BASIS AND BACKGROUND FOR THE 1992 PROPOSED REVISIONS TO THE SURFACE WATER QUALITY STANDARDS

State of New Jersey
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I. INTRODUCTION

A. 1989 TRIENNIAL REVIEW

The New Jersey Department of Environmental Protection and Energy (NJDEPE or Department) began working on its last triennial review of the Surface Water Quality Standards (SWQS), N.J.A.C. 7:9-4.1 et seq., in 1987. On July 18, 1988 the Department proposed revisions to the SWQS proposal which were published in the New Jersey Register at 20 N.J.R. 1597(a). Seventeen chemicals covered by the Safe Drinking Water Act at N.J.S.A. 58:12A-13a were evaluated in the preparation of the 1988 proposal. No criterion was proposed for one of the 17 toxic chemicals (1,4-dichlorobenzene) because the carcinogen classification was being changed by the USEPA. For two of the remaining 16 chemicals (chlordane and polychlorinated biphenyls (PCBs)), it was determined that the New Jersey aquatic protection criteria already in place should be retained because they were more stringent than the health-based criteria developed under the State Safe Drinking Water Act. Accordingly, 14 new ambient water quality criteria were included in the July 18, 1988 proposal. During the public comment period for the proposed revisions, a large number of comments sharply critical of the criteria proposed for N.J.A.C. 7:9-4.14(c) were received.

The comments fell into two general categories. The first dealt with the appropriateness of proposing criteria that incorporated economic and technological factors. The second dealt with the proposal of criteria that were based on considerations relevant to finished drinking water in public water supplies. Comments were also received on the absence of proposed aquatic life-based criteria for these chemicals and the failure of the Department to propose a lower criterion for lead despite new concerns of the United States Environmental Protection Agency (USEPA) on the health effects of that metal. The Department decided to reevaluate the criteria because of the critical comments received. As a result, the proposed criteria were not part of the SWQS revisions adopted in 1989.

B. COMPLETION OF 1989 TRIENNIAL REVIEW

Section 304(a)(1) of the Federal Clean Water Act (CWA) requires the USEPA to develop and publish water quality criteria. The USEPA has published criteria for a number of the pollutants listed pursuant to Section 307(a)(1) of the CWA, as well as for other toxic substances, based on available toxicological information on the pollutants (USEPA, 1976, 1980a, 1986a and b, 1987a and b, 1988a and b).

Section 303(c)(2)(B) of the CWA, as amended by the Water Quality Act of 1987, requires the states to adopt numeric criteria to protect the uses of their waters for all toxic pollutants listed pursuant to Section 307(a)(1) for which criteria have been published pursuant to Section 304(a)(1), and which are present or could reasonably be expected to be present at levels which would impair the uses. The USEPA identified three options the states could follow to satisfy the requirements of the CWA (USEPA, 1988c). Option 1 was for the states to adopt the Section 304(a) criteria. Option 2 was for the states to adopt specific criteria as needed. Option 3 was for the states to adopt a narrative water quality standard provision prohibiting toxicity in receiving waters and an approved translator mechanism to derive numeric criteria. New Jersey decided to comply by a combination of Options 1 & 2. Thus, some chemical-specific numerical criteria were adopted into the standards while the USEPA 304(a) criteria were adopted by reference for the rest of the chemicals.

The SWQS adopted in 1989 were submitted to the USEPA for review and approval. To date the USEPA has not issued its approval, in part, because chemical-specific numerical criteria for additional chemicals of concern were not included. A draft proposal was completed and circulated for internal review during the last quarter of 1990. Based on comments received, the draft proposal underwent revisions and was circulated for final departmental review in May of 1991. On November 19, 1991, while this final review was being completed, the USEPA proposed ambient chemical-specific numerical water quality criteria (USEPA, 1991a) for states and territories, including New Jersey, which the USEPA considered to be out of compliance with the requirements of Section 303(c)(2)(B) of the CWA. New Jersey believes that the USEPA's conclusion that the state is not in compliance with Section 303(c)(2)(B) of the CWA is incorrect. New Jersey's SWQS contain a provision which states:

> The Department shall utilize the parameter specific criteria contained in N.J.A.C. 7:9-4.14 in the development of chemical specific water quality based effluent limitations for point source discharges. Whenever parameter specific criteria have not been adopted, the Department will utilize the best available scientific information in the development of chemical specific water quality based effluent limitations for point source discharges. Ambient criteria published by the United States Environmental Protection Agency pursuant to section 304(a) of the Federal Clean Water Act represent the minimum acceptable best scientific information to be used in the development of water quality based effluent limitations for point source discharges. [N.J.A.C. 7:9-4.6(c)4iii]

This provision satisfies the intent of the 303(c)(2)(B) requirements by incorporating, via reference, the 304(a) criteria into New Jersey's SWQS for substances not already contained in

the SWQS. It should also satisfy the letter of the requirements of the CWA as interpreted by the USEPA through its regulations and guidance.

However, because the USEPA has included New Jersey among the states covered by its November 19, 1991 proposal, New Jersey has revised the SWQS proposal to reflect its review of the USEPA proposal. The Department's current proposal, as summarized in Tables 1 and 6, will satisfy the requirements of Section 303(c)(2)(B), upon adoption. This proposal incorporates chemical-specific numerical criteria into the SWQS for all chemicals for which Section 304(a) criteria have been published by the USEPA including those listed pursuant to Section 307(a)(1).

In addition to the chemical-specific numerical criteria this proposal also recodifies the SWQS as a separate chapter of the New Jersey Administrative Code (N.J.A.C.); incorporates a definition of wetlands and waters of the state; adds a severability clause; modifies the carcinogen policy at N.J.A.C. 7:9-4.5(a)4 to incorporate a risk management approach; changes the use of a single design flow to multiple design flows; changes the aquatic criteria to reflect acute criteria as one-hour average criteria and chronic criteria as four-day average criteria with no frequency of exceedence at or above the applicable design flow; incorporates a policy on compliance schedules; rewrites the policy concerning water quality management planning to eliminate outdated and redundant language; changes selected total metals criteria to total recoverable metals criteria; adopts toxics criteria found in N.J.A.C. 7:9-4.14(d) for the mainstem Delaware River; reclassifies certain waters as Category one; and proposes various other modifications to the surface water classification listings to address inconsistencies, confusing language, and minor errors.

1. Toxic Substances Criteria

Toxic substances in the Department's current proposal represent chemicals which could reasonably be expected to be present in quantities which could impair designated uses. They are comprised of priority pollutants and nonpriority pollutants for which the USEPA has published chemical-specific 304(a)(1) aquatic life or human health-based ambient water quality criteria. The 304(a)(1) human health criteria for toxic substances have been updated for this rulemaking by the Department wherever possible. The aquatic life criteria being proposed, listed in Table 6, are Section 304(a)(1) criteria as published by the USEPA.

The USEPA proposed chemical-specific numerical criteria (USEPA, 1991a) were compared to the NJDEPE chemical-specific numerical criteria initially prepared for this proposal. Where there was a difference of more than 10% between the criteria, the Department carefully reviewed the reasons for the differences before deciding whether to modify the NJDEPE proposal criteria. As the

result of this review some of the NJDEPE criteria were updated and/or revised. (For a detailed discussion see page 75).

Initially, the Department intended to postpone the proposal of human health-based criteria for saline waters until scientific consensus could be reached on saltwater fish consumption rates in New Jersey. However, the USEPA indicated that omission of human health-based saline criteria in the SWQS proposal would constitute noncompliance with Section 303(c)(2)(B) of the CWA (USEPA, 1990a, 1991b) and included human health-based saline water criteria for New Jersey in the November 19, 1991 criteria proposal. The Department decided to develop saline criteria for human health protection using the USEPA recommended fish consumption rate of 6.5 grams per day (USEPA, 1991b). Because of concerns discussed below in Section IIA, the Department planned to propose saline criteria only for toxic substances with bioconcentration factors (BCFs) above 15 L/kg. The USEPA proposal includes saline water quality criteria for toxic substances with BCFs below 15 L/kg. If the USEPA promulgated these criteria and New Jersey did not, compliance schedules and variances for limits based on these criteria could only be authorized by the USEPA through a rulemaking and would not be available from the Department. In order to retain the ability to issue compliance schedules and variances, the Department is proposing the criteria contained in the USEPA criteria proposal (USEPA, 1991a) for toxic substances with BCFs below 15 L/kg. Any of the USEPA proposed criteria for toxic substances with BCFs below 15 L/kg that are not adopted by the USEPA, will not be included in the Department's adoption of criteria. Comments are requested on the Department's decision to propose USEPA human health-based criteria for chemicals with BCFs that are less than 15 L/kg, with consideration given only to exposure through consumption of aquatic organisms.

For the 17 toxic substances evaluated for the 1988 proposal, as well as for lead, the Department conducted a comprehensive review of available toxicity information. The development of the proposed human health criteria is presented in Section II B of this document. For aquatic life-based surface water quality criteria, the Department attempted to develop State-specific criteria using the current USEPA method (USEPA, 1985a) with toxicity information on species that inhabit New Jersey waters. However, data were insufficient to allow the development of such criteria. The Department also attempted to update the national criteria for these chemicals using information contained in Aquatic Toxicity Information Retrieval (AQUIRE) data base (USEPA, 1989a). Neither State-specific nor updated defensible national criteria could be developed. (See discussion in Section II C below.)

For the other toxic substances included in this proposal, the Department updated the USEPA 304(a)(1) human health-based criteria, following the guidance of the USEPA (1986a), with information contained in the USEPA Integrated Risk Information

System (IRIS) (USEPA, 1987c). Initially, toxicological data retrieved from IRIS through September 1990 served as the basis for updating the human health-based criteria. Following the USEPA criteria proposal, the Department retrieved IRIS information through December 5, 1991 to obtain the most current information on chemicals for which the USEPA and NJDEPE criteria differed by more than 10%. Where there is no IRIS information to update the existing human health-based 304(a)(1) criteria, the Department is proposing the existing 304(a)(1) criteria or the current Maximum Contaminant Level Goals (MCLGs) as published by the USEPA. For easy reference, the existing 304(a)(1) human health-based criteria and MCLGs being proposed for adoption are listed separately in Table 2. Because of technical considerations (see discussions in section II), the Department initially decided not to propose criteria for selected toxic substances for which the USEPA has proposed criteria. Instead, this proposal includes the USEPA proposed criteria for these toxic substances (see Table 3) so that the Department can approve compliance schedules and variances, if warranted. For toxic substances for which the USEPA has not published proposed criteria in the November 19, 1991 proposal, the Department developed criteria for the NJDEPE proposal when toxicity information was available in IRIS and BCFs were available in the ambient water quality criteria documents (USEPA, 1980a). The chemical-specific criteria updated or developed by the Department, together with derivation factors, are presented in Table 4. Tables 2, 3 and 4 contain the information used to prepare Table 1, which presents all of the human health-based criteria included in this proposal. The human health-based criteria in the SWQS remain as anytime maxima criteria and are identified in the SWQS by "(hc)" or "(hcc)" when based on carcinogenic effects and by "(h)" when based on non-carcinogenic effects.

The Department is proposing to adopt the Section 304(a)(1) aquatic life-based criteria published by the USEPA. The Department is proposing to replace existing single number, maximum at any time, aquatic life protection criteria (identified in N.J.A.C. 7:9-4.14(c)) with acute and chronic aquatic life protection criteria as one-hour average and four-day average criteria, respectively. As part of this change from single to multiple number criteria, the criteria in N.J.A.C. 7:9B-1.14(c) will be identified as acute by "(a)" and chronic by "(c)".

Comments were received on the proposal published in 1988 questioning the appropriateness of New Jersey's aquatic life criteria for ammonia. In response to those comments, the Department entered into a contract with Versar, Inc. to perform a comprehensive examination of the available scientific literature on ammonia toxicity and develop updated New Jersey-specific ammonia criteria. This work, originally scheduled for completion in October of 1990, was not completed on schedule, in part due to administrative delays. A pre-proposal to modify the ambient ammonia criteria will be published in December.

2. Corrections and Clarifications

There were a number of minor discrepancies between the notice of adoption filed in July of 1989 with the Office of Administrative Law and the notice of adoption published in the New Jersey Register and subsequently incorporated in N.J.A.C.. The Department is proposing corrections and clarifications to the SWQS to remedy these discrepancies. In addition, various modifications are proposed to address inconsistencies, confusing language, and other errors encountered in the existing SWQS which were discovered since the last revision.

C. RECODIFICATION OF THE SWQS

The CWA requires that the states revise their SWQS at least once every three years. Executive Order No. 66 (1978) requires that regulations be readopted at least once every five years. Otherwise, under State law, the regulations lapse. Satisfaction of Executive Order No. 66 requires that the chapter of the N.J.A.C. containing the regulations be readopted. Currently, the SWQS are a subchapter of N.J.A.C. 7:9B and repromulgation of the SWQS alone does not satisfy the provisions of Executive Order No. 66. Because of this combination of mandatory schedules, New Jersey revises and repromulgates the SWQS in a changing schedule of three years, two years, one year, three years, one year, two years, etc. To avoid this situation, the Department proposes to recodify the SWQS as a separate chapter of the N.J.A.C. at N.J.A.C. 7:9B. In this manner, the revision and readopted process will occur once every three years and satisfy both federal law and Executive Order No. 66.

When recodified rules are published, the entire text is underlined because recodified rules are treated as new rules. In the interest of clarity, only language which has been changed or added, as compared to the existing regulation, has been underlined. The proposed recodification is:

Old Code	New Code
7:9-4.1	7:9B-1.1
7:9-4.2	7:9B-1.2
7:9-4.3	7:9B-1.3
7:9-4.4	7:9B-1.4
7:9-4.5	7:9B-1.5
7:9-4.6	7:9B-1.6
7:9-4.7	7:9B-1.7
7:9-4.8	7:9B-1.8
7:9-4.9	7:9B-1.9
7:9-4.10	7:9B-1.10
7:9-4.11	7:9B-1.11
7:9-4.12	7:9B-1.12
7:9-4.13	7:9B-1.13
7:9-4.14	7:9B-1.14
7:9-4.15	7:9B-1.15

D. DEFINITION OF WETLANDS AND WATERS OF THE STATE

At N.J.A.C. 7:9B-1.4, the Department is proposing the addition of definitions of "groundwater," "surface waters," "unsaturated zone," "vadose water," "waters of the State," and "wetlands" as a step toward explicitly including wetlands in the SWQS. The USEPA has directed the states to modify their surface water quality standards to explicitly include wetlands, as discussed in Agency Operating Guidance, FY 1991 (USEPA, 1990c) which states:

> By September 30, 1993, States and qualified Indian Tribes must adopt narrative water quality standards that apply directly to wetlands. ... In adopting water quality standards for wetlands, States and qualified Indian Tribes, at a minimum, shall: (1) define wetlands as "State waters"; (2) designate uses that protect the structure and function or wetlands; (3) adopt aesthetic narrative criteria (the "free froms") and appropriate numeric criteria in the standards to protect the designated uses; (4) adopt narrative biological criteria in the standards; and (5) extend the antidegradation policy and implementation methods to wetlands.

The Department is currently working on standards applicable to wetlands and will propose additional modifications to the SWQS to fully incorporate wetlands in the future.

E. SEVERABILITY CLAUSE

N.J.A.C. 7:9-4.3, which is presently reserved, is being amended to incorporate a severability statement into the SWQS. This provision is intended to ensure that the entire contents of the chapter are not overturned, should a particular subchapter or clause be determined to be unconstitutional or invalid by a court of competent jurisdiction.

F. CARCINOGEN POLICY

Adverse health effects such as carcinogenicity, mutagenicity, and teratogenicity are of particular concern to the Department because these types of health effects, in contrast to other types of toxic effects, are considered to be irreversible. Additionally, these effects may occur at relatively low exposure levels after long term exposure. The existing policy can be interpreted to require that there be no detectable amount of any carcinogen in an effluent. It could also be interpreted to indicate that there should be no detectable amount of a carcinogen in the surface waters of the state as a result of point source discharges. At the time the existing policy statement was written, approaches for quantitative risk assessment had not yet been developed. Current practice for

regulation of carcinogens involves selecting a risk level which should not be exceeded as a result of exposure to the chemical. Selection of a risk level is necessary because carcinogenic risk assessment is based on the assumption that no threshold exists for carcinogenesis. This means that there is some risk of cancer from exposure to any dose of a carcinogen. The risk level chosen for Group A and B carcinogens, one-in-one-million, is the same risk level specified for drinking water contaminants by the A-280 amendments to the New Jersey Safe Drinking Water Act (N.J.S.A. 58:12A-13b), and used in the USEPA criteria proposal (1991a), and is also within the range recommended by USEPA for development of criteria for surface waters (USEPA, 1980a). For Group C carcinogens (see Section II) where reference doses are not available, a risk level of one-in-one-hundred-thousand is used to develop ambient criteria. This risk level is also within the range the USEPA recommended (USEPA, 1980a). The Department invites comments on the revisions to the carcinogen policy.

G. DESIGN FLOW

Design flows are specific stream flows at which criteria are expected to be met. Discharge limitations are developed using the ambient criteria and the corresponding design flow. The higher the design flow, the higher the amount of a substance that can be discharged. Historically the Department has utilized the Minimum Average 7 Consecutive Day flow with a statistical recurrence interval of 10 years (MA7CD10) as the design flow for all criteria. The MA7CD10 flow, or sometimes an even lower flow, has historically been used by water purveyors to determine that quantity of water which they could divert from streams.

The Department is proposing to change the use of the MA7CD10 as the design flow for all criteria to reflect changes in guidance from the USEPA and to complement changes being proposed to the ambient criteria. Criteria being proposed are designed to protect certain uses of the waters. Specifically, there are criteria for protection of aquatic life from acute effects of toxics, protection of aquatic life from chronic effects of toxics, and protection of human health from carcinogens and from noncarcinogens. The design flows being proposed are intended to reflect the different exposure times associated with the criteria. Acute aquatic protection criteria are designed to protect against short duration exposures and the design flow proposed for use with these criteria is the Minimum Average 1 Consecutive Day flow with a statistical recurrence interval of 10 years (MA1CD10). Chronic aquatic protection criteria are designed to protect against longer term effects resulting from exposure periods greater than one day and less than the lifetime of the aquatic organism. The design flow proposed for these criteria is the MA7CD10. Noncarcinogenic human health-based criteria are developed assuming that effects occur after days or weeks of exposure and the proposed design flow is the Minimum Average 30 Consecutive Day flow with a statistical recurrence interval of 5 years (MA30CD5). Finally, carcinogenic effect-

based criteria are developed assuming exposure over a lifetime (70 years) and the proposed design flow is the long term harmonic mean flow.

Each stream has an MA1CD10, MA7CD10, MA30CD5 and harmonic mean flow which reflects the natural drainage from the watershed, the volume of discharges, the volume of withdrawals and other manmade influences including reservoirs, nearby wells and nonpoint sources of flow. Calculation of these flows for a specific discharge necessitates statistical analysis of streamflow data for the site, when a gauging station is present, or site specific extrapolations from an offsite gauging station.

The use of multiple design flows complicates the development of discharge limitations, which must be developed for each applicable criterion for a chemical (e.g. - acute aquatic protection, chronic aquatic protection and either carcinogenic or noncarcinogenic human health protection). The most stringent discharge limitation thus developed would represent the water quality-based discharge limitation. This limitation is then compared to applicable technology-based limitations, antibacksliding limitations and antidegradation-based limitations. The most stringent of these limitations is then applied for that substance in that discharge.

The Department has not historically been issuing discharge limitations for most of the toxic substances which will be regulated after adoption of the proposed criteria. Because of this the Department anticipates that the actual quantities of toxic substances being discharged to the waters of the state will be reduced. In proposing the change in design flows, the Department is aware that the incremental improvement in water quality utilizing the MA30CD5 and harmonic mean flows will not be as great as it would be if the existing MA7CD10 design flow were uniformly applied. However, this difference will only be applicable where aquatic criteria and associated wasteload allocations are not governing, as determined on a discharge and parameter specific basis. Where the aquatic protection criteria and associated wasteload allocations govern, the design flows would be the MA1CD10 and the MA7CD10 flows, which would result in the same or greater incremental improvements in water quality than the existing design flow.

In regard to potable water supplies New Jersey has a unique situation which must be considered in selecting design flows for human health-based criteria relating to potable water supplies. The 1904 Excess Diversion Statute, N.J.S.A. 58:2-1, governs diversions of water by public water purveyors. Under that statute diversions by a public water purveyor allow for a passing flow roughly equivalent to the MA7CD10 flow. This may increase the contaminants at downstream potable water intakes whenever the actual flow is less than the harmonic mean flow used for setting discharge limitations. Diversion rights may include requirements for maintenance of a passing flow. Purveyors have, in certain

waters and at certain times, diverted all of the water in a waterway. During times of drought and after declaration of an emergency, the State has directed certain purveyors to store water in reservoirs rather than maintaining passing flows.

While the actual quantities of toxic substances being discharged is expected, in general, to decrease, there is still some concern about the impacts of the change in design flows on potable water diversions in that incremental water quality improvements may not be adequate to address potable water impacts at all intakes at all times. However, until actual wasteload allocations are determined and permit limitations achieved, the actual impact of utilizing these design flows cannot be estimated. Furthermore, more stringent design flows may only be necessary on selected waterbodies in the state, and not statewide.

In selecting the proposed design flows, the Department has to weigh utilizing more stringent design flows which would result in the imposition of discharge limitations which could prove to be overly stringent, but could not be subsequently relaxed under the USEPA antibacksliding regulations.

After weighing all of the above factors, the Department has decided to propose utilization of the long term harmonic mean and MA30CD5 design flows with the human health protection criteria for carcinogens and noncarcinogens, respectively. In conjunction with proposing these design flows, the Department proposes to evaluate the need for imposition of more stringent design flows on selected waterbodies in the future so as to allow the gathering of additional information.

Comments are being solicited on this aspect of the proposal. The Department is especially interested in receiving comments from public water supply purveyors on any increased costs, reduced water supply quantities or increased health risks they believe would result from the proposed changes in design flows.

H. SCHEDULES OF COMPLIANCE

The Department is proposing the addition of language to the SWQS to reflect the existing rule at N.J.A.C. 7:14A-2.8, allowing compliance schedules in New Jersey Pollutant Discharge Elimination System (NJPDES) permits . The language being added to the SWQS is intended to clearly indicate that compliance schedules are permissible when dealing with water quality-based limitations. This language is being proposed as the result of an Order by the USEPA Administrator in the matter of Star-Kist Caribe (April 16, 1990). In that decision the Administrator stated, "Schedules of compliance for water quality-based permit limitations may not be included in National Pollutant Discharge Elimination System (NPDES) permits unless explicitly authorized by the State in its water quality standards or implementing regulations." Although the Department believes that the provision in the NJPDES regulations satisfies this requirement,

the addition of language explicitly authorizing compliance schedules to the SWQS eliminates the possibility of a challenge to the issuance of a compliance schedule because they are not explicitly authorized in the SWQS. Compliance schedules for water quality standards adopted prior to July 1, 1977 are not allowed because the language of Section 301(b)(1)(C) of the CWA required compliance with limitations necessary to meet those water quality standards by July 1, 1977.

I. WATER QUALITY MANAGEMENT PLANNING CHANGES

N.J.A.C. 7:9-4.7 dealt with water quality based effluent limitations as related to water quality management (WQM) plans. Proposed N.J.A.C. 7:9B-1.7 differs substantially from N.J.A.C. 7:9-4.7, much of which is outdated or redundant. The differences are reflected in the revised title of that section, "Waterway loadings in areawide water quality management plans."

Under N.J.A.C. 7:15-3.4(i), a provision in the Statewide WQM Planning rules adopted in 1989, all effluent limitations (not just water quality based effluent limitations) that are established as NJPDES permit conditions shall be considered to be part of the areawide WQM plans, not the Statewide WQM Plan. Because effluent limitations in NJPDES permits usually pertain to specific, individual discharges rather than to the State as a whole, it is more appropriate for such effluent limitations to be part of the areawide plans than the Statewide Plan.

N.J.A.C. 7:9-4.7(b) is redundant because the policy that the Department shall not grant a NJPDES permit (or any permit) that conflicts with an areawide WQM plan is expressed in the Water Pollution Control Act and the Water Quality Planning Act (see N.J.S.A. 10A-6.e and N.J.S.A. 58:11A-10), in the NJPDES rules (see N.J.A.C. 7:14A-1.3), and in the Statewide WQM Planning rules (see N.J.A.C. 7:15-3.1). It is unnecessary to repeat this policy in N.J.A.C. 7:9B-1.7.

