1,700[h]
Dieldrin	0.71[c]	0.0019[f]	0.00014[h]
Dimethylphenol 2,4	-[b]	-[b]	2,300[k]
Dimethyl dinitrophenol 4,6	-[b]	-[b]	765[h]
Dinitrophenol	-[b]	-[b]	14,300[i]
Dinitrophenol 2,4	-[b]	-[b]	14,000[h]

TABLE 3. (Continued)

Pollutant	Saltwater Acute Criteria (µg/L)	Saltwater Chronic Criteria (µg/L)	Human Health[g] (µg/L)
Dinitro-o-cresol 2,4	-[b]	-[b]	765[h]
Dinitrotoluene 2,4	590[a]	370[a]	9.1[i]
Dioxin (2,3,7,8-TCDD)	-[b]	-[b]	0.000000014[i]
Diphenylhydrazine 1,2	-[b]	-[b]	0.54[h]
Endosulfan	0.034[c]	0.0087[f]	159[i]
Endosulfan sulfate	-[b]	-[b]	2.0[h]
Endosulfan-alpha	0.034[c]	0.0087[f]	2.0[h]
Endosulfan-beta	0.034[c]	0.0087[f]	2.0[h]
Endrin	0.037[c]	0.0023[f]	0.81[h]
Endrin aldehyde	-[b]	-[b]	0.81[h]
Ethylbenzene	430[a]	-[b]	29,000[h]
Fluoranthene	40[a]	16[a]	370[h]
Fluorene	-[b]	-[b]	14,000[h]
Guthion	-[b]	0.01	-[j]
Halomethanes	12,000[a]	6,400[a]	15.7[i]
Heptachlor	0.053[c]	0.0036[f]	0.00021[h]
Heptachlor epoxide	0.053[c]	0.0036[f]	0.00011[h]
Hexachlorobutadiene	32[a]	-[b]	50[h]
Hexachlorocyclohexane (HCH)			
Lindane (gamma-HCH)	0.16[c]	--[b]	0.063[h]
HCH (mixture of isomers)	0.34[a]	-[b]	-[j]
HCH - alpha	-[b]	-[b]	0.013[h]
HCH - beta	-[b]	-[b]	0.046[h]
HCH - technical	-[b]	-[b]	0.0414[i]
Hexachlorocyclopentadiene	7.0[a]	-[b]	17,400[h]
Indenopyrene 1,2,3-cd	-[b]	-[b]	0.0311[h]
Isophorone	12,900[a]	-[b]	490,000[h]
Lead	140[d]	5.6[e]	-[j]
Malathion	-[b]	0.1	-[j]
Manganese	-[b]	-[b]	100[i]
Mercury	2.1[d]	0.025[e]	0.15[h]
Methoxychlor	-[b]	0.03	-[j]
Methyl bromide	-[b]	-[b]	4,000[h]
Methylene chloride	-[b]	-[b]	1,600[h]
Mirex	[b]	0.001	-[j]
Naphthalene	2,350[a]	-[b]	-[j]
Nickel	75[c]	8.3[f]	3,800[h]
Nitrobenzene	6,680[a]	-[b]	1,900[h]
Nitrophenols	4,850[a]	-[b]	-[j]
Nitrosamines	3,300,000[a]	-[b]	-[j]
Nitrosodibutylamine N	-[b]	-[b]	0.587[i]

TABLE 3. (Continued)

Pollutant	Saltwater Acute Criteria (μg/L)	Saltwater Chronic Criteria (μg/L)	Human Health[g] (μg/L)
Nitrosodiethylamine N	-[b]	-[b]	0.0012[i]
Nitrosodimethylamine N	-[b]	-[b]	8.1[h]
Nitrosodiphenylamine N	-[b]	-[b]	16[h]
Nitrosopyrolidine N	-[b]	-[b]	91.9[i]
N-Nitrosodi-n-propylamine	-[b]	-[b]	1.4[k]
pH	-[b]	6.5-8.5	-[j]
Phenol	5,800[a]	-[b]	4,600,000[h]
Phosphorous (elemental)	-[b]	0.1	-[j]
Phthalate esters	2,944[a]	3.4[a]	-[j]
Butylbenzyl phthalate	-[b]	-[b]	5,200[k]
Di-n-butyl phthalate	-[b]	-[b]	12,000[h]
Diethyl phthalate	-[b]	-[b]	120,000[h]
Dimethyl phthalate	-[b]	-[b]	2,900,000[i]
Ethylhexyl phthalate	-[b]	-[b]	5.9[h]
Polychlorinated biphenyls	10[a]	0.03[f]	0.000079[i]
PCB - 1016	-[b]	-[b]	0.000045[h]
PCB - 1221	-[b]	-[b]	0.000045[h]
PCB - 1232	-[b]	-[b]	0.000045[h]
PCB - 1242	-[b]	-[b]	0.000045[h]
PCB - 1248	-[b]	-[b]	0.000045[h]
PCB - 1254	-[b]	-[b]	0.000045[h]
PCB - 1260	-[b]	-[b]	0.000045[h]
Polynuclear aromatic hydrocarbons	300[a]	-[b]	0.0311[i]
Pyrene	-[b]	-[b]	11,000[h]
Selenium (inorganic selenite)	300[c]	71[f]	-[j]
Silver	2.3[l]	-[b]	-[j]
Sulfide (hydrogen sulfide, H_2S)	-[b]	2[f]	-[j]
Thallium	2,130[a]	-[b]	6.3[h]
Toluene	6,300[a]	5,000[a]	200,000[h]
Toxaphene	0.21[d]	0.0002[e]	0.00075[h]
Vinyl chloride	-[b]	-[b]	525[h]
Zinc	95[l]	86[l]	-[j]

Pollutants with no established criteria or with criteria dependent on other water quality parameters:

Acenaphthylene	Alachlor	Alkalinity
Aluminum (pH dependent)	Ammonia (pH and temperature dependent)	Asbestos
Atrizine	Bacteria (use dependent)	Barium
Benzoperylene 1,12	Beryllium[n]	Beta particle and photon activity
BHC - delta	Bromophenyl phenyl ether 4	Carbofuran
Chloride	Chloroalkyl ethers	Chloroethane
Chloroethoxy methane 2	Chloroethyl vinyl ether 2	Chlorophenoxy Herbicide 2,4,5-TP

TABLE 3. (Continued)

Chlorophenoxy Herbicide 2,4-D	Chlorophenyl phenyl ether 4	Color
Dibromochloropropane	Dichloroethane 1,1	Dichloroethylene cis 1,2
Dichloroethylene trans 1,2[k]	Dinitrotoluene 2,6	Di-n-octyl phthalate
Ethylene Dibromide	Gasses, total dissolved	Gross alpha particle activity
Haloethers	Iron	Methyl Chloride
Methylchlorophenol 3,4	Nitrate	Nitrite
Nitrophenol 2	Nitrophenol 4	Oil and grease
Oxygen, dissolved	Parathion	Phenanthrene
Radium 226/228	Solids, dissolved and salinity	Solids, suspended and turbidity
Styrene	Temperature	Tetrachloroethanes
Trichlorinated ethanes	Trichlorobenzene 1,2,4	Trichlorophenol 2,4,5
Xylenes		

[a]Data insufficient to derive criteria. Value presented is the lowest observed effect level (LOEL). These concentrations represent apparent threshold levels for acute and/or chronic toxic effects, and are intended to convey information about the degree of toxicity of a pollutant in the absence of established criteria. (U.S. EPA 1986a)
[b]Criterion has not been established for marine water quality.
[c]Final acute value, which by 1980 guidelines is instantaneous (U.S. EPA 1986a).
[d]Maximum 1-hour average. Not to be exceeded more than once every 3 years on the average (U.S. EPA 1986a).
[e]Maximum 96-hour (4-day) average. Not to be exceeded more than once every 3 years (U.S. EPA 1986a).
[f]Maximum 24-hour average. Not to be exceeded more than once every 3 years U.S. EPA 1986a).
[g]Human health (10^{-6} risk level for carcinogens) for consumption of marine organisms only. The 10^{-6} risk level is calculated assuming the following constant values are used in the equation: body weight equals 70 kg; exposure duration equals 70 years; exposure frequency equals 48 days/year; ingestion rate equals 6.5 grams per day; and averaging time equals 70 years. Criteria in the matrix are based on carcinogenicity (10^{-6} risk). For a risk level of 10^{-5}, move the decimal point in the table value one place to the right.
[h]Recalculated values using IRIS, as of December 22, 1992 Toxics Rule 57 FR 60911-60916.
[i]Published human health criteria values (U.S. EPA 1986a).
[j]No value available.
[k]Values presented in the proposed Toxics Rule that are not being presented as regulatory criteria, but were presented as notice for inclusion in future state triennial reviews (Toxics Rule, 57 FR 60890).
[l]Criteria for these metals are expressed as a function of the water effect ratio, as defined in 40 CFR 131.36(c).
[m]Criteria revised to reflect current EPA q_1^* or RFD, as contained in the Integrated Risk Information System (IRIS). The fish tissue bioconcentration factor (BCF) from the 1980 criteria documents was retained in all cases. The criteria refer to the inorganic form only. (57 FR 60916)
[n]Human health criteria for these pollutants were issued in 1980 (45 FR 79331) and were withdrawn in 1992 (57 FR 60848).
[o]Maximum 1-hour average. Not to be exceeded more than once every 3 years on the average (U.S. EPA 1987g).
[p]Maximum 96-hour (4-day) average. Not to be exceeded more than once every 3 years (U.S. EPA 1987g).

into compliance with section 303(c)(2)(B) of the CWA. With the National Toxics Rule, all states have legally enforceable state water quality standards for all toxic pollutants where 304(a)(1) water quality criteria had been established.

For carcinogens, EPA's section 304(a)(1) human health criteria for carcinogenic pollutants recommend a concentration of zero for maximum protection of human health. However, the CWA section 304(a)(1) criteria provide a range of risk levels and a corresponding criterion for each specific risk level. EPA has not established a specific risk level for use in the 301(h) program. However, there are EPA-approved numeric state water quality standards for carcinogens under CWA section 303 that correspond to risk levels above zero. The approach adopted for section 301(h) provides consideration of the state's views on an appropriate risk level or, in the absence of such state input, provides for EPA to consider all relevant information in setting a risk level. This information will include evidence that the state has consistently used a particular risk level when establishing its water quality standards for other carcinogens (see 56 FR 2814, 24 January 1991, for a more detailed description).

In the absence of an EPA-approved state water quality standard for a carcinogenic pollutant, the Administrator will consider a consistently used, or state-adopted or formally proposed, risk level recommendation with a satisfactory demonstration that the level is adequately protective of human health in light of exposure and uncertainty factors and population exposed (refer to *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual*, U.S. EPA 1989a). Exposure factors would include, for example, local patterns of fish consumption, cumulative effects of multiple contaminants, and local population sensitivities. Factors related to uncertainty would include, for example, the weight of scientific evidence concerning exposures and health effects and the reliability of exposure data. The state demonstration will need to account for the relevant exposure and uncertainty factors, show adequate public participation in the selection of the risk level, and show that use of the selected risk level is adequately protective of human health. EPA considers these and other pertinent factors to complete an overall judgment of human health risk factors. In cases where there is no consistent state policy or satisfactory state demonstration on which to base a risk level, EPA will set a specific risk level (for example, 10^{-6}) based on the circumstances of each case.

Additional guidance for demonstrating compliance with applicable state water quality standards and section 304(a)(1) criteria is provided in Appendix B; under Questions III.B.1 through III.B.6 for conventional water quality parameters; under Questions III.E.2 and III.F.1 for conventional parameters, toxic substances, and pathogens; and under Questions III.H.1 and III.H.2 for toxic substances. Guidance for performing the monitoring necessary to demonstrate compliance with these requirements can be found in the EPA documents *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (U.S. EPA 1982a) and *Summary of U.S. EPA-Approved Methods, Standard Methods, and Other Guidance for 301(h) Monitoring Variables* (U.S. EPA 1985e). Applicants should also refer to Appendix E of this document for further guidance regarding toxic pollutant criteria. The "Determinations of Compliance with Section 301(h) Modified Permit Conditions and 301(h) Criteria" chapter of this document should also be reviewed.

Another approach that EPA has used to assess the potential impacts of wastewater discharges on water quality and the biota in the receiving waters is the water quality-based toxics control approach. Information derived from this approach may be used to further support the applicant's response. Guidance for implementing the water quality-based toxics control approach can be found in the *Technical Support Document for Water Quality-Based Toxics Control* (U.S. EPA 1985g). Information regarding the water quality-based toxics control approach is briefly summarized in Appendix F.

> ***III.B.8. Provide the determination required by 40 CFR 125.61(b)(2) for compliance with all applicable provisions of State law, including water quality standards or, if the determination has not yet been received, a copy of a letter to the appropriate agency(s) requesting the required determination.***

*** ***Large and small dischargers must respond.***

Because all applications for reissuance of section 301(h) modified permits are considered applications for new NPDES permits, all applicants are required to provide new determinations of compliance, as required by §125.61(b)(2). A copy of the letter that requests the required determination may be provided if the determination by the appropriate state agency has not yet been received.

III.C. Impact on Public Water Supplies [40 CFR 125.62(b)]

> ***III.C.1. Is there a planned or existing public water supply (desalinization facility) intake in the vicinity of the current or modified discharge?***

*** ***Large and small dischargers must respond.***

It is possible that a public water supply (desalinization plant) intake could be contaminated by marine POTW discharges. Although such a possibility may be remote, the applicant should verify that no public water supply intakes are located within 16 km (10 mi) of the discharge. If none exist within 16 km (10 mi) of the discharge, no analyses are required. The names of the agencies contacted and the person(s) involved should be listed in the application.

III.C.2. If yes,

a. What is the location of the intake(s) (latitude and longitude)?

b. Will the modified discharge(s) prevent the use of intake(s) for public water supply?

c. Will the modified discharge(s) cause increased treatment requirements for public water supply(s) to meet local, state, and EPA drinking water standards?

**** Large and small dischargers must respond.*

If the answer to Question III.C.1 is affirmative, the location of the desalinization plant should be shown on a map with the discharge site marked. The travel time to the intake should be estimated using the average current speed. The applicant should show that all applicable water quality standards for use as a public water supply are met at the intake and that water quality at the intake will not result in any significant increase in treatment requirements to comply with local, state, and EPA standards for treated water.

III.D. Biological Impact of Discharge [40 CFR 125.62(c)]

POTW discharges can affect biological communities in the following ways:

- Modifications to the structure of benthic communities (bottom-dwelling/feeding fishes and invertebrates) caused by accumulation of discharged solids on the seabed;

- Increases in phytoplankton or macroalgal growth due to nutrient inputs;

- Reductions in phytoplankton or macroalgal growth due to turbidity increases;

- Reductions in dissolved oxygen due to phytoplankton blooms and subsequent die-offs, leading to mass mortalities of fish or invertebrates;

- Bioaccumulation of toxic substances in marine organisms due to direct contact with sediment, ingestion of sediment, direct uptake from effluent, or ingestion of contaminated organisms; and

- Induction of diseases in marine organisms caused by contact with contaminated sediments, ingestion of contaminated organisms, or exposure to effluent.

Most of these potential impacts are associated with discharged particulate matter. The potential effects of discharged solids may be compounded by the toxic substances adsorbed to these solids. Hence, the primary potential effects of sediment enrichment by organic particles and sediment contamination by toxic substances are closely linked and are generally manifested in the same biotic groups. Discharged effluent solids tend to accumulate near the sewage outfalls, and bottom-dwelling marine organisms (e.g., benthic macroinvertebrates and bottom-feeding fishes) are potentially affected by these accumulations because they live in or on the sediments.

Additional environmental effects are associated with the discharge of plant nutrients (e.g., nitrogen, phosphorus), which may result in eutrophication, especially in estuaries or coastal embayments. Related impacts can include stimulation of toxic or nuisance algal blooms. Such phytoplankton blooms may adversely affect commercial and recreational fisheries because the decomposition of phytoplankton after massive blooms can cause dissolved oxygen deficiencies and associated fish or invertebrate kills.

Biological assessments for improved discharges, altered discharges, or discharges into stressed waters involve predictive demonstrations of future biological conditions near the outfall and elsewhere in the receiving water body. These analyses may involve establishing relationships between water quality conditions and biological conditions and predicting future conditions based on these relationships. Thus, biological assessments for improved or altered discharges involve not only describing existing biological communities but also determining whether a BIP will exist beyond the ZID after improvements or alterations to the discharge.

To support a section 301(h) modification, the applicant does not have to show that conditions of each biological community at all points beyond the ZID fall within the natural range of variation observed at the reference sites. Rather, the applicant's assessment should concentrate on determining the conditions of the following types of biological assemblages at control sites and at the areas of potential impact:

- Communities that are most susceptible to impacts from POTW discharges;

- Communities of threatened and endangered species;

- Communities with aesthetic, recreational, or commercial importance; and
- Communities with distributional patterns that enable quantitative assessment with reasonable sampling effort and resources.

Using this approach, applicants should be able to study the important communities that are expected to demonstrate discharge-related effects while not wasting effort on studies with a limited potential for providing meaningful results. Based on the review of existing section 301(h) applications, the major potential effects of POTW discharges are associated with benthic macroinvertebrates and demersal fishes. Because of their distribution characteristics, both of these communities can be assessed quantitatively with a reasonable level of sampling effort. Benthic macroinvertebrates are also the primary food items for demersal fishes and early life stages of certain other fishes. Consequently, these two communities are linked by a food web relationship, and severe impacts on benthic macroinvertebrates may result in secondary impacts on demersal or other fishes.

Benthic macroinvertebrates and demersal fishes are two important groups that typically warrant BIP demonstrations. It should not be assumed, however, that these are the only biological communities that should be studied in all cases. Particular attention should be given to threatened and endangered species. The concept of a BIP includes any and all biological communities potentially affected by the discharge.

III.D.1. Does (will) a balanced indigenous population of shellfish, fish, and wildlife exist:

- ***Immediately beyond the ZID of the current and modified discharge(s)?***
- ***In all other areas beyond the ZID where marine life is actually or potentially affected by the current and modified discharge(s)?***

*** ***Large and small dischargers must respond.***

The purpose of the question is to demonstrate whether unacceptable biological impacts are occurring or will occur beyond the ZID as a result of the modified discharge, either alone or in combination with other discharges. Effective demonstrations include comparisons of biological conditions and habitat characteristics among stations or groups of stations at ZID-boundary, nearfield, farfield, and reference areas.

The applicant should compare the ranges of biological characteristics among the four specified areas where communities are to be assessed. If differences that are attributable to the discharge are detected between study areas (e.g., ZID boundary vs. reference), the applicant should assess the spatial extent of those differences. In addition, the magnitude of the effect should be characterized with regard to the relative deviation from reference conditions (e.g., percent reduction in species richness), the potential for intertrophic effects (e.g., reductions in fish food organisms), and the potential for involvement of threatened and endangered species and recreationally or commercially important species.

Numerous parameters can be used to describe and compare biological communities (e.g., numbers of species; total abundances of organisms; abundances of selected pollution-sensitive, pollution-tolerant, and opportunistic species). [See U.S. EPA (1987f) for further guidance on the selection of biological indices.] Physical characteristics of the receiving water that are often measured include water column characteristics, (e.g., depth, water temperature, salinity, nutrient concentrations, chlorophyll *a* concentrations) and substrate characteristics (e.g., bottom type and composition). Information on the physical characteristics of the environment may be used to interpret the biological data and to determine whether the discharge is altering the physical or chemical characteristics of the receiving water.

Species vary in their sensitivities to pollutants, including organic enrichment. Changes in species composition and abundance begin to occur when the mass emission rates of materials in a sewage discharge are sufficiently high to affect the most sensitive species. As the abundances of pollution-sensitive species decrease or are driven to zero, abundances of opportunistic and pollution-tolerant species are typically enhanced. For this reason, changes in the values of community parameters (e.g., numbers of species, total abundances, dominance) are often accompanied by changes in the abundances of opportunistic and pollution-tolerant species. Additional guidance on the evaluation of biological communities is provided in Appendix C.

Special Considerations for Small Dischargers

During the preparation of applications for original section 301(h) modified permits, many small applicants were able to respond to this question without conducting field studies of biological communities in the vicinity of the discharge. Those small applicants used existing information to demonstrate that the characteristics of the discharge and receiving water indicated a very low potential for adverse impacts. If an applicant was not required to collect biological information during the term of the existing permit, that applicant may continue to use other available information to demonstrate that the characteristics of the discharge and receiving water indicate a very low potential for adverse impacts. Applicants are reminded, however, that such demonstrations must consider the potential for adverse impacts of the discharge alone and in combination with other discharges (if any exist) [§125.57(a)(2)]. The following characteristics indicate a low potential for impact:

- Location of the discharge in water depths greater than 10 m (33 ft);

- Hydrographic conditions that result in low predicted solids accumulation rates;

- The absence of distinctive habitats of limited distribution and the absence of fisheries in the vicinity of the outfall, when such absences are not due to anthropogenic stresses; and

- The absence of known or suspected sources of toxic pollutants and pesticides or low concentrations of these substances in the effluent.

Most small dischargers that previously demonstrated a low potential for impact should be able to do so again. They need demonstrate only that characteristics of the discharge and receiving waters did not change greatly during the term of the existing permit. Monitoring data collected during the term of the original section 301(h) modified permit should also be useful for such demonstrations.

