BASIS AND BACKGROUND FOR THE GROUND WATER QUALITY STANDARDS
N.J.A.C. 7:9-6.1 et seq.

State of New Jersey
Department of Environmental Protection and Energy
14 November 1991

BASIS AND BACKGROUND FOR THE GROUND WATER QUALITY STANDARDS

TABLE OF CONTENTS

BASIS AND BACKGROUND FOR THE GROUND WATER QUALITY STANDARDS N.J.A.C. 7:9-6.1 et seq.

SECTION I -- INTRODUCTION

The proposed revisions to the Ground Water Quality Standards (N.J.A.C. 7:9-6.1 et seq.) were prepared by the Bureau of Water Supply Planning & Policy. The revisions are being made through a repeal of the existing regulations and adoption of the proposed regulations. This document discusses modifications from the proposed regulations.

The revisions are proposed pursuant to the enabling legislation of the N.J. Department of Environmental Protection (Department) (N.J.S.A. 13:1D-1 et seq.), the New Jersey Water Pollution Control Act (N.J.S.A. 58:10A-1 et seq.), and the New Jersey Water Quality Planning Act (N.J.S.A. 58:11A-1 et seq.). The Ground Water Quality Standards were adopted in 1981 and are being revised for the first time. (They were readopted without amendment in 1986 and 1991.) The "Basis and Background: Proposed Ground-Water Quality Standards" of February, 1980, and the "Response to Public Comments On The Ground-Water Quality Standards" (1981) from the initial adoption in 1981 are incorporated into this document by reference as the basis and background for those portions of the Ground Water Quality Standards which are not significantly altered.

The Standards will be applicable to the protection of ground water quality outside the boundaries of permitted discharge sites and pollution cleanup sites, as regulated by the Department. As such, the Standards will have a significant influence on the Department's regulation of discharges. These Standards will be applied through various regulatory programs such as the New Jersey Pollutant Discharge Elimination System (NJPDES) and the Cleanup Standards (to be proposed in early 1992); some modifications in the Standards' use may be required by the laws governing such programs. The Standards are applicable also to diffuse and other nonpoint sources of pollution, as authorized by the N.J. Water Pollution Control Act, the Pesticide Control Act and other laws. However, broad application of the Standards to many nonpoint and diffuse sources often will require new regulations governing such sources, and will occur over time as these regulations and programs are developed. Where pollution has occurred from such sources, the Cleanup Standards and existing authorities of the Department can be applied to effect remedies.

One significant change from the existing Standards is that the new Standards will not be self-executing. Rather, they will be applied to pollution and discharge control decisions through other regulations, pursuant to the Water Pollution Control Act, the Spill Compensation and Control Act (N.J.S.A. 58:23.11), the Solid Waste Management Act (N.J.S.A. 13:1E-1), the Environmental Cleanup Responsibility Act (N.J.S.A. 13:1K-6 et seq.), the Pesticide Control Act of 1971 (N.J.S.A. 13:1F-1 et seq.), the Storage of Hazardous Substances Act (N.J.S.A. 58:10A-21), and Realty Improvement Act (N.J.S.A. 58:11-23 et seq.). Uses of the Standards may include the derivation of effluent limits for intentional discharges, ground water protection standards, application or loading rates and targets for pollution mitigation activities.

Modifications and additions to the Department's regulations, specifically NJPDES and the Cleanup Standards, result in a dichotomy of functions. NJPDES and the Cleanup Standards (when adopted) result, among other decisions, in the delineation of areas directly subject to the two regulations (discharge sites and "contaminated sites", respectively). These two regulations (and other applicable regulations) affect the nature of ground water quality actions within the regulated sites, which are defined through the NJPDES regulations for ongoing discharges, or through the Cleanup Standards by the nature of the contaminated site. The Ground Water Quality Standards, in turn, regulate the nature of ground water quality at and outside the boundaries of these regulated sites. The Department has determined that this dichotomy will enhance the decision-making process for both the NJPDES and Cleanup Standards regulations. Both regulations rely upon the Ground Water Quality Standards for the classifications, designated uses, numerical criteria and practical quantitation levels applicable to ambient ground waters of New Jersey. Because the Standards must be met at the boundaries of the regulated sites, the Standards will have a significant influence on regulatory decisions.

SECTION II -- OVERVIEW OF THE STANDARDS

The Ground Water Quality Standards establish the basis for regulation of activities (discharges) that directly or indirectly do or may affect ground water quality. The scope of discharges covered is established primarily through the N.J. Water Pollution Control Act, as amended by the Clean Water Enforcement Act. The system established is differential: that is, ground waters in various parts of New Jersey are determined to have different natural utility and are classified and protected accordingly. The Standards classify ground water according to a combination of natural characteristics and actual or potential uses. Provisions are included for reclassification of ground water based on new information or changing circumstances. Uses that will be protected in each classification area are specified.