In regard to N.J.A.C. 7:9-4.7(a)2, a recent amendment to the definition of "effluent limitation" in the Water Pollution Control Act indicates that an "effluent limitation" does not exist (and thus cannot be part of an areawide WQM plan) until the "effluent limitation" is established by permit or imposed as an enforcement limit pursuant to an administrative order (see N.J.S.A. 58:10A-3.f, as amended by Section 1 of P L. 1990, c. 28, effective July 1, 1991). However, total maximum daily loads (TMDLs), wasteload allocations (WLAs), and load allocations (LAs) may still be adopted in areawide WQM plans prior to the establishment or imposition of "effluent limitations." (For an explanation of TMDLs, WLAs, and LAs, see USEPA regulations at 40 CFR 130, as well as N.J.A.C. 7:15-3.4(j) and definitions in N.J.A.C. 7:15-1.5.). Also, in the present Statewide WQM Planning Rules, procedures for amending areawide WQM plans are contained in N.J.A.C. 7:15-3.4, not N.J.A.C. 7:15-3.5. Therefore, N.J.A.C. 7:9-4.7(a)2 was rewritten (in N.J.A.C. 7:9B-1.7) to address

TMDLs, WLAs, and LAs rather than "effluent limitations," and to eliminate references to N.J.A.C. 7:15-3.5.

J. TOTAL RECOVERABLE METALS

The Department is proposing ambient criteria for certain metals as "total recoverable metal," which is defined as the concentration of metal in an unfiltered sample following treatment with hot dilute mineral acid (USEPA, 1979a). Currently, the Department regulates these metals as "total metal," defined as the concentration of metal in an unfiltered sample following vigorous digestion, or the sum of the concentration of metal in both the dissolved and suspended fractions (USEPA, 1979a). The Department's proposed change from "total" to "total recoverable" is intended to allow direct calculation of permit limits in the form required by the USEPA regulation at 40 CFR Section 122.45(c) which states:

> All permit effluent limitations, standards, or prohibitions for a metal shall be expressed in terms of "total recoverable metal"

The requirement to develop permit limitations for metals apply unless: 1) an applicable standard or limitation, promulgated under the CWA, specifies the limit for the metal in the dissolved, valent, or total form; 2) it is necessary to express the metal limit in the dissolved, valent, or total form when establishing the limit on a case-by-case basis under Section 125.3; or, 3) approved analytical methods for the metal inherently measure only its dissolved form.

Both the analytical method for "total metals" and the analytical method for "total recoverable metals" should measure all of the dissolved metal present at the time of sampling. They differ in the amount of the metal in the particulate fraction that they measure. The analytical procedure for measuring "total metals" utilizes a stronger acid than does the procedure for "total recoverable metals" and therefore dissolves more particulate metals than does the method for "total recoverable metal." The milder extraction condition used for "total recoverable metal" results in measuring less particulate metal than the "total" method.

The intent of the USEPA in regulating certain metals as "total recoverable" is to more accurately reflect metal concentrations that could be available under environmental conditions for biological processes, and not simply the concentration of metal available under conditions created in the laboratory, while ensuring that criteria are protective of the uses. Generally, dissolved metals in the water column have a greater potential for exerting a toxic effect than metals in the particulate fraction. Metal in the particulate fraction does, however, have a low toxic potential and may, under certain environmental conditions, become partially dissolved and available in the water column. The USEPA

tried to develop an "acid soluble" analytical procedure which was intended to be more vigorous than the dissolved method, less vigorous than the "total recoverable" method and more representative of the biologically available portion of the total metal present. Problems in developing the "acid soluble" methods, including sample preservation, have resulted in the USEPA reconsidering its recommendation of "acid soluble" as the appropriate form for certain metals criteria. Therefore, the method for "total recoverable" more accurately measures the metal available under environmental conditions than the "total" metal while still ensuring that the criteria are protective.

The Department specifies "total recoverable metal" for metals whose aquatic criteria are identified in the 304(a)(1) criteria documents cited in the Gold Book (USEPA, 1986a) and its updates.

As previously mentioned, this change in the form of metals criteria in the SWQS is being proposed to be consistent with federal NPDES regulations. It is also necessary to propose a change to the NJPDES regulations at N.J.A.C. 7:14A-3.14(c), calculating NJPDES permit conditions for metals, to ensure that effluent limitations based on these criteria are expressed as "total recoverable metal" as well.

K. DELAWARE RIVER AND DELAWARE BAY

The Department is proposing to change N.J.A.C. 7:9-4.14(d) by replacing the table of DRBC criteria and incorporating by reference reference the Delaware River Basin Commission (DRBC) criteria contained in "Delaware River Basin Commission, Administrative Manual - Part III, Water Quality Regulations," Article 3, dated May 22, 1991 and all amendments and future supplements thereto. Because the Department and the DRBC do not follow the same rulemaking schedules, the SWQS and the DRBC regulations will periodically contain different criteria for the mainstem Delaware River and Delaware Bay. The criteria in N.J.A.C. 7:9-4.14(d) accurately reflected the DRBC criteria when the SWQS were adopted in August of 1989. However, the DRBC modified their criteria in May of 1991. Because of this, the criteria listed in N.J.A.C. 7:9-4.14(d) do not accurately reflect the current DRBC criteria. To ensure adequate opportunities for public input, the Department will work with the DRBC to arrange for public notice to affected New Jersey parties and at least one public hearing in New Jersey on any DRBC proposals to modify the ambient water quality criteria for the mainstem Delaware River and Delaware Bay.

N.J.A.C. 7:9-4.14(d) is also being proposed for modification to specifically incorporate by reference the criteria at N.J.A.C. 7:9-4.14(c) for toxic substances for which the DRBC has not adopted criteria and to incorporate the use of Best Available Scientific Information-based Criteria when neither the Department nor the DRBC have adopted criteria. This will clarify which

criteria will be used in regulating the discharge of toxics to the Delaware River and provide more uniformity between member states in their regulation of toxic substances. The DRBC is currently working on a toxics criteria proposal and public hearings on the DRBC proposal are expected to be held later this year. Finally, the Department is proposing to replace the listing of designated uses for the mainstem Delaware River and Delaware Bay at N.J.A.C. 7:9-4.13 and incorporate by reference the designated uses contained within the DRBC regulations in Article 3.

L. SURFACE WATER CLASSIFICATION CHANGES

Surface water classifications are being amended so that the classification tables are internally consistent and free from incorrect or incomplete listings. Many nonsubstantive spelling changes are being made to correct errors in town or waterway names. Changes to some local creek, roadway, and river names are being made to names used on United States Geological Survey quadrangle maps. Town names or other descriptive place names are being added to waterways for clarity. In general, changes are proposed to the descriptive listings to provide more accurate descriptions and eliminate confusing listings.

In Tables 1 through 5 (the Tables referred to in the discussion of Surface Water Classification Changes refer to tables in the regulations, not tables in this document), the names of State parks, forests and wildlife management areas are updated to reflect names currently used by the Department. Names of these areas were previously updated in Table 6 during the 1985 review/revision of the SWQS. Likewise, many descriptions of FW1 waters in Table 6 were clarified and amended during the 1985 review/revision but the same waterway descriptions were not changed in Tables 1 through 5. These description revisions are now being made to reflect those descriptions already incorporated into Table 6.

Finally, a number of the State's waters are proposed for designation as Category one (C1). These waters represent waters adjacent to, between, or upstream of other high quality waters. These waters were identified as the Department continued to update its classification maps to show the changes resulting from the August 1989 revisions to the SWQS. The classifications proposed for change are provided in the discussion in Section III.

No waters are proposed for reclassification to less restrictive uses as part of the proposal.

M. COMMENTS ON THE READOPTION OF N.J.A.C. 7:9

The Department proposed the readoption, without changes, of N.J.A.C. 7:9, on November 20, 1990. This was done to avoid the expiration of these regulations on January 21, 1991 under

provisions of Executive Order 66 (1978). Contained within the comments received were some that deal with the SWQS. Comments or discussions within comments that relate to the SWQS are paraphrased below and followed by the Department's response.

COMMENT: The USEPA, "Quality Criteria for Water 1986" (USEPA, 1986a), or the Gold Book criteria verify that many water quality standards are overly stringent.

RESPONSE: The primary purpose of the current proposal is to adopt new and updated water quality criteria for chemicals of concern within New Jersey. Adoption of these new and updated water quality criteria will correct most of the criteria which could be considered overly stringent when compared to the Gold Book criteria. The one exception to this statement is the ammonia criteria. No change is proposed to the water quality criteria for ammonia. The Department hired consultants to perform a comprehensive review and evaluation of the available literature on ammonia toxicity and, if necessary, assist the Department in developing new ammonia criteria. Work on the development of ammonia criteria by the consultants was completed after the contracted completion date. The Department is currently preparing a SWQS preproposal, including revised ammonia criteria, which is expected to be published in December.

COMMENT: The Department should clarify its policy regarding application of seasonal limitations within NJPDES permits. See N.J.A.C. 7:9-4.5(e)3.

RESPONSE: The Department is still evaluating this request and will provide a definitive response as part of another revision of N.J.A.C. 7:9-4 scheduled for later this year.

COMMENT: NJDEPE should establish regulatory provisions providing for the use of flow variable permits which allow for increase pollutant discharges during wetter years or wetter periods of a given year. See N.J.A.C. 7:9-4.6.

RESPONSE: The comment cites N.J.A.C. 7:9-4.6 when discussing the need to modify the regulations to allow for flow variable permits. Examination of N.J.A.C. 7:9-4.6 failed to disclose language which precludes the issuance of flow variable permits. The request to allow flow variable permits is still being evaluated by the Department to determine whether it is appropriate to allow permits and which regulations most appropriately cover this topic. A definitive answer will be provided as part of other revisions to N.J.A.C. 7:9 expected to be published later this year.

COMMENT: Phosphorus is not typically a limiting nutrient in flowing-water habitats.

RESPONSE: No information or citations were provided in support of this comment. The USEPA ambient criteria discussion for

phosphorus contained in the "Quality Criteria for Water 1976," (USEPA, 1976) indicates, "Generally, it is recognized that phosphorus is not the sole cause of eutrophication but there is substantiating evidence that frequently it is the key element of all the elements required by freshwater plants, and generally, it is present in the least amount relative to need. Therefore, an increase in phosphorus allows the use of other already present nutrients for plant growth." Additionally, the Department's experience leads it to conclude that phosphorus is generally the limiting nutrient in New Jersey's waters.

II. CRITERIA DEVELOPMENT FOR TOXIC SUBSTANCES

A. HUMAN HEALTH CONSIDERATIONS

1. Exposure Considerations

a. Introduction

Surface waters of New Jersey are designated for uses which include drinking, fishing, and swimming. Therefore, potential routes of human exposure to surface water contaminants are ingestion of potable water, consumption of fish caught from New Jersey waters, and contact through recreational use. These potential routes of exposure were evaluated in developing the human exposure considerations for surface water quality criteria.

In developing the exposure scenario, a human body weight of 70 kg was assumed. This is a standard assumption utilized previously by New Jersey (NJDWQI, 1987a) and USEPA (USEPA, 1980a, 1985b, 1989b).

b. Drinking Water

(1). Quantitation of Exposure

The exposure scenario for drinking water is based on ingestion of treated surface water. It is assumed that the amount of drinking water ingested daily is two liters per day. This widely accepted assumption is currently utilized by both New Jersey (NJDWQI, 1987a) and the USEPA (1984) in developing Maximum Contaminant Levels (MCLs) for drinking water contaminants. It is recognized that exposure to potable water contaminants occurs during showering and bathing, as well as by ingestion. However, the information needed to accurately quantitate the non-ingestion routes of exposure is not currently available, and they are not considered in drinking water standards developed by New Jersey or the USEPA.

(2). Removal During Treatment

This discussion on treatment is limited to chemicals for which criteria were derived in conjunction with the drinking water program after an in depth review. The extent of removal during

conventional potable surface water treatment processes was assessed to determine whether this factor should be considered in developing the criteria. If a substantial percentage of a chemical is consistently removed by conventional drinking water treatment, the criteria could theoretically be increased accordingly.

The chemicals were categorized into related groups for purposes of this assessment. Only conventional treatment operations (coagulation, sedimentation, filtration, disinfection, etc.) were considered. As discussed below, treatment removal cannot be factored into the development of the human health-based criteria at this time. Additionally, development of ambient surface water quality criteria following the USEPA guidance does not include consideration of removal during conventional potable surface water treatment processes (USEPA, 1980a). Comments on whether and how, if at all, conventional potable surface water treatment removal of toxic substances should be incorporated into the development of ambient criteria are requested.

(a). Volatile Synthetic Organic Compounds
(benzene, carbon tetrachloride, chlorobenzene, 1,2-dichlorobenzene, 1,3-dichlorobenzene, 1,4-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethylene, trans-1,2-dichloroethylene, methylene chloride, tetrachloroethylene, 1,2,4-trichlorobenzene, 1,1,1-trichloroethane, trichloroethylene, vinyl chloride)

A study of the removal of volatiles by conventional treatment at New Jersey drinking water treatment plants was conducted by the Department (NJDEP, 1988). The study showed that the rate of removal of these volatile compounds in the course of normal water treatment operations is relatively low, and is not constant. It was found that 20-40% reductions in contaminant concentration were frequently achieved using conventional water treatment procedures, but removal to this extent does not always occur and depends on time of day and season. For these reasons, treatment removal was not factored into the development of the human health-based criteria for volatile organics.

(b). Other Synthetic Organic Compounds
(chlordane, PCBs)

These chemicals adsorb strongly to suspended particulates and are not very soluble in water. In surface waters, the greatest amounts of these chemicals are usually associated with sediments and suspended solids (USEPA, 1979b). Therefore, the concentration of these chemicals that will be found in true solution is expected to be very low. The Department is aware of no data which demonstrate the removal rate of these chemicals at drinking water treatment plants. Additionally, PCBs and chlordane are resistant to chemical reaction during water

treatment processes such as chlorination; thus no reduction of these contaminants via this route is expected. Because of these uncertainties, treatment removal was not factored into the development of the human health-based criteria for chlordane and PCBs.

(c). Lead

The extent of lead removal during conventional potable water treatment processes was examined by Sorg et al. (1978) at lead concentrations of 150 ppb to 10,000 ppb. At these concentrations, removal occurred to the extent of 75% or greater. For the purposes of developing a surface water criterion for lead, the concentration range of concern lies below 150 ppb (see page 26). The USEPA has stated that available treatment technology can remove lead to 5 ppb at concentrations normally occurring in surface water (USEPA, 1988d). Because of health effect considerations unique to lead (see page 26), it was decided not to quantitatively factor treatment removal into the development of the human health-based criterion for lead.

c. Consumption of Aquatic Organisms

Two assumptions need to be made regarding human exposure through consumption of aquatic organisms. These are the amount of aquatic organisms consumed each day and the percent lipid content in these organisms. The percent lipid content is utilized in calculating the BCF.

Currently, the USEPA recommends the use of an average per capita fresh water and estuarine fish consumption rate of 6.5 g/day (Stephan, 1980). This value was used by the USEPA (1980a) in setting ambient water quality criteria. It is recognized that this value represents the average for the total population including both fish eaters and non-fish eaters and may, therefore, underestimate the consumption rate for some individuals, including recreational fishermen. However, in light of the fact that no fish consumption data specific to New Jersey are presently available, the general value of 6.5 g/day will be employed for developing criteria for FW2 waters. Per the recommendation of USEPA, Region II (1990a), the consumption rate of 6.5 g/day will also be used in developing criteria for saline estuarine and saline coastal (SE and SC) waters for this rule making. When New Jersey-specific consumption rates become available, the Department will reevaluate the criteria and if appropriate make changes.

In order to incorporate consumption of aquatic organisms into the human exposure scenario, a BCF is needed which relates the concentration of the contaminant in the aquatic organism to the concentration in the water in which it lives. The USEPA draft technical document "Guidance on Assessment and Control of Bioconcentratable Contaminants in Surface Waters" (USEPA, 1990b) indicates that for chemicals with low capacity for

bioconcentration in aquatic organisms (BCF less than 100 L/kg), the potential for exposure through consumption of aquatic organisms is low. In order to develop meaningful criteria for chemicals with low BCFs, for the protection of human health, exposure through consumption of aquatic organisms alone is not sufficient, exposure through recreational activities should also be considered. Such exposure becomes proportionally more important for waters not designated for potable use because consumption of two liters of water per day is not considered in developing criteria.

Because of the USEPA criteria proposal for toxic substances (November 19, 1991) the Department is confronted with a dilemma. The Department does not believe that criteria based on aquatic organism consumption alone should be proposed for substances with extremely low BCFs (15 L/kg or less) and initially decided not to propose saline criteria for these substances. However, if the Department does not adopt this type of criteria for toxic substances with extremely low BCFs that are ultimately adopted by the USEPA, the Department would have to develop permit limitations based on the USEPA criteria without the ability to issue variances and compliance schedules when appropriate. In order to avoid having facilities put into immediate noncompliance with permit limitations, the Department is proposing to adopt the USEPA saline water aquatic organism consumption-based human health criteria for these toxic substances (See Table 3 for these chemicals and associated criteria). If the USEPA does not promulgate the saline water aquatic organism consumption-based human health criteria for these chemicals with extremely low BCFs, the Department will not include those criteria in its SWQS adoption. The Department invites comments on the decision to propose the USEPA aquatic organism consumption-based criteria for these chemicals with extremely low BCFs.

For risk assessment purposes, the USEPA estimates that edible fish contain approximately three percent lipid (Stephan, 1980). To determine whether this value was representative of edible New Jersey species, recent State-specific data collected from 42 sites throughout the State by the NJDEPE Toxics in Biota monitoring program were examined. This program is an effort by the Department to monitor representative New Jersey aquatic species for selected environmental contaminants. Lipid content was obtained from the analysis of edible muscle tissue (skinned fillet) for fishes. Analysis of blue claw crab included the hepatopancreas as well as the muscle tissue.

The percent lipid content of species sampled in New Jersey is provided in Table 5. A log transformation was necessary to normalize the lipid content data before calculating a measure of central tendency. Calculations were performed on log-lipid transformations and the means were then retransformed for interpretation. The overall mean, representing 1041 fishes and bluecrabs, was 3.12 percent. Weighting this mean by the pounds of commercial harvest for the included species does not

significantly alter it. The sample included 842 samples from strictly saltwater species and 199 samples from freshwater species. Two of the freshwater species, white catfish and white perch, can also be found in brackish waters. The means of the saline and fresh water sub-groups were 3.34 and 2.33 percent respectively. Species-specific means are displayed in Table 5.

Based on the available data, it was concluded that the three percent lipid content used by the USEPA is representative of New Jersey aquatic species and will be utilized for human health-based criteria development.

d. Recreational Exposure (Swimming)

The designated uses of surface waters include swimming. Exposure to surface water contaminants can occur during swimming through both incidental ingestion and dermal absorption. Data and approaches currently available which might be used for quantitation of the doses potentially received during these recreational exposures were thoroughly examined. The information evaluated included approaches proposed by the USEPA and State regulatory agencies, as well as the scientific literature on which these approaches are based. It was concluded that the information available at present is insufficient to quantitate the doses received during swimming. However, available information indicates that on a chronic basis potential exposure to freshwater contaminants from swimming is expected to be minor in comparison to the potential exposures from drinking water and ingestion of aquatic organisms.

Recreational exposure is not currently considered by the USEPA or by most other states in evaluating human exposure to surface water contaminants.

For these reasons, recreational exposures while swimming are not quantitatively factored into the development of the surface water quality criteria. In the future, it may become possible to consider such exposures if approaches for quantitating the exposures are further developed and validated.

2. Toxicity Considerations

a. Introduction

Of the 18 chemicals which the Department reviewed in depth, chemical-specific toxicity factor development for 17 chemicals was based on generally accepted risk assessment methodology procedures discussed more fully in NJDWQI (1987a). The criterion for lead is discussed separately on page 26 because of special considerations regarding its health effects. For the remaining chemicals in the current proposal, the Department relied on the toxicity information from USEPA ambient water quality criteria documents (USEPA, 1980a, 1986a) or IRIS (USEPA, 1987c) to develop or update the human health criteria.

b. Carcinogenicity Classification and Choice of Risk Level

Chemicals were classified as carcinogens or noncarcinogens for the purposes of risk assessment according to the weight of evidence approach proposed by USEPA (1985b) as discussed in NJDWQI (1987a). For chemicals contained in the 1988 proposal, the carcinogenicity classifications were assigned by the Department. For the remaining chemicals the carcinogenicity classifications designated by the USEPA in IRIS (USEPA, 1987c) were used in risk assessment and criteria derivations (see Table 4).

Chemicals classified as human carcinogens or probable human carcinogens (USEPA Groups A or B) were put in Category I and evaluated based on carcinogenicity. For these chemicals, a low dose extrapolation model assuming no threshold for carcinogenesis was employed to develop a carcinogen potency slope factor. Chemicals determined not to be classifiable as to human carcinogenicity, or as having evidence of noncarcinogenicity in humans (USEPA Groups D or E), were put in Category III and evaluated based on noncarcinogenic toxicity. In order to derive Reference Doses (RfDs) for these chemicals, uncertainty factors were applied to doses at which toxic effects were evaluated in humans or experimental animals. RfDs, formerly called acceptable daily intakes (NJDWQI, 1987a), are levels at which no adverse effects are expected in humans.

Chemicals classified as possible human carcinogens (USEPA Group C) were put in Category II. Chemicals classified in carcinogenicity Group C are chemicals with limited evidence of carcinogenicity which is insufficient to warrant classification as a probable human carcinogen. In general, the risk assessment for these chemicals was based on the RfD, derived from non-carcinogenic toxic effects, with an additional uncertainty factor of 10 applied to account for the uncertain carcinogenicity status. When an RfD has not been developed for a Group C carcinogen, it is not possible to use the method described above and the risk assessment is based on the carcinogen potency factor. The Department is aware that the recent USEPA proposal regulates Group C carcinogens similarly to Group A and B chemicals. Nevertheless, the Department maintains that the current State policy is reasonable and defensible for reasons discussed here and below.

For chemicals which had not been classified in IRIS as to carcinogenicity by the USEPA (1987c), the criteria were developed based on noncarcinogenicity. For chemicals where carcinogenicity classifications are noted in IRIS as "pending", the criteria were developed based on available toxicity information.

In conducting risk assessments for carcinogens, it is assumed that no threshold exists for carcinogenesis. This means that

some risk of cancer is predicted to occur from exposure to any dose of a carcinogen. Therefore, a risk level must be chosen as the basis for the risk assessment.

Since New Jersey freshwaters are designated for potable use, the lifetime risk level of one-in-one-million (1×10^{-6}), specified for drinking water by the A-280 amendments to the New Jersey Safe Drinking Water Act, (N.J.S.A. 58:12A) was also chosen as the basis for the risk assessment for the human health-based criteria for FW2 waters for Groups A and B carcinogens. The same risk level was applied in developing human health criteria for SE and SC waters.

For Group C carcinogens, where an RfD is not available and a carcinogen slope factor is used for risk assessment, a risk level of one-in-one-hundred-thousand (1×10^{-5}) was utilized for development of the criteria. This approach reflects the general policies utilized by New Jersey and the USEPA in developing human health-based drinking water standards for Group C contaminants. These chemicals are regulated less stringently than known or probable (Groups A or B) carcinogens and more stringently than chemicals with insufficient or negative evidence of carcinogenicity (Groups D or E) (NJDWQI, 1987a; USEPA, 1985b). Since a risk level of 1×10^{-6} is utilized for the Group A and Group B carcinogens, the use of a 1×10^{-5} risk level reflects a less stringent approach for these Group C chemicals. The recent USEPA proposal uses 1×10^{-6} risk level for Group C chemicals (USEPA, 1991a), a practice which the Department considers unnecessarily stringent in view of the uncertain carcinogenic status of these chemicals.

c. Toxicity Factors

For chemicals for which MCLs have been developed by the New Jersey Drinking Water Quality Institute (NJDWQI), the toxicity factors which provide the health basis for the MCLs (NJDWQI, 1987b) were utilized as the basis for the human health-based criteria for surface water.

The NJDWQI (1987a) recommended to the Department that the toxicity basis for the MCLs be reviewed as part of the A-280 process every three years. Any revisions in the toxicity factors will be incorporated into the human health-based criteria in future revisions of the criteria.

For chemicals of concern which have not been addressed by the NJDWQI, but which the USEPA has incorporated into IRIS, the oral toxicity factors in IRIS (slope factors for carcinogens and RfDs for non-carcinogens) were accessed and used by the Department when appropriate in deriving the criteria. Toxicity factors were recalculated from toxicity data, if provided in IRIS, in order to round to two significant figures for use in criteria derivation (see Table 4).

3. Derivation of Human Health-Based Criteria

The human health-based criteria for FW2 waters have been derived from the toxicity factor (carcinogenic potency slope factor or RfD) and the exposure assumptions for drinking water and consumption of aquatic organisms. The criteria for SE and SC waters have been based on the exposure assumptions for consumption of aquatic organisms alone. Criteria developed using carcinogen potency slope factors are identified in Table 1 with a "c". Criteria for the two Group C carcinogens developed using carcinogenic potency slope factors and a risk level corresponding to a lifetime incremental cancer risk of one-in-one-hundred-thousand are identified with a "j" in Table 1.