Some small dischargers may not be able to demonstrate a low potential for impacts because characteristics of the discharge or receiving water differ from those listed above. In some cases, the discharge or receiving water may not have exhibited the aforementioned characteristics at the time the original application for a section 301(h) modified permit was prepared. In others, characteristics of the discharge or receiving water may have changed, or additional information may now be available that documents a greater potential for impact than was previously supposed. For example, the composition of the discharge may have changed to include toxic pollutants or pesticides from a new industrial source. Alternatively, a fishery for a previously underutilized species may have developed in the vicinity of the discharge, or research by local scientists may have discovered that the habitat in the vicinity of the outfall is an important nursery ground for a commercially harvested species of fish or shellfish.

When it is apparent for one or more reasons that the discharge or receiving water does not exhibit characteristics that would indicate a low potential for impacts, the Regions have the discretion to require that an applicant perform a detailed assessment of biological conditions in the vicinity of the outfall. The level of detail that would be expected in such a demonstration would be comparable to that required of large dischargers.

In some cases, the applicant may have been required to monitor one or more biological communities under the conditions of the existing section 301(h) modified permit. The Region may require the applicant to analyze and discuss those biological monitoring data in response to this question. When biological monitoring data were not collected, but concern exists that the modified discharge might cause adverse impacts to the biota, the Region may require the applicant to collect biological data in support of the application for permit reissuance. The applicant should consult with the Region well in advance of the application deadline, especially if the Region required the collection of additional data. This will give the applicant adequate time to prepare and execute appropriate studies. Applicants required to perform these field surveys should consult U.S. EPA (1982a, 1987a, 1987c, 1987f) for guidance on the design and execution of such surveys. It is the applicant's responsibility to ensure the collection of adequate, high-quality data during all phases of the necessary studies.

III.D.2. Have distinctive habitats of limited distribution been impacted adversely by the current discharge and will such habitats be impacted adversely by the modified discharge?

*** *Large and small dischargers must respond.*

If distinctive habitats are present in areas potentially influenced by the discharge, the applicant should provide information documenting the extent and condition of those habitats. The applicant should also provide a detailed evaluation of available historical information on the spatial distribution of any distinctive habitats near the outfall and in nearby reference areas. Trends in spatial occurrence should be evaluated relative to historical discharges by the applicant and relative to other water quality or biological factors that may influence the habitat.

If available, the applicant should include documentation of any long-term changes in spatial extent or general health of the distinctive habitat. Examples of such information include areal extent of kelp beds or condition of algal cover on coral reefs. If historical changes in the habitat have occurred, the applicant should attempt to relate those changes to natural or pollution-related events. For example, severe storms can damage coral reefs and heavy pedestrian traffic can degrade rocky intertidal communities.

The applicant should evaluate any effects of the discharge with emphasis on the physical, chemical, and biological conditions that occurred within the distinctive habitats in the vicinity of the outfall during the term of the existing 301(h) permit. The applicant's discussion should be oriented toward an assessment of the potential for contact of the effluent plume with any nearby distinctive habitats. In cases where a distinctive habitat occurs near an outfall, the applicant can evaluate impacts by considering the following:

- Degree of initial dilution;
- Degree of farfield dispersion;
- Frequency and direction of waste transport; and
- Lack of prior appreciable harm.

The most effective demonstrations of impacts (or the lack of impacts) include comparisons of potentially impacted areas with reference areas beyond the influence of the discharge. Experience with applications for section 301(h) modified permits has shown, however, that suitable reference areas for distinctive habitats of limited distribution are often difficult to find. The biota that characterize distinctive habitats often require specific environmental conditions that occur discontinuously within the biogeographic zone, and often only in small areas. When a suitable reference area for a distinctive habitat of limited distribution does not occur in the vicinity of the applicant's outfall, the applicant should present (to the extent possible) detailed information on the typical physical, chemical, and biological characteristics of that distinctive habitat within the biogeographic zone. When suitable data are available, the applicant should assess potential impacts to distinctive habitats of limited distribution by using the graphical and mathematical tools discussed in Appendix C.

Special Considerations for Small Dischargers

When it appears that a small discharger is causing (or has the potential to cause) impacts to distinctive habitats of limited distribution, the Region may require the applicant to perform a detailed assessment of distinctive habitats in the vicinity of the discharge. Such a detailed assessment would be comparable to that required of large dischargers, as described above. Therefore, guidance provided above and under Questions II.C.2 and III.D.1 of the questionnaire is relevant to the performance of such detailed demonstrations. It is the applicant's responsibility to identify the need for additional data on distinctive habitats and provide adequate time to design and execute appropriate studies. Moreover, the applicant should work closely with the Region during all phases of the studies to ensure that adequate, high-quality data are collected.

III.D.3. Have commercial or recreational fisheries been impacted adversely by the current discharge (e.g., warnings, restrictions, closures, or mass mortalities) or will they be impacted adversely by the modified discharge?

*** *Large and small dischargers must respond.*

If fishery resources are present in areas potentially influenced by the discharge, the applicant should assess the effects of the discharge on these resources by analyzing catch records, market acceptability, contamination of tissues by toxic substances, prevalence of disease, and harvest warnings/closures.

The applicant should also determine whether any potential fishery resources remain unharvested in the area because of warnings or closures. If unharvested resources are identified, the applicant should indicate the reasons why these resources are not utilized, such as the following:

- Health-related factors [including paralytic shellfish poisoning (PSP), bacteriological contamination, and bioaccumulation of toxic substances];
- Economic or marketing considerations;
- Resource protection closures; and
- Other regulatory closures.

If closures are the result of tissue contamination, the applicant should specify the contributing pollutant sources.

Many sources of information are available to address the fish and fishery concerns outlined above:

- Local anglers;
- Public, institutional, and agency libraries;
- Academic institutions (e.g., marine science, biology, zoology departments; Sea Grant offices; cooperative fishery research units);

- Local (e.g., conservation boards), state (e.g., fish and game departments), and federal natural resource agencies and affiliated laboratories (e.g., National Marine Fisheries Service, U.S. Fish and Wildlife Service);
- Regional fishery management councils (contact information available from National Marine Fisheries Service); and
- County, state, and federal environmental protection and public health agencies.

Environmental protection and public health agencies should be contacted to obtain information on the health of fishes in the vicinity of an outfall. These agencies monitor water quality and coliform bacteria concentrations in shellfish as part of a national public health program. They will also provide information on PSP if it is known to occur in the geographic area. Depending on the distribution of fishery resources and pollutant levels in receiving waters, the agencies may also conduct laboratory studies on toxic bioaccumulation in fish species harvested for human consumption. An applicant should request all available information concerning the region and immediate vicinity of the discharge and, with the assistance of agency personnel, attempt to determine the discharge's contribution to any observed fish health problems. A conclusion by agency personnel that the discharge is not contributing to public health problems should be documented by the applicant.

State departments of environmental protection or ecology are generally responsible for recording occurrences of fish kills within state waters. Typically, a report is filed by a departmental agent who investigated the kill, recording such information as the severity of the incident and its probable causes. An applicant should request and review reports of relevant fish kills and document whether the discharge has been implicated in any of these incidents.

Some environmental protection and public health agencies do not routinely assess the health status of fish unless a serious problem with toxics bioaccumulation is suspected in species sought by commercial or recreational fishermen. However, many state environmental agencies conduct biological surveys as a part of intensive surveys and use attainability analyses. Also, numerous agencies are adding fish tissue monitoring to statewide monitoring efforts. Sources of information on fish diseases or abnormalities include academic institutions or fisheries agencies, many of which have conducted fish surveys in the vicinity of an outfall. In addition, the applicant should not overlook the possibility of state environmental agencies as sources of information.

A careful review of available information should enable a small applicant to characterize the local fish communities and fisheries without an actual field survey unless there is sufficient evidence to indicate that the discharge has adversely impacted, or is likely to adversely impact, important fish resources. Where a survey of fish and/or shellfish is necessary to determine levels of toxics accumulation in tissues, applicants should consult the EPA guidance documents *Bioaccumulation Monitoring Guidance: 4. Analytical Methods for U.S. EPA Priority Pollutants and 301(h) Pesticides in Tissue from Estuarine and Marine Organisms* (U.S. EPA 1985d) and *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual* (U.S. EPA 1989a). The first document describes analytical methods that allow for sensitive analyses of the target compounds with a reasonable amount of laboratory effort. The second document contains information on how to perform a health risk assessment based on standard toxicological parameters and criteria. Information on sampling design, target species selection, sampling location, quality assurance/quality control (QA/QC) protocols, and other topics is also presented.

III.D.4. Does the current or modified discharge cause the following within or beyond the ZID: [40 CFR 125.62(c)(3)]

- ***Mass mortality of fishes or invertebrates due to oxygen depletion, high concentrations of toxics, or other conditions?***
- ***An increased incidence of disease in marine organisms?***
- ***An abnormal body burden of any toxic material in marine organisms?***
- ***Any other extreme, adverse biological impacts?***

*** ***Small dischargers must respond to the extent practicable***
*** ***Large dischargers must respond.***

This question requires the assessment of several specific potential impacts of POTW discharges. The applicant should review and summarize available information on occurrences of mass mortalities of marine organisms in the receiving water environment. The suspected causes of mass mortalities should be evaluated to determine whether any of these events could have resulted from the discharge. Evaluation of actual or potential mass mortalities is especially important for applicants with discharges into estuaries or enclosed embayments. Dissolved oxygen deficiencies in waters with limited flushing characteristics may result from BOD inputs or algal decomposition following bloom conditions. Evaluation of disease incidence or tissue contamination in marine organisms should be conducted by spatial comparisons of communities near the discharge (ZID and ZID boundary) with those in control areas (see U.S. EPA 1985a, 1985b, 1985c, 1985d, 1987a).

Many studies have suggested that a relationship exists between the incidence of disease in marine organisms and contact with POTW effluents. These diseases include exophthalmia in spotfin croakers (*Roncador stearnsil*) and white seabass (*Cynoscion nobilis*), lip papilloma in white croakers (*Genyonemus lineatus*), and discoloration in halibut (*Macrostomus pacificus*) (McDermott-Ehrlich et al. 1977, Mearns and Sherwood 1974). Bioaccumulation of chlorinated hydrocarbons and heavy metals has been reported in marine organisms collected near sewage outfalls off southern California. Affected species included the Dover sole (*Microstomus pacificus*), rock crab (*Cancer anthonyi*), mussel (*Mytilus californianus*), and rock scallop (*Hinnites multirugosus*) (McCain et al. 1992; McDermott et al. 1976; McDermott-Ehrlich et al. 1978; Waterman and Kranz 1992; Young, McDermott, et al. 1976a; Young et al. 1978). A methodology for portraying the seriousness of probable pollutant-induced diseases to facilitate defensible decisions is presented in *Index of Pollutant-Induced Fish and Shellfish Disease* (National Ocean Survey 1987). Disease prevalence is indexed on a simple numeric scale, with corresponding categories of seriousness labeled "normal," "warning," and "alarm."

The discharge of sewage effluents containing toxic substances can result in bioaccumulation, especially in areas of organic sediment accumulation. Toxic heavy metals and persistent synthetic organic compounds generally have the highest potential for bioaccumulation in marine organisms (Office of Technology Assessment 1987). The identification of substantial concentrations of such substances in the plant effluent in combination with either of the following receiving water characteristics indicates the need for evaluation of bioaccumulation:

- Evidence of effluent transport toward areas used for shellfish harvesting or

- Significant occurrence of important recreational or commercial species and evidence of potential sediment accumulation near the outfall.

One approach the applicant may use to evaluate the potential for bioaccumulation is to compare the concentrations of toxic pollutants after initial dilution with EPA aquatic life water quality criteria. Two types of information are required for this comparison:

(1) Concentration of the pollutant in the discharged effluent and

(2) Critical initial dilution.

The value of (1) divided by (2) should then be compared with the available criterion.

Most of the toxic pollutants with a high bioaccumulation potential, however, will be associated with organic particulates in the discharged effluent. Thus, in determining bioaccumulation potential, it is important not only to evaluate concentrations of these substances in the effluent and in the receiving water following initial dilution, but also to examine sediment accumulation patterns. Substantial bioaccumulation is possible even when water quality criteria are met because of localized accumulation of contaminated sediments. Alternatively, the applicant may be able to demonstrate that bioaccumulation is not a serious problem even though toxic substances are present in the effluent, by providing information that demonstrates the following:

- Adequate initial dilution and

- Sufficient circulation to prevent localized accumulation of solids or trapping of effluent plumes in the nearfield and farfield.

The degree to which the applicant may be required to assess bioaccumulation using field surveys is also dependent upon the kinds of organisms present. Several investigators have demonstrated the ability of bivalve molluscs and crustaceans to accumulate metals and organic substances near sewage discharges (Brown et al. 1984; McLean et al. 1992; Young, McDermott, et al. 1976b; Young et al. 1978). Studies at some of the same sites and at other contaminated areas have indicated that demersal marine fishes do not generally accumulate metals in muscle tissue (with the exception of organic mercury) but accumulate organic substances such as high-molecular-weight chlorinated hydrocarbons (McDermott-Ehrlich et al. 1978, McDermott et al. 1976). The degree to which pollutants bioaccumulate in aquatic organisms depends on the type of food chain, on the availability and persistence of the pollutant, and especially on the physical-chemical properties of the pollutant (Rand and Petrocelli 1985). The degree of bioaccumulation is generally correlated with the partition coefficient measured in an octanol-water mixture. Chemicals with large partition coefficients (e.g., halogenated hydrocarbons) are more likely to bioaccumulate. The physical fate of trace metals in seawater is directly related to their particle or biological reactivity (NOAA 1988). Additional guidance on bioaccumulation can be found in *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual* (U.S. EPA 1989). Thus, in cases where an effluent contains substantial amounts of heavy metals, the potential data requirements would be greater if shellfish resources also occurred in potentially impacted areas than if fishes constituted the only locally important resources. Furthermore, the potential for bioaccumulation would be less if fishes with only transitory plume exposure were present (e.g., pelagic or migratory species) than if demersal species dominated in areas of sediment deposition.

Sessile filter-feeding molluscs that are highly susceptible to bioaccumulation, and that may also be important commercial or recreational resources, are generally found in nearshore habitats, especially in embayments or estuaries. If an applicant can demonstrate that shellfish resources do not occur in the outfall vicinity or in other areas potentially impacted by the discharge, or that effluent dispersion is adequate, tissue analyses of indigenous biota may not be required to demonstrate the absence of adverse bioaccumulation. Information can be obtained from *The 1990 National Shellfish Register of Classified Estuarine Water*, which contains data on 3,172 shellfishing areas encompassing 18.7 million acres of classified estuarine and offshore waters in 23 states (National Ocean Survey 1991). Discharges located in areas with limited dispersion, such as estuaries or embayments, may cause contamination of local shellfish resources. In such cases, the applicant should conduct analyses of tissue concentrations of toxic substances identified in the plant effluent. Examples of species that may be appropriate for tissue analyses include oysters, clams, mussels, crabs, and lobsters (U.S. EPA 1985b).

An additional situation that will influence the requirement for direct assessment of bioaccumulation is where other pollutant sources cause observed contamination of fish or shellfish resources. This would especially pertain to cases of nearby fishery closures or harvesting restrictions due to pollutant inputs. In such cases, it is important for the applicant to demonstrate that its discharge is not contributing to the existing contamination. This demonstration can be accomplished by the previously described analyses of effluent pollutant concentrations and initial dilutions, and/or by evaluation of existing information on the spatial patterns of pollutant concentrations in organisms or sediments. It may be necessary for the applicant to conduct tissue or sediment analyses if effluent and dilution analyses indicate the potential for bioaccumulation and sufficient data are not available to determine pollutant sources in areas of existing contamination of fishery resources. Where a survey of fish and/or shellfish is necessary to determine levels of toxics accumulation in tissues, applicants should consult the EPA guidance documents *Bioaccumulation Monitoring Guidance: 4. Analytical Methods for U.S. EPA Priority Pollutants and 301(h) Pesticides in Tissue from Estuarine and Marine Organisms* (U.S. EPA 1985d) and *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual* (U.S. EPA 1989a). These documents contain information on how to perform a health risk assessment based on standard toxicological parameters and criteria. Information on sampling design, target species selection, sampling location, QA/QC protocols, etc. is also presented.

Special Considerations for Small Dischargers

As indicated in the regulations [125.63(b)(2)], small applicants are not subject to the biological monitoring requirements of paragraphs 125.63(b)(1)(ii) through (iv) under special circumstances, which relate to assessments required for this question. These special circumstances include discharging at depths greater than 10 meters and demonstrating through a suspended solids deposition analysis that there will be negligible seabed accumulation in the vicinity of the modified discharge. Many of the small applicants used existing information to demonstrate that the characteristics of the discharge and receiving water indicated a very low potential for adverse impacts. If an applicant was not required to collect biological information during the term of the existing permit, that applicant may continue to use other available information to demonstrate that the characteristics of the discharge and receiving water indicate a very low potential for adverse impacts. Applicants are reminded, however, that such demonstrations must consider the potential for adverse impacts of the discharge alone and in combination with other discharges (if any exist) [§125.57(a)(2)]. The following characteristics indicate a low potential for impact:

- Location of the discharge in water depths greater than 10 m (33 ft);
- Hydrographic conditions that result in low predicted solids accumulation rates;
- The absence of distinctive habitats of limited distribution and the absence of fisheries in the vicinity of the outfall, when such absences are not due to anthropogenic stresses; and
- The absence of known or suspected sources of toxic pollutants and pesticides in the effluent.

Most small dischargers that previously demonstrated a low potential for impact should be able to do so again. They need demonstrate only that characteristics of the discharge and receiving water did not change greatly during the term of the existing permit. Monitoring data collected during the term of the original section 301(h) modified permit should also be useful for such demonstrations.

Some small dischargers may not be able to demonstrate a low potential for impacts because the characteristics of the discharge or receiving water differ from those listed above. In some cases, the discharge or receiving water may not have exhibited the aforementioned characteristics at the time the original application for a section 301(h) modified permit was prepared. In others, characteristics of the discharge or receiving water may have changed, or additional information may now be available that documents a greater potential for impact than was previously supposed. For example, the composition of the discharge may have changed to include toxic pollutants or pesticides from a new industrial source. Alternatively, a fishery for a previously underutilized species may have developed in the vicinity of the discharge, or research by local scientists may have discovered that the habitat in the vicinity of the outfall is an important nursery ground for a commercially harvested species of fish or shellfish.

When it is apparent for one or more reasons that the discharge or receiving water does not exhibit characteristics that would indicate a low potential for impacts, the Regions have the discretion to require that an applicant perform a detailed assessment of biological conditions in the vicinity of the outfall. The level of detail that would be expected in such a demonstration would be comparable to that required of large dischargers.

In some cases, the applicant may have been required to monitor one or more biological communities under the conditions of the existing section 301(h) modified permit. The Region may require the applicant to analyze and discuss those biological monitoring data in response to this question. When biological monitoring data were not collected, but concern exists that the modified discharge might cause adverse impacts to the biota, the Region may require the applicant to collect biological data in support of the application for permit reissuance. It is the applicant's responsibility to identify the need for additional biological data and provide adequate time to design and execute appropriate studies. Moreover, the applicant should work closely with the Region during all phases of the studies to ensure that adequate, high-quality data are collected. Applicants required to perform these field surveys should consult U.S. EPA (1982a, 1987a, 1987c, 1987f) for guidance on the design and execution of those surveys.

III.D.5. For discharges into saline estuarine waters: [40 CFR 125.62(c)(4)]

- ***Does or will the current or modified discharge cause substantial differences in the benthic population within the ZID and beyond the ZID?***

- ***Does or will the current or modified discharge interfere with migratory pathways within the ZID?***

- ***Does or will the current or modified discharge result in bioaccumulation of toxic pollutants or pesticides at levels which exert adverse effects on the biota within the ZID?***

No section 301(h) modified permit shall be issued where the discharge enters into stressed saline estuarine waters as stated in 40 CFR 125.59(b)(4).

*** ***Large and small dischargers must respond.***

The Water Quality Act of 1987 prohibits the issuance of section 301(h) modified permits for discharges into saline estuaries with any of the following characteristics regardless of the causes of any of those conditions:

- The estuary does not support a balanced indigenous population of shellfish, fish, and wildlife.

- The estuary does not allow for recreational activities.

- The estuary exhibits ambient water quality characteristics that are not adequate to protect public water supplies; protect shellfish, fish, and wildlife; allow for recreational activities; and comply with standards that assure and protect such uses.

Estuaries are generally more productive than nonestuarine coastal areas and are often more sensitive to pollutants. They also serve as spawning and nursery grounds for many invertebrates and fishes. Moreover, the flushing characteristics of estuaries may be considerably less than those of open coastal areas, especially during periods of reduced freshwater input. Thus, for a given discharge size, there is generally a higher potential impact in estuaries than in open coastal environments.

Additional information is required for saline estuarine discharges. U.S. EPA regulations [§125.62(c)(4)] require applicants to demonstrate that no substantial differences exist between the benthic communities within the ZID and those beyond the ZID. Hence, applicants discharging into saline estuaries must compare benthic communities within the ZID and beyond the ZID boundary with benthic communities at reference sites.