Numerical and narrative water quality criteria are established for each classification area which, when not exceeded, will protect the primary designated use. Requirements are included for protecting ground water of higher quality from significant degradation (an "antidegradation limit"), including requirements in some areas that no degradation occur beyond existing quality or even natural quality. The protection of higher-quality ground water will be improved over current regulations through this more specific antidegradation policy. Also, the Standards require the protection of surface and ground water to which ground water that has been affected by discharges will flow. The stringency required is determined by the use of site-specific ground water pollutant data.

The proposed Standards are significantly modified from the existing Standards (referred to herein as the 1981 Standards, which remain in effect until adoption of this revision). The site-specific classification system of the 1981 Standards has been changed to a mapped system based on regional classifications. Included in the new system is expanded protection of Pinelands ground water. Designated uses are primary and secondary, with the primary designated uses protected preferentially and the secondary uses protected to the extent that such protection will not impair the primary uses. Numerical criteria have been added for a wide variety of volatile organic chemicals and other constituents, and provision is made for Department derivation of interim criteria where specific criteria are not promulgated as part of this rule.

SECTION III -- DETAILED DISCUSSION OF PROPOSED REVISIONS TO SUBCHAPTER 6

A. LEGAL AUTHORITIES

Several of the laws cited in Section 6.1 have been cited as authority for the application of the Standards, primarily those related to diffuse sources of pollutants and the remedy of pollution by hazardous substances. The primary authority for the Standards, however, is found within the N.J. Water Pollution Control Act, wherein the Commissioner of the Department is given the authority to:

> "prepare, adopt, amend, repeal and enforce, pursuant to the 'Administrative Procedure Act'...reasonable codes, rules and regulations to prevent, control or abate water pollution and to carry out the intent of this act ...(which) may include, but shall not be limited to, provisions concerning:
>
> ...(c) the classification of the surface and ground waters of the State and the determination of water quality standards for each such classification;" (N.J.S.A. 58:10A-4)

The Ground Water Quality Standards constitute the rules and regulations promulgated by the Department pursuant to this authority. The remaining laws cited in these regulations involve the mechanisms for regulation of specific categories of discharges, such as intentional discharges, solid waste facilities, underground storage tanks, aboveground storage tanks, spills, pesticides, etc.

B. POLICIES

The policies proposed in Section 6.2 are primarily drawn from the existing Standards. Section 6.2(a) repeats the policy of the N.J. Water Pollution Control Act, and is the fundamental policy for the Standards. Section 6.2(b) provides a mechanism to control discharges so as to protect downgradient surface waters. Surface waters in several parts of the state have more stringent criteria than the adjacent ground waters, primarily due to the need to protect aquatic life (e.g., trout production areas). This policy establishes a clear link between the two water regimes, and is repeated in critical places throughout the proposed Standards. Section 6.2(c) is derived from the existing Standards; it helps determine when discharges have resulted in an undesirable alteration of ground water quality, and emphasizes the Department's responsibility to determine the management actions required to protect ground water quality. Finally, Section 6.2(d) states the Department's responsibilities pursuant to Pinelands Protection Act of 1979 to comply with the requirements of the Pinelands Comprehensive Management Plan within the Pinelands Area.

C. DEFINITIONS

A number of definitions were deleted from the list in the 1981 Standards, to reflect changes in terminology or because the defined terms were not used within the proposed regulations. Definitions have been added or modified to reflect significant changes in the Ground Water Quality Standards, or to clarify confusing terms. Key changes are:

1. Alternative concentration limits (ACL) -- Specific provision is made for less stringent ground water quality requirements, through ACLs, which must be established through NJPDES permit actions. Such decisions result in what are called "Classification Exception Areas" where the Ground Water Quality Standards do not apply <u>for specified contaminants only</u>. Instead, NJPDES are the controlling regulations. Ongoing and future discharges will very seldom receive ACLs, because the Department has found that feasible discharge controls generally exist for these discharges to protect ground water quality as required by the Standards. The use of ACLs in establishing Classification Exception Areas is discussed in III.D, below.