The equations used for the derivation of criteria from these factors are as follows:

For Carcinogens:

$$\text{FW2 Criterion} = \frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{q_1^* \text{ (mg/kg/day)}^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times \text{BCF(L/kg)}))}$$

$$\text{SE, SC Criterion} = \frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{q_1^* \text{ (mg/kg/day)}^{-1} \times (0.0065 \text{ kg/day} \times \text{BCF(L/kg)})}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
q_1^*	=	carcinogenic potency factor $(\text{mg/kg/day})^{-1}$
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
BCF	=	bioconcentration factor (L/kg)
ug	=	micrograms
mg	=	milligrams
kg	=	kilograms
L	=	liters

Where chemicals were reviewed in depth, human carcinogenic potency factors (q_1^*) were derived from animal data presented in NJDWQI (1987b) as follows, except in the case of benzene. For benzene, the human carcinogenic potency factor is derived from human epidemiological data. The full derivation of the human dose from which the potency factor is derived is presented in NJDWQI (1987b). For chemicals which have not been addressed by the NJDWQI but which the USEPA has incorporated into IRIS, oral slope factors cited in IRIS were used in developing the criteria.

$$q_1^* = \frac{\text{Risk}}{\text{Dose}}$$

$$q_1^* \ (\text{mg/kg/day})^{-1} = \frac{1 \times 10^{-6}}{\text{animal dose (mg/kg/day)} \times (W_A/W_H)^{1/3}}$$

Where:

1×10^{-6} = risk level

animal dose = dose to experimental animals predicted to result in 1×10^{-6} risk

$(W_A/W_H)^{1/3}$ = factor for extrapolating from animals to humans based on body surface area

W_A = assumed weight of animal:
for mice - 0.03 kg
for rats - 0.35 kg

W_H = assumed weight of human = 70 kg

For mice: $(W_A/W_H)^{1/3} = 0.075$

For rats: $(W_A/W_H)^{1/3} = 0.17$

For non-carcinogens:

$$\text{FW2 Criterion} = \frac{\text{RfD (mg/kg/day)} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2 \text{ L/day} + (0.0065 \text{ kg/day} \times \text{BCF (L/kg)})}$$

$$\text{SE, SC Criterion} = \frac{\text{RfD (mg/kg/day)} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.0065 \text{ kg/day} \times \text{BCF (L/kg)}}$$

Where:

RfD = Reference Dose
70 kg = assumed weight of average adult
2 L/day = assumed daily water consumption
0.0065 kg/day = assumed daily consumption of edible aquatic products
BCF = bioconcentration factor (L/kg)

Table 4 summarizes the carcinogenicity classification, toxicity factors, and BCFs for chemicals whose criteria were developed by the Department. A detailed discussion of the basis for the risk assessment of the chemicals which underwent an in depth review is provided in the health-based MCL documents supporting the MCLs developed by the NJDWQI (1987b) which are available from the Bureau of Safe Drinking Water, Water Technical Programs, NJDEPE.

These support documents provide the basis for the carcinogenicity categorization and choice of study and end point for the risk assessment. Additionally, background information relevant to the health effects of the chemical is given and includes metabolism, pharmacokinetics, neurobehavioral toxicity, reproductive and developmental effects, genotoxicity, carcinogenic and noncarcinogenic effects in humans and experimental animals.

For other chemicals in Table 4 for which updated USEPA toxicity data were used in deriving the criteria, the reader is referred to IRIS for carcinogenic classification, choice of study, toxic end points, slope factors and RfDs. Unless otherwise noted, BCFs listed in Table 4 were obtained from Charles Delos, USEPA, Office of Science and Technology, Health and Ecological Criteria Division. These are the BCFs used by the USEPA to develop their ambient water quality criteria proposal (USEPA, 1991a). BCFs for other chemicals are from the USEPA ambient water quality criteria documents (cited in USEPA, 1986a). For chemicals for which existing 304(a)(1) criteria were used, the reader is referred to USEPA ambient water quality criteria documents (listed in USEPA, 1980a), "Quality Criteria for Water 1986" (USEPA, 1986a) and its updates (USEPA, 1986b, 1987a).

Table 3 lists selected criteria, recently proposed by the USEPA (USEPA, 1991a) which the Department has included in its current SWQS proposal. These selected criteria were based on policy considerations instead of adequate scientific data. The Department did not intend to propose criteria that were not based on adequate scientific data. As mentioned previously, in order to retain the ability to issue compliance schedules and variances when appropriate, the Department is proposing these selected criteria from the USEPA proposal (USEPA, 1991a).

These criteria belong to four categories of toxic substances: 1) toxic substances with BCFs $\leq$ 15 L/kg that have criteria developed based on ingestion of aquatic organisms alone; 2) Group D polynuclear aromatic hydrocarbons (PAHs) for which RfDs are not available; 3) Group B2 PAHs for which carcinogenic slope factors are not available, and (4) pesticide metabolites (endosulfan sulfate and endrin aldehyde) and methyl chloride for which no chemical-specific information (BCFs, toxicity factors, carcinogenicity classification) is available for criteria development. For reasons discussed earlier in this document, the Department has decided not to develop criteria for chemicals with very low BCFs on the basis of ingestion of aquatic organisms alone. In the case of other chemicals in Table 3, the Department does not intend to develop criteria using data from surrogate chemicals as did the USEPA with data from benzo(a)pyrene, endosulfan, endrin and chloroform.

New Jersey's inclusion of these criteria in the current proposal does not mean endorsement of these criteria as technically viable alternatives to criteria to be developed by the Department. The Department invites comments on the criteria for these chemicals.

4. Criteria Durations

Since the criteria for carcinogens are based on a lifetime incremental cancer risk (i.e., 70 years), the criteria duration is a seventy-year average (USEPA, 1991c). Criteria for noncarcinogens, designed to protect against chronic human health effects, are generally derived using no observed adverse effect level (NOAEL) and lowest observed adverse effect level (LOAEL) data from animal exposure studies, human chronic or subchronic epidemiological studies (USEPA, 1991c). The durations of these studies vary from days to years. The criteria duration for non-carcinogens is a thirty-day average which is consistent with the averaging period for the design flow for noncarcinogen WLAs recommended by USEPA (1988e, 1991c). To be consistent with USEPA (1986a) criteria, no frequency of exceedence other than the exceedances resulting from flows less than the design flows is allowed for human health criteria.

5. Lead

Currently the human health-based surface water criterion adopted by New Jersey for lead is 50 ppb. This value was based on United States Public Health Service Recommendation and matches the New Jersey drinking water MCL which is currently in effect. There is general agreement that this MCL is not protective of human health because recent data indicate that adverse effects occur at levels below those previously believed to cause toxicity (USEPA, 1988d). Public comments on the revisions to the SWQS proposed by the Department on July 18, 1988 suggested that the surface water criterion for lead be reduced to reflect this new toxicity data.

It is not possible to use the same risk assessment approaches used to develop human health-based criteria for the other contaminants when developing a criterion for lead because of considerations unique to lead. No threshold has been detected for some of the non-carcinogenic effects of lead, in particular, those relating to neurotoxicity (USEPA, 1988d). However, the USEPA recognizes a level of concern at a blood level of 10-15 ug/dl below which the potential for adverse effects is considered minimal. Additionally, lead has been classified as a probable human carcinogen (B2) by the USEPA (1988d). No carcinogenic potency factor for lead has been derived by USEPA because of difficulties in interpreting the dose-response relationships in the bioassay results and pharmacokinetic considerations unique to lead (USEPA, 1988d). For these reasons, the USEPA has proposed (USEPA, 1988d) and promulgated (USEPA, 1991d) a health-based drinking water MCL (i.e. Maximum Contaminant Level Goal (MCLG)) of zero for lead.

The primary source of lead in drinking water is not surface or ground water, but corrosion within the distribution system after the water leaves the treatment plant. For this reason, the USEPA has proposed an MCL of 5 ug/L for water entering the distribution

system after treatment (USEPA, 1988d). The final drinking water regulation for lead consists of an action level determined at the customer's tap, rather than an MCL for source water (USEPA, 1991d). Lead intake through drinking water can be related to blood levels through a correlation coefficient. The coefficient used by the USEPA is 0.2 ug/dl blood per ug/L drinking water (USEPA, 1988d). Using this coefficient, a lead concentration of 10 ug/L in drinking water would result in a 2 ug/dl level in the blood. Considering the contributions from other important sources of exposure to lead such as air, food, soil, or paint chips, the drinking water values proposed by the USEPA are protective at the level of concern (10-15 ug/dl).

After consideration of the above information, the Department has decided to propose a human health-based surface water criterion for lead of 5 ug/L is appropriate. It is felt that 5 ug/L as a surface water quality criterion is a conservative value because the MCL proposed by USEPA (USEPA, 1988d) for water after treatment was 5 ug/L, and treatment of surface waters at a potable water treatment plant would only serve to reduce the lead concentration further. Public comments are requested on the proposed criterion for lead.

B. CHEMICAL-SPECIFIC HUMAN HEALTH-BASED CRITERIA DERIVATIONS

The following pages contain the derivations of human health-based criteria for each of the 18 chemicals which were reviewed in depth by the Department. For other chemicals listed in Table 4, the derivations of health-based criteria are not presented in detail. Sufficient toxicity information was available and presented in Table 4 to allow development of criteria following the methodology discussed on page 23 for these 18 toxic substances. All criteria being proposed have been rounded to three significant figures. This has been done to be consistent with the existing USEPA criterion dimethyl phthalate, the criterion with the largest number of significant figures (313 mg/L), which was rounded to three digits. The Department followed the general USEPA practice for rounding as discussed in "National Primary and Secondary Drinking Water Regulations" (USEPA, 1989c).

1. BENZENE

a. CAS #: 71-43-2

b. Synonyms: Benzol
Cyclohexatriene
Pyrobenzol

c. Physical Constants and Additional Information:

Chemical formula C_6H_6

Molecular weight	78.11
Physical state	clear, colorless liquid
Vapor pressure	95.2 torr at 25 ^{o}C
Water solubility	1.78 g/L at 25 ^{o}C
Log octanol/water partition coefficient	2.13
Odor threshold (water)	2 mg/L

d. New Jersey Carcinogenicity Classification:

Category I - Risk assessment based on carcinogenic end point

e. Basis for Risk Assessment:

Benzene is considered a human carcinogen and was therefore placed in Category I. It has been shown to cause cancer in numerous organs in rats and mice, and leukemia in humans. The risk assessment was based on pooled epidemiologic data from occupational studies (Ott et al., 1978; Rinsky et al., 1981; Wong, 1983). The end point considered was leukemia. A relative risk model for high to low dose extrapolation was used to derive a carcinogenic potency factor of 0.23 $(mg/kg/day)^{-1}$.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* \ (mg/kg/day)^{-1} = \frac{\text{Risk}}{\text{Human Dose (mg/kg/day)}}$$

$$= \frac{1 \times 10^{-6}}{\frac{(0.15 \text{ ug/L} \times 2 \text{ L/day})}{70 \text{ kg}}} \times \frac{1000 \text{ ug}}{\text{mg}} = 0.23 \ (mg/kg/day)^{-1}$$

Where:

0.15 ug/L	=	drinking water concentration resulting in 1×10^{-6} risk (For derivation from human epidemiologic data, see NJDWQI, 1987b.)
2 L/day	=	assumed daily water consumption
70 kg	=	assumed weight of average adult

g. Derivation of Human Health-Based Criteria:

FW2 Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.23(mg/kg/day)^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 5.2 \text{ L/kg}))}$$

$$= 0.150 \text{ ug/L}$$

SE, SC Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.23(mg/kg/day)^{-1} \times (0.0065 \text{ kg/day} \times 5.2 \text{ L/kg})} = 9.00 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
$0.23(mg/kg/day)^{-1}$	=	q_1^* (carcinogenic potency factor)
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
5.2 L/kg	=	BCF (USEPA, 1980b)

h. Comparison of Toxicity Factors Derived by New Jersey To USEPA Toxicity Factors:

Benzene is classified by the USEPA and New Jersey as a Group-A human carcinogen. The USEPA and New Jersey benzene carcinogenic potency factors are 0.029 and 0.23 $(mg/kg/day)^{-1}$, respectively. The dose response relationship between benzene and human leukemia was derived from three human epidemiological studies. The eight-fold more stringent New Jersey benzene potency factor arises from three risk assessment assumptions.

First, the Department determined that the best model of the epidemiological studies was the relative risk (multiplicative) model of cumulative benzene dose, while the USEPA calculated the geometric mean of estimates from four different models. The relative risk model assumes that the increased age-specific leukemia mortality from a specific benzene dose is proportional to background leukemia mortality. The relative risk model predicts that the effect of benzene exposure should be larger as the background occurrences of leukemia increases. The relative risk model

has been used to describe the causal relationship between cigarette smoking, asbestos, and human lung cancer.

Second, New Jersey used the 95% upper confidence interval on risk, while the USEPA applied the maximum likelihood estimate (MLE) of average risk. The 95% upper confidence level on risk or lower level dose is meant to protect 95% of the general population from one-in-one-million excess lifetime cancer risk.

Third, New Jersey assumed that workers absorb 50% of the benzene inhaled, while the USEPA assumed 100% absorption of inhaled benzene. Approximately 50% of inhaled benzene was retained in studies of human volunteers (Doctor and Zielhuis, 1967; Nomiyama and Nomiyama, 1974).

2. CARBON TETRACHLORIDE

a. CAS#: 56-23-5

b. Synonyms:
Methane, tetrachloro-
Carbon Tet
Carbona
Tetrachloromethane
Methane tetrachloride
Perchloromethane

c. Physical Constants and Additional Information:

Chemical formula	CCl_4
Molecular weight	153.8
Physical state	clear, colorless liquid
Vapor pressure	115.2 torr at 25 ^{o}C
Water solubility	785 mg/L at 20 ^{o}C
Log octanol/water partition coefficient	2.64
Taste threshold (water)	not available
Odor threshold (water)	not available

d. New Jersey Carcinogenicity Classification:

Category I - Risk assessment based on carcinogenic end point.

e. Basis for Risk Assessment:

Carbon tetrachloride is considered a probable human carcinogen and was therefore placed in Category I. This compound has been shown to cause liver cancer in rats, mice, and hamsters. The risk assessment was based on an oral exposure study in mice (NCI, 1976). The end point considered was combined male and female mouse hepatocellular carcinomas. The multistage-Weilbull model was used to derive a carcinogenic potency factor of 0.091 $(mg/kg/day)^{-1}$.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* = \frac{1 \times 10^{-6}}{1.46 \times 10^{-4} \text{ mg/kg/day} \times 0.075} = 0.091 \text{ (mg/kg/day)}^{-1}$$

Where:

1×10^{-6}	=	risk level
1.46×10^{-4} mg/kg/day	=	dose to mice predicted to result in 1×10^{-6} risk (NJDWQI, 1987b)
0.075	=	factor for extrapolation from mouse to human based on body surface area $-(W_A/W_H)^{1/3}$ (see p. 24)

g. Derivation of Human Health-Based Criteria:

FW2 Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.091 \text{ (mg/kg/day)}^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 18.75 \text{ L/kg}))}$$

$$= 0.363 \text{ ug/L}$$

SE, SC Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.091 \text{(mg/kg/day)}^{-1} \times (0.0065 \text{ kg/day} \times 18.75 \text{ L/kg})} = 6.31 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
0.091 $(mg/kg/day)^{-1}$	=	q_1^* (carcinogenic potency factor)
2 L/day	=	assumed daily water consumption

0.0065 kg/day = assumed daily consumption of edible aquatic products

18.75 L/kg = BCF (USEPA, 1980c)

h. Comparison of Toxicity Factors Derived by the New Jersey to USEPA Toxicity Factors:

Carbon tetrachloride is considered a probable human carcinogen by both USEPA (Group B2) and New Jersey. The USEPA carcinogenic potency factor given in IRIS of 0.13 $(mg/kg/day)^{-1}$ was derived by combining data from four carcinogenicity studies in three rodent species (mouse, rat and hamster). New Jersey did not consider two of these studies appropriate for risk assessment because the studies did not include concurrent controls and included only one dose level. Of the two remaining studies, which were bioassays in mice and rats conducted by National Cancer Institute, New Jersey selected the mouse bioassay because the mouse was more sensitive to the effects of carbon tetrachloride than the rat.

3. CHLORDANE

a. CAS #: 57-74-9

b. Synonyms: 1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methano-1H-indene
Dichlorochlordene
Chlorindan
Dowchlor
Velsicol 1068
Toxichlor

c. Physical Constants and Additional Information:

Chemical formula	$C_{10}H_6Cl_8$
Molecular weight	409.80
Physical state	amber-colored, viscous liquid
Vapor Pressure	1×10^{-5} torr at 25 ^{o}C
Water solubility	insoluble; technical grade: 9 ug/L at 25 ^{o}C
Log octanol/water partition coefficient	3.32
Taste threshold (water)	not available
Odor threshold (water)	0.005 mg/L

d. New Jersey Carcinogenicity Classification:

Category I - Risk assessment based on carcinogenic end point.

e. Basis for Risk Assessment:

Chlordane is considered a probable human carcinogen and was therefore placed in Category I. This insecticide has been shown to cause cancer in mice. The risk assessment was based on a study involving chronic oral exposure of mice (RIAST, 1983). The end point considered was the incidence of hepatocellular adenoma in male mice. The multistage model for high to low dose extrapolation was used to derive a carcinogenic potency factor of 2.7 $(mg/kg/day)^{-1}$.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* = \frac{1 \times 10^{-6}}{4.93 \times 10^{-6} \text{ mg/kg/day} \times 0.075} = 2.77 \text{ (mg/kg/day)}^{-1}$$

Where:

1×10^{-6} = risk level

4.93×10^{-6} mg/kg/day = dose to mice predicted to result in 1×10^{-6} risk (NJDWQI, 1987b)

0.075 = factor for extrapolation from mouse to human based on body surface area- $(W_A/W_H)^{1/3}$ (see p. 24).

g. Derivation of Human Health Based Criteria:

FW2 Criterion =

$$\frac{1 \times 10^{-6} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2.7 \text{ (mg/kg/day)}^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 14{,}100 \text{ L/kg}))}$$

$$= 0.000277 \text{ ug/L}$$

SE, SC Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2.7 \text{(mg/kg/day)}^{-1} \times (0.0065 \text{ kg/day} \times 14{,}100 \text{ L/kg})}$$

$$= 0.000283 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
2.7 $(mg/kg/day)^{-1}$	=	q_1^* (carcinogenic potency factor)
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
14,100 L/kg	=	BCF (USEPA, 1980d)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

Chlordane is considered a probable human carcinogen by both USEPA (Group B2) and New Jersey. The USEPA carcinogenic potency factor given in IRIS of 1.3 $(mg/kg/day)^{-1}$ was derived from combining data in male and female mice from two different chronic studies. The mouse study chosen by New Jersey as the basis for the risk assessment was not one of the studies utilized by USEPA. New Jersey considered the studies utilized by USEPA, and decided that they were not the most appropriate for risk assessment. In one of these studies, a high percentage of animals were lost due to autolysis and in the other study the dose was changed during the study and the control group had only a small number of animals.

4. CHLOROBENZENE

a. CAS #: 108-90-7

b. Synonyms: Monochlorobenzene
Benzene chloride
Phenyl chloride
Chlorobenzol

c. Physical Constants and Additional Information:

Chemical formula	C_6H_5Cl
Molecular weight	112.56
Physical state	colorless liquid (at room temperature)
Vapor pressure	10 torr at 22.2°C
Water solubility	insoluble; 0.49 g/L

Log octanol/water partition coefficient	2.84
Odor threshold (water)	10-20 ug/L

d. New Jersey Carcinogenicity Category:

Category II - Risk assessment based on noncarcinogenic end point with an additional uncertainty factor to account for possible carcinogenicity.

e. Basis for Risk Assessment:

Chlorobenzene is considered a possible human carcinogen by ingestion and was therefore placed in Category II. This compound has been shown to be associated with an increased occurrence of neoplastic nodules of the liver in male rats exposed to high doses. The risk assessment was based on a study involving subchronic oral exposure of dogs (Monsanto Company, 1977). The end points considered were histological changes in the liver, kidneys, and hematopoietic tissues. Appropriate uncertainty factors were applied to the NOAEL of 27.3 mg/kg/day, including an additional factor for the possible carcinogenicity of chlorobenzene, to derive an RfD of 6.5×10^{-4} mg/kg/day.

f. Reference Dose:

6.5×10^{-4} mg/kg/day (NJDWQI, 1987b), including an additional uncertainty factor of 10 for possible carcinogenicity

g. Derivation of Human Health-Based Criteria:

$$\text{FW2 Criterion} = \frac{6.5 \times 10^{-4} \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2 \text{ L/day} + (0.0065 \text{ kg/day} \times 10.3 \text{ L/kg})}$$

$$= 22.0 \text{ ug/L}$$

$$\text{SE, SC Criterion} = \frac{6.5 \times 10^{-4} \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.0065 \text{ kg/day} \times 10.3 \text{ L/kg}}$$

$$= 680 \text{ ug/L}$$

Where:

6.5×10^{-4} mg/kg/day	=	RfD, including an additional uncertainty factor of 10 for possible carcinogenicity
70 kg	=	assumed weight of average adult

2 L/day = assumed daily water consumption

0.0065 kg/day = assumed daily consumption of edible aquatic products

10.3 L/kg = BCF (USEPA, 1980e)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

The reference doses developed by USEPA and by New Jersey for chlorobenzene are based on the same toxicological study in dogs. The USEPA reference dose given in IRIS is 2×10^{-2} mg/kg/day. The 30-fold difference between USEPA and New Jersey reference dose arises from two factors. First, New Jersey included an additional modifying uncertainty factor of 3 because of the small number of experimental animals used in the study. Second, New Jersey classifies chlorobenzene as a possible human carcinogen, while USEPA now classifies it as Group D (inadequate evidence of carcinogenicity). New Jersey's classification is based on an increase in incidence of neoplastic liver nodules observed in male rats (NTP, 1985). This classification is consistent with the USEPA Risk Assessment Forum's recommendations on interpretation of liver lesions in the rat for purposes of risk assessment (USEPA, 1986c).

5. 1,2-DICHLOROBENZENE

a. CAS #: 95-50-1

b. Synonyms: ortho-Dichlorobenzene
o-Dichlorobenzene
o-DCB
o-Dichlorobenzol
Chloroben

c. Physical Constants and Additional Information:

Chemical formula	$C_6H_4Cl_2$
Molecular weight	147.01
Physical state	colorless liquid
Vapor pressure	1.0 torr at 20 °C
Water solubility	145 mg/L at 25 °C
Log octanol/water partition coefficient	3.38
Odor threshold (water)	0.01 mg/L

d. New Jersey Carcinogenicity Classification:

Category III - Risk assessment based on non-carcinogenic end point.

e. Basis for Risk Assessment:

1,2-Dichlorobenzene is considered to be a non-carcinogen and was therefore placed in Category III. Toxicity to the liver and kidney are the predominant effects of chronic exposure. The risk assessment was based on a study involving chronic oral exposure to male mice (NTP, 1985). The end point considered was a dose related increase in kidney tubular regeneration. Appropriate uncertainty factors were applied to the LOAEL of 60 mg/kg/day to derive an RfD of 0.085 mg/kg/day.

f. Reference Dose:

0.085 mg/kg/day (NJDWQI, 1987b)

g. Derivation of Human Health-Based Criteria:

$$\text{FW2 Criterion} = \frac{0.085 \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2 \text{ L/day} + (0.0065 \text{ kg/day} \times 55.6 \text{ L/kg})}$$

$$= 2{,}520 \text{ ug/L}$$

$$\text{SE, SC Criterion} = \frac{0.085 \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.0065 \text{ kg/day} \times 55.6 \text{ L/kg}}$$

$$= 16{,}500 \text{ ug/L}$$

Where:

0.085 mg/kg/day = RfD

70 kg = assumed weight of average adult

2 L/day = assumed daily water consumption

0.0065 kg/day = assumed daily consumption of edible aquatic products

55.6 L/kg = BCF (USEPA, 1980f)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

The basis for the Reference Doses derived by USEPA as given in IRIS and derived by New Jersey is identical. The only

difference arises from rounding the RfD to one (in IRIS) versus two significant figures by New Jersey.