The applicant should also assess the degree to which the discharge could interfere with migratory pathways within the ZID. Where a survey of fish and/or shellfish is necessary to determine levels of toxics accumulation in tissues, applicants should consult the EPA guidance documents *Bioaccumulation Monitoring Guidance: 4. Analytical Methods for U.S. EPA Priority Pollutants and 301(h) Pesticides in Tissue from Estuarine and Marine Organisms* (U.S. EPA 1985d) and *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish: A Guidance Manual* (U.S. EPA 1989a). These documents contain information on how to perform a health risk assessment based on standard toxicological parameters and criteria. Information on sampling design, target species selection, sampling location, QA/QC protocols, and other topics is also presented. In conducting this assessment, the applicant can calculate the proportion of the cross sectional area of the estuary that is influenced by the ZID. The potential for migratory interference can then be evaluated by considering the relative size and characteristics of the discharge-affected area and its location in the estuary with respect to known migratory pathways.

Applicants with saline estuarine discharges must also assess the bioaccumulation of toxic substances within the ZID (see U.S. EPA 1985a, 1985b, 1985c, 1985d, 1987d). There are several advantages of using caged indicator species versus indigenous species to monitor bioaccumulation (U.S. EPA 1992a). However, results using caged organisms may not provide an accurate estimate of the bioavailability of certain contaminants occurring at the site. If elevated or increasing concentrations of toxic substances are found in fish or shellfish, the applicant should assess the potential for adverse impacts such as restrictions on human use (e.g., FDA Action Levels), induction of disease, or interference with fish and shellfish growth or reproduction (U.S. EPA 1986a).

Special Considerations for Small Dischargers

When there is reasonable concern that one or more of the three foregoing conditions prohibiting the issuance of section 301(h) modified permits for discharges into saline estuaries has come into existence during the term of an existing section 301(h) modified permit, the Regions may require small applicants to demonstrate successfully that none of the conditions exist. To do so, small applicants may be required to perform a detailed biological survey similar to that required of large dischargers. Small applicants are advised to consult the information provided under Questions II.C.1 and III.D.1 (above) and in section III.F for guidance on the design and execution of detailed biological surveys. It is the applicant's responsibility to identify the need for a detailed biological survey to document the absence of stressed conditions in the receiving water and to allow adequate time to design and execute appropriate studies. Moreover, the applicant should work closely with the Region during all phases of the studies to ensure that adequate, high-quality data are collected.

III.D.6. For improved discharges, will the proposed improved discharge(s) comply with the requirements of 40 CFR 125.62(a) through 125.62(d)? [40 CFR 125.62(e)]

*** *Large and small dischargers must respond.*

EPA regulations require applicants that propose discharge improvements to demonstrate that the improvements will result in compliance with §125.62(a) through (d). This demonstration might be accomplished by comparing conditions at the outfall location with conditions near discharges that are similar to the proposed improved discharge. Assuming that there is a basic similarity in indigenous biota of the receiving water, such a comparison may be sufficient to predict protection of a BIP. Applicants may also conduct predictive analyses of effluent dispersion and seabed accumulation of solids following discharge improvements.

Applicants whose discharge improvement plans include outfall relocation should describe existing biological conditions at both the existing and proposed outfall sites. Those applicants are also to predict future biological conditions at the proposed site following relocation of the outfall. Such predictions might be made on the basis of comparisons with other discharges that are similar to the relocated discharge. Discharges used for such comparisons should be located in receiving waters similar to the applicant's.

III.D.7. For altered discharge(s), will the altered discharge(s) comply with the requirements of 40 CFR 125.62(a) through 125.62(d)? [40 CFR 125.62(e)]

*** *Large and small dischargers must respond.*

Applicants requesting modifications for altered discharges may use predictive methods similar to those described for improved discharges. However, such applicants must demonstrate that the increased pollutant loading resulting from population growth or industrial growth within the service area will still enable compliance with §125.62(a) through (d) as well as the appropriate state's antidegradation requirements. These predictions of compliance with 301(h) criteria during the 5-year permit term may be technically difficult and may require extensive analyses.

III.D.8. If your current discharge is to stressed ocean waters, does or will your current or modified discharge: [40 CFR 125.62(f)]

- *Contribute to, increase, or perpetuate such stressed condition?*

- ***Contribute to further degradation of the biota or water quality if the level of human perturbation from other sources increases?***

- ***Retard the recovery of the biota or water quality if human perturbation from other sources decreases?***

*** ***Large and small dischargers must respond.***

When it appears that an applicant's receiving waters are or may be stressed, the Region may require the applicant to demonstrate the presence or absence of stressed conditions. If stressed conditions exist, the areal extent and magnitude of those stresses should be documented. Because stressed water determinations are largely based on biological conditions in the receiving water, the Region may require applicants to perform detailed biological surveys. Applicants required to perform detailed biological surveys for the purpose of determining whether stressed conditions exist in the receiving water should consult section III.F of this document and guidance documents cited therein for information on the design and execution of those surveys. It is the applicant's responsibility to identify the need for a detailed biological survey to determine whether stressed conditions exist in the receiving water and to allow adequate time to design and execute appropriate studies. The applicant should work closely with the Region during all phases of the studies to ensure that adequate, high-quality data are collected.

III.E. <u>Impacts of Discharge on Recreational Activities [40 CFR 125.62(d)]</u>

It is necessary to ensure that a 301(h) modified discharge (1) will meet water quality standards relevant to recreational activities beyond the ZID and (2) will not cause legal restrictions on activities that would be lifted or modified if the applicant's POTW were updated to secondary treatment.

III.E.1. Describe the existing or potential recreational activities likely to be affected by the modified discharge(s) beyond the zone of initial dilution.

*** ***Large and small dischargers must respond.***

The impact of POTW discharges on recreational activities must be assessed. Recreational fisheries are considered in the biological evaluation section. Other activities involving contact with water may be affected by microbial contamination. For recreational impact assessment, dispersion and transport of the effluent need to be considered in conjunction with the applicant's disinfection procedures.

All recreational activities currently occurring within the bay, estuary, or an 8-km (5-mi) radius of the outfall should be identified (e.g., swimming, boating, fishing, shellfishing, underwater diving, picnicking, other beach activities). Any additional potential future recreational activities should also be identified (e.g., new ports, boat harbors). A map that indicates the location of current activities, along with the location of the existing or proposed outfall, should be provided. Qualitative or, whenever possible, quantitative information that indicates the extent of the existing activities should be provided. This information could include the number of boats or boat slips in the area, species of fish and shellfish recreationally harvested, size of catch, and number of beach user days.

III.E.2. What are the existing and potential impacts of the modified discharge(s) on recreational activities? Your answer should include, but not be limited to, a discussion of fecal coliform bacteria.

*** ***Large and small dischargers must respond.***

Water quality standards for protecting recreational uses, particularly coliform bacteria or enterococci standards, should be provided. Water classifications within 8 km (5 mi) of the discharge should be indicated. The schedule and frequency of chlorination should be established. To confirm compliance with standards relevant to recreational activities, any required coliform or enterococci bacteria monitoring data for the effluent obtained at the ZID boundary and on the adjacent shoreline should be submitted. Bacteriological sampling should be limited to the night or early morning hours. If shoreline areas are not normally monitored, sampling should occur on the shore near popular water activity areas. If noncompliance with coliform bacteria standards is noted, an explanation and corrective measures should be provided. Other sources of coliform bacteria present in the area that could be contributing to the problem should be identified.

III.E.3. Are there any Federal, State, or local restrictions on recreational activities in the vicinity of the modified discharge(s)? If yes, describe the restrictions and provide citations to available references.

*** ***Large and small dischargers must respond.***

Any federal, state, or local restrictions or closures relating to the discharge and recreational activities should be identified. The nature of the restrictions, the date implemented, and the agency responsible (e.g., state department of health) should be indicated.

III.E.4. If recreational restrictions exist, would such restrictions be lifted or modified if you were discharging a secondary treatment effluent?

*** ***Large and small dischargers must respond.***

If restrictions are in place, the relation of the restriction to the current or modified discharge quantity and quality should be established. If an improvement in the discharge quality would modify or eliminate the restriction on recreational activities, this should be indicated. In all such events, it should be determined whether secondary treatment would improve the discharge sufficiently to allow the restriction to be modified.

III.F. Establishment of a Monitoring Program [40 CFR 125.63]

A monitoring program for applicants granted section 301(h) modified discharge permits is important to evaluate the impact of the modified discharge on selected marine biological communities, to demonstrate continued compliance with applicable water quality standards or criteria, and to monitor the effectiveness of the urban pretreatment and toxics control programs. Only those scientific investigations which are necessary to study the effects of the proposed discharge should be included in the scope of the monitoring program [§125.63(a)(1)(i)(B)]. Unless special circumstances exist (e.g., the presence of distinctive habitats, high mass emission rates of toxic substances), monitoring programs for small dischargers are typically much less comprehensive than those for large dischargers.

The monitoring program consists of four parts: biological, water quality, influent, and effluent. Although each of these parts involves sampling at different locations and for different parameters, they should not be considered as independent activities, but as an integrated study. In this manner, the applicant will be able to meet the specific objectives of each part of the study while also conducting a meaningful assessment of impacts of the discharge. Moreover, as predictable relationships are established among the biological, water quality, influent, and effluent monitoring parameters, it should be possible to delete certain elements of the field monitoring studies.

The continued assessment of marine biota as part of the monitoring program involves the same type of comparative strategy as is required for a BIP demonstration in the application. The characteristics of selected marine communities in the discharge vicinity are compared with biological characteristics at reference areas. Hence, a primary objective of the biological monitoring program is to evaluate continued compliance with the BIP requirements. This demonstration can be accomplished by conducting periodic (e.g., quarterly) seasonal surveys of biological communities.

Biological communities selected for study in the monitoring program should include those communities which are most likely affected by the discharge. As is the case for BIP demonstrations in the original application, the monitoring program should address any biological effects in terms of spatial extent, magnitude, potential for secondary impacts, and potential for involvement of commercial or recreational species. All of these factors will be important in determining whether detectable differences in biological characteristics are adverse.

Bioaccumulation determinations and sediment sampling are used to evaluate biological effects of toxic substances in the effluent. The results of these studies can indicate the potential for adverse effects on human health, especially if recreationally or commercially important fishery resources occurred in the outfall vicinity. These results may also be used to determine the need for additional (or fewer) analyses of toxic substances in sediments or in organisms exposed to the diluted effluent. The National Research Council (1989) and, more recently, U.S. EPA (1992b) have completed studies on the assessment and classification of contaminated sediments. Also, considerable work is currently under way on how contaminated sediments and the potential for bioaccumulation are related.

The water quality monitoring program is intended to evaluate compliance with applicable water quality standards and criteria and to measure the presence of toxic substances. An additional objective of the water quality monitoring program is to provide information that will supplement the biological monitoring program, in particular to assist in the interpretation of observed biological differences.

Monitoring POTW influent and effluent is important for providing supplementary information for both the water quality and biological programs. Influent and effluent data are also used as a means of demonstrating continued compliance with the modified permit effluent limitations and removal efficiency requirements, and as a data source for permit renewal applications.

III.F.1. Describe the biological, water quality, and effluent monitoring programs which you propose to meet the criteria of 40 CFR 125.63. Only those scientific investigations that are necessary to study the effects of the proposed discharge should be included in the scope of the 301(h) monitoring program [40 CFR 125.63(a)(1)(i)(B)].

****** Large and small dischargers must respond.***

The extent of the monitoring program required as part of a section 301(h) variance will depend on the characteristics of the discharge and the receiving water. Monitoring of the influent, effluent, and receiving water may also be required as part of the applicant's existing NPDES permit or to meet state regulations. The applicant's proposed monitoring program must be submitted with the section 301(h) application.

Detailed guidance on the design of section 301(h) monitoring programs is provided in *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Water* (U.S. EPA 1982a) and *Framework for 301(h) Monitoring Program* (U.S. EPA 1987e). Although some technical information (primarily literature citations, analytical protocols, and legal citations and requirements) provided in U.S. EPA (1982a) has been superseded, most of the information is still valid and applicable to the design of 301(h) monitoring programs. More recent documents (e.g., U.S. EPA 1985e, 1986c, 1987c, 1987e) include the addition of recent literature citations, updated analytical protocols, and updated legal citations and requirements. The updated information in these more recent documents, together with the earlier guidance provided by U.S. EPA (1982a, 1987e), is sufficient to design and implement an effective monitoring program. Applicants are referred to the following documents for additional or updated guidance on specific topics relevant to the design and execution of 301(h) monitoring programs:

- U.S. EPA (1987a) for information on positioning methods in nearshore marine and estuarine waters;

- U.S. EPA (1985c, 1985d, 1985e, 1986c) for information on analytical methods;

- U.S. EPA (1987c) for information on quality assurance/quality control procedures for field and laboratory methods;

- U.S. EPA (1985a, 1985b, 1985c, 1985d, 1987d) for information on bio-accumulation monitoring studies;

- U.S. EPA (1987b) for information on fish liver pathology monitoring studies; and

- U.S. EPA (1989a) for information on human health risk assessments associated with contaminated fish and shellfish.

The full titles and facts of publication for these documents can be found in the reference section of this manual.

Biological Monitoring

The applicant's biological monitoring program must include the following elements to the extent practicable:

(1) Periodic surveys of control sites and biological communities most likely to be affected by the discharge;

(2) Periodic bioaccumulation studies and examination of possible adverse effects of effluent-related toxic substances;

(3) Periodic sampling of sediments; and

(4) Periodic assessment of commercial or recreational fisheries (if present).

Small applicants are not subject to items (2) through (4) above if they discharge at depths greater than 10 meters and if they demonstrate through a suspended solids deposition analysis that there will be negligible seabed accumulation in the vicinity of the modified discharge.

The objectives of the biological monitoring program are to evaluate the impact of the modified discharge and to demonstrate compliance with section 301(h) biological requirements. Thus, the biological monitoring program must enable the same spatial comparisons (i.e., ZID, ZID boundary, discharge impact area, and control) as are required for demonstration of a BIP.

The applicant's monitoring program should include only those study elements which are practicable and appropriate in the receiving water. When the applicant believes that one or more of the aforementioned study types is not practicable, a justification for the proposed deletion from the monitoring program should be provided. Examples of situations in which reductions in the frequency or extent of biological surveys would be reasonable might include conditions of high current speeds or adverse climatic periods (sampling not practical) and periods of low biological variability or extremely low productivity (sampling not appropriate).

Monitoring program specifications supplied by the applicant must include the following information:

- Biological groups to be sampled;
- Sampling methods;
- Station locations;
- Sampling schedules;
- Preservation techniques;
- Analytical techniques;
- Quality assurance/quality control procedures;
- Statistical analyses; and
- Taxonomic sources.

The three types of sampling stations that should generally be included in the periodic biological surveys to the extent practicable are located as follows:

- In the vicinity of the ZID;
- In other areas of potential discharge impact; and
- In control (i.e., reference) areas.

Monitoring at intermediate sites between control and outfall locations may be necessary, especially for large discharges where definition of the spatial extent of biological effects is an important consideration. Additional station requirements would also be associated with discharges into estuaries (within-ZID station), into stressed waters, or in situations where other pollutant sources potentially affect biological communities near the discharge. For modified discharges involving outfall relocation, monitoring must be conducted at the existing discharge site until cessation of discharge, and at the relocation site.

Selection of control stations is one of the more important aspects of monitoring program design because BIP comparisons will rely on data from these sites. Control stations should be located in areas not influenced by the applicant's previous or existing discharge or other pollutant sources. Sediment characteristics at control station(s) should be similar to those expected to occur naturally in the vicinity of the discharge. Discharge and control stations should be located at similar water depths.

Bioaccumulation studies are to be included in the monitoring program to evaluate the potential adverse effects of toxic substances. Section III.D.4 provides additional discussion on bioaccumulation studies. *In situ* bioassays may be needed on a case-by-case basis. Caged specimens of bivalve molluscs (e.g., *Mytilus edulis* or *M. californianus*) are recommended as test organisms for *in situ* bioassays. Exposures should be conducted in the discharge vicinity and at an appropriate reference site. Additional exposure sites may be necessary for large dischargers, especially in situations where other pollutant sources contribute toxic substances to the receiving water body. Those toxic pollutants and pesticides known or suspected in the applicant's discharge need to be measured in the exposed organisms. Specific guidance on bioaccumulation studies can be found in the following documents:

- *Bioaccumulation Monitoring Guidance: 1. Estimating the Potential for Bioaccumulation of Priority Pollutants and 301(h) Pesticides Discharged into Marine and Estuarine Waters* (U.S. EPA 1985a).

- *Bioaccumulation Monitoring Guidance: 2. Selection of Target Species and Review of Available Bioaccumulation Data* (U.S. EPA 1985b).

- *Bioaccumulation Monitoring Guidance: 3. Recommended Analytical Detection Limits* (U.S. EPA 1985c).

- *Bioaccumulation Monitoring Guidance: 4. Analytical Methods for U.S. EPA Priority Pollutants and 301(h) Pesticides in Tissues from Estuarine and Marine Organisms* (U.S. EPA 1985d).

- *Summary of U.S. EPA-Approved Methods, Standard Methods, and Other Guidance for 301(h) Monitoring Variables* (U.S. EPA 1985e).

- *Analytical Methods for U.S. EPA Priority Pollutants and 301(h) Pesticides in Estuarine and Marine Sediments* (U.S. EPA 1986c).

- *Guidance for Conducting Fish Liver Pathology Studies During 301(h) Monitoring* (U.S. EPA 1987b).

The monitoring program must also include sediment sampling for toxic substances in the vicinity of the discharge, in other areas of expected solids accumulation, and at appropriate reference sites. Within-ZID sampling should be undertaken where practicable. The sediment sampling is intended to provide an indication of the toxics accumulation within sediments near the discharge and the associated contamination potential. If elevated or increasing concentrations of toxic substances are detected, the applicant must also analyze tissue concentrations of toxic substances in indigenous organisms to determine whether adverse bioaccumulation is occurring. Recommended organisms for such analyses include demersal fishes (e.g., flounder or sole), epibenthic megainvertebrates (e.g., crabs or lobster), or sessile filter-feeding organisms (e.g., clams, mussels, or oysters). Detailed guidance on sediment sampling can be found in *Analytical Methods for EPA Priority Pollutants and 301(h) Pesticides in Estuarine and Marine Sediments* (U.S. EPA 1986c).

Sediment samples should also be analyzed for characteristics that would support the water quality and biological surveys. These parameters should include particle size distribution and total volatile solids. Other parameters, such as BOD_5, sulfides, and total organic carbon, are also useful and may be required by some states.

If recreational or commercial fisheries are present in areas potentially affected by the discharge, the applicant should also periodically assess those fisheries. The kinds of evaluations conducted will depend on the nature of the local fisheries and on the level of detail of available fisheries data. These evaluations should reflect an understanding of the potential impacts of the discharge on the fisheries. Sources of information used to determine the productivity and status of fisheries include state resource agencies, voluntary logbooks, interviews, and field observations. The period and level of effort of fishery surveys will depend on the size and location of the discharge, concentrations of toxic substances in the effluent, species harvested, and importance of the commercial or recreational fishery.

Water Quality Monitoring

The objectives of the water quality monitoring program are to provide data for determining compliance with applicable water quality standards and criteria and to measure the presence of toxics identified or expected in the effluent. However, some pollutants are not readily detected in the water column alone. As a result, the collection of biological data and sediment sampling are necessary for a comprehensive monitoring program.

The water quality measurements usually required include dissolved oxygen, BOD_5, suspended solids, pH, temperature, salinity, and light transmittance. Light transmittance standards may be specified in terms of turbidity, Secchi disc depth, extinction coefficient, or percent light transmittance. With the exception of Secchi disc depth, water column profiles should be determined for these parameters. However, because the Secchi disc provides cumulative data on water transparency measured from the surface down to the depth at which the Secchi disk disappears from sight, the Secchi disc should not be used to detect the effect of a submerged plume on light transmittance.

Other parameters that may be required include nitrogen (nitrate, nitrite, total Kjeldahl nitrogen, and ammonia), total and reactive phosphorus, toxic substances identified in the effluent, chlorophyll *a*, floating particulates, color, settleable solids, surface oil and grease, total and fecal coliform bacteria, and enterococci bacteria. Samples for these parameters should be collected 1.0 m (3.3 ft) below the water surface, at mid-depth, and 1.0 m (3.3 ft) above the bottom. In deep water, sampling at additional water column depths may be required. The applicant's monitoring program should specify the parameters for which profiles are to be taken along with the sampling interval. Table 2 provides a list of the priority pollutants and 301(h) pesticides.

For existing discharges, stations should be located in the following areas:

- ZID boundaries (both upcurrent and downcurrent);
- Control (i.e., background) stations along the primary axis of the longshore component of the current (both upcurrent and downcurrent);
- Intermediate upcurrent stations between the ZID boundary and the upcurrent control station; and

- Potential impact areas (e.g., in the nearshore zone and close to areas with distinctive habitats).

The applicant should use information on local currents and wastefield dispersion patterns in selecting sampling station locations in potentially impacted areas. Sampling stations located at the ZID boundary, control stations, and intermediate upcurrent stations should be in approximately the same depth of water. Control stations should be located in areas not influenced by the discharge. Intermediate upcurrent stations should be selected to represent the approximate residual wastefield concentrations upcurrent of the location, thereby accounting for potential recirculation of previously discharged effluent (by reversing tidal currents, upwelling, or stagnant net circulation). Data should be collected at the intermediate and ZID stations at least twice daily (e.g., high and low slack tides) to evaluate short-term conditions. The duration of the longshore current in relation to the time of sampling is an important factor in determining whether the intermediate upcurrent stations are representative of persistent conditions or of only a temporary plume reversal. For discharges involving outfall relocation, monitoring stations must be located at the current discharge site until cessation of discharge, and at the relocation site.