2. Geology Terms -- "Aquitard" has been defined because significant recharge to aquifers may occur from or through aquitards, and therefore the quality of ground water in aquitards should be protected. "Aquitard" has been defined such that only the larger aquitard units are included. Known and accepted aquitards, primarily in the Coastal Plain geologic province, were used as the basis for the hydraulic conductivity used of 0.1 ft/day. In addition, this value provides a clear distinction between aquitards and formations accepted as aquifers, based on hydraulic conductivity. The 50 foot thickness is proposed to eliminate thinner units that are more likely to be discontinuous or to have significant variations in hydraulic conductivity. The areal extent of the aquitards was chosen as 100 acres to eliminate minor units that do not significantly affect ground water flow. As a check on this area, the following estimates were made. Given a 50 foot thickness and a hydraulic conductivity of 0.1 ft/day (a worse case scenario under the other two parameters), the vertical time of travel in the Coastal Plain aquitards is approximately 1 year. A one year time of travel for major pumping wells yields a contribution zone approaching 100 acres. (The gradient across a particular aquitard will have a significant effect on the velocity and direction of ground water flow.) Selection of these values are necessarily somewhat arbitrary, as hydrogeologic parameters are a continuum with no discrete, indisputable boundaries. The Department recognizes that some "accepted" aquitards may not meet these values, but most often these aquitards will not be of sufficient thickness and extent to protect downgradient ground waters.

The definition of ground water is clarified, and definitions of the unsaturated zone and surface water have been added to specify where each zone begins and ends. These definitions do not alter current policy of the Department regarding requirements for permits and remedial actions.

3. **Antidegradation and Antidegradation Limit** -- The 1981 Standards include a narrative antidegradation policy that has been difficult to quantify and apply. The terms "antidegradation" and "antidegradation limit" are defined as part of a concept, discussed below, to explicitly quantify the Department's antidegradation policy. The Department believes that the redefined policy will significantly improve protection of higher quality waters.

4. **Classification area** -- This term replaces "designated area" to avoid confusion inherent in the 1981 Standards between "classification", "designated area" (which actually refers to a classified area near a discharge) and "designated use." The proposed classification system is based on narrative descriptions and interpreted in maps, and therefore "designated area" is no longer appropriate.

5. **Constituent Standard** -- This subchapter results in specific concentrations or levels of each constituent (ground water quality parameter), which concentrations and levels are called "constituent standards" and are a basis for (not the sole determinant of) the control of discharges through the Department's regulatory programs. The term "constituent standard" is distinct from and not synonymous with the term "concentration limit" used within the NJPDES regulations (N.J.A.C. 7:14A-6.15). The latter definition is used to define a regulatory limit on concentrations of hazardous constituents from a permitted discharge.

6. **Designated use** -- This definition was revised to clarify that "use" means both direct withdrawal of ground water for human use and the discharge of ground water to surface waters for human and ecological uses.

7. **Discharge, Pollutant, Toxic Pollutant, Hazardous Pollutant** -- The Clean Water Enforcement Act (signed into law in 1990) amended these definitions in the N.J. Water Pollution Control Act. The new definitions have been cited in the proposed Standards to ensure consistency. The definition of "discharge" has been amplified to make clear that the movement of pollution in the unsaturated or saturated zones to a new part of either zone is considered an actionable discharge under the Standards. Pursuant to the Water Pollution Control Act, nonpoint sources of pollution are considered discharges.

8. **Natural quality** -- This term is defined to assist in the protection of ecologically sensitive (Class I) ground waters. The "natural quality" definition provides recognition that natural quality may vary over large areas, and so the best estimate of natural quality will be from the same or a similar hydrologic unit. Further, the natural quality of Synthetic Organic Chemicals (SOCs) is defined as zero, because substances of human manufacture should not be present in such ecologically sensitive waters. The Standards explicitly recognize that some organic chemicals that are SOCs may also occur naturally and exempt those naturally occurring substances from the definition of SOCs and "discharge." Natural quality is the quality of ground water without human disturbance or influence other than that of pollutants from regional precipitation. The term is distinct from background quality, which is the actual quality of ground water coming onto a discharge site or contaminated site but not influenced by that site. In pristine areas of the state, the background quality could be the natural quality.

9. **NJPDES permit action** -- The New Jersey Pollutant Discharge Elimination System is a primary regulatory program of the Department for controlling discharges. Ongoing and potential discharges from regulated facilities require

NJPDES permits. However, the NJPDES regulations may also be used for decisions that do not result in permits, and the "NJPDES permit action" makes this clear in its application to the Standards. Remedial actions taking place pursuant to the federal Comprehensive Environmental Responsibility, Cleanup and Liability Act (CERCLA, also known as Superfund) by law do not require State permits. However, the remedies must meet the State requirements. NJPDES permit actions may be required for certain aspects of the remedial action (such as discharges of treated wastewater), and result in decisions that are considered "permit equivalents." Further, the Department may determine that a pollutant discharge does not require an active response or NJPDES permit. NJPDES permit actions include such decisions of non-applicability for "de minimus" pollution.