6. 1,3-DICHLOROBENZENE

a. CAS #: 541-73-1

b. Synonyms: meta-Dichlorobenzene
m-Dichlorobenzene
m-Dichlorobenzol
m-Phenylene dichloride

c. Physical Constants and Additional Information:

Chemical formula	$C_6H_4Cl_2$
Molecular weight	147.01
Physical state	colorless liquid
Vapor pressure	1.89 torr at 25 ^oC
Water solubility	123 mg/L at 25 ^oC
Log octanol/water partition coefficient	3.38
Odor threshold (water)	0.02 mg/L

d. New Jersey Carcinogenicity Classification:

Category III - Risk assessment based on non-carcinogenic end point.

e. Basis for Risk Assessment:

Based on available studies 1,3-dichlorobenzene appears to be similar to 1,2-dichlorobenzene in its toxicity, and does not appear to be more toxic than 1,2-dichlorobenzene. The criterion for 1,3-dichlorobenzene derived below is based on toxicity data for 1,2-dichlorobenzene, since appropriate data for 1,3-dichlorobenzene are not available.

1,2-Dichlorobenzene is considered to be a non-carcinogen and was therefore placed in Category III. Toxicity to the liver and kidney are the predominant effects of chronic exposure to 1,2-dichlorobenzene. The risk assessment was based on a study involving chronic oral exposure of 1,2-dichlorobenzene to male mice (NTP, 1985). The end point considered was a dose related increase in kidney tubular regeneration. Appropriate uncertainty factors were applied to the LOAEL of 60 mg/kg/day, and an RfD of 0.085 mg/kg/day was derived.

f. Reference Dose:

0.085 mg/kg/day (NJDWQI, 1987b)

g. Derivation of Human Health-Based Criteria:

$$\text{FW2 Criterion} = \frac{0.085 \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2 \text{ L/day} + (0.0065 \text{ kg/day} \times 41.2 \text{ L/kg})}$$

$$= 2{,}620 \text{ ug/L}$$

$$\text{SE, SC criterion} = \frac{0.085 \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.0065 \text{ kg/day} \times 41.2 \text{ L/kg}}$$

$$= 22{,}200 \text{ ug/L}$$

Where:

0.085 mg/kg/day	=	RfD
70 kg	=	assumed weight of average adult
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
41.2 L/kg	=	BCF (USEPA, 1980f)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

There is no toxicity factor for 1,3-dichlorobenzene given in IRIS. The human health-based criteria proposed by USEPA is based on the 304(a) criterion for dichlorobenzenes in general, which was derived in 1980 or earlier, while the New Jersey criterion is based on the toxicity factor currently developed for 1,2-dichlorobenzene. Both USEPA and New Jersey base their criteria on non-carcinogenic effects.

7. 1,4-DICHLOROBENZENE

a. CAS #: 106-46-7

b. Synonyms: para-Dichlorobenzene,
p-DCB,
p-Dichlorobenzol
Paracide

c. Physical Constants and Additional Information:

Chemical formula $C_6H_4Cl_2$

Molecular weight	147.01
Physical state	colorless,, crystalline solid at room temperature
Vapor pressure	1.0 mm at 20 °C
Water solubility	123 mg/L at 25 °C
Log octanol/water partition coefficient	3.38
Odor threshold (water)	0.03 mg/L

d. New Jersey Carcinogenicity Category:

Category II - Risk assessment based on non-carcinogenic endpoint with an additional uncertainty factor to account for possible carcinogenicity.

e. Basis for Risk Assessment:

The toxicological studies considered for risk assessment for this contaminant is presented in detail by USEPA in this final rule for the drinking water standard for 1,4-dichlorobenzene (USEPA, 1987d). The drinking water standard adopted by New Jersey for p-dichlorobenzene is based on the USEPA risk assessment (USEPA, 1987d and e), which is summarized below. In a bioassay conducted by the National Toxicology Program (NTP, 1986), 1,4-dichlorobenzene caused an increased incidence of kidney tubule adenocarcinomas in male rats, and an increased incidence of malignant and benign liver tumors in male and female mice. The kidney tumors observed in male rats were judged to arise through a mechanism not relevant to humans. Based on this data, 1,4-dichlorobenzene was classified as a possible human carcinogen (Group C, equivalent to New Jersey Category II) by USEPA. The risk assessment was based on a study involving subchronic oral exposure in rats (Battelle's Columbus Laboratories, 1979). The endpoint considered was necrosis of the renal epithelium. Appropriate uncertainty factors were applied to the NOAEL of (150 mg/kg/day x 5/7 days/week administered) to derive an RFD of 10.7 ug/kg/day, including an additional uncertainty factor for possible carcinogenicity.

f. Reference Dose:

0.011 mg/kg/day, including an additional uncertainty factor of 10 for possible carcinogenicity

g. Derivation of Human Health-Based Criteria:

$$\text{FW2 criterion} = \frac{0.011 \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2 \text{ L/day} + (0.0065 \text{ kg/day} \times 37.5 \text{ L/kg})}$$

$$= 343 \text{ ug/L}$$

$$\text{SE, SC criterion} = \frac{0.011 \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.0065 \text{ kg/day} \times 37.5 \text{ L/kg}}$$

$$= 3{,}159 \text{ ug/L}$$

Where:

0.011 mg/kg/day	=	RfD, including an additional uncertainty factor of 10 for possible carcinogenicity
70 kg	=	assumed weight of average adult
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
37.5 L/kg	=	BCF (USEPA, 1980f)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

There is no toxicity factor for 1,4-dichlorobenzene given in IRIS. The human health-based criterion proposed by USEPA is based on the 304(a) criterion for dichlorobenzenes in general, which was derived in 1980 or earlier, while the New Jersey criterion is based on the toxicity factor derived more recently (USEPA, 1987d). Both USEPA and New Jersey base their criteria on noncarcinogenic effects. However, 1,4-dichlorobenzene is considered as Group C carcinogen by New Jersey. Therefore, an additional uncertainty factor of ten was included in deriving the criteria for this chemical.

8. 1,2-DICHLOROETHANE

a. CAS #: 107-06-2

b. Synonyms: Ethylene dichloride
Ethylene chloride
S-Dichloroethane

c. Physic-l Constants and Additional Information:

Chemical formula $C_2H_4Cl_2$

Molecular weight	98.96
Physical state	clear, colorless
Vapor pressure	64 torr at 20 ^{o}C
Water solubility	8.82 g/L
Log octanol/water partition coefficient	1.48
Odor threshold (water)	20 mg/L

d. New Jersey Carcinogenicity Category:

Category I - Risk assessment based on carcinogenic end point.

e. Basis for Risk Assessment:

1,2-Dichloroethane is considered a probable human carcinogen and was therefore placed in Category I. This compound has been shown to cause cancer in various organs of rats and mice. The risk assessment was based on a study involving chronic oral exposure of rats and mice (NCI, 1978). The end point considered was the incidence of hemangiosarcomas in male rats. The multistage model for high to low dose extrapolation was used to derive a carcinogenic potency factor of 0.12 $mg/kg/day^{-1}$.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* = \frac{1 \times 10^{-6}}{4.87 \times 10^{-5} \text{ mg/kg/day} \times 0.17} = 0.12 \text{ (mg/kg/day)}^{-1}$$

Where:

1×10^{-6}	=	risk level
4.87×10^{-5} mg/kg/day	=	dose to rats predicted to result in 1×10^{-6} risk (NJDWQI, 1987b)
0.17	=	factor for extrapolation from rats to humans based on body surface area $(W_A/W_H)^{1/3}$ (See p. 24)

g. Derivation of Human Health Based-Criteria:

$$\text{FW2 Criterion} = \frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.12 \text{ (mg/kg/day)}^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 1.2 \text{ L/kg}))}$$

$$= 0.291 \text{ ug/L}$$

$$\text{SE, SC Criterion} = \frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.12 \text{(mg/kg/day)}^{-1} \times (0.0065 \text{ kg/day} \times 1.2 \text{ L/kg})}$$

$$= 74.8 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
$0.12 \text{ (mg/kg/day)}^{-1}$	=	q_1^* (carcinogenic potency factor)
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
1.2 L/kg	=	BCF (USEPA, 1980g)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

Both USEPA and New Jersey classify 1,2-dichloroethane as a probable human carcinogen (Group B2). The USEPA carcinogenic potency factor given in IRIS of 0.091 $(mg/kg/day)^{-1}$ is in close agreement with the New Jersey carcinogenic potency factor. Both values are derived from the same tumor type in the same carcinogenicity bioassay. USEPA's derivation included time-to-event analysis in the low dose extrapolation modeling, while New Jersey did not.

8. 1,1-DICHLOROETHYLENE

a.	CAS #:	75-35-4
b.	Synonyms:	1,1-DCE Vinylidene chloride 1,1-Dichloroethene VDC DCE

c. Physical Constants and Additional Information:

Chemical formula	$C_2H_2Cl_2$
Molecular weight	96.95
Physical state	clear, colorless liquid
Vapor pressure	591 torr at 20 °C
Water solubility	400 mg/L at 20 °C
Log octanol/water partition coefficient	1.32

d. New Jersey Carcinogenicity Classification:

Category II - Risk assessment based on non-carcinogenic end point with an additional uncertainty factor to account for possible carcinogenicity.

e. Basis for Risk Assessment:

1,1-Dichloroethylene is considered to be a possible human carcinogen and was therefore placed in Category II. 1,1-Dichloroethylene has been shown to cause liver and kidney injury in experimental animals. The risk assessment was based on a chronic study involving exposure of mice to 1,1-dichloroethylene (NCI/NTP, 1982). The toxic end point was an increase in liver necrosis in mice. Appropriate uncertainty factors were applied to the LOAEL of 2 mg/kg/day, including an additional uncertainty factor for possible carcinogenicity, to derive an RfD of 1.4×10^{-4} mg/kg/day.

f. Reference Dose:

1.4×10^{-4} mg/kg/day (NJDWQI, 1987b), including an additional uncertainty factor of 10 for possible carcinogenicity

g. Derivation of Human Health-Based Criteria:

$$\text{FW2 Criterion} = \frac{1.4 \times 10^{-4} \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2 \text{ L/day} + (0.0065 \text{ kg/day} \times 5.6 \text{ L/day}}$$

$$= 4.81 \text{ ug/L}$$

$$\text{SE, SC Criterion} = \frac{1.4 \times 10^{-4} \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.0065 \text{ kg/day} \times 5.6 \text{ L/kg}}$$

$$= 269 \text{ ug/L}$$

Where:

1.4×10^{-4} mg/kg/day	= RfD, including an additional uncertainty factor of 10 for possible carcinogenicity
70 kg	= assumed weight of average adult
2 L/day	= assumed daily water consumption
0.0065 kg/day	= assumed daily consumption of edible aquatic products
5.6 L/kg	= BCF (USEPA, 1980h)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

1,1-Dichloroethylene is classified as a possible human carcinogen (Group C) by both USEPA and New Jersey. The USEPA Reference Dose given in IRIS of 9×10^{-3} mg/kg/day is based on a study in rats. This study was considered by New Jersey, but was not selected because in the study which New Jersey utilized the mice were more sensitive to the toxic effects of the compound than were the rats in the study used by USEPA.

10. trans-1,2-DICHLOROETHYLENE

The New Jersey Health-based Maximum Contaminant Level for trans-1,2-dichloroethylene was based on the toxicity of the isomer, 1,1-dichloroethylene, since appropriate data was not available for the trans-1,2-dichloroethylene. The Reference Dose used was 0.0014 mg/kg/day. Subsequent to the development of the New Jersey Health-based Maximum Contaminant Level, appropriate toxicity studies have been conducted on the trans-1,2-dichloroethylene. Based on this data, the Reference Dose of 0.02 mg/kg/day has been derived by USEPA and incorporated into IRIS. The Lists and Levels Subcommittee of the New Jersey Drinking Water Quality Institute has reviewed this data and recommended to the New Jersey Drinking Water Quality Institute that the New Jersey Health-based MCL be revised to reflect the new Reference Dose. The proposed human health-based surface water criterion for trans-1,2-dichloroethylene is based on the Reference Dose of 0.017 mg/kg/day, and therefore, reflects current knowledge on the toxicity of this chemical. The difference in reference dose arises from recording IRIS toxicity data as two significant figures by NJDEPE versus one significant figure by USEPA.

11. LEAD

a. CAS #: 7439-92-1

b. Synonyms: None

c. Physical Constants and Additional Information:

Chemical formula	Pb
Molecular weight	207.2
Physical state	bluish-white, silvery, gray metal (elemental)
Vapor pressure	not applicable
Water solubility	dependent on pH and on particular organic or inorganic lead compound
Log octanol/water partition coefficient	not available
Odor threshold (water)	not available

d. New Jersey Carcinogenicity Classification:

Not available (see discussion, starting on page 26)

e. Basis for Risk Assessment:

See discussion, starting on page 26

f. Toxicity Factor:

See discussion, starting on page 26

g. Derivation of Human Health-Based Criterion:

5 ug/L (see discussion, starting on page 26).

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

The human health-based surface water quality criterion of 5 ug/L being proposed by New Jersey is based on considerations discused in detail on page 26. The USEPA criterion of 50 ug/L in the current USEPA proposal (USEPA, 1991a) was based on the United States Public Health Service Recommendation as the drinking water MCL.

12. METHYLENE CHLORIDE

a. CAS #: 75-09-2

b. Synonyms: Dichloromethane
Methylene dichloride

Methane dichloride
DCM

c. Physical Constants and Additional Information:

Chemical formula	CH_2Cl_2
Molecular weight	84.94
Physical state	clear, colorless liquid
Vapor pressure	349 torr at 20 ^oC
Water solubility	2.0 g/100 ml at 20 ^oC
Log octanol/water partition coefficient	1.25
Odor threshold (water)	not available

d. New Jersey Carcinogenicity Classification:

Category I - Risk assessment based on carcinogenic end point.

e. Basis for Risk Assessment:

Methylene chloride is considered a probable human carcinogen and was therefore placed in Category I. It has been shown to cause cancer in various organs in rats and mice. The risk assessment was based on a study involving oral exposure in mice (NCA, 1983). The end point considered was a combination of hepatocellular carcinoma and adenoma in male mice. The multistage model for high to low dose extrapolation was used to derive a carcinogenic potency factor of $0.014 (mg/kg/day)^{-1}$.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* = \frac{1 \times 10^{-6}}{(9.35 \times 10^{-4} \text{ mg/kg/day}) \times 0.075} = 0.014 \text{ (mg/kg/day)}^{-1}$$

Where:

1×10^{-6}	= risk level
9.35×10^{-4} mg/kg/day	= dose to mice predicted to result in 1×10^{-6} risk (NJDWQI, 1987b)
0.075	= factor for extrapolation from mouse to human based on body surface area $(W_A/W_H)^{1/3}$ (See p. 24)

g. Derivation of Human Health-Based Criteria:

$$\text{FW2 Criterion} = \frac{1 \times 10^{-6} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.014 \text{ (mg/kg/day)}^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 0.91 \text{ L/kg}))}$$

$$= 2.49 \text{ ug/L}$$

$$\text{SE, SC Criterion} = \frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.014 \text{ (mg/kg/day)}^{-1} \times 0.0065 \text{ kg/day} \times 0.91 \text{ L/kg}}$$

$$= 845 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
$0.014 \text{ (mg/kg/day)}^{-1}$	=	q_1^* (carcinogenic potency factor)
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
0.91 L/kg	=	BCF (USEPA, 1980i)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

Both USEPA and New Jersey classify methylene chloride as a probable human carcinogen (Group B2). The USEPA potency factor given in IRIS of 7.5×10^{-3} $(\text{mg/kg/day})^{-1}$ is derived from combining data from an oral study and an inhalation study. New Jersey's potency factor is based on only the oral study, as the oral route of exposure is most relevant for the surface water criterion.

13. POLYCHLORINATED BIPHENYLS

a. CAS #: 1336-36-3

b. Synonyms:
1,1-Biphenyl, chloro-derivatives
PCBs
Chlorinated diphenyl
Chlorinated biphenyl
Aroclor (USA)
Kanechlor (Japan)
Clophen (Germany)

c. Physical Constants and Additional Information:

Chemical Formula	Polychlorinated biphenyls (PCBs) consist of compounds with a biphenyl backbone substituted by varying numbers of chlorine atoms on the aromatic rings. As many as 209 different compounds (congeners) of PCBs are possible; they exist in varying proportions in commercial mixtures called Aroclor (USA), Kanechlor (Japan) and Clophen (Germany). Commercial PCB mixtures are distinguished by a number (e.g., Aroclor 1254), which is based on the average percentage of chlorine in the mixture.
Molecular weight range	189-499
Physical state	Lower-chlorinated PCBs are colorless mobile oils. Higher-chlorinated PCBs vary from viscous liquids to sticky resins.
Vapor pressure (Aroclor 1254)	4.94×10^{-4} torr at 25 ^{o}C
Water solubility (Aroclor 1254)	50 ug/L at 25 ^{o}C
Log octanol/water partition coefficient	4-4.3 for lower chlorinated PCBs
Odor threshold (water)	odorless

d. New Jersey Carcinogenicity Classification:

Category I - Risk assessment based on carcinogenic end point.

e. Basis for Risk Assessment:

PCBs are considered to be probable human carcinogens and were therefore placed in Category I. These compounds were found to cause cancer in both rats and mice. The risk assessment was based on a study involving chronic oral exposure of Clophen 60 (a PCB mixture) to rats (Schaeffer et al., 1984). The toxic end point was an increase in liver tumors in male rats. The multistage model for high to low dose extrapolation was used to derive a carcinogenic potency factor of 1.4 $(\text{mg/kg/day})^{-1}$.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* = \frac{1 \times 10^{-6}}{4.08 \times 10^{-6} \text{ mg/kg/day} \times 0.17}$$

$$= 1.4 \text{ (mg/kg/day)}^{-1}$$

Where:

1×10^{-6}	=	risk level
4.08×10^{-6} mg/kg/day	=	dose to rats predicted to result in 1×10^{-6} risk (NJDWQI, 1987b)
0.17	=	factor for extrapolation from rats to humans based on body surface area $(W_A/W_H)^{1/3}$, (see p. 24)

g. Derivation of Human Health-Based Criteria:

FW2 Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{1.4 \text{ (mg/kg/day)}^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 31{,}200 \text{ L/kg}))}$$

$$= 0.000244 \text{ ug/L}$$

SE, SC Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{1.4 \text{(mg/kg/day)}^{-1} \times (0.0065 \text{ kg/day} \times 31{,}200 \text{ L/kg})}$$

$$= 0.000247 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
$1.4\text{(mg/kg/day)}^{-1}$	=	q_1^* (carcinogenic potency factor)
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
31,200 L/kg	=	BCF (USEPA, 1980j)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

Both USEPA and New Jersey classify PCBs as a probable human carcinogen (Group B2). The USEPA potency factor given in IRIS is 7.7 (mg/kg/day)^{-1}. The study which USEPA used to develop its potency factor was considered by New Jersey, but was not selected as most appropriate for risk assessment because of the variable dosing regimen which was utilized.

14. TETRACHLOROETHYLENE

a. CAS #: 127-18-4

b. Synonyms: 1,1,2,2-Tetrachloroethylene
Perchloroethylene
PCE
PERC

c. Physical Constants and Additional Information:

Chemical formula	C_2Cl_4
Molecular weight	165.85
Physical state	colorless liquid
Vapor pressure	19 torr at ^oC
Water solubility	150 mg/L at 25 ^oC
Log octanol/water partition coefficient	2.86
Odor threshold (water)	300 ug/L

d. New Jersey Carcinogenicity Classification:

Category I - Risk assessment based on carcinogenic end point.

e. Basis for Risk Assessment:

Tetrachloroethylene is considered a probable human carcinogen and was, therefore, placed in Category I. It has been shown to cause cancer at various sites in rats and mice. The risk assessment was based on an oral exposure study in male mice (NCI, 1977). The end point considered was hepatocellular carcinoma. The multistage model for high to low dose extrapolation was used to derive a carcinogenic potency factor of 0.082 (mg/kg/day)^{-1}.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* = \frac{1 \times 10^{-6}}{1.62 \times 10^{-4} \text{ mg/kg/day} \times 0.075} = 0.082 (\text{mg/kg/day})^{-1}$$

Where:

1×10^{-6}	=	risk level
1.62×10^{-4} mg/kg/day	=	dose predicted to result in 1×10^{-6} risk in mice (NJDWQI, 1987b)
0.075	=	factor for extrapolation from mice to humans based on body surface area $(W_A/W_H)^{1/3}$ (see p. 24)

g. Derivation of Human Health-Based Criteria:

FW2 Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.082 (\text{mg/kg/day})^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 30.6 \text{ L/kg}))}$$

$$= 0.388 \text{ ug/L}$$

SE, SC Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.082 (\text{mg/kg/day})^{-1} \times (0.0065 \text{ kg/day} \times 30.6 \text{ L/kg})} = 4.29 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
0.082 $(\text{mg/kg/day})^{-1}$	=	q_1^* (carcinogenic potency factor)
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
30.6 L/kg	=	BCF (USEPA, 1980k)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

No toxicity factor is given in IRIS for tetrachloroethylene. Both the USEPA and New Jersey criteria for this contaminant are based on potential carcinogenic effects. The USEPA

criterion is a 304(a) criterion which was developed by USEPA in 1980 or earlier, prior to the New Jersey evaluation of this contaminant.

15. 1,2,4-TRICHLOROBENZENE

a. CAS #: 120-82-1

b. Synonyms: 1,2,4-TCB
Benzene, 1,2,4-trichloro
asym-Trichlorobenzene
1,2,4-Trichlorobenzol

c. Physical Constants and Additional Information:

Chemical formula	$C_6H_3Cl_3$
Molecular weight	181.46
Physical state	colorless liquid
Vapor pressure	1 torr at 38.4 °C 0.29 torr at 25 °C
Water solubility	34.6 mg/L at 25 °C
Log octanol/water partition coefficient	4.0
Odor threshold	not available

d. New Jersey Carcinogenicity Classification:

Category III - Risk assessment based on non-carcinogenic end point.

e. Basis for Risk Assessment:

1,2,4-Trichlorobenzene is considered a non-carcinogen and was therefore placed in Category III. This compound causes toxicity to the kidney, lungs, liver, and reproductive system. The risk assessment was based on a study involving subchronic inhalation exposure of rats (Watanabe et al., 1978). The end point considered was liver porphyria in rats. Appropriate uncertainty factors were applied to the NOAEL of 3 ppm to derive an RfD of 1.2×10^{-3} mg/kg/day.

f. Reference Dose:

1.2×10^{-3} mg/kg/day (NJDWQI, 1987b)

g. Derivation of Human Health-Based Criteria:

$$\text{FW2 Criterion} = \frac{1.2 \times 10^{-3} \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2 \text{ L/day} + (0.0065 \text{ kg/day} \times 114 \text{ L/kg})}$$

$$= 30.6 \text{ ug/L}$$

$$\text{SE, SC Criterion} = \frac{1.2 \times 10^{-3} \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.0065 \text{ kg/day} \times 114 \text{ L/kg}}$$

$$= 113 \text{ ug/L}$$

Where:

1.2×10^{-3} mg/kg/day	=	RfD
70 kg	=	assumed weight of average adult
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
114 L/kg	=	BCF (USEPA, 1980e)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

No toxicity factor is given in IRIS for this chemical. No criterion is proposed by USEPA.

16. 1,1,1-TRICHLOROETHANE

a. CAS #: 71-55-6

b. Synonyms: Ethane, 1,1,1-trichloro
Methyl chloroform
Methyl trichloromethane
1,1,1-TCE

c. Physical Constants and Additional Information:

Chemical formula	$C_2H_3Cl_3$
Molecular weight	133.4
Physical state	colorless liquid
Vapor pressure	127 torr at 20 °C
Log octanol/water partition coefficient	2.17

Water solubility	4.4 g/L at 20 °C
Odor threshold (water)	50 mg/L

d. New Jersey Carcinogenicity Classification:

Category III - Risk assessment based on non-carcinogenic end point.

e. Basis for Risk Assessment:

1,1,1-Trichloroethane is considered a non-carcinogen and was therefore placed in Category III. Repeated exposure of experimental animals to this compound has been associated with liver toxicity. The risk assessment was based on a subchronic study involving continuous inhalation exposure of mice (McNutt et al., 1975). The end point considered was hepatic toxicity. Pharmacokinetic modeling was used to derive the oral dose in humans equivalent to the dose received in the mice by continuous inhalation exposure. Appropriate uncertainty factors were applied to the dose received at the LOAEL of 250 ppm to derive an RfD of 3.7×10^{-3} mg/kg/day.

f. Reference Dose:

$$\text{RfD} = \frac{1280 \text{ mg/L} \times 2 \text{ L}}{70 \text{ kg} \times 10{,}000} = 3.7 \times 10^{-3} \text{ mg/kg/day}$$

Where:

1280 mg/L	=	drinking water concentration predicted by pharmacokinetic modeling to result in a human body burden of 22.8 mg/kg. 22.8 mg/kg is the body burden predicted by the model at the LOAEL in mice (NJDWQI, 1987b).
2 L	=	assumed daily water consumption
70 kg	=	assumed weight of human adult
10,000	=	uncertainty factor to derive a Reference Dose from a LOAEL in a subchronic animal study.

g. Derivation of Human Health-Based Criteria:

$$\text{FW2 Criterion} = \frac{0.0037 \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{2 \text{ L} + (0.0065 \text{ kg/day} \times 5.6 \text{ L/kg})}$$

$$= 127 \text{ ug/L}$$

$$\text{SE, SC Criterion} = \frac{0.0037 \text{ mg/kg/day} \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.0065 \text{ kg/day} \times 5.6 \text{ L/kg}}$$

$$= 7{,}120 \text{ ug/L}$$

Where:

0.0037 mg/kg/day	=	RfD
70 kg	=	assumed weight of average adult
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
5.6 L/kg	=	BCF (USEPA, 1980g)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

At present, no toxicity factor for 1,1,1-trichloroethane is given in IRIS. The criterion proposed by USEPA is apparently based on a Reference Dose from IRIS which was withdrawn on 8/1/91. Both the New Jersey and USEPA criteria are based on non-carcinogenic effects; the New Jersey criterion is approximately 24-fold lower than the USEPA criterion.