For all cases, the applicant should include a chart showing the location of the outfall, the shoreline, any distinctive habitats, and all sampling stations. The latitudes, longitudes, and depths of the stations should be specified.

Sampling frequencies should be selected to comply with state requirements and to provide data for critical periods. In most cases, quarterly surveys that include the critical periods (e.g., time of maximum stratification) should meet state requirements. More frequent sampling (e.g., for coliform bacteria) in swimming or shellfish-harvesting areas may be required by some states. The analytical methods and quality control/quality assurance procedures should be described. [For detailed guidance on quality assurance/quality control procedures for field and laboratory methods, refer to *Quality Assurance/Quality Control Procedures for 301(h) Monitoring Programs* (U.S. EPA 1987c).]

Influent and Effluent Monitoring

The major objectives of treatment plant monitoring are to provide data for determining compliance with permit effluent limitations, section 304(a)(1) water quality criteria, and state requirements; to measure the effectiveness of the toxic substance control program; and to relate discharge characteristics to the receiving water biological and water quality conditions. In addition, influent and effluent monitoring provides data for assessment of treatment plant performance that may be required to meet modified discharge permit conditions.

Parameters that should be measured in the influent are BOD_5 and suspended solids; however, other parameters may also require measurement. Parameters that should be measured in the effluent are BOD_5, suspended solids, pH, dissolved oxygen, section 304(a)(1) water quality criteria pollutants, toxic pollutants, and pesticides present or likely to be present in the discharge. The toxic pollutants and pesticides that should be measured are specified in §125.58(aa) and (p). Monitoring of other parameters, such as grease and oil, settleable solids, nutrients, fecal coliform bacteria, pathogens, and temperature, may also be required by other permit conditions or monitoring requirements.

Required influent samples should be collected just downstream of any coarse screens or grit chambers. Effluent samples should be collected downstream of any chlorination or disinfection units. Effluent samples to be analyzed for toxic substances should be collected just upstream of the outfall. Sample collection and analysis should be performed as required in 40 CFR Part 136, or as specified by EPA.

III.F.2. Describe the sampling techniques, schedules, and locations, analytical techniques, quality control and verification procedures to be used.

*** ***Large and small dischargers must respond.***

The following information must be provided for all portions of the proposed monitoring program:

- Parameters to be measured;
- Sampling methods;
- Sampling schedule;
- Sampling locations;
- Analytical techniques; and
- Quality control and verification procedures.

Guidance on the above subjects is provided in the documents listed under Question III.F.1. Current EPA-approved methods should be used for all parameters. Additional guidance on navigational requirements is provided in Appendix D.

III.F.3. Describe the personnel and financial resources available to implement the monitoring programs upon issuance of a modified permit and to carry it out for the life of the modified permit.

*** ***Large and small dischargers must respond.***

The applicant must provide information on available personnel, facilities, and financial resources to show that the proposed monitoring program can be implemented and continued for the term of the modified discharge permit if a section 301(h) modification is granted. The applicant should review state monitoring requirements to ensure that the proposed program meets those requirements.

III.G. *Effect of Discharge on Other Point and Nonpoint Sources [40 CFR 125.64]*

III.G.1. Does (will) your modified discharge(s) cause additional treatment or control requirements for any other point or nonpoint pollution source(s)?

*** ***Large and small dischargers must respond.***

The section 301(h) regulations require an analysis of whether a decreased treatment level at the applicant's discharge would require other pollution sources in the vicinity to increase their treatment levels or apply additional controls. For open coastal waters, a list of discharges within the anticipated impact area of the applicant's modified discharge should be provided. The subsequent dilution at each outfall can be estimated using Table B-5 in Chapter B-IV of Appendix B of this document. The total dilution is the product of the initial dilution and the subsequent dilution. If the effect of the applicant's discharge on other sources is small, further analysis may not be needed. Otherwise, an analysis of compliance with water quality standards at the other discharger sites is appropriate for determining the effects of the applicant's discharge at those sites. For most small POTW discharges, the effects on other sources should be negligible.

In estuaries where outfalls are close together, effects on other sources are possible. The approach outlined above can be used to estimate total dilution at the other outfalls.

III.G.2. Provide the determination required by 40 CFR 125.64(b) or, if the determination has not yet been received, a copy of a letter to the appropriate agency(s) requesting the required determination.

*** ***Large and small dischargers must respond.***

The applicant must provide a copy of a determination from the state or interstate agencies that are authorized to establish wasteload allocations indicating whether the proposed discharge will result in the imposition of additional pollution control requirements on any other point or nonpoint sources. This determination must also explain the basis of the conclusions.

If the required determination has not been received when the application is submitted to EPA, the applicant should include copies of the request letters to the appropriate agencies. When the determination is made, a copy of the determination letter should be forwarded to EPA.

III.H. *<u>Toxics Control Program and Urban Area Pretreatment Program [40 CFR 125.65 and 125.66]</u>*

The toxics control program is designed to identify and ensure control of toxic pollutants and pesticides discharged to the POTW. The section 301(h) toxics control provisions (§125.66) require both industrial and nonindustrial source control programs. In addition, applicants serving a population of 50,000 or more must now comply with the urban area pretreatment requirements under §125.65. Applicants must also comply with the pretreatment program requirements and compliance schedules in 40 CFR Part 403. The pretreatment program regulations [40 CFR 403.8(d)] require all industrial pretreatment programs to have been approved by 1 July 1983.

U.S. EPA's section 301(h) toxics control program regulations (§125.66) apply to all 301(h) applicants. However, small applicants that certify that there are no known or suspected sources of toxic pollutants and pesticides to the POTW are relieved of most of the cost burden for industrial pretreatment toxics control program development.

III.H.1. a. Do you have any known or suspected industrial sources of toxic pollutants or pesticides?

b. If no, provide the certification required by 40 CFR 125.66(a)(2) for small dischargers, and required by 40 CFR 125.66(c)(2) for large dischargers.

c. *Provide the results of wet and dry weather effluent analyses for toxic pollutants and pesticides as required by 40 CFR 125.66(a)(1).*

d. *Provide an analysis of known or suspected industrial sources of toxic pollutants and pesticides identified in (1)(c) above in accordance with 40 CFR 125.66 (b).*

*** ***Small dischargers must respond to parts a and b through d to the extent practicable.***
*** ***Large dischargers must respond to parts a through d.***

Applicants must conduct an industrial waste survey, as described in 40 CFR 403.8(f)(2), as the basis for determining whether there are any known or suspected industrial sources of toxic pollutants or pesticides. Guidance for conducting an industrial waste survey is provided by EPA (U.S. EPA 1983).

Toxic pollutants and pesticides are defined in §125.58(aa) and (p), respectively, and include those substances listed in Table 2. Marine water quality criteria are summarized in Table 3. Guidance on sampling and analytical methods is found in U.S. EPA (1982a, 1987c, 1987e) and 40 CFR Part 136.

If there are no known or suspected industrial sources of toxic pollutants or pesticides, the applicant must certify this fact, based on the results of an industrial waste survey.

Large and small applicants must submit results of wet- and dry-weather analyses of the treatment plant effluent if known or suspected industrial sources of toxic pollutants or pesticides exist. The analysis must be performed on a minimum of two 24-hour composite effluent samples (one dry-weather and one wet-weather). Applicants subject to the urban area pretreatment requirements under §125.65 must also conduct representative sampling and analysis of the POTW influent, effluent, and sludge for toxic pollutants. The Pretreatment Regulations (40 CFR Part 403) require that an applicant comply with Code of Federal Regulations, Title 40, Part 503, 58 FR 9387, 19 February 1993* (Standards for the Use or Disposal of Sewage Sludge). Sludge sampling is required in order to determine compliance with 40 CFR Part 503. Other applicants not subject to the pretreatment regulations may also be required to conduct sludge sampling and analysis. The *POTW Sludge Sampling and Analysis Guidance Document* (U.S. EPA 1989b) provides guidance on sludge sampling and analysis. If historic data are available, they should

*hereinafter referred to as 40 CFR Part 503.

be presented as well. Results of the analyses should be tabulated in a summary form that allows the toxic quality of the discharge to be evaluated. The applicant should describe the sampling effort by describing the procedures for collecting, compositing, and preserving the samples. The number of grab samples taken for volatile organics analysis should be included in the discussion.

Rainfall data submitted for at least 5 days preceding the sampling will confirm wet or dry conditions at the time of sampling. In past analyses (Feiler 1980), toxics concentrations have been substantially higher on Monday through Friday than on Saturday and Sunday. It is therefore recommended that composite effluent samples not be collected on weekends unless it can be shown that this sampling period is more representative.

Analytical methods should be discussed, with appropriate references to published analytical procedures. The analytical laboratory should be identified. Quality assurance procedures for the analysis should be summarized, and results presented for review. Differences between the wet- and dry-weather analyses should be explained, if possible. Also, a comparison with past results can be made.

Sources of detected toxic pollutants must be identified and, to the extent practicable, categorized according to industrial and nonindustrial origins. The purpose of this identification and categorization is to provide a useful reference for toxics monitoring and source controls. If the applicant recognizes that the source list requires improvement, procedures to accomplish this improvement should be described. In-system sampling and analysis, industrial discharge analysis, permit data, and site inspections could yield quantitative information as to sources of identified priority pollutants. A list entitled "Industrial Categories Subject to National Categorical Pretreatment Standards" can be found at 40 CFR Part 403, Appendix C. Additional information on categorical pretreatment standards can be found at 40 CFR 403.6 and under appropriate sections of 40 CFR chapter I, subchapter N (Effluent Guidelines).

Special Considerations for Small Dischargers

In the original section 301(h) application, unless required by the state, many small applicants were exempted from providing an analysis of toxic substances and pesticides in their effluent because they were able to certify that there were no known or suspected sources of those substances in their service area. However, those exemptions were not permanent (U.S. EPA 1982b). Section 125.63(d) requires all section 301(h) modified permit holders to analyze their effluent for toxic substances and pesticides, to the extent practicable, as part of their monitoring programs and to measure the effectiveness of the toxic control program. Hence, to the extent practicable, all section 301(h) permittees will have performed at least one effluent analysis for toxic substances at a representative time during the 5-year term of the original section 301(h) permit. To the extent practicable, they will also perform another effluent analysis for toxic substances at a representative time during the 5-year term of the reissued permit. Results of those analyses should be used to demonstrate compliance with federal water quality criteria.

III.H.2. a. Are there any known or suspected water quality, sediment accumulation, or biological problems related to toxic pollutants or pesticides from your modified discharge(s)?

b. If no, provide the certification required by 40 CFR 125.66(d)(2) together with available supporting data.

c. If yes, provide a schedule for development and implementation of nonindustrial toxics control programs to meet the requirements of 40 CFR 125.66(d)(3).

d. Provide a schedule for development and implementation of a nonindustrial toxics control program to meet the requirements of 40 CFR 125.66(d)(3).

***** Small dischargers must respond to parts a through c.***
***** Large dischargers must respond to part d.***

The purpose of nonindustrial source control programs is to identify the specific nonindustrial sources of priority pollutants and pesticides and then to develop specific means for their control. To properly address these requirements, the applicant should describe existing programs or present a schedule and description of proposed programs to identify and control non-industrial sources of toxic pollutants and pesticides. At a minimum, all applicants must develop a public education program to limit nonindustrial sources (see Question III.H.3 below).

Nonindustrial source control programs must be developed and implemented within 18 months of the issuance of a section 301(h) modified permit; applicants for reissued 301(h) modified permits must have nonindustrial source control programs in place. The schedule must include the following two elements:

- A schedule of activities for identification of nonindustrial sources of toxic pollutants and pesticides and

- A schedule for the development and implementation of practicable control programs for nonindustrial sources of toxic pollutants and pesticides.

Activities to identify nonindustrial sources could include literature searches, in-system sampling and analysis, research on nonindustrial products commonly released to the sewer, and pooling of information with other POTW operators having a similar mix of users. The applicant should also consult the data and guidance on nonindustrial sources provided by EPA (U.S. EPA 1991a).

There are no clearly defined rules to determine the level of effort that an applicant should apply to identify nonindustrial sources. This level of effort, however, is expected to be directly related to the size of the discharger. For example, dischargers with diverse land uses within the service area may find it necessary to perform in-system sampling and analysis to explain the occurrence of toxic pollutants and pesticides.

Concentrations of pollutants within the system not accounted for by industrial sources are generally attributable to nonindustrial sources. Applicants should therefore be careful not to duplicate any in-system sampling efforts performed for compliance with industrial pretreatment regulations.

Extensive control measures may be necessary where nonindustrial sources produce concentrations of toxic pollutants and pesticides within 50 percent or more of the receiving water criteria after initial dilution. These measures could include control of the sale, use, handling, and disposal stages of substances containing priority pollutants and pesticides.

EPA recognizes the potential for serious adverse effects on marine organisms and humans that can result from the accumulation and bioaccumulation of discharged toxic pollutants and pesticides. EPA also recognizes the potential complexity of nonindustrial source control programs. Therefore, applicants are encouraged to consult with EPA during development of nonindustrial source control programs. Proposed nonindustrial source control programs are subject to review and revision by EPA prior to the issuance of a section 301(h) modified permit and during the term of any such modified permit.

III.H.3. Describe the public education program you propose to minimize the entrance of nonindustrial toxic pollutants and pesticides into your treatment system [40 CFR 125.66(d)(1)]

*** ***Large and small dischargers must respond.***

The applicant must propose a public education program to minimize the amounts of nonindustrial toxic pollutants and pesticides that enter the waste stream. The plan must be developed and implemented within 18 months of the issuance of a 301(h) modified permit; applicants for reissued 301(h) modified permits must have a public education program in place. The public education program may include preparation of newspaper articles, posters, or radio and television announcements to increase public awareness of the need for proper disposal of waste oils, solvents, herbicides, pesticides, and other substances that contain toxic pollutants.

III.H.4. Do you have an approved industrial pretreatment program (40 CFR 125.66(c)(1)?

a. If yes, provide the date of EPA approval.

b. If no, and if required by 40 CFR Part 403 to have an industrial pretreatment program, provide a proposed schedule for development and implementation of your industrial pretreatment program to meet the requirements of 40 CFR Part 403.

*** *Large and small dischargers must respond.*

An applicant with known or suspected industrial sources of toxic pollutants or pesticides must have an approved pretreatment program and demonstrate compliance with its requirements before a waiver may be granted. Applicants that certify to the Administrator that they have no known or suspected industrial sources of toxic pollutants or pesticides are not required to have an industrial pretreatment program.

In this section, applicants required to have an industrial pretreatment program should indicate the date of approval and clearly present a history of compliance with the 40 CFR Part 403 industrial pretreatment program requirements. The history of compliance should summarize all compliance inspections and the results of those inspections; any enforcement actions including notices of violation, the reason for the enforcement action, and any actions taken to correct the causes of violations; and the current compliance status at the time of application.

III.H.5. Urban area pretreatment requirement [40 CFR 125.65]
Dischargers serving a population of 50,000 or greater must respond.

a. Provide data on all toxic pollutants introduced into the treatment works from industrial sources (categorical and noncategorical).

b. Note whether applicable pretreatment requirements are in effect for each toxic pollutant. Are the industrial sources introducing such toxic pollutants in compliance with all of their pretreatment requirements? Are these pretreatment requirements being enforced? [40 CFR 125.65(b)(2)]

c. If applicable pretreatment requirements do not exist for each toxic pollutant in the POTW effluent introduced by industrial sources,

- *provide a description and a schedule for your development and implementation of applicable pretreatment requirements [40 CFR 125.65(c)], or*

- *describe how you propose to demonstrate secondary removal equivalency for each of those toxic pollutants, including a schedule for compliance, by using a secondary treatment pilot plant. [40 CFR 125.65(d)]*

**** Dischargers serving a population of 50,000 or more must respond.*

Applicants must conduct an industrial waste survey, as described in 40 CFR 403.8(f)(2), as the basis for characterizing industrial sources by industry type (SIC code), types and concentrations of toxic pollutants in discharge(s), wastewater flow to the POTW, and other factors as outlined in guidance provided by EPA (U.S. EPA 1983). All industrial sources should be identified separately as categorical or noncategorical industries. It is likely that this information has already been developed as part of the applicant's approved industrial pretreatment program under 40 CFR Part 403.

Once the toxic pollutants being introduced by industrial sources and those sources have been identified, the applicant can choose between two methods to comply with the urban area pretreatment requirements. The applicant must address each toxic pollutant introduced by industrial sources. In the first method, called the Applicable Pretreatment Requirement Approach, the applicant would demonstrate that it has in effect applicable pretreatment requirements for each toxic pollutant discharged to the POTW by industry [§125.65(c)]. In the second method, called the Secondary Removal Equivalency Approach, the applicant would demonstrate that the existing POTW treatment process (including any existing pretreatment) removes at least the same amount of that toxic pollutant as would have been removed by secondary treatment if there were no pretreatment for that toxic pollutant [§125.65(d)]. Appendix E provides guidance for conducting the above demonstrations for compliance with urban area pretreatment requirements. A summary of these methods is provided below.

Applicable Pretreatment Requirement Approach

General Approach. Under §125.65(b)(1)(i), an applicant must have in effect applicable pretreatment requirements for each toxic pollutant discharged to the POTW from one or more industrial users. Applicable pretreatment requirements may take the form of (1) categorical standards; (2) local limits (numeric and/or narrative), or a combination of (1) and (2); and (3) where it is determined that local limits are not necessary for a toxic pollutant, annual monitoring and technical review of industrial discharges, and, where appropriate, implementation of industrial management practices plans (IMPs), best management practices (BMPs), and other pollution prevention activities, and determination on an annual basis of the need to revise local limits and/or to demonstrate that there is no need for a local limit for a specific toxic pollutant. When an industrial discharger is subject to both a categorical standard (1) and a numeric local limit (2) for a specific toxic pollutant, the more stringent of the two limits applies.

Categorical standards (see 40 CFR 403.6) are nationally uniform, technology-based limits developed for specific industries and for specific toxic pollutants. All categorical industries must comply with categorical standards, even if they discharge to a POTW without a federally approved local pretreatment program. By contrast, local limits are developed by the POTW, among other purposes, to prevent interference with the treatment works or pass-through of toxic pollutants, as required by 40 CFR 403.5(b).

A specific categorical industry may be subject to categorical standards for some pollutants and local limits for other pollutants. When both local limits and categorical standards address a particular pollutant for a specific industry, the more stringent requirement applies. Furthermore, local limits for specific toxic pollutants found in the POTW waste stream can apply to both categorical and noncategorical industries when the toxic pollutants cannot be entirely attributed to categorical industries and/or when categorical standards alone are not sufficient to satisfy the requirements of 40 CFR Part 403.

Local limits (see 40 CFR 403.5) are requirements developed by a POTW based on local conditions and unique requirements at the POTW. These limits are primarily intended to protect the treatment plant from industrial discharges that could interfere with POTW treatment processes or pass through the treatment plant to receiving waters and adversely impact water quality or the environment. Local limits are also designed to prevent sludge contamination and protect workers at the treatment plant.

Under the applicable pretreatment requirement approach, the applicant must address each toxic pollutant introduced by industry. However, the POTW need not develop a specific numeric local limit that applies to each industrial source of each toxic pollutant. After conducting a local limit analysis, the POTW may apportion the allocation of the numeric local limit (if any) to any number of industrial sources of the toxic pollutant (categorical and/or noncategorical) that the POTW deems appropriate, subject to approval of the applicable Regional office. Moreover, when it is not appropriate or practical to develop and implement numeric local limits to prevent pollutant pass-through or interference for a specific toxic pollutant, the EPA pretreatment program has provided for narrative local limits (i.e., industrial management and best management practices) as useful supplements to numeric limits. Narrative local limits are most appropriate where management plans are needed to help control or eliminate chemical spills or leaks, slug discharges, or the handling of hazardous or toxic materials from both categorical and noncategorical industries.

For toxic pollutants for which the POTW determines that neither numeric nor narrative local limits are necessary, a program of periodic POTW monitoring and annual technical review of data on industrial discharges would be conducted by the POTW and, where appropriate, would require industrial users to institute IMPs and other pollution prevention activities to control and reduce the levels of those toxic pollutants for selected industries. For those toxic pollutants, the POTW would report annually to EPA on the status of the need for development of local limits. If such monitoring and technical review of data indicate that a local limit is needed, the POTW would establish and implement a local limit.

IMPs are intended to minimize the discharge of toxic pollutants to the sewer, or reduce the impact of toxic pollutant discharges by avoiding short-term, high-concentration discharges. IMPs can be applied to all classes of industrial users, e.g., major and minor industrial users. Examples of appropriate uses of IMPs include control of chemical spills and slug discharges to the POTW through formal chemical or waste management plans (including BMPs), solvent management plans, batch discharge policies, waste recycling, and waste minimization. It would also be appropriate to consider IMPs in cases where the POTW does not include biological treatment processes, or provides less treatment, e.g., primary treatment. In these cases, IMPs can be tailored for industrial sources of toxic pollutants that might otherwise interfere with biological treatment or would be degraded or removed through additional treatment.

EPA's *Guidance on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program* (U.S. EPA 1987h) provides various methods for calculating numeric local limits. Applicants should consult the appropriate EPA Regional office for more specific information regarding pretreatment programs and local limits development. The following discussion is intended as a guidance framework for a process to demonstrate and comply with the §125.65 urban area pretreatment requirements through the applicable pretreatment requirement approach.