17. TRICHLOROETHYLENE

a. CAS #: 79-01-6

b. Synonyms: Ethene, trichloro
Acetylene trichloride
TCE

c. Physical Constants and Additional Information:

Chemical formula	C_2HCl_3
Molecular weight	131.39
Physical state	colorless liquid
Vapor pressure	77 torr at 25 ^oC
Water solubility	0.1% w/v at 20 ^oC
Log octanol/water partition coefficient	2.38

Odor threshold (water) 0.5 mg/L

d. New Jersey Carcinogenicity Classification:

Category I - Risk assessment based on carcinogenic end point.

e. Basis for Risk Assessment:

Trichloroethylene is considered a probable human carcinogen and was therefore placed in Category I. This compound has been shown to cause liver cancer in mice. The risk assessment was based on a study involving oral exposure to mice (NTP, 1984). The end point considered were hepatocellular carcinoma and adenoma in male mice. The multistage model for high to low dose extrapolation was used to derive a carcinogenic potency factor of 0.031 $(mg/kg/day)^{-1}$.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* = \frac{1 \times 10^{-6}}{4.34 \times 10^{-4} \text{ mg/kg/day} \times 0.075} = 0.031 (\text{mg/kg/day})^{-1}$$

Where:

1×10^{-6}	=	risk level
4.34×10^{-4}	=	dose to mice predicted to result in 1×10^{-6} risk (NJDWQI, 1987b)
0.075	=	factor for extrapolation from mouse to human on a body surface area basis $(W_A/W_H)^{1/3}$ (see p. 24).

g. Derivation of Human Health-Based Criteria:

FW2 Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.031 (\text{mg/kg/day})^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 10.6 \text{ L/kg}))}$$

$$= 1.09 \text{ ug/L}$$

SE, SC Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.031 (\text{mg/kg/day})^{-1} \times (0.0065 \text{ kg/day} \times 10.6 \text{ L/kg})} = 32.8 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
0.031 $(mg/kg/day)^{-1}$	=	q_1^* (carcinogenic potency factor)
2 L/day	=	assumed daily water consumption
0.0065 kg/day	=	assumed daily consumption of edible aquatic products
10.6 L/kg	=	BCF (USEPA, 19801)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

No toxicity factor for trichloroethylene is given in IRIS. Both the USEPA and New Jersey criteria for this contaminant are based on potential carcinogenic effects. The USEPA criterion is a 304(a) criterion which was developed by USEPA in 1980 or earlier, prior to the New Jersey evaluation of this contaminant.

18. VINYL CHLORIDE

a. CAS #: 75-01-4

b. Synonyms: Chloroethylene
Chloroethene
Vinyl chloride monomer

c. Physical Constants and Additional Information:

Chemical formula	C_2H_3Cl
Molecular weight	62.50
Physical state	colorless gas
Vapor pressure, volatility	2,660 torr at 25 °C
Water solubility	1.1 g/L at 25 °C
Log octanol/water partition coefficient	0.60
Odor threshold (water)	3.4 ppm

d. New Jersey Carcinogenicity Classification:

Category I - Risk assessment based on carcinogenic end point.

e. Basis for Risk Assessment:

Vinyl chloride is considered a human carcinogen and was therefore placed in Category I. It has been shown to induce liver cancer in rats, mice, hamsters, and humans. The risk assessment was based on a study involving oral exposure of rats (Feron et al., 1981). The end point considered was hepatocellular carcinoma in female rats. The multistage model for high to low dose extrapolation was used to derive a carcinogenic potency factor of 0.42 $(mg/kg/day)^{-1}$.

f. Derivation of Carcinogenic Potency Factor:

$$q_1^* = \frac{1 \times 10^{-6}}{1.4 \times 10^{-5} \text{ mg/kg/day} \times 0.17} = 0.42 \text{ (mg/kg/day)}^{-1}$$

Where:

1×10^{-6}	=	risk level
1.4×10^{-5} mg/kg/day	=	dose to rats predicted to result in 1×10^{-6} risk (NJDWQI, 1987b)
0.17	=	factor for extrapolation from rats to humans based on body surface area $(W_A/W_H)^{1/3}$ (See p. 24)

g. Derivation of Human Health-Based Criteria:

FW2 Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.42 \text{ (mg/kg/day)}^{-1} \times (2 \text{ L/day} + (0.0065 \text{ kg/day} \times 1.17 \text{ L/kg}))}$$

$$= 0.0830 \text{ ug/L}$$

SE, SC Criterion =

$$\frac{(1 \times 10^{-6}) \times 70 \text{ kg} \times 1000 \text{ ug/mg}}{0.42 \text{ (mg/kg/day)}^{-1} \times (0.0065 \text{ kg/day} \times 1.17 \text{ L/kg})} = 21.9 \text{ ug/L}$$

Where:

1×10^{-6}	=	upper bound lifetime excess cancer risk
70 kg	=	assumed weight of average adult
0.42 $(mg/kg/day)^{-1}$	=	q_1^* (carcinogenic potency factor

2 L/day = assumed daily water consumption of edible aquatic products

1.17 L/kg = BCF (USEPA, 1980m)

h. Comparison of Toxicity Factors Derived by New Jersey to USEPA Toxicity Factors:

No toxicity factor for vinyl chloride is given in IRIS. The USEPA and New Jersey criteria for this contaminant are based on potential carcinogenic effects. The USEPA criterion is a 304(a) criterion which was developed by USEPA in 1980 or earlier, prior to the New Jersey evaluation of this contaminant.

C. AQUATIC LIFE CONSIDERATIONS

1. Criteria for Toxic Substances

The existing aquatic life protection criteria, with the exception of un-ionized ammonia, are proposed for change from a single, maximum at any time criterion to a combination of acute criterion, as a one-hour average, and chronic criterion, as a four-day average. This change to the aquatic life protection criteria required a change in the identification of the criteria as acute or chronic in N.J.A.C. 7:9B-1.14(c). Instead of following a criterion with an "(a)" to indicate that it is an aquatic protection criterion, the aquatic protection criteria will now be followed by an "(a)" to indicate criteria based on acute toxicity and a "(c)" to indicate criteria based on chronic toxicity.

The numerical criteria for un-ionized ammonia are not proposed for a change, but the listing is being changed to reflect the fact that the criteria are chronic aquatic life protection criteria. In order to determine the applicable notation, the Department reviewed "Quality Criteria For Water 1976" (the Red Book) (USEPA, 1976), and discussed the criteria with Ken Potts, Office of Criteria and Standards, USEPA, Washington, D.C. (December 1990). The Red Book indicated that the criteria listed in the Red Book were designed to provide an adequate degree of safety to protect against long term effects. For chemicals

> where only 96 hour bioassay data were available, judgmental prudence dictates that a substantial safety factor be employed to protect all life stages of the test organisms in waters of varying quality, as well as to protect associated organisms within the aquatic environment that have not been tested and that many be more sensitive to the test constituent. Application factors have been used to provide the degree of protection required.

Based on this review and the discussion with Ken Potts, it was determined that the existing ammonia criteria are chronic.

Therefore, the un-ionized ammonia criteria will be followed with a "(c)".

USEPA 304(a) aquatic life-based criteria for acute and chronic exposure to toxics in freshwater and saltwater (USEPA, 1976, 1980a, 1986a and b, 1987a and b, 1988a and b) which are being proposed for adoption, are presented in Table 6. The allowable exposure durations to average concentrations are one-hour for the acute criterion and four-days for the chronic criterion except as noted for ammonia which is regulated as a 24-hour average concentrations. No frequency of exceedence at flows at or above the applicable design flows is allowed. The Department has decided to propose all the 304(a) aquatic criteria regardless of whether they are priority (307(a)(1)) or nonpriority pollutants.

The current proposal contains acute aquatic protection criteria for: aldrin, gamma-BHC, chlordane, 4,4'-DDT, dieldrin, endosulfans, endrin, heptachlor, and silver which are based on the USEPA 1980 304(a) documents. Those criteria are Final Acute Values (FAV) which, according to the 304(a) documents, are instantaneous maxima. In 1985 the USEPA issued "Guidelines of Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses" which indicates that dividing the FAV by two gives the Criterion Maximum Concentration (CMC) which is applied as a one-hour average concentration. The Department considered dividing the 1980 FAV by two to approximate criteria developed following the 1985 guidelines. However, there are uncertainties with how these criteria will ultimately be calculated and how the chemicals will ultimately be regulated under USEPA guidance. The Delaware and New York/New Jersey Harbor Estuary Programs, with the participation of the USEPA, have been moving in the direction of using the FAVs as one-hour average concentration criteria. USEPA has scheduled a reexamination of the guidelines for calculating numerical aquatic protection criteria for completion toward the end of this year. Because of these considerations the Department has decided not to modify the 1980 criteria pursuant to the 1985 guidelines for this proposal. As proposed these FAV-based criteria would be applied as one-hour average concentrations. Comments are solicited on the inclusion, form and appropriate duration for these criteria.

The criteria for arsenic listed in Table 6 are the national criteria which the USEPA developed for arsenic (III) (USEPA, 1985c). Since there are no national criteria for arsenic (V), the Department decided to propose the criteria for the more toxic form, arsenic (III), as criteria for arsenic (total recoverable) in N.J.A.C. 7:9B-1.14(c) in order to be protective.

In the 1989 adoption of the SWQS, criteria for Chlorine Produced Oxidants (CPO) were the only new aquatic criteria that were included for adoption. To be consistent with the monitoring practices at that time, the criteria for CPO were regulated as "less than maximum at any time" and "24-hour average

concentrations". The Department is now proposing to change the durations for CPO to one-hour and four-day average concentrations, respectively, with the adoption of both acute and chronic concentrations.

The total chromium criteria proposed are based on the USEPA criteria for chromium (VI). Although the USEPA has developed freshwater criteria for chromium (III) (USEPA, 1986a), the Department has determined that it is not appropriate to distinguish between the two forms in this proposal. This determination was based on the consideration that currently available field collection and preservation methods do not allow the separate determination of chromium (III) and chromium (VI) concentrations that accurately represent their respective true concentrations in the environment. In addition, ion-specific toxicity testing results on the various forms of chromium are questionable because of the potential for interconversion of the forms during the test and in vivo.

The Department conducted an analysis to compare the protection provided by the chromium criteria (III or VI) in freshwaters. Based on the chromium (VI) criteria listed in Table 6, and the chromium (III) criteria expressed as $e^{(0.8190[\ln(H) + 1.561)}$ for four-day average concentrations and $e^{(0.8190[\ln(H) + 3.688)}$ for one-hour average concentrations, it was found that only at hardnesses below 2.7 mg/L (as $CaCO_3$) would the acute and chronic chromium (III) criteria be more stringent than the respective acute and chronic chromium (VI) criteria. The vast majority of waters in the State have hardnesses in excess of 2.7 mg/L (as $CaCO_3$). Thus, by ensuring that total chromium concentrations in State waters comply with the USEPA chromium (VI) criteria, the Department concludes that aquatic life is protected from exposure to chromium (III) and chromium (VI) in toxic concentrations.

The Department is proposing the criteria for heptachlor epoxide, contained in the USEPA criteria proposal (USEPA, 1991a), despite the fact that these criteria are not presented as criteria specifically developed for heptachlor epoxide in the 304(a) criteria documents (USEPA, 1980n). This will allow the Department to grant variances and issue compliance schedules, when warranted. If the USEPA does not adopt criteria for heptachlor epoxide, the Department will not adopt those criteria either.

Criteria presented in Table 6 for endosulfans and PCBs represent criteria for entire groups of chemicals and not for each individual priority pollutant as listed in the USEPA proposal. In this proposal criteria for alpha and beta endosulfans are included under endosulfans and criteria for PCBs 1016, 1221, 1232, 1242, 1248, 1254 and 1260 are included under PCBs to reflect the general occurrence of these substances as mixtures.

2. Attempt to Develop State-Specific Criteria for Chemicals in the 1988 Criteria Proposal and Lead

a. Introduction

The Department attempted to develop State-specific aquatic life-based criteria for the 17 toxic chemicals contained in the 1988 criteria proposal and for lead (Table 7). As explained below, no New Jersey-specific criteria could be developed because there were not enough acceptable toxicity test results for New Jersey species to satisfy the distribution of animal families required by the USEPA methodology.

b. Derivation of Aquatic Life-Based Criteria

New Jersey specific criteria were to be based on the toxicity of pollutants to aquatic biota indigenous to New Jersey waters and developed in accordance with USEPA guidelines (USEPA, 1985a). In order to develop criteria for both acute and chronic exposure to pollutants, acceptable measurements of toxicity to animals representing a specified distribution of families must be available.

For fresh water, data for the following families must be available:

1. the family Salmonidae in the class Osteichthyes
2. a second family in the class Osteichthyes, preferably a commercially or recreationally important warm water species
3. a third family in the phylum Chordata
4. a planktonic crustacean
5. a benthic crustacean
6. an insect
7. a family in a phylum other than Arthropoda or Chordata
8. a family in any order of insect or any phylum not already represented.

To derive saltwater criteria, data for the following distribution of families must be available:

1. two families in the phylum Chordata
2. a family in a phylum other than Arthropoda or Chordata
3. either the Mysidae or Penaeidae family
4. three other families not in the phylum Chordata with the possible inclusion of either Mysidae or Penaeidae, whichever was not used above
5. any other family.

The Department reviewed criteria documents and summaries (USEPA, 1976, 1980a-n, 1985d, 1986a and b, 1987a) and the current aquatic toxicity data from AQUIRE (USEPA, 1989a) for the 18 chemicals listed in Table 7. Toxicity test results from AQUIRE with unreliable data, as indicated in the database by review codes 3

and 4, were excluded from the development of criteria. Acceptable toxicity tests for New Jersey species were considered for development of criteria while test results for species in animal families not found in the State (Conant, 1975; Versar, 1990) were eliminated from use. The acceptable toxicity tests for New Jersey species were examined to determine whether they fit the required family distribution listed above for each of the 18 chemicals.

Table 8 and 9 list animal families to which New Jersey freshwater and saltwater species belong that have available toxicity data for the 18 toxic substances. Acceptable acute toxicity test results for eight or more freshwater animal families were only available for three of the 18 toxic substances (chlordane, PCBs and lead) (Table 8). Acceptable acute toxicity test results for eight or more saltwater animal families were available only for lead (Table 9). For all 18 of the toxic substances, less than ten families from both freshwater and saltwater species were represented in chronic toxicity bioassay test results (Tables 8 and 9).

Examination of the available, acceptable national acute bioassay test results revealed that the required distribution of eight families was satisfied for chlordane in freshwater, and lead in both freshwater and saltwater. The required distribution of freshwater families could not be met for PCBs because acceptable acute toxicity test results were not available for a planktonic crustacean, a family in a phylum other than Arthropoda or Chordata, and a family in any order of insect or any phylum not already represented by families previously selected to help meet the distribution requirements.

No data for State species were available for four of the eleven State families for which acceptable freshwater acute toxicity data for chlordane was available (Table 10). The seven families for which State species have been tested do not satisfy the required distribution of eight families needed to develop a criterion.

No data for State species were available in three of the ten State families for which freshwater acute toxicity for lead has been tested (Table 11). The seven families for which State species have been tested do not satisfy the required distribution of eight families needed to develop a criterion.

No State species are represented in three of the fourteen State families for which saltwater acute toxicity data for lead was available (Table 12). The eleven families for which State species have been tested do not satisfy the required distribution of eight families needed to develop a criterion because no State species belonging to either Mysidae or Penaeidae have been tested.

In summary, no State-specific acute or chronic toxicity aquatic life-based criteria could be developed for the 18 toxic substances reviewed because bioassay test results were not available for enough State species.

3. Attempt to Update/Develop Criteria for Chemicals in the 1988 Criteria Proposal and Lead

a. Introduction

The Department also attempted to update/develop aquatic criteria for the same 18 chemicals. As discussed above under Derivation of Aquatic Life-Based Criteria, the appropriate criteria documents and AQUIRE data were reviewed and the USEPA method (1985a) was followed in trying to update the national criteria. Toxicity values and BCFs necessary to meet the required family distribution for North American species were only available to update acute and chronic, freshwater and saltwater, toxicity criteria for lead, and an acute freshwater toxicity criterion for chlordane. Although the available toxicity test data appeared to be sufficient to meet the distribution requirements for updating criteria, discussions with the USEPA (USEPA, 1990d) on the quality of the available toxicity test data and examination of the original literature containing the lowest acute toxicity values for chlordane and lead (Rao et al., 1975), indicated that the data is questionable. The Department agrees with the USEPA's recommendation (USEPA, 1990d) not to use these values in the derivation of water quality criteria because of the questionable quality of the Rao data. Therefore, the Department has decided not to propose updated criteria, at this time, but proposes to adopt the 304(a)(1) aquatic life-based criteria, as published by the USEPA, for chlordane. For lead, the 304(a) freshwater criteria and recalculated 304(a) saltwater criteria are proposed. Because of the lack of acceptable toxicity test data on a distribution of species meeting the updated method the Department is also proposing the USEPA 304(a) criteria for the other 16 toxic substances reviewed in detail. A chemical by chemical discussion of the toxicity data and species distribution for these 18 chemicals follows (USEPA, 1976, 1980a, 1986a and b, 1987a and b, 1988a and b).

b. Benzene

No criteria could be developed for benzene. Acute freshwater toxicity data were available for only seven families: a cladoceran (Daphnidae), a snail (Lymnaeidae), and five families of fishes (Cyprinidae, Centrarchidae, Ictaluridae, Poeciliidae and Percichthyidae). Thus, the required distribution of eight families needed to develop the criterion could not be met.

Chronic toxicity information was available for only one species (in the fish family Percichthyidae) and no plant values or BCFs were available. Thus, no chronic criterion could be developed.

Saltwater acute toxicity data were reported for four families: the crustaceans Cancridae, Crangonidae and Palaemonidae, and the mollusc Ostreidae. The required distribution of eight families could not be met. No chronic toxicity test data for animals, plant toxicity data or BCFs were available. Thus, no saltwater criteria could be developed.

c. Carbon Tetrachloride

Acute toxicity information was available for only two freshwater species in the families Daphnidae (a crustacean), and Centrarchidae (a fish), and one saltwater species in the fish family Atherinidae. Information on chronic toxicity, plant toxicity and BCFs was not available. No criteria could be developed for either freshwater or saltwater because the required distribution of eight families needed to develop acute criteria could not be met, and no data at all were available for development of chronic criteria.

d. Chlordane

Acute toxicity information for chlordane was available for species in six freshwater invertebrate families (Daphnidae, Gammaridae, Chironomidae, Palaemonidae, Pteronarcidae and Planorbidae) and five fish families (Salmonidae, Cyprinidae, Centrarchidae, Percichthyidae and Poeciliidae). The USEPA, 1980 criteria listed in Table 6 are being proposed for adoption as discussed in the introduction.

No information was available on freshwater chronic toxicity and plant toxicity. BCFs were available for one fish (Cyprinidae). Because the information available was not sufficient to meet the required family distribution, a freshwater chronic criterion could not be developed.

Saltwater acute toxicity information was available for a species in three invertebrate families (Palaemonidae, Penaeidae and Ostreidae) and two fish families (Cyprinodontidae and Gasterosteidae). Chronic toxicity information was available for only one fish family, Cyprinodontidae, and no acceptable data were available for saltwater plants.

The saltwater criteria could not be updated because the information available did not include test data representing the required distribution of eight families.

e. Chlorobenzene

The only information available on freshwater acute toxicity was for single species in the invertebrate family, Daphnidae and two fish families, Cyprinidae and Centrarchidae. No information was available on freshwater chronic toxicity, plant toxicity or BCFs. The required distribution of eight families could not be met to develop acute or chronic criteria for freshwater.

No information was available on saltwater acute and chronic animal toxicity, plant toxicity or BCFs. Thus, no saltwater criteria were developed.

f. 1,2-Dichlorobenzene

Acute toxicity data were available for a cladoceran (Daphnidae) and two fish (Cyprinidae and Centrarchidae). No data were available on freshwater chronic toxicity, plant toxicity or BCFs. Thus, the data requirements could not be met to develop the freshwater criteria.

Data on saltwater acute toxicity were available for a shrimp (Palaemonidae) and a fish (Atherinidae). However, data on chronic toxicity, plant toxicity and BCFs were not available for any saltwater species. Criteria could not be developed due to the lack of test data on the required number of families.

g. 1,3-Dichlorobenzene

Freshwater acute toxicity data were available for a cladoceran (Daphnidae) and a fish (Cyprinidae). Chronic toxicity data were also available for species in the families Daphnidae and Cyprinidae. No data were reported on plant toxicity and BCFs on any freshwater species. The data available were not sufficient to develop freshwater acute and chronic criteria.

No data were available on saltwater acute, chronic and plant toxicity and on BCFs for criteria development.

h. 1,4-Dichlorobenzene

Freshwater acute toxicity data were available for a species in each of the following families: Daphnidae, Chironomidae, Salmonidae, and Cyprinidae. Chronic toxicity data were available for the daphnid and cyprinid species. Freshwater plant toxicity data were available for a green algae but no BCF data were available. The information available was not sufficient to develop freshwater acute or chronic criteria for 1,4-dichlorobenzene.

Saltwater acute toxicity data were available for species in the family Palaemonidae and Mysidae. No information was available on saltwater chronic toxicity, plant toxicity or BCFs. Therefore, saltwater acute or chronic criteria could not be developed.

i. 1,2-Dichloroethane

Acute freshwater toxicity information was available for species in the following animal families: Daphnidae, Pteronarcidae, Salmonidae, and Cyprinidae. Chronic toxicity data were available for species only in one invertebrate and one fish families, Daphnidae and Cyprinidae respectively. No data were available on

plant toxicity or BCFs. Thus, the required distribution of eight families could not be met to allow criteria for freshwater to be developed.

Saltwater toxicity data were not available on acute, chronic, plant or BCFs for any species. Hence, criteria could not be developed.

j. 1,1-Dichloroethylene

Freshwater acute toxicity information was available for a species in Daphnidae, Cyprinidae and Centrarchidae animal families. No information was available on chronic toxicity, plant toxicity or BCFs. The lack of data for the required distribution of eight families did not allow for development of either acute or chronic criteria for freshwater.

The only saltwater data available were on acute toxicity to a fish in the family Atherinidae. Criteria could not be developed due to insufficient information.

k. trans-1,2-Dichloroethylene

Acute toxicity data were available on only one freshwater species in the family Daphnidae. Data were not available on chronic toxicity, plant toxicity and BCFs. No criteria could be developed because the data requirement could not be met.

No saltwater criteria were developed because no toxicity data were available.

l. Lead

Acute toxicity information for lead was available for species in five freshwater invertebrate families (Philodinidae, Physidae, Daphnidae, Gammaridae and Chironomidae) and four fish families (Salmonidae, Cyprinidae, Poeciliidae and Centrarchidae). Freshwater chronic toxicity data were available for species in two invertebrate families (Daphnidae and Lymnaeidae) and four fish families (Salmonidae, Esocidae, Ictaluridae and Centrarchidae). No information was available on plant toxicity. BCFs were available for species in one fish family, Salmonidae. Even though the quantity of information available was sufficient to update freshwater acute and chronic criteria, the Department decided, as discussed earlier, to adopt USEPA 304(a) freshwater acute and chronic criteria for lead because some of the available data was questionable.

Saltwater acute toxicity information for lead was available for species in thirteen invertebrate families (Nereidae, Dorvilleidae, Ctenodrilidae, Capitellidae, Mytilidae, Pectinidae, Ostreidae, Macridae, Veneridae, Myidae, Acartiidae, Mysidae and Ampeliscidae) and two fish families (Cyprinodontidae and Atherinidae). Chronic toxicity information was available for a

single species in the family Mysidae. No plant toxicity information was available and no BCF was available for species in an invertebrate family, Mytilidae. The Department is proposing to adopt USEPA 304(a) saltwater acute and chronic criteria as recalculated by the USEPA. A personal communication with Ken Potts (March 19, 1991), Office of Criteria and Standards, USEPA, Washington D.C., indicated that the saltwater criteria as listed in "Ambient Water Quality Criteria for Lead 1984" (USEPA, 1985d) and "Quality Criteria for Water 1986" (USEPA, 1986a) were in error. The criteria were recalculated by the USEPA to be 220 ug/L and 8.5 ug/L for acute and chronic criteria, respectively. These recalculated criteria are being proposed for adoption.

m. Methylene Chloride

No criteria could be developed for methylene chloride. Freshwater acute toxicity data were available for a cladoceran (Daphnidae) and a fish (Centrarchidae). No data were available on chronic toxicity, plant toxicity or BCFs. Thus, the requirement for data on eight families could not be met and criteria could not be developed.

Saltwater acute toxicity data were available for species in only three families: an Ostreidae, a Penaeidae, and an Atherinidae. Information on chronic toxicity, plant toxicity and BCFs was not available for any species. No criteria could be developed as the required data were not available.

n. Polychlorinated Biphenyls

Acute toxicity data were available for three invertebrate families (a Gammaridae, a Coenagrionidae and a Astacidae), five fish families (a Salmonidae, a Cyprinidae, a Centrarchidae, a Catostomidae, and an Ictaluridae) and two amphibians (a Ranidae and a Bufonidae). Freshwater acute criteria could not be developed even though there were data for more than eight families because the required distribution of families could not be met.

Chronic toxicity data were available for two invertebrates in the families: Gammaridae and Chironomidae, and two fish in the families: Salmonidae and Cyprinidae. No data were available on plant toxicity. BCFs were available for species in Gammaridae, Astacidae, Salmonidae and Cyprinidae families. The State is proposing to adopt the USEPA freshwater chronic criterion.

Saltwater acute toxicity data were available for species in the following families: Palaemonidae, Penaeidae, Ostreidae and Crangonidae. Chronic toxicity data were available for single species in the families, Ostreidae and Palaemonidae. No data were available on plant toxicity. BCFs were available for species in Ostreidae, Penaeidae and Palaemonidae animal families. The information available was not sufficient to update an acute

criterion. There is no updated information on chronic toxicity from the final USEPA existing 304(a)(1) saltwater criterion.

o. Tetrachloroethylene

Acute toxicity data were available for a species in two freshwater invertebrate families, Daphnidae and Chironomidae, and three fish families, Salmonidae, Cyprinidae and Centrarchidae. No data were reported on chronic toxicity, plant toxicity or BCFs. Criteria could not be developed due to insufficient data.

No data were available on acute, chronic and plant toxicity or on BCFs. Thus, saltwater criteria could not be developed.

p. 1,2,4-Trichlorobenzene

Freshwater acute toxicity data were available for a species in Cyprinidae and Centrarchidae fish families. Information was not available on chronic animal or plant toxicity. BCFs were available for a single species in the family Cyprinidae. Freshwater criteria could not be developed as the required distribution of test data among animal families could not be developed.

No data were available for any saltwater species on toxicity to 1,2,4-Trichlorobenzene; thus, criteria could not be updated.

q. 1,1,1-Trichloroethane

Freshwater acute toxicity data were available for species in the following families: Daphnidae, a Cyprinidae and a Centrarchidae. Data were not available on chronic toxicity, plant toxicity or BCFs. No criteria could be developed due to insufficient data.

Saltwater toxicity data were not available on any acute, chronic and plant tests, or on BCFs. Thus, no saltwater criteria could be developed.

r. Trichloroethylene

Acute toxicity data were available for species in two invertebrate families, Daphnidae and Lymnaeidae, and two fish families, Cyprinidae and Centrarchidae. No information was available on chronic tests, plant tests, or BCFs for any freshwater species.

Saltwater acute toxicity data were available for species in two families, Cyprinidae and Mysidae. No data were available for any species on chronic toxicity, plant toxicity, or on BCFs. No criteria could be developed for freshwater or saltwater because the required distribution of data was not available.

s. Vinyl Chloride

There were no data available on either freshwater or saltwater aquatic plants or animals; thus, criteria could not be developed for vinyl chloride.

D. CHANGES TO THE EXISTING CRITERIA FOR TOXIC SUBSTANCES

This proposal results in changes to the criteria for most of the toxic substances contained in the 1989 SWQS. All of the toxic substance criteria contained in the 1989 SWQS, except for ammonia and chlorine produced oxidants (CPOs), were maximum concentration criteria reflecting then current monitoring practices. The criteria for ammonia were 24 hour average, while the criteria for CPOs were a combination of anytime maximums and 24 hour averages. In the proposal, the criteria from the 1989 SWQS for ammonia are unchanged and the numerical criteria for CPOs are retained but proposed as one hour averages (acute aquatic protection) and four day averages (chronic aquatic protection). This is consistent with the federal 304(a) criteria document.

A brief discussion of the changes in criteria proposed for each of the 1989 toxic substance criteria follows (all criteria are in micrograms per liter):

Aldrin - The aquatic protection based criterion of 0.0019, applicable to fresh and saline waters, is proposed for replacement with freshwater criteria of 3.0 (acute aquatic protection) and 0.000135 (human carcinogen protection), and saline criteria of 1.3 (acute aquatic protection) and 0.000144 (human carcinogen protection).

Arsenic - The human health protection criterion of 50, applicable to FW2 waters, is proposed for replacement with a human carcinogen protection criterion for FW2 waters of 0.0170. Additional freshwater criteria of 360 (acute aquatic protection) and 190 (chronic aquatic protection) are proposed, as well as saline water criteria of 69 (acute aquatic protection), 36 (chronic aquatic protection), and 0.136 (human carcinogen protection).

Barium - The freshwater human health protection criterion of 1,000 is proposed for change to 2,000.

Benzidine - The 1989 criterion of 0.1 for fresh and saline waters is proposed for replacement with criteria of 0.000118 (freshwater, human carcinogen protection) and 0.000535 (saline waters, human carcinogen protection).

Cadmium - The freshwater human health criterion of 10 is proposed for change to 15.9. Aquatic protection criteria in the form of equations are being added for freshwaters. At a hardness of 100 the freshwaters acute aquatic protection criterion is 3.9, while the freshwaters chronic aquatic

protection criterion is 1.1. Additionally, the Department is proposing criteria of 43 (acute aquatic protection), 9.3 (chronic aquatic protection) and 169 (human health protection) for the saline waters.

Chlordane - The existing freshwater aquatic protection criterion of 0.0043 is proposed for replacement with an acute aquatic protection criterion of 2.4 and a chronic aquatic protection criterion of 0.0043. Additionally, a freshwater human carcinogen protection criterion of 0.000277 is proposed. For saline waters, the existing aquatic protection criterion of 0.0040 is proposed for replacement with an acute aquatic protection criterion of 0.09 and a chronic aquatic protection criterion of 0.0040. Additionally, a human carcinogen protection criterion of 0.000283 is proposed.

Chromium - The freshwaters human health criterion of 50 is proposed for change to 160. A freshwater acute aquatic protection criterion of 16 and a freshwater chronic aquatic protection criterion of 11 are proposed in addition to the human health criterion. Additionally, saline waters criteria of 1,100 (acute aquatic protection), 50 (chronic aquatic protection) and 3,230 (human health protection) are proposed.

DDT and metabolites - The single aquatic protection criterion of 0.001 for DDT and metabolites is proposed for replacement with individual entries for 4,4'-DDD, 4,4'-DDE and 4,4'-DDT. Criteria proposed for 4,4'-DDD are a freshwater human carcinogen protection criterion of 0.000832 and a saline water human carcinogen protection criterion of 0.000837. Criteria proposed for 4,4'-DDE are a freshwater human carcinogen protection criterion of 0.000588 and a saline water human carcinogen protection criterion of 0.000591. The freshwater criteria proposed for 4,4'-DDT are an acute aquatic protection criterion of 1.1, a chronic aquatic protection criterion of 0.0010 a human carcinogen protection criterion of 0.000832. Finally, saline water criteria being proposed are an acute aquatic protection criterion of 0.13, a chronic aquatic protection criterion of 0.0010 and a human carcinogen protection criterion of 0.000591.

Dieldrin - The existing aquatic protection criterion of 0.0019 is proposed for replacement with a freshwater acute aquatic protection criterion of 1.25, a freshwater chronic aquatic protection criterion of 0.0019, a saline waters acute aquatic protection criterion of 0.355 and a saline waters chronic aquatic protection criterion of 0.0019. Additionally, a freshwater human carcinogen protection criterion of 0.000135 and a saline waters human

carcinogen protection criterion of 0.000144 are proposed.

Endosulfans - The existing freshwater aquatic protection criterion of 0.056 is proposed for replacement with an acute aquatic protection criterion of 0.22 and a chronic aquatic protection criterion of 0.056. Additionally, a freshwater human health protection criterion of 0.932 is proposed. For saline waters, the existing aquatic protection criterion of 0.0087 is proposed for replacement with an acute aquatic protection criterion of 0.034 and a chronic aquatic protection criterion of 0.0087. Additionally, a human health protection saline waters criterion of 1.99 is proposed.

Endrin - The existing aquatic protection criterion of 0.0023 is proposed for replacement with a freshwater acute aquatic protection criterion of 0.18, a freshwater chronic aquatic protection criterion of 0.0023, a saline waters acute aquatic protection criterion of 0.037 and a saline waters chronic aquatic protection criterion of 0.0023. Additionally, a freshwater human protection criterion of 0.629 and a saline waters human protection criterion of 0.678 are proposed.

Heptachlor - The existing freshwater aquatic protection criterion of 0.0038 is proposed for replacement with an acute aquatic protection criterion of 0.52 and a chronic aquatic protection criterion of 0.0038. Additionally, a freshwater human carcinogen protection criterion of 0.000208 is proposed. For saline waters, the existing aquatic protection criterion of 0.0036 is proposed for replacement with an acute aquatic protection criterion of 0.053 and a chronic aquatic protection criterion of 0.0036. Additionally, a human carcinogen protection criterion of 0.000214 is proposed.

Lead - The freshwaters human health criterion of 50 is proposed for change to 5. Freshwater aquatic protection criteria are being proposed as formulae to reflect the relationship of hardness to the aquatic toxicity lead. The freshwater acute formula results in a criterion of 82 and a freshwater chronic aquatic protection criterion of 3.2 at a hardness level of 100. Additionally, saline waters criteria of 220 (acute aquatic protection) and 8.5 (chronic aquatic protection) are proposed.

Lindane - The freshwater aquatic protection criterion of 0.08 is proposed for replacement with an acute aquatic protection criterion of 2.0, a chronic aquatic protection criterion of 0.80 and a human carcinogen criterion of 0.0186. Similarly, the saline waters aquatic protection criterion of 0.004 is proposed for replacement with an acute aquatic protection criterion

of 0.16 and a human carcinogen protection criterion of 0.0625.

Mercury - The freshwaters human health criterion of 2 is proposed for change to 0.144. A freshwater acute aquatic protection criterion of 2.4 and a freshwater chronic aquatic protection criterion of 0.012 are proposed in addition to the human health criterion. Additionally, saline waters criteria of 2.1 (acute aquatic protection), 0.025 (chronic aquatic protection) and 0.146 (human health protection) are proposed.

Polychlorinated biphenyls (PCBs) - The existing freshwater aquatic protection criterion of 0.014 is proposed for change to a chronic aquatic protection criterion. Additionally, a freshwater human carcinogen protection criterion of 0.000244 is proposed. For saline waters, the existing aquatic protection criterion of 0.030 is proposed for change to a chronic aquatic protection criterion. Additionally, a saline waters human carcinogen protection criterion of 0.000247 is proposed.

Selenium - The freshwaters human health criterion of 10 is proposed for change to 179. A freshwater acute aquatic protection criterion of 20 and a freshwater chronic aquatic protection criterion of 5.0 are proposed in addition to the human health criterion. Additionally, saline waters criteria of 300 (acute aquatic protection), 71 (chronic aquatic protection) and 6,800 (human health protection) are proposed.

Silver - The freshwaters human health criterion of 50 is proposed for change to 164. A freshwater acute aquatic protection criterion is being proposed as a formula reflecting the relationship of hardness to the aquatic toxicity of silver. The freshwater acute formula results in a criterion of 4.1 at a hardness level of 100. Additionally, a saline waters acute aquatic protection criterion of 1.15 and a saline waters human health protection criterion of 65,000 are proposed.

Toxaphene - The existing freshwater aquatic protection criterion of 0.013 is proposed for replacement with an acute aquatic protection criterion of 0.73 and a chronic aquatic protection criterion of 0.0002. Additionally, a freshwater human carcinogen protection criterion of 0.000730 is proposed. For saline waters, the existing aquatic protection criterion of 0.005 is proposed for replacement with an acute aquatic protection criterion of 0.21 and a chronic aquatic protection criterion of 0.0002. Additionally, a human carcinogen protection criterion of 0.000747 is proposed.

In evaluating the effect of these proposed changes it should be remembered that the existing, single design flow of the MA7CD10 flow is proposed for change to design flows of MA1CD10 for acute aquatic protection, MA7CD10 for chronic aquatic protection, 30CD5 for noncarcinogenic human health protection and the Mean Harmonic flow for carcinogenic human health protection. The MA1CD10 flow is generally lower than the MA7CD10 flow, while the MA30CD5 and Mean Harmonic flows are usually higher than the MA7CD10 flows. On certain waterways (e.g., flow regulated) there may not be significant difference in design flows. Because of the waterway-specific relationship of the existing and proposed design flows, the proposed addition of aquatic protection and human health criteria, and the change in duration proposed for these toxic substances, a general indication that the proposed criteria for a given toxic substance are more or less stringent cannot be provided. Determination of whether proposed criteria are more stringent, less stringent or as stringent as the existing criteria is best made on a discharge-specific basis.

E. COMPARISON OF USEPA AND NJDEPE PROPOSAL CRITERIA

Criteria are developed to protect the designated uses of a waterbody. These criteria are split between those applicable to fresh waters and those applicable to saline waters. The criteria are further divided into those for protection of human health and aquatic biota. Finally, the criteria for protection of the aquatic biota are split between protection from acute and chronic toxicity. This is shown more clearly below.

AQUATIC PROTECTION				HUMAN HEALTH	
FRESHWATER		SALINE WATER		FRESH	SALINE
ACUTE	CHRONIC	ACUTE	CHRONIC	WATER	WATER

The USEPA proposed criteria for all toxic pollutants listed pursuant to section 307(a)(1) of the Act for which criteria could be calculated. The NJDEPE proposal includes all chemicals for which the USEPA published criteria pursuant to Section 304(a) of the Act and chemicals (identified by the NJPDES permitting program) which are present in New Jersey discharges at levels which could reasonably be expected to interfere with those designated uses adopted by the NJDEPE. New Jersey based its classification of chemicals as toxic upon data showing toxic effects to humans or the aquatic biota that were sufficient to establish criteria. Because of the differences in how the agencies selected toxic substances for which criteria are proposed, iron, ammonia, nitrates, chloride, etc., are included in New Jersey's proposal but not in the USEPA proposal.

The USEPA proposal includes 306 criteria for 105 toxic chemicals or chemical groups. (Only 249 of the USEPA proposed criteria are actually proposed for New Jersey waters.) Twenty eight criteria for seven isomers of PCB, 10 criteria for two valence states of

chromium and 12 criteria for alpha and beta endosulfan are included in the USEPA proposal. New Jersey's draft proposal includes 324 criteria for 124 toxic chemicals or groups. The NJDEPE proposal lists the seven isomers of PCB under the umbrella listing "PCBs", the two valence states of chromium under the umbrella listing "Chromium (Total Recoverable)" and alpha and beta endosulfan under the umbrella listing "Endosulfans." For purposes of this comparison, the toxic substances listed in the NJDEPE proposal have been used. This reduces the number of criteria under the USEPA proposal to 272. (18 criteria developed by the USEPA are listed in parenthesis in their proposal but are not actually proposed.) The NJDEPE organoleptic criterion for chloride was not included in this comparison and the separate NJDEPE criteria for un-ionized ammonia applicable to trout waters and nontrout waters were counted as only one "more stringent" criterion.

Criteria proposed by one agency only were considered to be more stringent than the nonexistent criteria of the other agency. Criteria were considered to be the same, if the more stringent criterion was within 10% of the less stringent criterion. The use of the ±10% factor was an arbitrary cutoff point established for this comparison. Table 13 is a listing of all of the chemicals for which criteria are proposed by either the USEPA or the NJDEPE for application to NJ waters. The results of the criteria comparison are shown on Table 13 as follows: USEPA proposed criteria that are more stringent than the New Jersey proposal criteria are identified by a "-"; NJDEPE proposal criteria that are more stringent than the USEPA proposed criteria are identified by a "+" and those criteria that are considered the same are identified by an "o." (The listing for the human health criteria for PCBs notes that the criteria cannot be universally identified as more stringent, less stringent or the same.) Counting the trout and nontrout waters ammonia criteria as one and eliminating the human health criteria for PCBs and the organoleptic criterion for chloride leaves a total of 320 criteria being compared. The information set forth in Table 13 shows that the New Jersey proposal criteria are more stringent in 86 (26.87% of all criteria) instances. Two hundred and fifteen (215) criteria (67.19% of all criteria) are within 10% of each other. For 19 criteria (5.94% of all criteria) the USEPA proposed criteria are more stringent.

CRITERIA COMPARISON SUMMARY

	NUMBER	PERCENT
NJDEPE Criteria More Stringent	86	26.87
Criteria Within ±10%	215	67.19
USEPA Criteria More Stringent	19	5.94

Examination of the criteria proposals revealed a number of factors which resulted in differences for a number of criteria.

These factors, the toxic substances and the number of criteria involved are discussed briefly below.

A total of 48 criteria, which were not included in the USEPA proposal, were proposed by the NJDEPE for the following 26 toxic substances:

aluminum, ammonia (un-ionized), barium, butylbenzyl phthalate, 2-chlorophenol, chloride, chlorine produced oxidants, chlorpyrifos, demeton, trans 1,2-dichloroethylene, guthion, iron, malathion, manganese, methoxychlor, mirex, nitrate, N-nitrosodi-n-butylamine, N-nitrosodiethylamine, N-nitrosopyrrolidine, parathion, pentachlorobenzene, phosphorus (yellow), sulfide (hydrogen sulfide), 1,2,4,5-tetrachlorobenzene and 2,4,5-trichlorophenol

Differences in rounding policies resulted in 8 NJDEPE criteria which were more stringent than those proposed by the USEPA for the following toxic substances:

antimony, bis(2-chloroisopropyl)ether, endrin, nickel and pyrene.

Differences in rounding policies resulted in 2 USEPA criteria which were more stringent than those proposed by the NJDEPE for di-n-butyl phthalate.

Differences in criteria development methodologies for USEPA Group C carcinogens resulted in 9 USEPA criteria which are more stringent than those proposed by the NJDEPE for the following toxic substances:

beta-BHC, dibromochloromethane, hexachlorobutadiene, hexachloroethane, isophorone, 1,1,2,2-tetrachloroethane, and 1,1,2-trichloroethane.

III. SURFACE WATER CLASSIFICATIONS

During the 1985 review/revision of the SWQS, it was discovered that changes had been made to the descriptions of certain FW1 waters over the years. In order to clarify the descriptions it was decided that the persons who were originally involved in identifying waters to be classified as FW1 would be contacted. Bruce Pyle, currently Chief of the Bureau of Freshwater Fisheries, Division of Fish, Game and Wildlife, and David Moore, currently with the New Jersey Conservation Foundation, were involved in the original selection process. Mr. Moore and Mr. Pyle were contacted and provided their assistance in reviewing and rewriting, as needed, the FW1 descriptions to reflect the waters originally intended to be classified as FW1. These revisions were incorporated into what is now referred to as Table 6 of N.J.A.C. 7:9-4, but many changes were not made in Tables 1 through 5 of N.J.A.C. 7:9-4. These changes are now being proposed so that classification listings in Tables 1 through 5 of

N.J.A.C. 7:9-4 for FW1 waters reflect the listings adopted and used in Table 6 of N.J.A.C. 7:9-4.

As part of the 1985 review/revision of the SWQS, the names of State parks, forests and wildlife management areas were also updated to reflect names currently recognized and used by the Department. Many of these names inadvertently were not updated in Tables 1 through 5 of N.J.A.C. 7:9-4. Therefore, in Tables 1 through 5 of N.J.A.C. 7:9-4, the following State park, forest and wildlife management area names are being updated:

Old Name	Currently Recognized Name
Greenwood Forest Tract	Greenwood Forest Wildlife Management Area
Wharton Tract	Wharton State Forest
Worthington Tract	Worthington State Forest
Colliers Mills Tract	Colliers Mills Wildlife Management Area
Pasadena Fish and Game Tract	Pasadena Wildlife Management Area
Peaselee Fish and Game Tract	Peaselee Wildlife Management Area
Whittingham Tract	Whittingham Wildlife Management Area
Hamburg Mtn. Tract	Hamburg Mtn. Wildlife Management Area
Wawayanda Tract	Wawayanda State Park
Millville Fish and Game Tract	Edward G. Bevan Wildlife Management Area
Blewitt Tract	Flatbrook-Roy Wildlife Management Area

In order to clarify the classification listings, town or other descriptive place names are being proposed for waters for which no descriptive place name has previously been used. The following place names are proposed to be added to the classification listings to facilitate locating them:

Table 1 Mile Thorofare (Brigantine)
Sedge Creek (MacNamara)
Table 2 Clint Millpond (Beaver Swamp)
Table 3 Morses Creek (Linden)
Piles Creek (Grasselli)
Smith Creek (Woodbridge)
Woodbridge Creek (Woodbridge)

Several classification listings contain inaccurate or ambiguous place names that do not help locate the particular waterway. Place name changes being proposed to more adequately reflect the actual location of the waterway are listed below:

Old Listing	New Listing
Table 1	
Jimmies Creek (Stone Harbor) (Stone Harbor)	Jimmies Creek (Great Bay) (Parkers Landing)
Brisbane Lake (Allenwood)	Brisbane Lake (Allaire State Park)
Table 2	
Buckshutem Creek (Millville)	Buckshutem Creek (Edward G. Bevan)
Cedar Branch (Millville)	Cedar Branch (Edward G. Bevan)
Cedar Creek (Millville)	Cedar Creek (Edward G. Bevan)
Dividing Creek (Millville)	Dividing Creek (Edward G. Bevan)
East Creek (Lake Nummi)	East Creek (Dennis)
Furnace Brook	Furnace (Oxford) Brook
Gravelly Run (Millville)	Gravelly Run (Edward G. Bevan)
Little Flat Brook (Bevan)	Little Flat Brook (Flatbrook-Roy)
Long Tree Creek	Lone Tree Creek
Marcia Lake (Montague)	Marcia Lake (High Point State Park)
Nancy Gut (Newport)	Nancy Gut (Nantuxent)
Nantuxent Creek (Newport Landing)	Nantuxent Creek (Nantuxent)
Table 3	
Cedar Pond (Clinton)	Cedar Pond (Postville)
Cherry Ridge Brook (Canistear)	Cherry Ridge Brook (Wawayanda State Park)
Cupsaw Brook (Skylands)	Cupsaw Brook (Ringwood State Park)
Table 4	
Pigeon Swamp (S. Brunswick)	Pigeon Swamp (Pigeon Swamp State Park)

Several creek, river and roadway names are being proposed to be changed from names commonly used by the Division of Fish, Game and Wildlife to names used on United States Geological Survey (USGS) quadrangle maps or on the 1985 Hagstrom series of New Jersey county maps. This will eliminate confusion that may arise because the local name of a particular waterbody or roadway was previously used. In addition, it is proposed that several spelling errors be corrected to reflect spelling as indicated on the USGS quadrangle maps.

Many waters listed in the Surface Water Classifications have incomplete, incorrect, or unclear descriptions that may create confusion while using the tables. In Table 1 of N.J.A.C. 7:9-4, the Batsto River (Wharton) (Brooks and tributaries to the Batsto River between and immediately to the west of Tylertown and

Crowleytown, from their headwaters to the head of tide at mean high water) listing is being proposed to be deleted as a Batsto River listing and added to the listing for the Mullica River as they actually feed the Mullica and not the Batsto River. Likewise, the Mullica River (Wharton) (Skit Branch and tributaries from their headwaters to the confluence with Robert's Branch) is being proposed to be deleted as a Mullica River listing and added as a Batsto River listing as they actually empty into the Batsto River.