Maximum Allowable Headworks Loading (MAHL) Method. The predominant approach used is a chemical-specific approach known as the maximum allowable headworks loading (MAHL) method. This is accomplished pollutant by pollutant for each environmental criterion or plant requirement, and the lowest or most limiting value for each pollutant serves as the basis for allocation to industry and ultimate numeric local limits. As an example, steps of the maximum allowable headworks loading method are summarized below, as the method might be applied for purposes of meeting the urban area pretreatment requirements (i.e., applicable pretreatment requirement in effect). Other approaches for establishing numeric local limits may also be appropriate. Applicants should establish local limits programs in coordination with Regional Administrators on a case-by-case basis. Appendix E provides additional information on the MAHL approach and on alternative approaches.

Determine Pollutants of Concern--The applicant must address all toxic pollutants [40 CFR 401.15 and §125.65(b)(1)] that are identified as known or suspected to be discharged by industry to the POTW. An initial screening of the known or suspected toxic pollutants may be performed to select those likely to require numeric local limits as determined under the MAHL method. For the remaining toxic pollutants, the POTW must evaluate the need to set narrative local limits (i.e., industrial management and best management practices) to control and reduce levels of these toxic pollutants from appropriate industrial sources. For toxic pollutants for which the POTW determines that neither numeric nor narrative local limits are necessary, the POTW must conduct periodic monitoring and annual review of industrial discharges to check the status of the need for development of local limits.

Characterize Existing Loadings--An industrial waste survey must be conducted, as previously discussed, using guidance provided by EPA (U.S. EPA 1983). The POTW must characterize existing loadings to the treatment plant by conducting monitoring of all industrial users. Either POTW monitoring data or self-monitoring data are acceptable, and information from the industrial waste survey may also be of use. The applicant should also characterize nonindustrial sources of toxic pollutants such as hauled wastes and domestic/background sources. The applicant must conduct sufficient monitoring at the treatment plant to adequately characterize influent, effluent, and sludge loadings of toxic pollutants. Monitoring of the treatment plant influent, effluent, and sludge should represent a minimum of 5 consecutive days to capture the typical short-term range and variability in the wastewater composition. Preferably, in addition, monitoring should include data for at least 1 day per month over at least 1 year for metals and other inorganic pollutants and 1 day of sampling per year for all other toxic pollutants. The method for analysis of a toxic pollutant should be selected according to the type of pollutant to be analyzed (i.e., grab samples over 24 hours for volatile organic compounds, total recoverable phenolic compounds, and cyanide and flow-proportioned 24-hour composite samples for all other toxic pollutants). Appendix E provides additional guidance on development of a toxic pollutant monitoring program.

Determine Applicable Environmental Criteria--Environmental criteria generally include NPDES permit limits, water quality standards or criteria, sludge disposal requirements, and unit process inhibition values. Other appropriate requirements may include worker health and safety criteria, collection system effects, incinerator emission requirements, or other applicable federal, state, or local environmental protection requirements.

Calculate Maximum Headworks Loadings--If using the MAHL approach, the applicant calculates the maximum amount (lb/day) of each toxic pollutant contributed by an industrial user or received at the headworks of the treatment plant that will allow the POTW to achieve all of the above applicable environmental criteria. All calculations should be consistent with the approach outlined in the EPA guidance manual (U.S. EPA 1987h).

Calculate Allowable Industrial Loadings--If using the MAHL approach, the applicant incorporates a safety factor (range of 10 to 30 percent) and discounts the value for domestic/background loadings in order to determine the maximum allowable allocation available for industrial users.

Allocate Allowable Industrial Loadings--The method chosen to allocate the allowable industrial loading depends on the number and types of industrial users and the method of application (permits, contract, or sewer use ordinance) employed by the POTW. Where the current loading of a toxic pollutant exceeds the maximum allowable headworks loading, the applicant must establish a numeric local limit to reduce loadings to within the range of the maximum allowable headworks loading. Under the applicable pretreatment requirement approach, the POTW must address each toxic pollutant introduced by industry. The POTW may allocate the allowable industrial loading among any number of industrial sources of the toxic pollutant (categorical and/or noncategorical) that the POTW deems appropriate, subject to the approval of EPA. Where the current loading is below the maximum allowable headworks loading, the applicant is encouraged, but not required, to set industrial discharge limits at current loadings to provide a safety factor. Numeric local limits could be allocated, for example, according to the following classification scheme developed under the industrial waste survey. For major or significant industries, the POTW could set specific effluent limitations (categorical standards, numeric local limits, or both). For minor industries, the POTW may choose to set numeric local limits when these industries as a group represent a significant source of toxic pollutants to the POTW; otherwise, the POTW could evaluate the need to set narrative local limits for appropriate industries (i.e., industrial management and best management practices) to control and reduce levels of toxic pollutants. Examples of industrial management practices include waste recycling, solvent management plans, batch discharge policies, and other "good housekeeping" practices. Narrative local limits may also be implemented in conjunction with numeric local limits for the same industry, if deemed appropriate. Once local limits have been developed, they must be effectively implemented. Local limits should be incorporated into the sewer use ordinance or some form of individual control mechanism.

Ongoing Review/Revision of Local Limits and Screening Pollutants of Concern. Local limits should be reviewed and revised on a periodic basis to reflect changes in conditions or assumptions. Conditions that might require that local limits be revised include, but are not limited to, changes in environmental criteria, changes in the industrial users, availability of additional monitoring data, changes in plant processes, and changes in POTW capacity or configuration.

Annual monitoring should be conducted by the POTW as described above and in Appendix E. The results of the monitoring and data review must be made available in the annual report required under 40 CFR 403.12. If the applicant determines, based on results of annual monitoring of the POTW influent/effluent/sludge and/or technical review of data on discharges from industrial sources (also updated annually), that the level of a toxic pollutant is expected to exceed the maximum allowable level determined through the local limits analysis, the applicant should establish a new numeric local limit and modify the individual control mechanism or sewer use ordinance, as appropriate, to implement the new local limit. Furthermore, the applicant should update the initial screening of toxic pollutants based on results of the same technical review to determine the need for inclusion of any new toxic pollutants/industries in the local limits analysis (either numeric or narrative).

Ongoing Analysis of Other Toxic Pollutants Not Addressed by Local Limits. For toxic pollutants for which the POTW determines that neither numeric nor narrative local limits are necessary (e.g., not pollutants of concern, insignificant industrial contribution), a program of periodic POTW monitoring (as described above and in Appendix E) and annual technical review of data on industrial sources should be conducted. Where appropriate, the POTW should require industrial users to institute IMPs and other pollution prevention activities to control and reduce the levels of these toxic pollutants for selected industries. For these toxic pollutants, the POTW should report annually to EPA on the status of the need for development of local limits (e.g., whether these toxics are now pollutants of concern, whether IMPs are needed for additional industries, etc.). If such monitoring and technical review of data indicate that a local limit is needed, the POTW would establish and implement a local limit.

Secondary Removal Equivalency Approach

Alternatively, an applicant may demonstrate that its own treatment processes, in combination with existing pretreatment by industrial dischargers, achieves "secondary removal equivalency." Applicants are required to make this demonstration when they cannot show that a known or suspected toxic pollutant introduced by an industrial discharger has an "applicable pretreatment requirement" in effect as defined in §125.65(c) and discussed above. Although secondary treatment removes conventional pollutants, a certain amount of toxic pollutants in the influent is incidentally removed during the process. In the absence of an applicable pretreatment requirement in effect for a toxic pollutant, WQA section 303(c) requires that a section 301(h) discharger remove at least that same amount of a toxic pollutant, through a combination of industrial pretreatment and the applicant's own treatment at less-than-secondary levels, as would be removed if the applicant were to apply secondary treatment and no pretreatment program existed for that pollutant.

To demonstrate secondary removal equivalency, an applicant would need to use a secondary treatment pilot plant. By diverting part of its primary effluent (secondary influent) to the pilot plant, the applicant would empirically determine the incremental amount of each toxic pollutant that would be removed from the primary effluent (secondary influent) if secondary treatment were applied. Having determined the amount of each toxic pollutant removed, the applicant would then demonstrate that its existing less-than-secondary treatment plus industrial pretreatment removes at least the same amount of each toxic pollutant as did the secondary treatment pilot plant (including removals in the primary effluent) without any industrial pretreatment.

In cases where an applicant already has an ongoing industrial pretreatment program that addresses categorical industries but not all toxic pollutants discharged to the POTW from categorical and noncategorical industries, the applicant may choose to perform the empirical secondary removal equivalency demonstration using influent that has been subject to that existing industrial pretreatment. (The applicant is not expected, in most cases, to be able to provide "unpretreated" industrial wastewaters to perform the empirical demonstration.) Such a demonstration may then be conservative because it may overstate the amount of toxic pollutant that would be removed by applying only primary and secondary treatment. Because it would be conservative, applicants are permitted (but not required) to make the secondary equivalency demonstration using effluent that has undergone partial industrial pretreatment.

Effluent limits (concentration values and/or flow-corrected mass loading values) will be developed based on data from the secondary removal equivalency demonstration when these values are more stringent than effluent limits based on state water quality standards or water quality criteria, or required to ensure that all applicable environmental protection criteria are met. Once the effluent limits are established, the applicant may either develop local limits (as described above) or perform additional treatment at the POTW, or combine the two to achieve the permit limit.

DETERMINATIONS OF COMPLIANCE WITH SECTION 301(h) MODIFIED PERMIT CONDITIONS AND 301(h) CRITERIA

PERMIT CONDITIONS

POTWs that hold section 301(h) modified permits must comply with section 301(h) criteria and regulations, as well as all applicable state water quality standards, state and federal laws, regulations, and Executive orders. General guidance is presented below for assessing the effects of POTW discharges into the marine environment, including water quality, physical, and biological evaluations. Question III.B.7 of the Applicant Questionnaire places additional requirements to meet federal water quality criteria, as well as applicable state standards [§125.62(a)(1)] on all section 301(h) dischargers. These requirements have the potential to expand the scope of the water quality demonstrations that must be made by each section 301(h) discharger to include more parameters, but do not create a fundamentally different, or new, class of standards, criteria, or requirements that must be met. Therefore, the general guidance provided below includes information relevant to determinations of compliance with the federal water quality criteria and applicable state standards. Guidance is also presented on the evaluation of biological monitoring data collected to identify biological impacts that may occur as a result of a discharge. Such biological monitoring efforts should be designed to identify potential problems early, as well as to demonstrate compliance with 301(h) requirements.

The first step in evaluating effects of 301(h) discharges on water quality, especially when applicants are seeking renewal of a 301(h) modified permit, is to compare the data to be submitted for the renewal with the data collection requirements specified in the existing section 301(h) modified permit. The following two key questions should be addressed:

- Are all physical, chemical, and biological parameters required by the section 301(h) modified permit measured?
- Is each required parameter measured at the specified locations and at the specified frequency?

If either question cannot be answered affirmatively, the applicant could be considered in noncompliance with the terms of the existing section 301(h) modified permit. In cases of apparent noncompliance, the applications for reissuance of the modified permit may be denied without further examination of the monitoring data.

Assuming that all the appropriate data are available, the second step is to evaluate the technical merit and interpretation of the data. Three major areas should be considered when preparing assessments of the data:

- Data quality;
- Execution of the analyses; and
- Interpretation of the analytical results.

Applicants should provide sufficient information to document that data quality is high, analyses are properly executed, and data interpretation is reasonable. Procedures for proper data collection are found in guidance presented in U.S. EPA (1982a, 1982c) and guidance given under the appropriate questions in the Applicant Questionnaire (especially Questions III.F.1 and III.F.2). Of critical importance to the collection of data for any parameter is whether appropriate field and laboratory methods are used to collect the data and whether appropriate QA/QC procedures are followed. Data are of little value if they are collected using inappropriate methods or if the collection process is so poorly executed that their accuracy is in doubt. Refer to U.S. EPA (1987c) for additional QA/QC guidance.

As is true for data collection methods, data analysis methods vary greatly in terms of the various types of physical, chemical, and biological parameters. Applicants are referred to the aforementioned documents for guidance on evaluating data analysis methods. The following questions should be kept in mind during the presentation of the data analyses:

- Are values for each parameter reported in appropriate units?
- Are the analytical methods appropriate for the type of data being analyzed?
- Do the mathematical or graphical analyses illustrate what is being discussed in the text of the application?
- Are calculations correct, and have data points been plotted correctly?

Provided that the foregoing questions (and other questions related to data analysis that may be relevant in specific instances) are answered in the affirmative, applicants should indicate how the data and the results of analyses of those data support the applicant's conclusions concerning whether the existing or proposed discharge contributes to adverse impacts on the receiving water or biota.

DETERMINATIONS OF COMPLIANCE WITH SECTION 301(h) CRITERIA

When monitoring data indicate that impacts to water quality, sediment quality, or biota are occurring, it will be necessary to determine whether such impacts are adverse. Many physical and chemical criteria (e.g., dissolved oxygen concentrations, concentrations of toxic pollutants in the water column after initial dilution) are quantitative. Determinations of water quality values are reasonably straightforward and rely primarily on the results of well-documented mathematical calculations. Provided that the physical and chemical data were properly collected and analyzed, the resulting values for each physical and chemical parameter can be compared with applicable section 301(h) criteria, state standards, and federal water quality criteria. Results of such comparisons can be used to determine the presence of an adverse impact.

The initial dilution is a critical parameter relative to compliance with water quality standards and 304(a)(1) water quality criteria. The magnitude of initial dilution achieved depends on ambient water density gradients and diffuser design. The ZID size is important to determine compliance with water quality and biological criteria. Methods for determining the size of the ZID can be found in discussions of Questions III.A.1 and III.A.2 and Appendix A.

The transport of diluted effluent beyond the ZID is also important to determine whether a discharge will comply with water quality standards. In addition, dischargers—particularly those to estuaries or partially enclosed (e.g., restricted flow) areas—may need to demonstrate that reentrainment or accumulation of effluent will not result in violations of applicable water quality standards.

When the values of one or more physical or chemical parameters consistently fall outside the ranges specified by the foregoing criteria, the discharge can be inferred (by definition) to be causing adverse impacts to the physical or chemical characteristics of the receiving water. Applicants that propose improvements to outfall or treatment systems will need to predict the values of parameters relevant to 301(h) criteria that can be expected following implementation of the proposed improvements.

The assessment of adverse biological effects in the section 301(h) process involves assessment of whether a balanced indigenous population of shellfish, fish, and wildlife exists in the vicinity of the discharge and in other areas potentially affected by the discharge. Since the BIP concept forms an integral part of the applicant's biological assessment, it is important to establish the meaning and interpretation of the term in the context of a section 301(h) biological demonstration.

The term "population" does not mean a reproducing unit of a single species, but rather all biological communities existing in the receiving water body. Similarly, the terms "shellfish," "fish," and "wildlife" should be interpreted to include any and all biological communities that may be affected adversely by a marine POTW discharge [§125.58(y)].

A BIP is defined in the section 301(h) regulations [§125.58(f)] as "an ecological community that: (1) exhibits characteristics similar to those of nearby, healthy communities existing under comparable but unpolluted environmental conditions; or (2) may reasonably be expected to become re-established in the polluted water body segment from adjacent waters if sources of pollution were removed." Balanced, indigenous populations occur in unpolluted waters. The second part of the definition concerning the reestablishment of communities is included because of its relevance to proposed, improved discharges and to discharges into waters that are stressed by sources of pollution other than the applicant's modified discharge.

The biological community characteristics that might be examined in an evaluation of a BIP include, but are not limited to, species composition, abundance, biomass, dominance, and diversity; spatial/temporal distributions; growth and reproduction of populations; disease frequency; trophic structure and productivity patterns; presence or absence of certain indicator species; bioaccumulation of toxic materials; and the occurrence of mass mortalities of fish and invertebrates.

The first step in an applicant's BIP demonstration is to define the "indigenous population" and establish the natural variability of the "balanced population." Because EPA has determined that these are observable characteristics of natural communities existing in the absence of human disturbance, a comparative strategy is found throughout the section 301(h) regulations. Biological parameters of concern near the discharge should be compared to the range of natural variability found in comparable, but unpolluted, habitats. The section 301(h) applicant should compare biological conditions at reference (control) sites with conditions in areas of potential discharge impact within and beyond the ZID.

While biological criteria are not defined in the same straightforward, quantitative way as physical and chemical criteria, some extreme adverse impacts are defined specifically in the

301(h) regulations and are known endpoints in a spectrum of possible biological conditions that might result from the discharge of sewage effluent. For example, the 301(h) regulations state that conditions within the ZID must not contribute to extremely adverse biological impacts, including the following conditions:

- Destruction of distinctive habitats of limited distribution;
- Presence of disease epicenters;
- Stimulation of phytoplankton blooms that have adverse impacts beyond the ZID; and
- Conditions that result in mass mortalities of fish and invertebrates.

In addition, other biological effects on a particular marine community that result in substantial secondary effects on another community, or result in a potential for adverse effects on humans, would normally be considered adverse. For example, within and beyond the ZID, adverse impacts include, but are not limited to, the following:

- Damage to distinctive habitats of limited distribution;
- Creation of disease epicenters in commercially or recreationally important species;
- Contamination of fishery resources by pathogenic microorganisms or their indicators;
- Mass mortalities of fish or shellfish;
- Bioaccumulation of toxic substances in fish and shellfish at levels injurious to the marine organisms or humans; or
- Substantially decreased abundance of commercially or recreationally important species.

Applications that propose improvements to eliminate any of these adverse impacts may be considered. Because all of these impacts are considered extremely adverse, however, it would be difficult to demonstrate that a balanced indigenous population will become reestablished following improvements to the treatment plant or outfall.

Many biological impact assessments that are necessary under 301(h) regulations require determinations of degrees of impact relative to unstressed conditions. These assessments rely largely on comparisons of biological conditions between reference areas and potentially impacted areas to determine the locations of changes along theoretically or empirically derived impact gradients. Quantitative comparisons between reference sites and potentially impacted areas may be made using various types of biological data [e.g., numbers of individuals per unit area, values of the Infaunal Trophic Index (Word 1978, 1980)] and various analytical tools (e.g., normal classification analysis), as discussed under Question III.D.1 above. However, no quantitative biological criteria have been established. Therefore, changes in, or differences between, biological communities require careful consideration of the types of responses that are manifested by the pollutant stress, as well as their spatial extent and magnitude.

Three approaches have been used in the 301(h) program to assess the degree of change in the biota (and associated receiving water). The first is to determine whether the observed change represents a reduction in the areal extent or health of a community or ecosystem. This approach has most often been used in cases where a change in major taxa that characterize the community greatly modifies the environment, thereby creating habitat for other, less desirable species. Primary examples include distinctive habitats of limited distribution, such as kelp communities, coral reefs, and seagrass beds. Because most of the taxa in these communities are highly dependent on the major taxa that characterize the community (and create habitat niches), the loss of those major taxa due to pollutant impacts results in destruction of the community. One assemblage of organisms is not replaced by another in which the species belong to the same, or similar, major taxonomic groups, and in which the new taxa are able to tolerate, and in many cases thrive in, the modified environment. In cases where a community or ecosystem is highly dependent on a limited number of major taxa to provide habitat for a wide variety of dependent species, any loss or decline in the health of those major taxa is an adverse impact.

In communities where pollutant impacts result in changes in species composition and abundance, but not in the destruction of the habitat, it is more difficult to assess changes. However, two approaches to the problem have been used in the past. The first is based on the assumption that a major change in the function (i.e., trophic relationships) of a community (e.g., benthic infauna, demersal fishes) affects, or has the potential to affect, all of the major elements of the ecosystem. The second approach is a corollary of the first. It assumes that a major change in the structure (i.e., species composition and abundance) of a community indicates that change in the function of that community has occurred, even if a change in function cannot be demonstrated. A change in the structure of a community is usually much easier to document than is a change in the function of a community.

Benthic infauna are used in the following example to demonstrate how the functional and structural approaches may be implemented to demonstrate compliance with section 301(h) regulatory requirements. The generalized model developed by Pearson and Rosenberg (1978) for changes in benthic communities along a gradient of organic enrichment (Figure 3) has been used extensively in the 301(h) program and has been successfully applied to a variety of soft-bottom benthic communities in temperate and tropical latitudes. At low to moderate levels of organic enrichment (i.e., the "transition zone" in Figure 3), biomass increases moderately and numbers of species increase slightly. Total abundance does not increase significantly until the "ecotone point" is approached. In the "transition zone," there is simply an enhancement of the community that is typical of the biogeographic region, with the addition of a few new species. There are no major functional or structural changes. If there are no major impacts associated with other aspects of the benthic infauna (e.g., bioaccumulation of toxic substances), the impact to benthic infauna may or may not be evidence of the presence of a BIP.

At and beyond the "peak of opportunists" as shown in Figure 3, Pearson and Rosenberg (1978) document that the number of species and abundance of the benthic infauna change substantially. The fauna becomes dominated by a few opportunistic or pollution-tolerant species whose abundance increases dramatically in response to increased organic loading. Most of these species are surface or subsurface deposit feeders. Suspension feeders and surface detrital feeders typically decrease in abundance or are eliminated. Hence, the structure (i.e., species composition and abundance) and function (i.e., trophic relationships) of the benthic infauna are altered substantially.

In most cases, information is not available to demonstrate that major changes in the structure and function of a particular benthic community affect other biological communities (e.g., demersal fishes). However, many cases of prey specificity by demersal fishes and large epibenthic invertebrates that prey on benthic infauna have been recorded in the scientific literature. Hence, there is a sound scientific basis for assuming that major changes in the structure and function of benthic communities as a result of organic enrichment can induce changes in the species composition and abundance of predators on infauna, most of which are demersal fishes and large epibenthic invertebrates.