In Table 2 of N.J.A.C. 7:9-4, the East Creek (Belleplain) (All tributaries to Lake Nummi from their origins to the Lake) listing is being proposed to be deleted as an East Creek listing and added to a listing for Savages Run. This is being proposed because Lake Nummi and its tributaries actually feed Savages Run and not East Creek. The Big Flat Brook (Stokes State Forest) entry is being proposed to be deleted as a Big Flat Brook listing and added as a Flat Brook listing because the two tributaries originating along Struble Road actually empty in Flat Brook. The Steeny Kill Lake (High Point) entry is being proposed to be classified as an FW1 waterway as the waters downstream of the Lake are already classified as FW1 (see the Clove (Mill) Brook (High Point State Park) entry and Table 6). This is consistent with New Jersey's antidegradation policy contained in N.J.A.C. 7:9-4.5(d). Also in Table 2, it is proposed that Sunfish Pond be deleted from the Dunnfield Creek listing and be given a separate listing as the Pond is not contained within the Dunnfield Creek watershed.

The classification for Smith Creek in Table 3 is being proposed to be changed from FW2-NT\SE2 to FW2-NT\SE3. Smith Creek is tributary to the SE3 segment of the Arthur Kill. This change does not represent a proposed reclassification for less restrictive uses, it serves to correct a typographical error. For many years prior to 1985 the "Tidal portion of Smith Creek" was expressly listed in the SWQS under "Class TW-3". In 1984-1985 the Department proposed and adopted the new SWQS Index D that listed the entire length of Smith Creek as FW2-NT\SE2. The general policy in 1984-1985 was to apply the new SE3 classification to all saline waters that had the old TW-3 classification, and the 1985 classification of the saline portion of Smith Creek as SE2 was a typographical error. The 1984 basis and background document indicated no intent to upgrade the classification of Smith Creek. The 1988 SWQS proposal correctly listed Smith Creek as FW2-NT\SE3. The 1989 SWQS adoption notice stated that "the proposed change for Smith Creek is really the correction of a typographical error made during the 1985 revision of the Standards." Without any indication of an intentional change being made, the 1989 SWQS adoption notice reversed the 1988 proposal by again listing Smith Creek as FW2-NT\SE2. The Department concludes that this was a typographical error in the adoption notice.

In Table 4 of N.J.A.C. 7:9-4, it is proposed that the South Branch Raritan River (Mt. Olive) listing (Source to the dam that is 390 feet upstream of the Flanders-Drakestown Road bridge) be modified to include two tributaries which originate in the Drakestown area. These two streams are currently classified as FW2-NT waters in N.J.A.C. 7:9-4.15(b)5i. By adding the phrase "and the two tributaries which originate north and east of the Budd Lake Airfield", these two tributaries will be afforded the C1 antidegradation protection originally intended for them. These tributaries were originally intended to be afforded the C1 antidegradation protection because they originate in a largely undeveloped area and are upstream of FW2-TM(C1) and FW2-TP(C1) waters. This omission in C1 protection was an inadvertent result of the wording of the listing.

Other changes are proposed simply to clarify descriptions, or as previously mentioned, to update Tables 1 through 5 with the 1985 changes to Table 6. The following waters have changes proposed to their listings:

Table 1

Absecon Creek
Batsto River
Cedar Creek
Great Egg Harbor River
Hawkins Creek
Manahawkin Creek
Mullica River
Taugh Creek
Tulpehocken Creek

Table 2

Assunpink Creek
Bear Creek
Beers Creek
Big Flat Brook
Criss Brook
Cedar Branch
Dunnfield Creek
East Creek
Flat Brook
Kittatinny Lake Tributary
Lahaway Creek
Little Ease Run
Little Flat Brook
Marcia Lake
Mile Branch
Mud Pond
Pequest River
Rundle Brook
Savages Run
Shaws Mill Pond
Smith Creek
Steele Run
Steeny Kill Lake
Stony Brook (Stokes State Forest)
Stony Lake
Tillman Brook

Table 3

Cherry Ridge Brook
Cooley Brook
Green Brook
Lake Stockholm Brook
Lud-Day Brook
Pacack Brook
Pequannock River
Whippany River

Table 4

Blackberry Creek
South Branch Raritan River

Table 5

Franklin Pond Creek
Lake Lookout
Lake Lookout Brook
Lake Rutherford

Table 6

Belleplain State Forest - East Creek Watershed
Lebanon State Forest - Shinns and McDonalds Branches
A.S. Hewitt State Forest - Cooley Brook and Green Brook
Wharton State Forest - Mullica River Watershed
High Point State Park - Flat Brook Watershed
Sussex Borough Water Supply Land - Lake Rutherford Watershed
Worthington State Forest - Dunnfield Creek Watershed
Delaware Water Gap National Recreation Area - Delaware River Watershed
Flatbrook-Roy Wildlife Management Area - Flat Brook Watershed
Glassboro Wildlife Management Area - Maurice River Watershed
High Point State Park/Stokes State Forest - Clove Brook Watershed
City of Newark Holdings/Wawayanda State Park - Cedar Pond and Lake Lookout

The following are proposed new listings to the SWQS. With the exception of Ocquittunk Lake Tributary which is being proposed as an FW1(tp) classification, all of these waters are being proposed for C1 antidegradation protection because they feed trout production waters or they are trout waters themselves. Ashroe and Deer Lakes and their tributaries connect FW1 and FW2-TP(C1) waters.

Table 2

Ashroe Lake
Deer Lake
Mashipacong Pond
Ocquittunk Lake
Ocquittunk Lake Tributary

Table 3

Granney Brook
Spring (Granney) Brook

IV. TABLES

Table 1. **HUMAN HEALTH-BASED CRITERIA**

Toxic Substance	CAS Registry Number	Human Health-Based Criteria+ (ug/L) FW2 Waters		SE & SC Waters	
Acenaphthylene	208-96-8	0.0028	cd	0.031	cd
Acrolein	107-02-8	320	b	780	b
Acrylonitrile	107-13-1	0.0591	ce	0.665	ce
Aldrin	309-00-2	0.000135	ce	0.000144	ce
Anthracene	120-12-7	9,570	e	108,000	e
Antimony	7440-36-0	12.2	e	4,300	d
Arsenic (Total recoverable)	7440-38-2	0.0170	ce	0.136	ce
Asbestos	1332-21-4	7 million f/L	g		
Barium	7440-39-3	2,000	g		
Benz(a)anthracene	56-55-3	0.0028	cd	0.031	cd
Benzene#	71-43-2	0.150	ce	71	cd
Benzidine	92-87-5	0.000118	ce	0.000535	ce
Benzo(a)pyrene (BaP)	50-32-8	0.0028	bc	0.031	bc
3,4-Benzofluoranthene (Benzo(b)fluoranthene)	205-99-2	0.0028	cd	0.031	cd
Benzo(ghi)perylene	191-24-2	0.0028	cd	0.031	cd
Benzo(k)fluoranthene	207-08-9	0.0028	cd	0.031	cd
Beryllium	7440-41-7	0.00767	ce	0.132	ce
alpha-BHC (alpha-HCH)	319-84-6	0.00391	ce	0.0131	ce
beta-BHC (beta-HCH)	319-85-7	0.137	ej	0.460	ej
gamma-BHC (gamma-HCH/Lindane)	58-89-9	0.0186	bc	0.0625	bc
Bis(2-chloroethyl) ether	111-44-4	0.0311	ce	1.4	cd
Bis(2-chloroisopropyl) ether	108-60-1	1,250	e	170,000	d
Bis(2-ethylhexyl) phthalate	117-81-7	1.76	ce	5.92	ce
Bromodichloromethane (Dichlorobromomethane)	75-27-4	0.266	ce	22	cd

(Table 1. continued)

Toxic Substance	CAS Registry Number	Human Health-Based Criteria+ (ug/L) FW2 Waters		SE & SC Waters	
Bromoform	75-25-2	4.38	ce	360	cd
Butylbenzyl phthalate	85-68-7	239	e	416	e
Cadmium (Total recoverable)	7440-43-9	15.9	e	169	e
Carbon tetrachloride#	56-23-5	0.363	ce	6.31	ce
Chloride	16887-00-6	250,000	k		
Chlordane#	57-74-9	0.000277	ce	0.000283	ce
Chlorobenzene#	108-90-7	22.0	e	21,000	d
Chloroform	67-66-3	5.67	ce	470	cd
2-Chlorophenol	95-57-8	122	e	402	e
Chromium (III & VI) (Total recoverable)	7440-47-3	160	eh	3,230	en
Chrysene	218-01-9	0.0028	cd	0.031	cd
Cyanide	57-12-5	768	e	220,000	d
4,4'-DDD (p,p'-TDE)	72-54-8	0.000832	ce	0.000837	ce
4,4'-DDE	72-55-9	0.000588	ce	0.000591	ce
4,4'-DDT	50-29-3	0.000588	ce	0.000591	ce
Dibenz(a,h)anthracene	53-70-3	0.0028	cd	0.031	cd
Dibromochloromethane (Chlorodibromomethane)	124-48-1	72.6	e	34	cd
Di-n-butyl phthalate	84-74-2	3,530	e	15,700	e
1,2-Dichlorobenzene#	95-50-1	2,520	e	16,500	e
1,3-Dichlorobenzene#	541-73-1	2,620	e	22,200	e
1,4-Dichlorobenzene#	106-46-7	343	e	3,159	e
3,3-Dichlorobenzidine	91-94-1	0.0386	ce	0.0767	ce
1,2-Dichloroethane#	107-06-2	0.291	ce	99	cd
1,1-Dichloroethylene#	75-35-4	4.81	e	3.2	cd

(Table 1. continued)

Toxic Substance	CAS Registry Number	Human Health-Based Criteria+ (ug/L) FW2 Waters		SE & SC Waters	
trans-1,2-Dichloroethylene#	156-60-5	592	e		
2,4-Dichlorophenol	120-83-2	92.7	e	794	e
1,3-Dichloropropene	542-75-6	0.193	ce	1,700	d
Dieldrin	60-57-1	0.000135	ce	0.000144	ce
Diethyl phthalate	84-66-2	21,200	e	111,000	e
Dimethyl phthalate	131-11-3	313,000	b	2,900,000	b
4,6-Dinitro-o-cresol	534-52-1	13.4	b	765	d
2,4-Dinitrophenol	51-28-5	69.7	e	14,000	d
2,4-Dinitrotoluene	121-14-2	0.11	bc	9.1	cd
1,2-Diphenylhydrazine	122-66-7	0.0405	ce	0.541	ce
Endosulfans (alpha & beta)	115-29-7	0.932	e	1.99	e
Endosulfan sulfate	1031-07-8	0.93	d	2.0	d
Endrin	72-20-8	0.629	e	0.678	e
Endrin aldehyde	7421-93-4	0.76	d	0.81	d
Ethylbenzene	100-41-4	3,030	e	27,900	e
Fluoranthene	206-44-0	310	e	393	e
Fluorene	86-73-7	1,340	e	15,100	e
Heptachlor	76-44-8	0.000208	ce	0.000214	ce
Heptachlor epoxide	1024-57-3	0.000103	ce	0.000106	ce
Hexachlorobenzene	118-74-1	0.000748	ce	0.000775	ce
Hexachlorobutadiene	87-68-3	6.94	e	50	cd
Hexachlorocyclopentadiene	77-47-4	245	e	17,000	d
Hexachloroethane	67-72-1	2.73	e	12.4	e
Indeno(1,2,3-cd)pyrene	193-39-5	0.0028	cd	0.031	cd
Isophorone	78-59-1	552	e	600	cd

(Table 1. continued)

Toxic Substance	CAS Registry Number	Human Health-Based Criteria+ (ug/L) FW2 Waters		SE & SC Waters	
Lead (Total recoverable)	7439-92-1	5	e		
Manganese	7439-96-5			100	bi
Mercury (Total recoverable)	7439-97-6	0.144	b	0.146	b
Methoxychlor	72-43-5	40	g		
Methyl bromide (Bromomethane)	74-83-9	48.4	e	4,000	d
Methyl chloride (Chloromethane)	74-87-3	5.7	cd	470	cd
Methylene chloride#	75-09-2	2.49	ce	1,600	cd
Nickel (Total recoverable)	7440-02-0	516	e	3,900	e
Nitrate (as N)	14797-55-8	10,000	b		
Nitrobenzene	98-95-3	16.0	e	1,900	d
N-Nitrosodi-n-butylamine	924-16-3	0.00641	ce		
N-Nitrosodiethylamine	55-18-5	0.000233	ce		
N-Nitrosodimethylamine	62-75-9	0.000686	ce	8.1	cd
N-Nitrosodiphenylamine	86-30-6	4.95	ce	16.2	ce
N-Nitrosopyrrolidine	930-55-2	0.0167	ce		
Pentachlorobenzene	608-93-5	3.67	e	4.21	e
Pentachlorophenol	87-86-5	0.282	ce	8.2	cd
Phenanthrene	85-01-8	0.0028	cd	0.031	cd
Phenol	108-95-2	20,900	e	4,600,000	d
Polychlorinated biphenyls# (PCBs-1016, 1221, 1232, 1242, 1248, 1254, 1260)	1336-36-3	0.000244	ce	0.000247	ce
Pyrene	129-00-0	797	e	8,970	e
Selenium (Total recoverable)	7782-49-2	179	e	6,800	d

(Table 1. continued)

Toxic Substance	CAS Registry Number	Human Health-Based Criteria+ (ug/L) FW2 Waters		SE & SC Waters	
Silver (Total recoverable)	7440-22-4	164	e	65,000	d
1,2,4,5-Tetrachlorobenzene	95-94-3	2.56	e	3.25	e
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	0.000000013	bc	0.000000014	bc
1,1,2,2-Tetrachloroethane	79-34-5	1.72	ej	11	cd
Tetrachloroethylene#	127-18-4	0.388	ce	4.29	ce
Thallium	7440-28-0	1.70	e	6.22	e
Toluene	108-88-3	7,440	e	200,000	d
Toxaphene	8001-35-2	0.000730	ce	0.000747	ce
1,2,4-Trichlorobenzene#	120-82-1	30.6	e	113	e
1,1,1-Trichloroethane#	71-55-6	127	e		
1,1,2-Trichloroethane	79-00-5	13.5	e	42	cd
Trichloroethylene#	79-01-6	1.09	ce	81	cd
2,4,5-Trichlorophenol	95-95-4	2,580	e	9,790	e
2,4,6-Trichlorophenol	88-06-2	2.14	ce	6.53	ce
Vinyl chloride#	75-01-4	0.0830	ce	525	cd

+ = Unless otherwise noted (see g and i), criteria for FW2 waters (except for lead) are based on daily ingestion of two liters of water and 6.5 grams of aquatic organisms. Criteria for SE & SC waters are based on daily consumption of 6.5 grams of aquatic organisms alone. For details on criterion for lead, see discussion starting on page 25. For classes of chemicals (endosulfans and PCBs), the criteria shown represent the total combined concentration of all chemicals in that class.

b = Human health-based criteria from existing 304(a)(1) documents, see Table 2.

c = Criterion corresponding to a lifetime incremental cancer risk of one-in-one-million

d = Human health-based criterion from the USEPA proposed rule (56 FR 58420, November 19, 1991) see Table 3.

(Table 1. continued)

e = Human health-based criterion developed by the Department, see Table 4.

f = Fibers longer than 10 micrometers

g = USEPA MCLG, 40 CFR part 141, USEPA National Primary Drinking Water Regulations, final rule, 3526 (January 30, 1991) and 30266 (July 1, 1991)

h = Criterion developed for chromium (VI). Separate criteria for chromium (III), the less toxic form, and chromium (VI) are not proposed because of difficulty in making independent, accurate measurements of chromium in the two valence states.

i = Criterion developed for protection of consumers of marine mollusks (USEPA, 1986a)

j = Criterion corresponding to a lifetime incremental cancer risk of one-in-one-hundred-thousand

k = Organoleptic criterion retained from the 1989 SWQS

L = liter ug = micrograms # = A-280 chemical (N.J.A.C. 7:10-16.7)

Table 2. **EXISTING USEPA 304(a)(1) AND MAXIMUM CONTAMINANT LEVEL GOAL-BASED HUMAN HEALTH CRITERIA**

Toxic Substance	CAS Registry Number	Human Health-Based Criteria+ (ug/L) FW2 Waters		SE & SC Waters	
Acrolein	107-02-8	320		780	
Asbestos	1332-21-4	7 million f/L	b		
Barium	7440-39-3	2,000	b		
Benzo(a)pyrene (BaP)	50-32-8	0.0028	c	0.031	c
gamma-BHC (gamma-HCH/Lindane)	58-89-9	0.0186	c	0.0625	c
Dimethyl phthalate	131-11-3	313,000		2,900,000	
4,6-Dinitro-o-cresol	534-52-1	13.4			
2,4-Dinitrotoluene	121-14-2	0.11	c		
Manganese	7439-96-5			100	d
Mercury (Total recoverable)	7439-97-6	0.144		0.146	
Methoxychlor	72-43-5	40	b		
Nitrate (as N)	14797-55-8	10,000			
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	0.000000013	c	0.000000014	c

ug = micrograms L = liter f = fibers longer than 10 micrometers

+ = Criteria (except those noted b) are as listed in "Quality Criteria for Water" (USEPA, 1986a), and its updates (USEPA, 1986b, 1987a) and in USEPA ambient water quality criteria documents for chemicals cited therein. Unless otherwise noted (see b and d) criteria for FW2 waters are based on daily ingestion of two liters of water and 6.5 grams of aquatic organisms. Criteria for SE & SC waters are based on daily consumption of 6.5 grams of aquatic organisms.

b = USEPA MCLG, 40 CFR part 141, USEPA National Primary Drinking Water Regulations, final rule, 3526 (January 30, 1991) and 30266 (July 1, 1991)

c = Criterion corresponding to lifetime incremental cancer risk of one-in-one-million

d = Criterion for protection of consumers of marine mollusks (USEPA, 1986a)

Table 3. **HUMAN HEALTH-BASED CRITERIA FROM USEPA PROPOSED RULE**[+]

Toxic Substance	CAS Registry Number	Human Health-Based Criteria (ug/L) FW2 Waters		SE & SC Waters	
Acenaphthylene	208-96-8	0.0028	c	0.031	c
Antimony	7440-36-0			4,300	
Benz(a)anthracene	56-55-3	0.0028	c	0.031	c
Benzene[#]	71-43-2			71	c
3,4-Benzofluoranthene (Benzo(b)fluoranthene)	205-99-2	0.0028	c	0.031	c
Benzo(ghi)perylene	191-24-2	0.0028	c	0.031	c
Benzo(k)fluoranthene	207-08-9	0.0028	c	0.031	c
Bis(2-chloroethyl) ether	111-44-4			1.4	c
Bis(2-chloroisopropyl) ether	108-60-1			170,000	
Bromodichloromethane (Dichlorobromomethane)	75-27-4			22	c
Bromoform	75-25-2			360	c
Chlorobenzene[#]	108-90-7			21,000	
Chloroform	67-66-3			470	c
Chrysene	218-01-9	0.0028	c	0.031	c
Cyanide	57-12-5			220,000	
Dibenz(a,h)anthracene	53-70-3	0.0028	c	0.031	c
Dibromochloromethane (Chlorodibromomethane)	124-48-1			34	c
1,2-Dichloroethane[#]	107-06-2			99	c
1,1-Dichloroethylene[#]	75-35-4			3.2	c
1,3-Dichloropropene	542-75-6			1,700	c
4,6-Dinitro-o-cresol	534-52-1			765	
2,4-Dinitrophenol	51-28-5			14,000	
2,4-Dinitrotoluene	121-14-2			9.1	c
Endosulfan sulfate	1031-07-8	0.93		2.0	
Endrin aldehyde	7421-93-4	0.76		0.81	

(Table 3. continued)

Toxic Substance	CAS Registry Number	Human Health-Based Criteria (ug/L) FW2 Waters		SE & SC Waters	
Hexachlorobutadiene	87-68-3			50	c
Hexachlorocyclopentadiene	77-47-4			17,000	
Indeno(1,2,3-cd)pyrene	193-39-5	0.0028	c	0.031	c
Isophorone	78-59-1			600	c
Methyl bromide (Bromomethane)	74-83-9			4,000	
Methyl chloride (Chloromethane)	74-87-3	5.7	c	470	c
Methylene chloride[#]	75-09-2			1,600	c
Nitrobenzene	98-95-3			1,900	
N-Nitrosodimethylamine	62-75-9			8.1	c
Pentachlorophenol	87-86-5			8.2	c
Phenanthrene	85-01-8	0.0028	c	0.031	c
Phenol	108-95-2			4,600,000	
Selenium (Total recoverable)	7782-49-2			6,800	
Silver (Total recoverable)	7440-22-4			65,000	
1,1,2,2-Tetrachloroethane	79-34-5			11	c
Toluene	108-88-3			200,000	
1,1,2-Trichloroethane	79-00-5			42	c
Trichloroethylene[#]	79-01-6			81	c
Vinyl chloride[#]	75-01-4			525	c

ug = micrograms L = liter # = A-280 chemical (N.J.A.C. 7:10-16.7)

+ = 40 CFR Part 131, "Amendments to the Water Quality Standards Regulation; Compliance with CWA Section 303(c)(2)(B); Proposed Rule (56 FR 58420, November 19, 1991)

c = Criterion corresponding to a lifetime incremental cancer risk of one-in-one-million

Table 4. **HUMAN HEALTH-BASED CRITERIA DEVELOPED BY THE DEPARTMENT**

Toxic Substance	CASRN	Oral RfD* (mg/kg)/day	Oral Slope Factor* 1/[(mg/kg)/day]	BCF** (L/kg)	Carcinogen Class* (oral)	Human Health-Based Criteria+ (ug/L) FW2 Waters	SE & SC Waters
Acrylonitrile	107-13-1		0.54	30	B1	0.0591	0.665
Aldrin	309-00-2	0.000025	17	28 e	B2	0.000135 a	0.000144 a
Anthracene	120-12-7	0.3		30	D	9,570	108,000
Antimony	7440-36-0	0.00035		1		12.2	
Arsenic (Total recoverable)	7440-38-2		1.8	44	A	0.0170	0.136
Benzene#	71-43-2		0.23	5.2	A	0.150	
Benzidine	92-87-5	0.0027	230	87.5	A	0.000118	0.000535
Beryllium	7440-41-7	0.0054	4.3	19	B2	0.00767	0.132
alpha-BHC (alpha-HCH)	319-84-6		6.3	130	B2	0.00391	0.0131
beta-BHC (beta-HCH)	319-85-7		1.8	130	C	0.137	0.460
Bis(2-chloroethyl) ether	111-44-4		1.1	6.9	B2	0.0311	
Bis(2-chloroisopropyl) ether	108-60-1	0.036		2.47		1,250	
Bis(2-ethylhexyl) phthalate	117-81-7	0.019	0.014	130	B2	1.76	5.92
Bromodichloromethane (Dichlorobromomethane)	75-27-4	0.018	0.13	3.75	B2	0.266	
Bromoform	75-25-2	0.018	0.0079	3.75	B2	4.38	
Butylbenzyl phthalate	85-68-7	0.16		414	C	239	416
Cadmium (Total recoverable)	7440-43-9	0.0005 water 0.001 food b		64		15.9	169
Carbon tetrachloride#	56-23-5		0.091	18.75	B2	0.363	6.31
Chlordane#	57-74-9		2.7	14,100	B2	0.000277	0.000283
Chlorobenzene#	108-90-7	0.0065		10.3	C	22.0	
Chloroform	67-66-3	0.013	0.0061	3.75	B2	5.67	
2-Chlorophenol	95-57-8	0.005		134		122	402
Chromium (III & VI) (Total recoverable)	7440-47-3[f]	0.0048 f		16		160	3,230
Cyanide	57-12-5	0.022		1	D	768	

(Table 4. continued)

Toxic Substance	CASRN	Oral RfD* (mg/kg)/day	Oral Slope Factor* 1/[(mg/kg)/day]	BCF** (L/kg)	Carcinogen Class* (oral)	Human Health-Based Criteria+ (ug/L) FW2 Waters	SE & SC Waters
4,4'-DDD (p,p'-TDE)	72-54-8		0.24	53,600	B2	0.000832	0.000837
4,4'-DDE	72-55-9		0.34	53,600	B2	0.000588	0.000591
4,4'-DDT	50-29-3	0.0005	0.34	53,600	B2	0.000588	0.000591
Dibromochloromethane (Chlorodibromomethane)	124-48-1	0.021	0.084	3.75	C	72.6	
Di-n-butyl phthalate	84-74-2	0.13		89	D	3,530	15,700
1,2-Dichlorobenzene#	95-50-1	0.085		55.6	D	2,520	16,500
1,3-Dichlorobenzene#	541-73-1	0.085		41.2 e	D	2,620	22,200
1,4-Dichlorobenzene#	106-46-7	0.11		37.5 e	C	343	3,159
3,3-Dichlorobenzidine	91-94-1		0.45	312	B2	0.0386	0.0767
1,2-Dichloroethane#	107-06-2		0.12	1.2	B2	0.291	
1,1-Dichloroethylene#	75-35-4	0.0014		5.61	C	4.81	
trans-1,2-Dichloroethylene#	156-60-5	0.017		1.58		592	
2,4-Dichlorophenol	120-83-2	0.003		40.7		92.7	794
1,3-Dichloropropene	542-75-6	0.0003	0.18 d	1.91	B2	0.193	
Dieldrin	60-57-1	0.00005	16	4,670	B2	0.000135	0.000144
Diethyl phthalate	84-66-2	0.75		73	D	21,200	111,000
2,4-Dinitrophenol	51-28-5	0.002		1.51		69.7	
1,2-Diphenylhydrazine	122-66-7		0.8	24.9	B2	0.0405	0.541
Endosulfans (alpha & beta)	115-29-7	0.00005		270		0.932	1.99
Endrin	72-20-8	0.00025		3,970	D	0.629	0.678
Ethylbenzene	100-41-4	0.097		37.5	D	3,030	27,900
Fluoranthene	206-44-0	0.042		1,150	D	310	393
Fluorene	86-73-7	0.042		30	D	1,340	15,100
Heptachlor	76-44-8	0.0005	4.5	11,200	B2	0.000208	0.000214
Heptachlor epoxide	1024-57-3	0.000013	9.1	11,200	B2	0.000103	0.000106