The concepts of spatial extent of the discharge-related biological and intercommunity effects are important in a BIP demonstration. Therefore, if differences between the ZID boundary communities and control communities are observed, the assessment of a BIP should include a characterization of the extent and possible interrelationship of effects beyond the ZID.

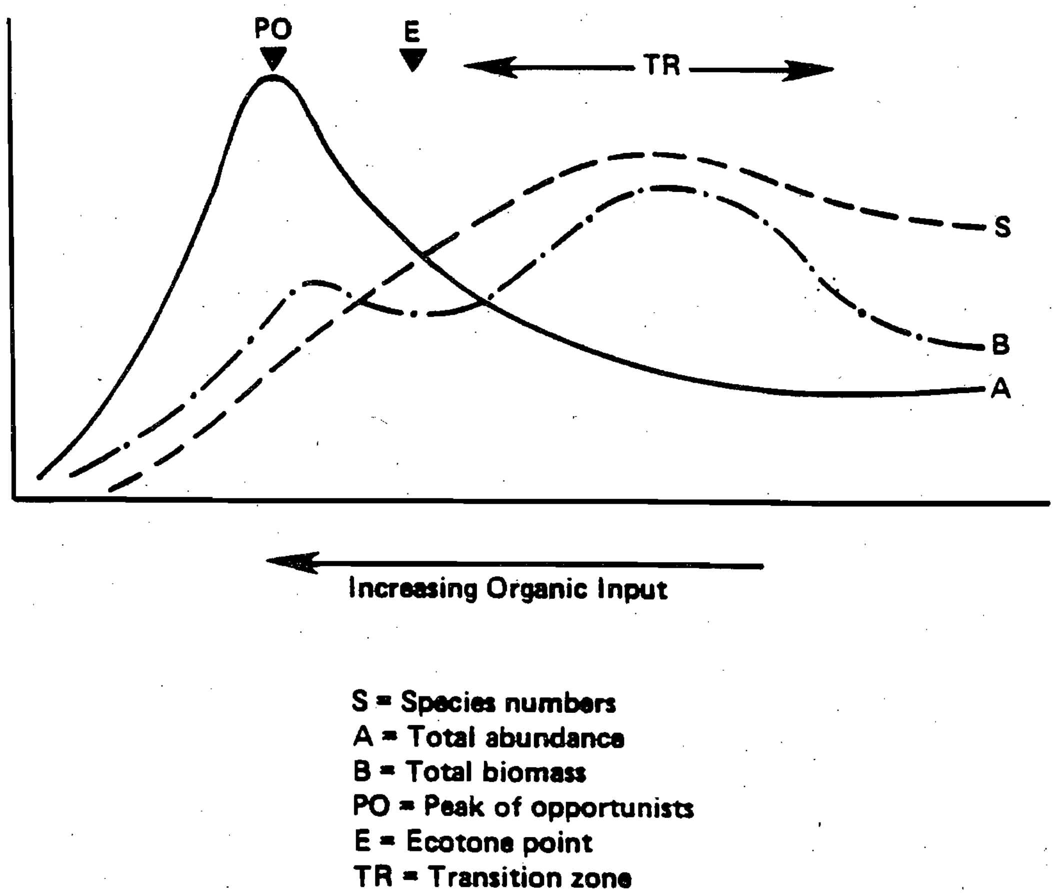


Figure 3. Generalized depiction of changes in species numbers, total abundances, and total biomass along a gradient of organic enrichment (Pearson and Rosenberg 1978).

Special emphasis should be placed on any predicted changes in the areal extent of discharge-related effects following discharge improvements or alterations. Further, in addition to assessing benthic communities and demersal fishes, the applicant should consider the need to assess other discharge-related effects on other biological communities. In assessing this need, the applicant should consider the nature of the discharge (e.g., flow, location, solids emission rates, and concentrations of discharged pollutants, including toxic substances) and characteristics of the receiving water body (e.g., circulation patterns, productivity, and trophic relationships). For example, if a discharge is located close to shore or there is significant onshore transport, the assessment of effects on intertidal or subtidal macroalgae may be another important component of the BIP demonstration. Similarly, if a discharge is located in an estuary or enclosed embayment where phytoplankton blooms may be stimulated by nutrient inputs, the assessment of plankton communities may be appropriate as part of the applicant's demonstration.

If an existing discharge may be causing an adverse impact to the biota or if the proposed discharge has the potential to cause an adverse impact to the biota or would result in non-compliance with section 301(h) criteria, then the applicant should perform a detailed biological demonstration to support approval of the application. The Region could require detailed biological demonstrations to be performed to validate the acceptability of proposed improvements. It is the applicant's responsibility to allow sufficient time to design and execute appropriate studies.

EVALUATIONS OF PREDICTED CONDITIONS AND PREDICTED CONTINUED COMPLIANCE

Under the original 301(h) regulations, POTWs were allowed to apply for first-time section 301(h) modified permits based on current, improved, or altered discharges. A "current discharge" is defined in §125.58(h) as the volume, composition, and location of an applicant's discharge at the time of permit application. An "improved discharge" may include planned improvements in the outfall, the level of treatment, discharge characteristics, operation and maintenance procedures, or controls on the introduction of pollutants into the treatment system [§125.58(i)]. An "altered discharge" is defined as any discharge other than a current discharge or an improved discharge as defined in §125.58(b).

For improved and altered discharges, applicants were required to predict conditions that would occur in the receiving water following implementation of the proposed improvements or alterations. Section 301(h) modified permits were issued upon a satisfactory demonstration that the predicted conditions were reasonable and would satisfy section 301(h) criteria and regulations. For dischargers whose original section 301(h) modified permit was issued based in part on predictions of conditions that would occur after proposed improvements or alterations were implemented, prior to reissuance of a permit it is necessary to evaluate whether the predicted conditions have been realized. Because monitoring data collected during the term of the existing permit should be used in support of the application for permit reissuance, evaluations of the applicant's original predictions of compliance are not unlike other determinations of compliance.

As was the case for original section 301(h) applications, applications for reissuance of section 301(h) modified permits may propose improved levels of sewage treatment, either in response to comments by EPA or at the permittee's initiative. Applications for permit reissuance that are based on altered discharges are also allowed when downgrading of effluent quality is attributable entirely to population growth and/or industrial growth within the service area. Applicants that propose improved or altered discharges must also comply with the appropriate state's antidegradation requirements. Proposals for improved and altered discharges require that the permittee predict the physical, chemical, and biological conditions that will occur in the receiving water as a result of the proposed discharge. In such cases [as in the original section 301(h) applications], it will be necessary to evaluate whether the permittee's predictions are reasonable and whether the predicted conditions would satisfy section 301(h) criteria and regulations.

Applicants should consider the following when preparing applications with predictions based on improved or altered discharges:

- Appropriateness of the models used to generate the predictions (see discussion in Appendix A);
- Data quality;
- Execution of the analyses; and
- Interpretation of the analytical results.

It is essential that the applicant conduct each of these steps in the predictive process properly. Otherwise, the validity of the results and compliance with applicable regulations and criteria may be questionable.

To predict conditions that might occur as a result of a proposed discharge, applicants may compare attributes of the proposed discharge (e.g., volume and composition) and receiving water with conditions near other outfalls that discharge effluent of similar volume and composition and in similar receiving waters. The validity of such comparisons rests on the similarity of the discharges and the similarity of the receiving waters. Substantial differences in the diffuser design, the volumes of the two discharges, or the mass emission rates of pollutants from the two discharges would render such comparisons questionable, especially for biological parameters. For physical and chemical parameters, it might be possible to compensate mathematically for such differences. However, biological responses to pollutants cannot be assumed to be linear. Therefore, the validity of predictions involving comparisons between substantially different discharges is very tenuous unless the response patterns of the biota within the biogeographic region are well known.

Similarity of the receiving waters is also critical to such comparisons. It is important that both discharges be located within the same biogeographic zone because responses to pollutants vary among species. Species in one biogeographic zone may respond somewhat differently to a given pollutant than do species in another biogeographic zone. For that reason, it may be possible to predict the general types of changes that might occur as a result of the proposed discharge, but it will not generally be possible to predict the areal extent or magnitude of such changes unless both discharges are in the same biogeographic zone. It is also important that the physical and chemical characteristics of both receiving waters be similar. For example, discharges into open coastal areas should not be compared with discharges into embayments. The more similar the two receiving waters are, the more reliable the applicant's predictions may be assumed to be.

Applicants may also use water quality models to predict impacts of the proposed discharge. Such models would be especially helpful for physical and chemical parameters (e.g., deposition of suspended solids in the receiving water, concentrations of toxic substances at the ZID boundary). The appropriateness of such models should be judged on their prior use in the 301(h) program, their acceptance or recommendation by EPA, and their acceptance by the scientific community. Models that have not been evaluated previously or that have not been received favorably should be avoided.

REFERENCES

Ambrose, R.B., J.L. Martin, and G.H. Jirka. 1992. Technical guidance manual for performing waste load allocations. Book III: Estuaries. Part 3, Use of mixing zone models in estuarine waste load allocations. EPA-823/R-92/004. U.S. Environmental Protection Agency, Washington, DC.

Baptista, A.M., E.E. Adams, and K.D. Stolzenbach. 1984. The solution of the 2-D unsteady convection diffusion equation by the combined use of the FE method and the method of characteristics. Presented at the 5th International Conference on Finite Elements in Water Resources, University of Vermont, Burlington, VT.

Brown, D.A. et al. 1984. Municipal wastewater contamination in the Southern California Bight. Metals and organic contaminants in sediments and animals. Submitted to Mar. Environ. Res.

Christodoulou, G.C., J.J. Connor, and B.R. Pearce. 1976. Mathematical modeling of dispersion in stratified waters. TR No. 219. Massachusetts Institute of Technology, R.M. Parsons Laboratory for Water Resources and Hydrodynamics, Cambridge, MA.

Christodoulou, G.C., J.R. Pagenkopf, B.R. Pearce, and J.J. Connor. 1976. A user's manual for "DISPER-2" - a multi-layer finite element dispersion model. TR No. 221. Massachusetts Institute of Technology, R.M. Parsons Laboratory for Water Resources and Hydrodynamics, Cambridge, MA.

Crane, S.R., and J.A. Moore. 1986. Modeling enteric bacterial die-off: A review. Water Air Soil Pollut. 27:411-439.

Dickson, A.G., and J.P. Riley. 1979. The estimation of acid dissociation constants in seawater media from potentiometric titrations with strong base; I. The ionic product of water-K_w. Mar. Chem. 7:89-99.

Elliot, E.L., and R.R. Colwell. 1985. Indicator organisms for estuarine and marine waters. FEMS Microbiol. Rev. 32:61-79.

Feiler, H. 1980. Fate of priority pollutants in publicly owned treatment works. Interim report. EPA-440/1-80/301. U.S. Environmental Protection Agency, Washington, DC.

Fischer, H.B., E.J. List, R.C.Y. Koh, J. Imberger, and N.H. Brooks. 1979. Mixing in inland and coastal waters. Academic Press, New York, NY.

Grace, R. 1978. Marine outfall systems planning, design, and construction. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Koh, R.C.Y. 1973. Hydraulic test of discharge ports. Technical Memorandum 73-4. California Institute of Technology, W.M. Keck Laboratory of Hydraulics and Water Resources, Pasadena, CA.

McCain, B.B., et al. 1992. Chemical contamination and associated fish diseases in San Diego Bay. Environ. Sci. Technol. 26: 725.

McDermott, D.J., G.V. Alexander, D.R. Young, and A.J. Mearns. 1976. Metal contamination of flatfish around a large submarine outfall. J. Water Pollut. Control Fed. 48:1913-1918.

McDermott-Ehrlich, D.J., M.J. Sherwood, T.C. Heesen, D.R. Young, and A.J. Mearns. 1977. Chlorinated hydrocarbons in Dover sole, Microstomus pacificus: Local migrations and fin erosion. Fish. Bull. 75:513-517.

McDermott-Ehrlich, D.J., D.R. Young, and T.C. Heesen. 1978. DDT and PCB in flatfish around southern California municipal outfalls. Chemosphere 6:453-461.

McLean et al. 1992. Effects of three primary treatment sewage outfalls on metal concentrations in the fish *Cheilodactylus fuscus* collected along the coast of Sydney, Australia. *Mar. Pollut. Bull.* (G.B.) 22: 134.

Mearns, A.J., and M. Sherwood. 1974. Environmental aspects of fin erosion and tumors in southern California Dover sole. Trans. Amer. Fish. Soc. 103:799-810.

Metcalf and Eddy. 1979. Wastewater engineering: Treatment/disposal/reuse. McGraw-Hill Book Company, New York, NY.

Muellenhoff, W.P., A.M. Soldate, Jr., D.J. Baumgartner, M.D. Schuldt, L.R. Davis, and W.E. Frick. 1985a. Initial mixing characteristics of municipal ocean discharges. Vol. I. Procedures and applications. EPA-600/3-85-073a. U.S. Environmental Protection Agency, Narragansett, RI.

Muellenhoff, W.P., A.M. Soldate, Jr., D.J. Baumgartner, M.D. Schuldt, L.R. Davis, and W.E. Frick. 1985b. Initial mixing characteristics of municipal ocean discharges. Vol. II. Computer programs. EPA-600/3-85-073b. U.S. Environmental Protection Agency, Narragansett, RI.

National Ocean Survey. 1987. Index of pollutant-induced fish and shellfish disease. National Oceanic and Atmospheric Administration, National Ocean Survey, Rockville, MD.

National Ocean Survey. 1988b. Tidal current tables 1988, Pacific Coast of North America and Asia. National Oceanic and Atmospheric Administration, National Ocean Survey, Washington, DC.

National Ocean Survey. 1991. The 1990 national shellfish register of classified estuarine waters. National Oceanic and Atmospheric Administration, National Ocean Survey, Rockville, MD.

National Research Council. 1989. Contaminated marine sediments—Assessment and remediation. National Research Council, Commission on Engineering and Technical Systems. National Academy Press, Washington, DC.

NOAA. 1988. Federal plan for ocean pollution research, development, and monitoring: Fiscal years 1988-1992. National Oceanic and Atmospheric Administration, National Ocean Pollution Program Office, Rockville, MD.

Office of Technology Assessment. 1987. Wastes in marine environments. U.S. Congress, Office of Technology Assessment. U.S. Government Printing Office, Washington, DC.

Pagenkopf, J.R., G.C. Christodoulou, B.R. Pearce, and J.J. Connor. 1976. A user's manual for "CAFE-2" - a two-layer finite element circulation model. TR No. 220. Massachusetts Institute of Technology, R.M. Parsons Laboratory for Water Resources and Hydrodynamics, Department of Civil Engineering, Cambridge, MA.

Pearson, T.H., and R. Rosenberg. 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Oceanogr. Mar. Biol. Annu. Rev. 16:229-311.

Rand, G.M., and S.R. Petrocelli. 1985. Fundamentals of aquatic toxicology. Hemisphere Publishing Corp., New York, NY.

Sheng, Y.P., and H.L. Butler. 1982. A three-dimensional numerical model of coastal, estuarine, and lake currents. ARO Report 82-3. In Proc. of the 1982 Army Numerical Analysis and Computer Conference.

Spaulding, M.L., and D. Pavish. 1984. A three-dimensional numerical model of particulate transport for coastal waters. Cont. Shelf Res. 3:55-67.

Stumm, W., and J.J. Morgan. 1981. Aquatic chemistry. John Wiley and Sons, Inc., New York.

U.S. EPA. 1980. Water quality criteria documents; availability. U.S. Environmental Protection Agency, Washington, DC. Federal Register Vol. 45, No. 231, pp. 79318-79379.

U.S. EPA. 1982a. Design of 301(h) monitoring programs for municipal wastewater discharges to marine waters. EPA-430/9-82-010. U.S. Environmental Protection Agency, Washington, DC.

U.S. EPA. 1982b. Modifications of secondary treatment requirements for discharges into marine waters; final rule. U.S. Environmental Protection Agency, Washington, DC. Federal Register Vol. 47, No. 228, pp. 53666-53684.

U.S. EPA. 1982c. Revised section 301(h) technical support document. EPA-430/9-82-011. U.S. Environmental Protection Agency, Washington, DC.

U.S. EPA. 1983. Guidance manual for POTW pretreatment program development. U.S. Environmental Protection Agency, Office of Water Enforcement and Permits, Washington, DC.

U.S. EPA. 1985a. Bioaccumulation monitoring guidance: 1. Estimating the potential for bioaccumulation of priority pollutants and 301(h) pesticides discharged into marine and estuarine waters. EPA-430/9-86-005. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1985b. Bioaccumulation monitoring guidance: 2. Selection of target species and review of available bioaccumulation data. 2 vols. EPA 430/9-86-005 (Vol. I) and EPA 430/9-86-006 (Vol. II). U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1985c. Bioaccumulation monitoring guidance: 3. Recommended analytical detection limits. EPA-503/6-90-001. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1985d. Bioaccumulation monitoring guidance: 4. Analytical methods for U.S. EPA priority pollutants and 301(h) pesticides in tissues from estuarine and marine organisms. EPA-503/6-90-002. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1985e. Summary of U.S. EPA-approved methods, standard methods, and other guidance for 301(h) monitoring variables. EPA-503/4-90-002. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1985f. Water quality criteria; availability of documents. U.S. Environmental Protection Agency, Washington, DC. Federal Register Vol. 50, No. 145, pp. 30784-30796.

U.S. EPA. 1985g. Initial mixing characteristics of municipal ocean discharges: Volume 1. Procedures and applications. EPA 430/9-84/073a. U.S. Environmental Protection Agency, Environmental Research Laboratory, Narragansett, RI.

U.S. EPA. 1985h. Technical support document for water quality-based toxics control. EPA 440/4-85-032. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

U.S. EPA. 1986a. Quality criteria for water—1986. EPA-440/5-86-001. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, DC.

U.S. EPA. 1986b. Training manual for NPDES permit writers. U.S. Environmental Protection Agency, Office of Water Enforcement and Permits, Washington, DC.

U.S. EPA. 1986c. Analytical methods for U.S. EPA priority pollutants and 301(h) pesticides in estuarine and marine sediments. EPA 503/6-90-004. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1986d. 301(h) Permit reissuance guidance document for small dischargers. EPA-503/9-90-008. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Washington, DC.

U.S. EPA. 1987a. Evaluation of survey positioning methods for nearshore and estuarine waters. EPA-430/9-86-003. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1987b. Guidance for conducting fish liver pathology studies during 301(h) monitoring. EPA-430/9-87-004. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1987c. Quality assurance and quality control (QA/QC) procedures for 301(h) monitoring programs: Guidance on field and laboratory methods. EPA-430/9-86-004. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1987d. Bioaccumulation monitoring guidance: 5. Strategies for sample replication and compositing. EPA-430/9-87-003. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1987e. Framework for 301(h) monitoring programs. EPA-430/09-88-002. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1987f. Recommended biological indices for 301(h) monitoring programs. EPA-430/9-86-004. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection, Marine Operations Division, Washington, DC.

U.S. EPA. 1987g. Update No. 2 to quality criteria for water - 1986. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, DC. (1 May 1987).

U.S. EPA. 1987h. Guidance on the development and implementation of local discharge limitations under the pretreatment program. U.S. Environmental Protection Agency, Office of Water Enforcement and Permits, Washington, DC.

U.S. EPA. 1989a. Assessing human health risks from chemically contaminated fish and shellfish: A guidance manual. EPA-503/8-89-002. U.S. Environmental Protection Agency, Office of Marine and Estuarine Protection and Office of Water Regulations and Standards, Washington, DC.

U.S. EPA. 1989b. POTW sludge sampling and analysis guidance document. U.S. Environmental Protection Agency, Office of Water Enforcement and Permits, Washington, DC.

U.S. EPA. 1991a. Supplemental manual on the development and implementation of local discharge limitations under the pretreatment program—Residential and commercial toxic pollutant loadings and POTW removal efficiency estimation. U.S. Environmental Protection Agency, Office of Wastewater and Compliance, Washington, DC.

U.S. EPA. 1991b. Technical support document for water quality-based toxics control. EPA-505/2-90-001. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, Washington, DC.

U.S. EPA. 1992a. Monitoring guidance for the National Estuary Program. EPA 842-B-92-004. U.S. Environmental Protection Agency, Office of Wetlands, Ocean and Watersheds, Oceans and Coastal Protection Division, Washington, DC.

U.S. EPA. 1992b. Sediment classification methods compendium. EPA 823-R-006. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Wang, J.D., and J.J. Connor. 1975. Mathematical modeling of near coastal circulation. Report No. 200. Massachusetts Institute of Technology, R.M. Parsons Laboratory for Water Resources and Hydrodynamics, Cambridge, MA.

Waterman, B. and H. Kranz. 1992. Pollution and fish diseases in the North Sea: Some historical aspects. Mar. Pollut. Bull. (G.B.) 24: 131.

Westerink, J.J., K.D. Stolzenbach, and J.J. Connor. 1985. A frequency domain finite element model for tidal circulation. Report No. 85-006. Massachusetts Institute of Technology, Energy Laboratory, Cambridge, MA.

Word, J.Q. 1978. The infaunal trophic index. In Coastal Water Research Project annual report, ed. W. Bascom, pp. 19-39. Southern California Coastal Water Research Project, El Segundo, CA.

Word, J.Q. 1980. Classification of benthic invertebrates into infaunal trophic index feeding groups. In Coastal Water Research Project, biennial report for the years 1979-1980, ed. W. Bascom, pp.103-121. Southern California Coastal Water Research Project, Long Beach, CA.