(Table 4. continued)

Toxic Substance	CASRN	Oral RfD* (mg/kg)/day	Oral Slope Factor* 1/[(mg/kg)/day]	BCF** (L/kg)	Carcinogen Class* (oral)	Human Health-Based Criteria+ (ug/L) FW2 Waters	SE & SC Waters
Hexachlorobenzene	118-74-1	0.0008	1.6	8,690	B2	0.000748	0.000775
Hexachlorobutadiene	87-68-3	0.002	0.078	2.78	C	6.94	
Hexachlorocyclopentadiene	77-47-4	0.0071		4.34	pending	245	
Hexachloroethane	67-72-1	0.001	0.014	86.9	C	2.73	12.4
Isophorone	78-59-1	0.16	0.0041	4.38	C	552	
Lead (Total recoverable)	7439-92-1			49	B2	5	
Methyl bromide (Bromomethane)	74-83-9	0.0014		3.75	D	48.4	
Methylene chloride#	75-09-2		0.014	0.91	B2	2.49	
Nickel (Total recoverable)	7440-02-0	0.017		47		516	3,900
Nitrobenzene	98-95-3	0.00046		2.89	pending	16.0	
N-Nitrosodi-n-butylamine	924-16-3		5.4	3.38 e	B2	0.00641	
N-Nitrosodiethylamine	55-18-5		150	0.20 e	B2	0.000233	
N-Nitrosodimethylamine	62-75-9		51	0.026	B2	0.000686	
N-Nitrosodiphenylamine	86-30-6		0.0049	136	B2	4.95	16.2
N-Nitrosopyrrolidine	930-55-2		2.1	0.055e	B2	0.0167	
Pentachlorobenzene	608-93-5	0.00083		2,125 e	pending	3.67	4.21
Pentachlorophenol	87-86-5	0.03	0.12	11	B2	0.282	
Phenol	108-95-2	0.6		1.4		20,900	
Polychlorinated biphenyls# (PCBs 1016, 1221, 1232, 1242, 1248, 1254, 1260)	1336-36-3		1.4	31,200	B2	0.000244	0.000247
Pyrene	129-00-0	0.025		30	D	797	8,970
Selenium (Total recoverable)	7782-49-2	0.0052		4.8	D	179	
Silver (Total recoverable)	7440-22-4	0.0047		0.5	D	164	
1,2,4,5-Tetrachlorobenzene	95-94-3	0.00034		1,125 e		2.56	3.25
1,1,2,2-Tetrachloroethane	79-34-5		0.2	5.0	C	1.72	

(Table 4. continued)

Toxic Substance	CASRN	Oral RfD* (mg/kg)/day	Oral Slope Factor* 1/[(mg/kg)/day]	BCF** (L/kg)	Carcinogen Class* (oral)	Human Health-Based Criteria+ (ug/L) FW2 Waters	SE & SC Waters
Tetrachloroethylene#	127-18-4		0.082	30.6	B2	0.388	4.29
Thallium	7440-28-0	0.000067		116	D	1.70	6.22
Toluene	108-88-3	0.22		10.7	D	7,440	
Toxaphene	8001-35-2		1.1	13,100	B2	0.000730	0.000747
1,2,4-Trichlorobenzene#	120-82-1	0.0012		114	D	30.6	113
1,1,1-Trichloroethane#	71-55-6	0.0037		5.6	D	127	
1,1,2-Trichloroethane	79-00-5	0.0039	0.057	4.5	C	13.5	
Trichloroethylene#	79-01-6		0.031	10.6	B2	1.09	
2,4,5-Trichlorophenol	95-95-4	0.1		110 e	pending	2,580	9,790
2,4,6-Trichlorophenol	88-06-2		0.011	150	B2	2.14	6.53
Vinyl chloride#	75-01-4		0.42	1.17	A	0.0830	

kg = kilograms mg = milligrams ug = micrograms L = liter

* = Based on data retrieved from USEPA, Integrated Risk Information System (IRIS) (USEPA, 1987c) through September 17, 1990 or December 5, 1991 (underlined), except for A-280 chemicals (see #). Slope factor for arsenic was derived from unit risk retrieved from IRIS. Toxicity factors were based on adverse health effects (except for silver where critical effect observed is a cosmetic effect).

** = BCFs used by the USEPA to develop proposed ambient water quality criteria (56 FR 58420, November 19, 1991), unless otherwise noted (see e)

\+ = Criteria for FW2 waters (except for lead) are based on daily ingestion of two liters of water and 6.5 grams of aquatic organisms. Criteria for SE & SC waters are based on the consumption of 6.5 grams of aquatic organisms. For Groups A&B carcinogens, criteria were calculated using slope factors to correspond to lifetime incremental cancer risk of 10^{-6}. For Groups C&D carcinogens and for chemicals where no carcinogen classification was indicated, criteria were developed using RfDs. An additional uncertainty factor of 10 was applied to derive criteria for Group C carcinogens. Where RfDs were not available for Group C carcinogens (beta-BHC, 1,1,2,2-tetrachloroethane), criteria were developed using slope factors at 10^{-5} risk level. For classes of chemicals (endosulfans and PCBs), the criteria shown represent the total combined concentration of all chemicals in that class.

(Table 4. continued)

a = Criterion calculated using BCFs of both Aldrin and Dieldrin (USEPA, 1980o)

b = The RfD for food, 0.001 (mg/kg)/day, was used to calculate the criterion for SE & SC waters. The RfD for water, 0.0005 (mg/kg)/day, was used to calculate the criterion for FW2 waters. In order to compensate for the reduced absorption from food, a factor of (0.0005/0.001) was used to multiply the consumption rate of 6.5 g/day in developing the FW2 criterion.

d = From USEPA, Health Effects Assessments Summary Table B, update, December, 1990 (Annual FY-1991, January, 1991)

e = BCFs from Section 304(a) ambient water quality criteria documents cited in USEPA (1986a)

f = CASRN & RfD for chromium (VI). Separate criteria for chromium (III), the less toxic form, and chromium (VI) are not proposed because of difficulty in making independent, accurate measurements for the two valence states.

= A-280 chemical (N.J.A.C. 7:10-16.7). Oral RfD or slope factor used for calculating criterion was developed by the Department except for trans-1,2-dichloroethylene which was based on IRIS data.

Table 5

% Lipid in New Jersey Aquatic Species (1986-1987 sampling)[1]

Species	N[2]	Mean[3]
American Eel	115	7.08
Blue Claw Crab[4]	139	2.45
Bluefish	309	3.24
Striped Bass	136	3.02
Weakfish	143	2.88
White Catfish[5]	5	0.79
White Perch[5]	30	2.63
Brown Bullhead[5]	45	1.58
Carp[5]	96	4.47
Largemouth Bass[5]	23	0.35
TOTAL	1041	3.12

Notes:

1 Samples taken from 42 locations throughout New Jersey.

2 Number of individual aquatic organisms.

3 Individual species mean and overall mean represent re-transformed average of log percent lipid.

4 Samples include muscle and hepatopancreas.

5 Fresh water species. Other species are saline.

Table 6. **AQUATIC CRITERIA FOR TOXIC SUBSTANCES**

TOXIC SUBSTANCE	CRITERIA (ug/L, unless otherwise noted)			
	Freshwater		Saltwater	
	Acute	Chronic	Acute	Chronic
Aldrin**	3.0	-	1.3	-
Aluminum (TR)#***	750	87	-	-
Ammonia un-ionized	-	20 (TP&TM); 50 (NT)	0.1xLC$_{50}$ or EC$_{50}$	
Arsenic (TR)*** (III & V)	360	190	69	36
Gamma-BHC (Lindane)**	2.0	0.080	0.16	-
Cadmium (TR)***	$e^{(1.128(\ln(H))-3.828)}$	$e^{(0.7852(\ln(H))-3.490)}$	43	9.3
Chlordane**	2.4	0.0043	0.09	0.0040
Chloride***	860 mg/L	230 mg/L	-	-
Chlorpyrifos***	0.083	0.041	0.011	0.0056
Chromium (TR)*** (III & VI)	16	11	1,100	50
Copper (TR)***	$e^{(0.9422(\ln(H))-1.464)}$	$e^{(0.8545(\ln(H))-1.465)}$	2.9	2.9@
CPO***	19	11	13	7.5
Cyanide***	22	5.2	1.0	1.0
4,4'-DDT**	1.1	0.0010	0.13	0.0010
Demeton*	-	0.1	-	0.1
Dieldrin**	2.5	0.0019	0.71	0.0019
Endosulfans (I & II)**	0.22	0.056	0.034	0.0087
Endrin**	0.18	0.0023	0.037	0.0023
Guthion*	-	0.01	-	0.01
Heptachlor**	0.52	0.0038	0.053	0.0036
Heptachlor epoxide@	0.52	0.0038	0.053	0.0036
Iron*	-	1.0 mg/L	-	-
Lead (TR)***	$e^{(1.273(\ln(H))-1.460)}$	$e^{(1.273(\ln(H))-4.705)}$	220	8.5
Malathion*	-	0.1	-	0.1
Mercury (TR)***	2.4	0.012	2.1	0.025
Methoxychlor*	-	0.03	-	0.03
Mirex*	-	0.001	-	0.001

(Table 6. continued)

TOXIC SUBSTANCE	CRITERIA (ug/L, unless otherwise noted)			
	Freshwater		Saltwater	
	Acute	Chronic	Acute	Chronic
Nickel (TR)***	$e^{(0.8460(\ln(H))+3.3612)}$	$e^{(0.8460(\ln(H))+1.1645)}$	75	8.3
Parathion***	0.065	0.013	-	-
PCBs**	-	0.014	-	0.030
Pentachloro-phenol***	$e^{(1.005(pH)-4.830)}$	$e^{(1.005(pH)-5.290)}$	13	7.9
Phosphorus (yellow)*	-	-	-	0.1
Selenium (TR)***	20	5.0	300	71
Silver (TR)**	$e^{(1.72(\ln(H))-6.52)}$	-	2.3	-
Sulfide-hydrogen sulfide (undissociated)*	-	2.0	-	2.0
Toxaphene***	0.73	0.0002	0.21	0.0002
Zinc (TR)***	$e^{(0.8473(\ln(H))+0.8604)}$	$e^{(0.8473(\ln(H))+0.7614)}$	95	86

#	at pH 6.5 to 9.0	**H**	Hardness (mg/L)	**TR**	Total recoverable

* Criteria developed in 1976 for the Red Book (USEPA, 1976).

** Criteria developed by the 1980 method of USEPA (USEPA, 1980a).

*** Criteria developed by the 1985 method of USEPA (USEPA, 1985a).

@ Criteria based on USEPA proposed rule (USEPA, 1991a).

TP&TM Criteria for FW2 trout production and trout maintanence waters

NT Criterion for FW2 nontrout waters

Table 7. **LIST OF CHEMICALS REVIEWED FOR DEVELOPMENT OF STATE-SPECIFIC CRITERIA**

(1) Benzene

(2) Carbon tetrachloride

(3) Chlordane

(4) Chlorobenzene

(5) 1,2-Dichlorobenzene

(6) 1,3-Dichlorobenzene

(7) 1,4-Dichlorobenzene

(8) 1,2-Dichloroethane

(9) 1,1-Dichloroethylene

(10) trans-1,2-Dichloroethylene

(11) Lead

(12) Methylene chloride

(13) Polychlorinated biphenyls (PCBs)

(14) Tetrachloroethylene

(15) 1,2,4-Trichlorobenzene

(16) 1,1,1-Trichloroethane

(17) Trichloroethylene

(18) Vinyl chloride

The above list also indexes the chemicals referenced by number in Tables 8 and 9.

Table 8. **AVAILABLE BIOASSAY DATA FOR NEW JERSEY FRESHWATER ANIMAL FAMILIES**

GROUP*/Family	CHEMICAL REFERENCE NUMBER# (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
ROTIFERA																		
Philodinidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
MOLLUSCA																		
Physidae	-	-	A	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
CRUSTACEA																		
Astacidae	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-
Daphnidae	A	A	A	A	A	B	B	B	A	A	B	A	-	A	A	A	A	-
Gammaridae	-	-	A	-	-	-	-	-	-	-	A	-	B	A	B	A	A	-
Palaemonidae	-	-	A	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-
INSECTA																		
Chironomidae	-	-	A	-	-	-	A	-	-	-	A	-	A	-	-	-	-	-
Coenagrionidae	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-
Pteronarcidae	-	-	A	-	-	-	-	-	A	-	-	-	-	-	-	-	-	-
PISCES																		
Catostomidae	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-
Centrarchidae	A	A	A	A	A	-	-	-	-	-	A	-	A	-	-	-	-	-
Cyprinidae	A	-	A	A	A	B	B	B	B	A	B	A	-	A	A	A	A	-
Ictaluridae	A	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Percichthyidae	B	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Poeciliidae	A	-	A	-	-	-	-	-	-	A	-	-	-	-	-	-	-	-
Salmonidae	-	-	A	-	-	-	A	-	A	B	-	B	A	-	-	-	-	-
AMPHIBIA																		
Bufonidae	-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-
Ranidae	-	-	-	-	-	-	-	-	-	-	A	-	A	-	-	-	-	-

* Phylum or Class
\# See Table 7 for names of chemicals referenced by number
A Acute toxicity B Acute & Chronic toxicity C Chronic toxicity

Table 9. **AVAILABILE BIOASSAY DATA FOR NEW JERSEY SALTWATER ANIMAL FAMILIES**

GROUP*/Family	CHEMICAL REFERENCE NUMBER# (1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
POLYCHAETA (WORMS)																		
Capitellidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Dorvilleidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Nereidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
MOLLUSCA																		
Macridae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Myidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Mytilidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Ostreidae	A	-	A	-	-	-	-	-	-	-	A	A	B	-	-	-	-	-
Pectinidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Veneridae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
CRUSTACEA																		
Acartiidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Ampeliscidae	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-	-
Cancridae	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crangonidae	-	-	-	-	-	-	-	-	-	-	B	-	-	-	-	-	A	-
Mysidae	-	-	-	-	-	-	A	-	-	-	-	-	B	-	-	-	-	-
Palaemonidae	A	-	A	-	A	-	A	-	-	-	-	A	A	-	-	-	-	-
Penaeidae	-	-	A	-	-	-	-	-	-	-	-	A	-	-	-	-	-	-
PISCES																		
Atherinidae	-	A	-	-	A	-	-	-	A	-	A	A	-	-	-	-	-	-
Cyprinodontidae	-	-	B	-	-	-	-	-	-	-	-	-	-	-	-	-	A	-
Gasterosteidae	-	-	A	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Phylum or Class
\# See Table 7 for names of chemicals referenced by number.
A Acute toxicity B Acute & Chronic toxicity
C Chronic toxicity

Table 10. **NEW JERSEY FRESHWATER SPECIES FOR WHICH ACUTE TOXICITY OF CHLORDANE HAS BEEN DOCUMENTED**

GROUP*/Family	Species
MOLLUSCA	
Physidae	Aplexa hypnorum
CRUSTACEA	
Daphnidae	Daphnia magna Daphnia pulex Simocephalus serrulatus
Gammaridae	Gammarus faciatus
PISCES	
Centrarchidae	Lepomis macrochirus
Cyprinidae	Cyprinus carpio Pimephales promelas
Percichthyidae	Morone saxatilis
Salmonidae	Oncorhynchus mykiss

* Phylum or Class

Table 11. **NEW JERSEY FRESHWATER SPECIES FOR WHICH ACUTE TOXICITY OF LEAD HAS BEEN DOCUMENTED**

GROUP*/Family	Species
ROTIFERA	
Philodinidae	Philodina sp.
MOLLUSCA	
Physidae	Aplexa hypnorum
CRUSTACEA	
Daphnidae	Daphnia magna
Gammaridae	Crangonyx pseudogracilis
PISCES	
Centrarchidae	Lepomis macrochirus
Cyprinidae	Carassius auratus Cyprinus carpio Pimephales promelas
Salmonidae	Oncorhynchus mykiss Salvelinus fontinalis

* Phylum or Class

Table 12. **NEW JERSEY SALTWATER SPECIES FOR WHICH ACUTE TOXICITY OF LEAD HAS BEEN DOCUMENTED**

GROUP*/Family	Species
POLYCHAETA (WORMS)	
Capitellidae	Capitella capitata
Nereidae	Nereis arenaceodentata
MOLLUSCA	
Macridae	Spisula solidissima
Myidae	Mya arenaria
Mytilidae	Mytilus edulis
Ostreidae	Crassostrea virginica
Pectinidae	Argopecten irradians
Veneridae	Mercenaria mercenaria
CRUSTACEA	
Acartiidae	Acartia clausi
Ampeliscidae	Ampelisca abdita
PISCES	
Atherinidae	Menidia beryllina Menidia menidia
Cyprinodontidae	Cyprinodon variegatus Fundulus heteroclitus

* Phylum or Class

TABLE 13

USEPA PROPOSED CRITERIA VERSUS NJDEPE PROPOSAL CRITERIA*

	AQUATIC PROTECTION				HUMAN HEALTH	
	FRESHWATER		SALINE WATER		FRESH	SALINE
	Acute	Chronic	Acute	Chronic	WATER	WATER
Acenaphthylene					o	o
Acrolein					o	o
Acrylonitrile					o	o
Aldrin	o		o		o	o
Aluminum (Total recoverable)	+	+				
Ammonia, un-ionized		+		+		
Anthracene					o	o
Antimony					+	o
Arsenic (Total recoverable)	o	o	o	o	o	o
Asbestos					o	
Barium					+	
Benz(a)anthracene					o	o
Benzene					+	o
Benzidine					o	o
3,4-Benzofluoranthene (Benzo(b)fluoranthene)					o	o
Benzo(a)pyrene (BaP)					o	o
Benzo(ghi)perylene					o	o
Benzo(k)fluoranthene					o	o
Beryllium					o	o
alpha-BHC (alpha-HCH)					o	o
beta-BHC (beta-HCH)					-	-
gamma-BHC (gamma-HCH/Lindane)	o	o	o		o	o
Bis(2-chloroethyl)ether					o	o
Bis(2-chloroisopropyl)ether					+	o
Bis(2-ethylhexyl)phthalate					o	o
Bromoform					o	o
Butylbenzyl phthalate					+	+
Cadmium (Total recoverable)	o	o	o	o	o	o
Carbon tetrachloride					-	-

* Chemicals included in the USEPA proposal are limited to those listed pursuant to Section 307(a). Where criteria are proposed by only one agency, they are identified as more stringent.

\+ = NJ MORE STRINGENT BY 10%+ - = EPA MORE STRINGENT BY 10%+ O = CRITERIA AGREE WITHIN ± 10%

	AQUATIC PROTECTION				HUMAN HEALTH	
	FRESHWATER		SALINE WATER		FRESH	SALINE
	Acute	Chronic	Acute	Chronic	WATER	WATER
Chlordane	o	o	o	o	+	+
Chloride	+	+				
Chlorine Produced Oxidants	+	+	+	+		
Chlorobenzene					+	o
Chloroform					o	o
2-Chlorophenol					+	+
Chlorpyrifos	+	+	+	+		
Chromium (Total recoverable)	+	+	+	+	+	+
(Includes Chromium^{+3} & $^{+6}$)					o	o
Chrysene						
Copper (Total recoverable)	o	o	o	o		
Cyanide	o	o	o	o	o	o
4,4'-DDD (p,p'TDE)					o	o
4,4'-DDE					o	o
4,4'-DDT	o	o	o	o	o	o
Demeton		+		+		
Dibenz(a,h)anthracene					o	o
Dibromochloromethane (Chlorodibromomethane)					-	o
Dichlorobromomethane (Bromodichloromethane)					o	o
Di-n-butyl phthalate					-	-
1,2-Dichlorobenzene					o	o
1,3-Dichlorobenzene					-	-
1,4-Dichlorobenzene					+	-
3,3'-Dichlorobenzidine					o	o
1,2-Dichloroethane					+	o
1,1-Dichloroethylene					-	o
trans-1,2-Dichloroethylene					+	
2,4-Dichlorophenol					o	o
1,3-Dichloropropene (cis and trans)					+	o
Dieldrin	o	o	o	o	o	o
Diethyl phthalate					o	o
Dimethyl phthalate					o	o
4,6-Dinitro-o-cresol					o	o
2,4-Dinitrophenol					o	o

\+ = NJ MORE STRINGENT BY 10%+ - = EPA MORE STRINGENT BY 10%+ O = CRITERIA AGREE WITHIN ± 10%

	AQUATIC PROTECTION				HUMAN HEALTH	
	FRESHWATER		SALINE WATER		FRESH	SALINE
	Acute	Chronic	Acute	Chronic	WATER	WATER
2,4-Dinitrotoluene					o	o
1,2-Diphenyl-hydrazine					o	o
Endosulfans	+	+	+	+	+	+
(Includes alpha and beta-Endosulfan)						
Endosulfan sulfate					o	o
Endrin	o	o	o	o	+	+
Endrin Aldehyde					o	o
Ethylbenzene					o	o
Fluoranthene					o	o
Fluorene					o	o
Guthion		+		+		
Heptachlor	o	o	o	o	o	o
Heptachlor epoxide	o	o	o	o	o	o
Hexachlorobenzene					o	o
Hexachlorobutadiene					-	o
Hexachlorocyclopentadiene					o	o
Hexachloroethane					-	-
Indeno(1,2,3-cd)pyrene					o	o
Iron		+				
Isophorone					-	o
Lead (Total recoverable)	o	o	o	o	+	
Malathion		+		+		
Manganese						+
Mercury (Total recoverable)	o	o	o	o	o	o
Methoxychlor		+		+	+	
Methyl bromide (bromomethane)					o	o
Methyl chloride (chloromethane)					o	o
Methylene chloride					+	o
Mirex		+		+		
Nickel (Total recoverable)	o	o	o	o	+	+
Nitrate (as N)					+	
Nitrobenzene					o	o
N-Nitrosodi-n-butylamine					+	

+ = NJ MORE STRINGENT BY 10%+ - = EPA MORE STRINGENT BY 10%+ O = CRITERIA AGREE WITHIN ± 10%

	AQUATIC PROTECTION				HUMAN HEALTH	
	FRESHWATER		SALINE WATER		FRESH	SALINE
	Acute	Chronic	Acute	Chronic	WATER	WATER
N-Nitrosodiethylamine					+	
N-Nitrosodimethylamine					o	o
N-Nitrosodiphenylamine					o	o
N-Nitroso-pyrrolidine					+	
Parathion	+	+				
Pentachlorobenzene					+	+
Pentachlorophenol	o	o	o	o	o	o
Phenanthrene					o	o
Phenol					o	o
Phosphorous (yellow)				+		
Polychlorinated biphenyls (PCBs) (Includes Aroclors: 1016; 1221; 1232; 1242; 1248; 1254 and 1260)		+		+	**	**
Pyrene					+	+
Selenium (Total recoverable)	o	o	o	o	-	o
Silver (Total recoverable)	o		o		-	o
Sulfide, hydrogen sulfide (undissociated)		+		+		
1,2,4,5-Tetrachlorobenzene					+	+
2,3,7,8-Tetrachloro dibenzo-p-dioxin (TCDD)					o	o
1,1,2,2-Tetrachloroethane					-	o
Tetrachloroethylene					+	+
Thallium					o	o
Toluene					o	o
Toxaphene	o	o	o	o	o	o
1,2,4-Trichlorobenzene					+	+
1,1,1-Trichloroethane					+	
1,1,2-Trichloroethane					-	o
Trichloroethylene					+	o
2,4,5-Trichlorophenol					+	+
2,4,6-Trichlorophenol					o	o
Vinyl chloride					+	o
Zinc (Total recoverable)	o	o	o	o		

+ = NJ MORE STRINGENT BY 10%+ - = EPA MORE STRINGENT BY 10%+ O = CRITERIA AGREE WITHIN ± 10%

** Cannot be identified as "+", "-", or "o" due to differences in criteria proposed and how each agency lists PCbs in their proposal.

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