Young, D.R., D.J. McDermott, and T.C. Heesen. 1976a. DDT in sediments and organisms around southern California outfalls. J. Water Pollut. Control Fed. 48:1919-1928.

Young, D.R., T.C. Heesen, and D.J. McDermott. 1976b. An offshore biomonitoring system for chlorinated hydrocarbons. Mar. Pollut. Bull. 7:156-159.

Young, D.R., M.D. Moore, G.V. Alexander, T.K. Jan, D. McDermott-Ehrlich, R.P. Eganhouse, and P. Hershelman. 1978. Trace elements in seafood organisms around southern California municipal wastewater outfalls. Publ. No. 60. Southern California Coastal Water Research Project, El Segundo, CA.

APPENDIX A
PHYSICAL ASSESSMENT

PHYSICAL ASSESSMENT

The primary purpose of this appendix is to provide guidance on the calculation of initial dilution and trapping depth. For the purpose of section 301(h) evaluations, "dilution" is defined as the ratio of the total volume of a sample (ambient water plus wastewater) to the volume of wastewater in that sample. A dilution of 100 to 1, therefore, is a mixture composed of 99 parts of ambient water and 1 part of wastewater. The calculation of initial dilution and trapping depth consists of two sets of procedures:

- Calculate the port flow distribution along the outfall diffuser(s) for the total effluent flow rates of importance.

- Compute initial dilution and trapping depth based on a characterization of the computed port flow distribution, the physical characteristics of the outfall diffuser, and the receiving water density and current velocity profiles.

An important variable in both sets of procedures is the total effluent flow rate. Historical data should be used to determine the minimum, average, highest 2- to 3-hour average, and maximum flow rates for dry-weather, wet-weather, and annual average conditions. The adequacy of the diffuser's hydraulic design is dependent on the port flow distribution of the diffuser during minimum and maximum flow. Characteristics of a hydraulically well-designed diffuser are described by Grace (1978). According to Mullenhoff et al. (1985a) the critical (i.e., minimum) initial dilutions must be calculated on the basis of the highest 2- to 3-hour average flow rates. Average flow rates, together with average receiving water current speeds, are commonly used to compute the trapping depth used in effluent suspended solids accumulation predictions.

Port flow distribution along an outfall diffuser is commonly calculated using computer programs based on well-known hydraulic methods (Grace 1978, Fischer et al. 1979). This distribution depends on the total effluent flow rate, the effluent density, the density of seawater at the average diffuser port depth, and the physical specifications of the diffuser. The physical specifications include diffuser pipe diameter, depth, and port diameter and type (i.e., bell-mouth or sharp-edged) for each port in the diffuser. In the event that the risers are used instead of the ports, specifications sufficient to compute the discharge coefficient of the risers must be known. These specifications include the diameter, length, shape, type of transition between the riser pipe and the diffuser pipe, number of ports, and shape and diameter of the ports for each riser. Koh (1973) provides a useful method for computing riser discharge coefficients. (Note, however, that the summary of this method in Fischer et al. (1979) contains errors.) Head loss determinations for contractions, expansions, and bends can be found in standard engineering and hydraulics texts (e.g., Brater and King 1976, Daugherty and Franzini 1977).

The port flow distribution should be computed for the minimum and maximum flows to ensure that the diffuser is hydraulically well-designed (Grace 1978). For any diffuser, there is a minimum flow below which the diffuser is inoperable. For flows lower than the minimum, not all of the ports flow fully and the port flows from the diffuser can behave erratically (Grace 1978). On a sloping bottom, the minimum operational flow usually increases with increasing bottom slope. Port flows along the diffuser may be very uneven on a sloping bottom, even for flows above the minimum operational flow. The hydraulic behavior of the diffuser should also be checked to investigate whether the port flows vary greatly at maximum flows.

Initial dilution computations are usually not performed for each port individually, but rather on groups of ports within which the port flows are relatively uniform. The initial dilution and trapping depth for each group of ports are then computed based on the average port flow and port depth within the group. The group initial dilutions and trapping depths can then be flow-rate-averaged as a group to obtain estimates of the average initial dilution and trapping depth for the diffuser for a specific total effluent flow rate and set of receiving water conditions. A common choice for a group is a diffuser pipe section, within which the diffuser pipe diameter and the diffuser port (riser) specifications are constant.

Initial dilution is the flux-averaged dilution achieved during the period when dilution is primarily a result of plume entrainment. It is averaged over the cross-sectional area of the plume and characterized by a time scale on the order of minutes. With proper location and design, marine outfalls can achieve initial dilution values of about 100 to 1 or better before the plume begins a transition from an essentially vertical flow to an essentially horizontal flow dominated by ambient oceanographic conditions.

Adequate initial dilution is necessary to ensure compliance with water quality standards. The following factors influence the degree of initial dilution that will be achieved:

- Discharge depth;
- Flow rates;
- Density of effluent;
- Density gradients in the receiving water;

- Ambient current speed and direction;

- Diffuser characteristics:

  - Port sizes,

  - Port spacing,

  - Port orientation, and

  - Port depth.

Because initial dilution calculations can be strongly dependent on the vertical gradient of ambient density, larger applicants should evaluate a substantial amount of data from both the discharge site and nearby areas that have similar environmental conditions before selecting a worst-case density profile (i.e., the profile producing the lowest initial dilution). Often the worst-case profiles are not the most stratified, but rather are those having sufficiently steep density gradients some distance [on the order of 5 m (16 ft)] above a diffuser port. These profiles can usually be identified only by computing initial dilutions for several or all of the available density profiles. Because ambient currents may affect the initial dilution achieved, a modest amount of current (the lowest 10 percentile) can be used when predicting initial dilution for use in determining compliance with applicable water quality standards and criteria.

Five numerical mathematical models to calculate initial dilution are available from EPA (Muellenhoff et al. 1985a, 1985b). Characteristics of these models are summarized below and in Table A-1:

- UPLUME - Analyzes a single, positively buoyant plume in an arbitrarily stratified stagnant environment.

- UOUTPLM - Analyzes a single, positively buoyant plume in an arbitrarily stratified flowing environment.

- UDKHDEN - Analyzes a multiport, positively buoyant plume in a linearly stratified flowing receiving water.

TABLE A-1. SUMMARY OF PLUME MODEL CHARACTERISTICS

Model Name	Current Speed	Current Direction Θ[a]	Port Type	Density Profile Type
UPLUME	No		Single	Arbitrary
UOUTPLM	Yes	90°	Single	Arbitrary
UDKHPLM	Yes	$45° < \Theta < 135°$	Multiple	Arbitrary
UMERGE	Yes	90°	Multiple	Arbitrary
ULINE	Yes	$0 \leq \Theta \leq 180°$	Line	Arbitrary

Source: From Table 1 of Muellenhoff et al. (1985a).
[a]A current flowing perpendicular to the diffuser axis has current direction $\Theta = 90°$. The widest range of possible angles is 0 to 180°.

- UMERGE - Analyzes either positively or negatively buoyant discharges. Analyzes a plume element through the history of its trajectory and dilution, accounting for the effects of adjacent plume interference in a receiving water with arbitrary vertical density and current variation.

- ULINE - Treats discharges as a line source accounting for adjacent plume interference. Can analyze positively buoyant discharges in an arbitrarily stratified receiving water with a current flowing parallel or perpendicular to the diffuser.

In situ observations may also be used to determine initial dilution. However, if *in situ* observations are used, the applicant should demonstrate that they represent the lowest dilutions in center sections of the effluent wastefield, not merely a typical dilution.

Other mathematical methods available in the published literature can be adapted for estimating initial dilution. The following references describe several of these methods: Abraham (1963, 1971); Baumgartner and Trent (1970); Baumgartner et al. (1971); Briggs (1969); Brocard (1985); Brooks (1973); Cederwall (1971); Davis (1975); Davis and Shirazi (1978); Fan (1967); Hinwood and Wallis (1985); Hirst (1971a, 1971b); Isaacson et al. (1983); Kannberg and Davis (1976); Koh and Fan (1970); Lee and Cheung (1986); Morton (1959); Morton et al. (1956); Priestley and Ball (1955); Roberts (1979); Roberts et al. (1989a, 1989b, 1989c); Rouse et al. (1952); Sotil (1971); Teeter and Baumgartner (1979); Wallace and Sheff (1987); Winiarski and Frick (1976); and Wright (1982). Only flux-averaged initial dilutions should be used in water quality computations. Other types of initial dilutions, such as centerline and minimum surface, must be converted to flux-averaged. Many of the above investigations provide ways to estimate flux-averaged initial dilutions (see Fischer et al. 1979 for additional guidance).

REFERENCES

Abraham, G. 1963. Jet diffusion in stagnant ambient fluid. Delft Hydraulics Publication No. 29. Delft, Netherlands.

Abraham, G. 1971. The flow of round buoyant jets issuing vertically into ambient fluid flowing in a horizontal direction. Delft Hydraulics Publication No. 81. Delft, Netherlands.

Baumgartner, D.J., and D.S. Trent. 1970. Ocean outfall design: Part I. Literature review and theoretical development. U.S. Department of Interior, Federal Water Quality Administration, Washington, DC.

Baumgartner, D.J., D.S. Trent, and K.V. Byram. 1971. User's guide and documentation for outfall plume model. Working Paper No. 80. U.S. Environmental Protection Agency, Pacific Northwest Water Laboratory, Corvallis, OR.

Brater, E.F., and H.W. King. 1976. Handbook of hydraulics for the solution of hydraulic engineering problems. 6th ed. McGraw-Hill Book Company, New York, NY.

Briggs, G.A. 1969. Plume rise. U.S. Atomic Energy Commission, Oak Ridge, TN.

Brocard, D.N. 1985. Surface buoyant jets in steady and reversing crossflows. ASCE J. Hydraul. Eng. 111:793-809.

Brooks, N.H. 1973. Dispersion in hydrologic and coastal environments. EPA-660/3-73-010. U.S. Environmental Protection Agency, Corvallis, OR.

Cederwall, K. 1971. Buoyant slot jets into stagnant or flowing environment. Report No. KH-R-25. California Institute of Technology, W.M. Keck Laboratory of Hydraulics and Water Resources, Pasadena, CA.

Daugherty, R.L., and J.B. Franzini. 1977. Fluid mechanics with engineering applications. 7th ed. McGraw-Hill Book Company, New York, NY.

Davis, L.R. 1975. Analysis of multiple cell mechanical draft cooling towers. EPA-660/3-75-039. U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR.

Davis, L.R., and M.A. Shirazi. 1978. A review of thermal plume modeling. Keynote address. In Proc. of the Sixth International Heat Transfer Conf., ASME, 6-11 August 1978, Toronto, Canada.

Fan, L.H. 1967. Turbulent buoyant jets into stratified and flowing ambient fluids. Report No. KH-R-15. California Institute of Technology, W.M. Keck Laboratory of Hydraulics and Water Resources, Pasadena, CA.

Fischer, H.B., E.J. List, R.C.Y. Koh, J. Imberger, and N.H. Brooks. 1979. Mixing in inland and coastal waters. Academic Press, New York, NY.

Grace, R. 1978. Marine outfall systems planning, design, and construction. Prentice-Hall, Inc., Englewood Cliffs, NJ.

Hinwood, J.B., and I.G. Wallis. 1985. Initial dilution for outfall parallel to current. ASCE J. Hydraul. Eng. 111:828-845.

Hirst, E.A. 1971a. Analysis of round, turbulent, buoyant jets discharged into flowing stratified ambients. Report No. ORNL-4685. U.S. Atomic Energy Commission, Oak Ridge National Laboratory, Oak Ridge, TN.

Hirst, E.A. 1971b. Analysis of buoyant jets within the zone of flow establishment. Report No. ORNL-TM-3470. U.S. Atomic Energy Commission, Oak Ridge National Laboratory, Oak Ridge, TN.

Isaacson, M.S., R.C.Y. Koh, and N.H. Brooks. 1983. Plume dilution for diffusers with multiport risers. ASCE J. Hydraul. Eng. 109:199-220.

Kannberg, L.D., and L.R. Davis. 1976. An experimental/analytical investigation of deep submerged multiple buoyant jets. EPA-600/3-76-001. U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR.

Koh, R.C.Y. 1973. Hydraulic test of discharge ports. Technical Memorandum 73-4. California Institute of Technology, W.M. Keck Laboratory of Hydraulics and Water Resources, Pasadena, CA.

Koh, R.C., and L.N. Fan. 1970. Mathematical models for the prediction of temperature distribution resulting from the discharge of heated water in large bodies of water. Water Poll. Cont. Res. Series Rep. 1613 ODWO/70. U.S. Environmental Protection Agency.

Lee, J.H.W., and V.W.L. Cheung. 1986. Inclined plane buoyant jet in stratified fluid. ASCE J. Hydraul. Eng. 112:580-589.

Morton, B.R. 1959. Forced plumes. J. Fluid Mech. 5:151-163.

Morton, B.R., G.I. Taylor, and J.S. Turner. 1956. Turbulent gravitational convection from maintained and instantaneous sources. Proc. of the Royal Society of London, Vol. A234, pp. 1-23.

Muellenhoff, W.P., A.M. Soldate, Jr., D.J. Baumgartner, M.D. Schuldt, L.R. Davis, and W.E. Frick. 1985a. Initial mixing characteristics of municipal ocean discharges. Vol. I. Procedures and applications. EPA-600/3-85-073a. U.S. Environmental Protection Agency, Narragansett, RI.

Muellenhoff, W.P., A.M. Soldate, Jr., D.J. Baumgartner, M.D. Schuldt, L.R. Davis, and W.E. Frick. 1985b. Initial mixing characteristics of municipal ocean discharges. Vol. II. Computer programs. EPA-600/3-85-073b. U.S. Environmental Protection Agency, Narragansett, RI.

Priestley, C.H.B., and F.K. Ball. 1955. Continuous convection from an isolated source of heat. Quarterly J. Royal Meteor. Soc. 81:144-157.

Roberts, P.J.W. 1979. A mathematical model of initial dilution for deepwater ocean outfalls. In Proceedings of a Specialty Conference on Conservation and Utilization of Water and Energy Resources, pp. 218-225. American Society of Civil Engineers.

Roberts, P.J.W., W.H. Snyder, and D.J. Baumgartner. 1989a. Ocean outfalls. I: Submerged wastefield formation. ASCE J. Hydraul. Eng. 115:1-25.

Roberts, P.J.W., W.H. Snyder, and D.J. Baumgartner. 1989b. Ocean outfalls. II: Spatial evolution of submerged wastefield. ASCE J. Hydraul. Eng. 115:26-48.

Roberts, P.J.W., W.H. Snyder, and D.J. Baumgartner. 1989c. Ocean outfalls. III: Effect of diffuser design on submerged wastefield. ASCE J. Hydraul. Eng. 115:49-70.

Rouse, H., C.S. Yih, and W.G. Humphreys. 1952. Gravitational convection from a boundary source. Tellus 4:201-210.

Sotil, C.A. 1971. Computer program for slot buoyant jets into stratified ambient environments. Tech. Memo 71-2. California Institute of Technology, W.M. Keck Laboratory of Hydraulics and Water Resources, Pasadena, CA.

Teeter, A.M., and D.J. Baumgartner. 1979. Predictions of initial dilution for municipal ocean discharges. Environmental Research Laboratory Pub. No. 043. U.S. Environmental Protection Agency, Corvallis, OR.

Wallace, R.B., and B.B. Sheff. 1987. Two-dimensional buoyant jets in a two-layer ambient fluid. ASCE J. Hydraul. Eng. 113:992-1005.

Winiarski, L.D., and W.E. Frick. 1976. Cooling tower plume model. EPA-600/3-76-100. U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR.

Wright, S.J. 1982. Outfall diffuser behavior in stratified ambient fluid. ASCE J. Hydraul. Eng. 108:483-489.

APPENDIX B
WATER QUALITY ASSESSMENT

CONTENTS

FIGURES

Number | Page

AGA 2337

TABLES

INTRODUCTION

This appendix provides detailed guidance for responding to water quality-related questions in the Applicant Questionnaire. Methods for predicting values of the following water quality variables are presented:

- Suspended solids deposition;
- Dissolved oxygen concentration following initial dilution;
- Farfield dissolved oxygen depression;
- Sediment oxygen demand;
- Suspended solids concentration following initial dilution;
- Effluent pH after initial dilution;
- Light transmittance; and
- Other water quality variables.

B-I. SUSPENDED SOLIDS DEPOSITION

The applicant must predict the seabed accumulation due to the discharge of suspended solids into the receiving water. Two prediction methods are described in this appendix. The first is a simplified approach for small dischargers only. If this method is applicable, then a small discharger need not perform dissolved oxygen calculations dependent on settled effluent suspended solids accumulations. The second prediction method is applicable for both small and large dischargers.

SMALL DISCHARGER APPROACH

Two types of problems (dissolved oxygen depletion and biological effects) and two types of receiving water environments (open coastal and semi-enclosed bays or estuaries) are considered in the following approach.

Figure B-1 is to be used for open coastal areas that are generally considered well-flushed. The dashed line represents combinations of solids mass emission rates and plume heights-of-rise that would result in a steady-state sediment accumulation of 50 g/m^2. Review of data from several open coast discharges has indicated that biological effects are minimal when accumulation rates are estimated to be below this level. Consequently, if the applicant's mass emission rate and height-of-rise fall below this dashed line, no further sediment accumulation analyses are needed. Applicants whose charge characteristics fall above the line should conduct a more detailed analysis of sediment accumulation, as discussed in the following section.

The solid line in Figure B-1 represents a combination of mass emission rates and plume heights-of-rise that were projected to result in sufficient sediment accumulation to cause a 0.2-mg/L oxygen depression. Applicants whose discharge falls below this solid line need not provide any further analysis of sediment accumulation as it relates to dissolved oxygen.

Figure B-2 should be used in a similar manner for discharges to semi-enclosed embayments or estuaries. Because estuaries and semi-enclosed embayments are potentially more sensitive than open coastal areas, the critical sediment accumulation was set at 25 g/m^2.

Methods described in U.S. EPA (1982a) were used to determine the mass emission rates and heights-of-rise resulting in the sediment accumulation rates specified above. To use these methods, several assumptions were made. A current velocity of 5 cm/sec was assumed for the open coastal sites, and a velocity of 2.5 cm/sec was assumed for the semi-enclosed embayments. These velocities are conservative estimates of average current velocities over a 1-year period.

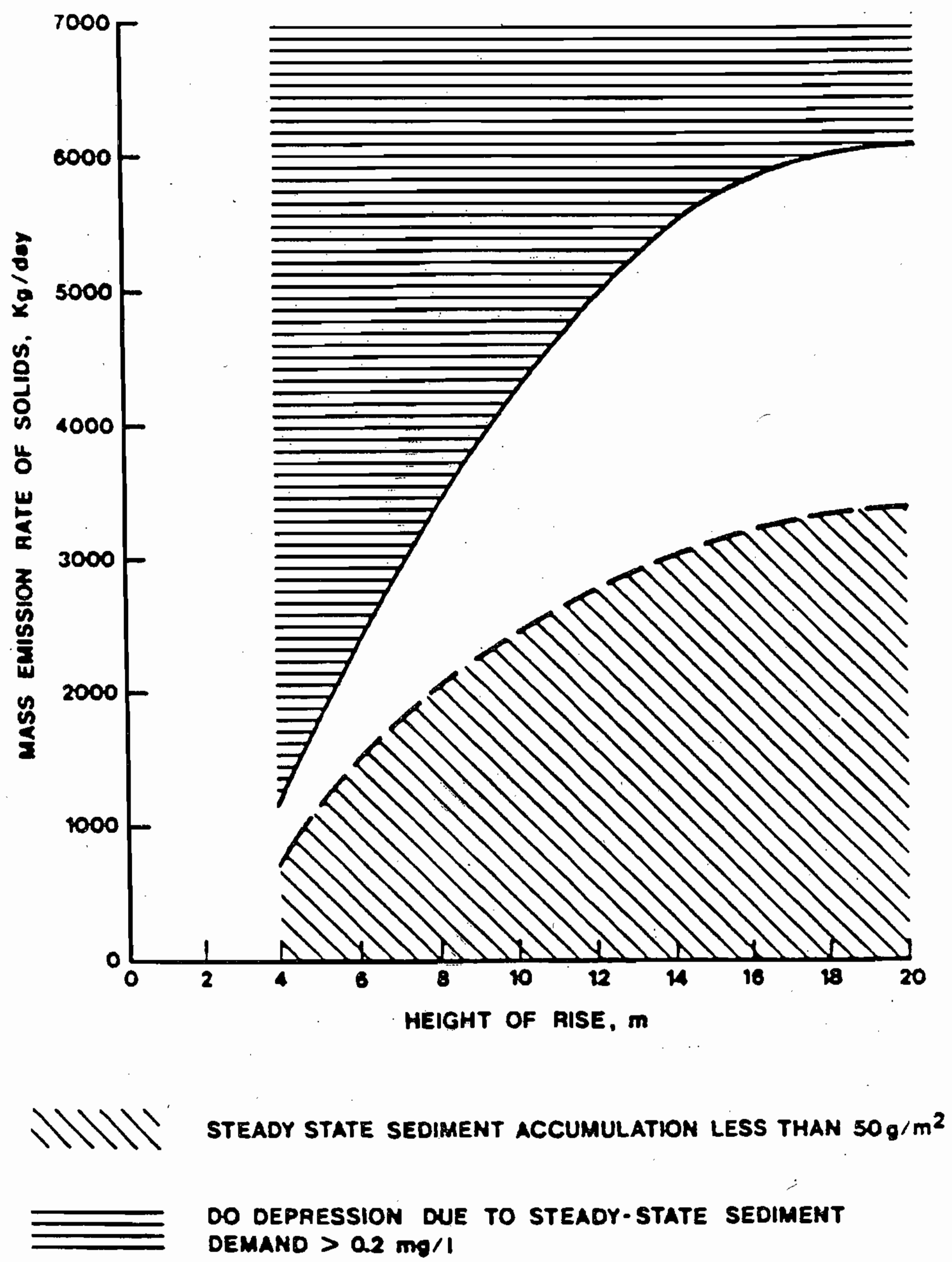


Figure B-1. Projected relationships between suspended solid mass emission, plume height-of-rise, sediment accumulation, and dissolved oxygen depression for open coastal areas (U.S. EPA 1982b).

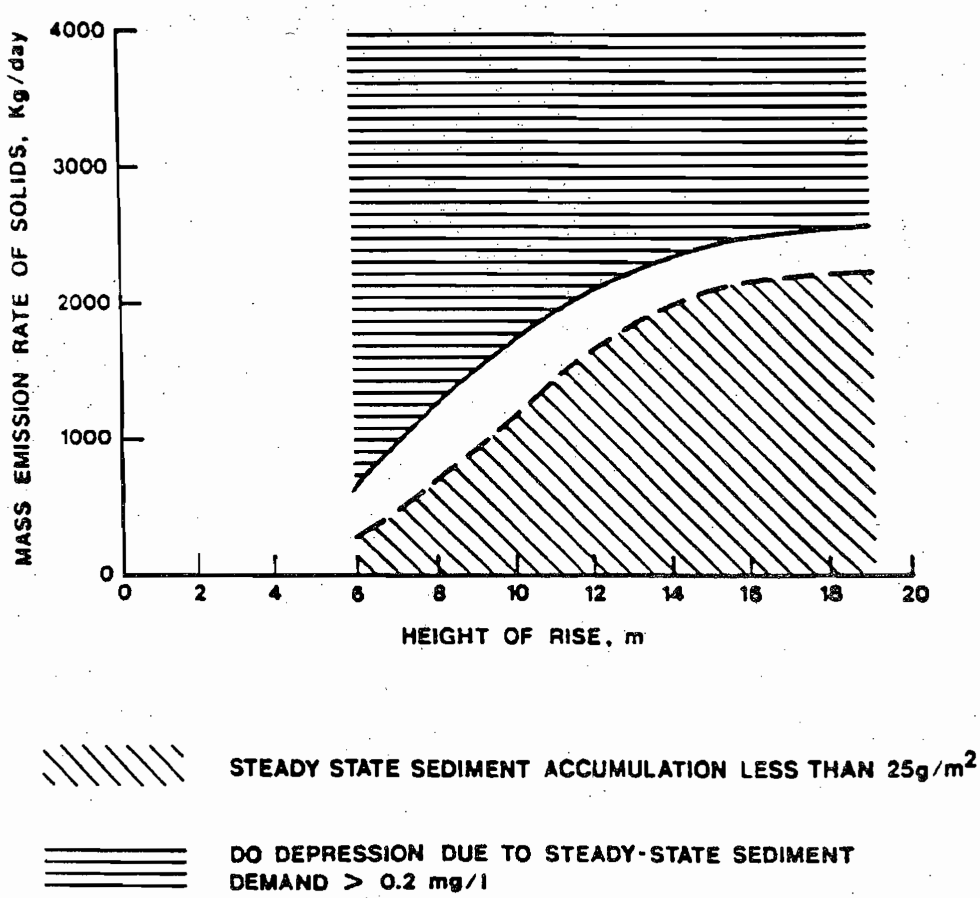


Figure B-2. Projected relationships between suspended solid mass emission, plume height-of-rise, sediment accumulation, and dissolved oxygen depression for semi-enclosed embayments and estuaries (U.S. EPA 1982b).

The settling velocity (V_s) distribution used is considered typical of primary or advanced primary effluents and is shown below:

5 percent have $V_s \geq 0.1$ cm/sec
20 percent have $V_s \leq 0.01$ cm/sec
30 percent have $V_s \geq 0.006$ cm/sec
50 percent have $V_s \geq 0.001$ cm/sec

The remaining solids settle so slowly that they are assumed to remain suspended in the water column indefinitely. The effluent is considered to be 80 percent organic and 20 percent inorganic. The above distribution is based on the review of data in section 301(h) applications and other published data (Myers 1974, Herring and Abati 1978).

The annual suspended solids mass emission rate should be calculated using the average flow rate and an average suspended solids concentration. The plume height-of-rise, determined previously in the initial dilution calculation, or 0.6 times the water depth, whichever is larger, should be used in the appropriate figure (Figure B-1 or B-2).

LARGE DISCHARGER APPROACH

The approach described here considers the processes of sediment deposition, decay of organic materials, and resuspension. However, the strictly quantitative prediction of seabed accumulation is based only on the processes of deposition and decay. Because resuspension is not evaluated easily using simplified approaches, the analyses described in this chapter consider resuspension separately and in a more qualitative manner that is based on measured near-bottom current speeds in the vicinity of the diffuser.

Data Requirements

To predict seabed deposition rates of suspended solids, the following information is required:

- Suspended solids mass emission rate;
- Current speed and direction;
- Height-of-rise of the plume; and

- Suspended solids settling velocity distribution.

The mass emission rate, M (kg/day), is:

$$M = 86.4(S) \qquad \text{B-1}$$

where:

S = Suspended solids concentration, mg/L
Q = Volumetric flow rate, m^3/sec.

It is suggested that the applicant develop estimates of the suspended solids mass emission rate for the season (90-day period) critical for seabed deposition and for a yearly period. If the applicant anticipates that the mass emission rate will increase during the permit term, the mass emission rate at the end of the permit term should be used.

Current-speed data are needed to determine the distance from the outfall that the sediments will travel before accumulating on the bottom. Consequently, depth-averaged values are best, if available. Otherwise, current speeds near mid-depth may be sufficient. The following current data are needed for the assessment:

- Average value upcoast, when the current is upcoast;
- Average value downcoast, when the current is downcoast;
- Average value onshore, when the current is onshore; and
- Average value offshore, when the current is offshore.

If no current data are available, values of 5 cm/sec for longshore transport and 3 cm/sec for onshore-offshore transport have been found to be reasonable.

Plume-trapping levels representative of both the critical 90-day period and the annual cycle are needed. The applicant should use density profiles, effluent volumetric flow rates, and ambient currents characteristic of these time periods. Extreme values should not be used. Usually the annual average and critical 90-day average flow rates and current speeds (in the predominant current direction) should be used. The expected average plume heights-of-rise above the seafloor should be determined using available receiving water density profiles. If large numbers of profiles exist for each month (or oceanographic season), then the applicant can compute the plume height-of-rise above the seafloor for each of the available profiles and then average the heights. If relatively few profiles are available for each month, then the applicant can compute the plume height of rise for each profile and substitute the lowest height-of-rise as the average. The monthly average heights-of-rise can then be used to compute the average height-of-rise for annual and critical 90-day periods. If so few profiles exist that it is not possible to determine whether differences exist between months (or oceanographic seasons), then the applicant should substitute the lowest plume height-of-rise (based on calculations using the average effluent flow and current speed) as the average height-of-rise for both the annual and critical 90-day periods.

If the applicant has not determined a suspended solids settling velocity distribution, the following can be used based on [data from other section 301(h) applications]:

Primary or Advanced Primary Effluent	Raw Sewage
5 percent have $V_s \geq 0.1$ cm/sec	5 percent have $V_s \geq 1.0$ cm/sec
20 percent have $V_s \geq 0.01$ cm/sec	20 percent have $V_s \geq 0.5$ cm/sec
30 percent have $V_s \geq 0.006$ cm/sec	40 percent have $V_s \geq 0.1$ cm/sec
50 percent have $V_s \geq 0.001$ cm/sec	60 percent have $V_s \geq 0.01$ cm/sec
	85 percent have $V_s \geq 0.001$ cm/sec.

The remaining solids settle so slowly that they are assumed to remain suspended in the water column indefinitely (i.e., they act as colloids). Consequently, 50 percent of the suspended solids in a treated effluent and 85 percent of those in a raw sewage discharge are assumed to be settleable in the ambient environment.

Prediction of Deposition

Although a portion of the settled solids is inert, the organic fraction of the settled solids is a primary concern. For purposes of this evaluation, composition of the waste discharge can be assumed to be as follows:

- 80 percent organic and 20 percent inorganic for primary or advanced primary effluent or
- 50 percent organic and 50 percent inorganic for raw sewage.

Accumulation of solids should be predicted for the critical 90-day period when seabed deposition is likely to be highest and for steady-state conditions where average annual values are used. The results should be presented in graphical form, as shown in Figure B-3. Supporting tables should be submitted with the application. The applicant must exercise judgment when developing the contours, especially when accounting for rapid depth changes offshore. Sediment contours should be expressed in units of g/m^2, not as an accumulation depth.

An applicant may use a proprietary or publicly available sedimentation model. Two widely known models are that of Hendricks (1987), which has been used extensively offshore of Palos Verdes Peninsula in the Southern California Bight, and that of Farley (U.S. EPA 1987), which describes the Ocean Data Evaluation System (ODES) model DECAL. The model DECAL is publicly available through EPA. A simple model is described herein. It can be used to obtain estimates of sediment accumulation in a variety of environments. If its use predicts sediment accumulations that lead to violations of state standards or federal criteria for receiving water quality, an applicant may opt to try a more sophisticated effluent sediment accumulation model that better simulates the marine environment.

The method described below assumes that effluent sediment particles having a specific particle fall velocity settle uniformly within an elliptical area. This area depends on the plume height-of-rise relative to the seafloor (not the port depth), the particle fall velocity, and the average current speeds in four directions (upcoast, downcoast, onshore, and offshore) appropriate for an effluent wastefield at the plume height-of-rise. For the following sample calculations, the diffuser was assumed to have a single point of discharge. Use of this assumption may not produce reasonable estimates of sediment accumulation if the diffuser is long. If the diffuser is long, then estimates of the sediment accumulation from each diffuser port can be summed to obtain an estimate for the entire diffuser. This sum is approximately the same as that obtained from assuming that the sediment accumulation area is a ZID-like area (with ends the same as the similar elliptical halves computed for a single point discharge) and that the effluent suspended solids having the specific particle fall velocity uniformly settle in this area. The sediment accumulation due to the entire discharge is the sum of the accumulations for each particle fall velocity modeled.

To begin computations for a discharge at a single point of discharge, the applicant can create a table similar to Table B-1, showing the amount of organic solids that settle within each settling velocity group and the maximum distance from the outfall at which each group settles. If the applicant has current data for more than four quadrants, those data can be used. The maximum settling distances for each group in each direction are calculated using the formula shown in the footnote of Table B-1.

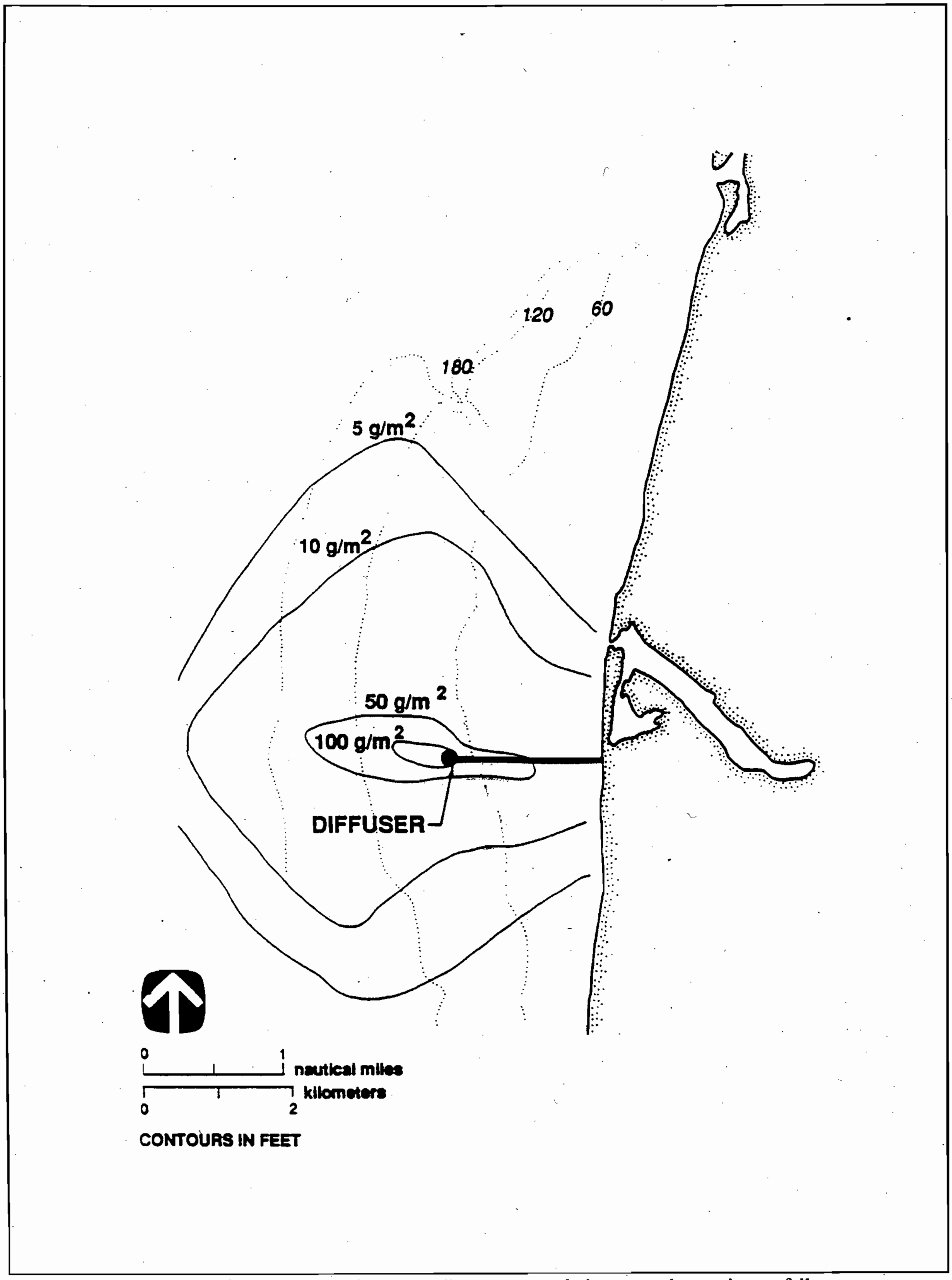


Figure B-3. Examples of predicted steady-state sediment accumulation around a marine outfall.

AGA 2347

TABLE B-1. EXAMPLE TABULATIONS OF SETTLEABLE ORGANIC COMPONENTS BY GROUP AND MAXIMUM SETTLING DISTANCE BY GROUP

Mass Emission Rate = M_T

Organic Component = M_O = $\begin{cases} 0.8\ M_T \text{ for primary effluent} \\ 0.5\ M_T \text{ for raw effluent} \end{cases}$

Percent by Settling Velocity Group	Organic Component by Group	Maximum Settling Distance from Outfall[a]			
		Upcoast	Downcoast	Onshore	Offshore
Primary Effluent					
5 (V_s = 0.1 cm/sec)	0.04 M_T	D_1	D_2	D_3	D_4
15 (V_s = 0.01 cm/sec)	0.12 M_T	D_5	D_6	D_7	D_8
10 (V_s = 0.006 cm/sec)	0.08 M_T	D_9	D_{10}	D_{11}	D_{12}
20 (V_s = 0.001 cm/sec)	0.16 M_T	D_{13}	D_{14}	D_{15}	D_{16}
	Sum = 0.40 M_T				
Raw Sewage					
10 (V_s = 1.0 cm/sec)	0.05 M_T	R_1	R_2	R_3	R_4
10 (V_s = 0.5 cm/sec)	0.05 M_T	R_5	R_6	R_7	R_8
20 (V_s = 0.1 cm/sec)	0.10 M_T	R_9	R_{10}	R_{11}	R_{12}
20 (V_s = 0.01 cm/sec)	0.10 M_T	R_{13}	R_{14}	R_{15}	R_{16}
25 (V_s = 0.001 cm/sec)	0.125 M_T	R_{17}	R_{18}	R_{19}	R_{20}
	Sum = 0.425 M_T				

[a] The distance D (or R) is calculated as: ***D (or R)*** =

where:

V_a = Ambient velocity = 5 cm/sec upcoast and downcoast (default) and 3 cm/sec onshore and offshore (default)

H_T = Average trapping level of plume, measured above bottom

V_s = Appropriate settling velocity by group for primary or raw discharges

If the bottom slope is 5 percent or greater, D (or R) should be calculated as follows:

$$D = \frac{H_T}{S + \frac{V_s}{V_a}}$$

where:

S = Slope, m/m, positive if onshore, negative if offshore.

With a sufficiently detailed map (e.g., a NOAA bathymetric chart), each point D_1 through D_{16}, or R_1 through R_{20}, can be plotted with the center of the diffuser as the reference point. Depositional contours are formed by the four points that define the perimeter of a depositional field (e.g., D_1, D_2, D_3, and D_4). The applicant should join these points by smooth lines so that the contours are elliptically shaped. If the applicant has current data at 60° or 30° intervals, instead of the 90° intervals used here, then the contours can be created more accurately.

The deposition rates corresponding to each contour are determined as follows. First, the deposition rate within each contour due to each individual settling velocity group is predicted, as shown in Table B-2. This quantity is M_i/A_i, or the group deposition rate divided by the area within the contour. The area within any contour is a function of the four points (e.g., D_1, D_2, D_3, and D_4) and is denoted in the table by $f(D_1D_2D_3D_4)$. A planimeter is probably the most accurate method of finding the area. Once the deposition rates by group have been found, the total deposition rate can be calculated by summing all contributing deposition rates. For example, the innermost contour receives contributions from all groups, while the outermost contour receives a contribution from only one group.

So far, only the rates of organic deposition (in units of $g/m^2/yr$) have been predicted. The accumulation of the organic material (S_i) can be predicted by including decay as follows:

$$S_i\ (g/m^2) = \frac{f_i}{k_d},\ \textit{at steady state} \qquad \text{B-2}$$

$$S_i\ (g/m^2) = \frac{f_i}{k_d}\left[1 - \exp\left(-90\ k_d\right)\right],\ \textit{for 90 days}$$

The f_i are the deposition rates in units of $g/m^2/day$, as contrasted to the units of $g/m^2/yr$ in Table B-2. The decay rate constant, k_d, has a typical value of 0.01/day. For example, if the organic deposition rate for annual conditions is 100 $g/m^2/yr$, the steady-state accumulation is:

$$100\ g/m^2/yr \times \frac{1\ yr}{365\ days} \times \frac{1}{0.01/day} = 27\ g/m^2 \qquad \text{B-3}$$

If the organic deposition rate for the critical 90-day period is 300 $g/m^2/yr$, the 90-day accumulation is:

TABLE B-2. EXAMPLE TABULATIONS OF DEPOSITION RATES AND ACCUMULATION RATES BY CONTOUR

Organic Mass Component by Group	Bottom Area	Mass Deposition Rate, by Group	Total Organic Deposition Rate Within Area ($g/m^2/yr$)	Accumulation (g/m^2)	
				Steady-State	90-Day
Primary Effluent					
$0.04\ M_T = M_1$	$A_1 = f(D_1D_2D_3D_4)$	N_1/A_1	$N_1/A_1+N_2/A_2+N_3/A_3+N_4/A_4 = f_1$	$\frac{f_i}{k_d}$	$\frac{f_i}{k_d}[1 - \exp(-90k_d)]$
$0.12\ M_T = M_2$	$A_2 = f(D_5D_6D_7D_8)$	N_2/A_2	$N_2/A_2+N_3/A_3+N_4/A_4 = f_2$		
$0.08\ M_T = M_3$	$A_3 = f(D_9D_{10}D_{11}D_{12})$	N_3/A_3	$N_3/A_3+N_4/A_4 = f_3$		
$0.16\ M_T = M_4$	$A_4 = f(D_{13}D_{14}D_{15}D_{16})$	N_4/A_4	$N_4/A_4 = f_4$		
Raw Sewage					
$0.05\ M_T = M_1$	$A_1 = f(R_1R_2R_3R_4)$	N_1/A_1	$N_1/A_1+N_2/A_2+N_3/A_3+N_4/A_4+N_5/A_5 = f_1$	$\frac{f_i}{k_d}$	$\frac{f_i}{k_d}[1 - \exp(-90k_d)]$
$0.05\ M_T = M_2$	$A_2 = f(R_5R_6R_7R_8)$	N_2/A_2	$N_2/A_2+N_3/A_3+N_4/A_4+N_5/A_5 = f_2$		
$0.10\ M_T = M_3$	$A_3 = f(R_9R_{10}R_{11}R_{12})$	N_3/A_3	$N_3/A_3+N_4/A_4+N_5/A_5 = f_3$		
$0.10\ M_T = M_4$	$A_4 = f(R_{13}R_{14}R_{15}R_{16})$	N_4/A_4	$N_4/A_4+N_5/A_5 = f_4$		
$0.125\ M_T = M_5$	$A_5 = f(R_{17}R_{18}R_{19}R_{20})$	N_5/A_5	$N_5/A_5 = f_5$		

Note: Units of f_i are $g/m^2/day$.