10. **Practical quantitation level (PQL)** -- The additional lifetime risk resulting from exposure to carcinogens in drinking water at concentrations specified by provisions of the New Jersey Safe Drinking Water Act (NJSDWA) is very low. The NJSDWA establishes a goal that the additional risk of cancer due to the drinking of a single carcinogen be no more than one additional cancer per one million people with a lifetime exposure. The Standards use the same policy for such substances. The "health based" and "ecologically based" concentrations for many carcinogens (and some non-carcinogens) are not reliably measurable by current laboratory practices. The PQL is the lowest concentration of a constituent which can be reliably measured on a routine basis within acceptable levels of precision and accuracy. For monitoring and permit compliance purposes, the resulting PQLs will be deemed equivalent to the constituent standards, wherever the PQL is a greater concentration than the constituent standard. This proposed policy will reduce the potential for the Department to require the measurement of compliance with constituent standards which are not in fact measurable. The PQLs are specified in the regulations by definition and concentration (see Section III.I below). It is important to note that a discharger must show compliance to the PQL using an analytical method sensitive enough to have the listed PQL (or better). However, where discharges have resulted in an elevated constituent concentration, the discharger may use other analytical techniques as long as the PQL for the alternative technique is lower than the constituent concentration. One implication of this policy is that discharges will be required to move from less sensitive techniques to more sensitive techniques as the constituent concentration is brought closer to the constituent standard.

Several commentors to the draft Standards requested that the Department consider the potential for matrix interference in establishing PQLs, and specifically mentioned the difficulty of meeting the listed PQLs in polluted ground water. The

Department never intended that all monitoring be conducted using the most sensitive methods; these methods are required when full compliance with the Standards must be shown. However, the Department does recognize that natural quality of ground water may sometimes cause matrix interference. The drinking water analytical methods were chosen wherever possible to establish PQLs. The Department feels fully justified in doing so, because 13 percent of New Jersey's residents rely on drinking water from domestic wells that usually lack any significant treatment. Most public ground water supplies are provided to consumers with only conventional treatment. In New Jersey (unlike some other states), the ground water matrix _is_ the drinking water matrix in much of the state. Monitoring for compliance with the Standards most often will involve a relatively clean matrix. Where more significant matrix interferences do exist, the Department has decided to allow dischargers to prove that the listed PQL is invalid, that an alternative PQL is valid, and that the alternative PQL does not mask the existence of any targeted compounds that exist in the ground water above their listed PQLs and constituent standard. The Department has determined that this policy constitutes the minimum possible alleviation of the Standards to provide for realistic analytical requirements.

Finally, the PQL policy does not negate responsibility of dischargers to design, construct and operate treatment works so as to meet the constituent standards, even though the PQL will be used to determine compliance.

11. **Synthetic Organic Chemicals (SOCs)** -- Ground water pollution often involves discharges of SOCs, substances that are synthesized or otherwise manufactured and contain carbon. This term is defined to assist in the development of numerical criteria for such substances where insufficient information is available to derive a specific criterion at this time, and for establishing natural quality of these substances in Class I areas.

D. GROUND WATER CLASSIFICATION SYSTEM AND DESIGNATED USES

The classification system adopted in 1981 used a mapped GW1 designation for the Central Pine Barrens Water Quality Critical Area, and narrative description of all other classifications based on natural levels of Total Dissolved Solids (TDS). This system has been eliminated in favor of a system which relies on narrative descriptions that are interpreted through maps for most classes. Because the maps generalize data, field confirmations of geology-based classification areas should be made wherever appropriate, such as near the classification area boundaries. Each classification is applicable to specific ground waters, aquifers and aquitards, and does not necessarily apply to all aquifers or formations within the boundaries of a mapped area in plan view. For instance, one area may have several aquifers and aquitards in vertical sequence (shown through cross-section representations on some maps). Each aquifer and major aquitard is classified as a separate unit. The classifications are:

Class I -- Ground Water of Special Ecological Significance
- Class I-A -- Exceptional Ecological Significance
  - Areas with endangered species, Natural Areas, undisturbed ecosystems, FW1 waters, etc., which are dependent upon the quality of ground water.
- Class I-PL -Pinelands Area
  - As defined by the Pinelands Protection Act of 1979

Class II -- Potable Water Supplies
- Class II-A -- Suitable for Potable Water Use
  - All ground water not in the other Classes.
- Class II-B -- Currently Not Suitable for Potable Use
  - Have areawide pollution problems that are often technologically infeasible to correct in the near future, and where potable use is nonexistent or very limited and has little likelihood of increasing in the foreseeable future.

Class III -- Other Than Potable Water Supplies
- Class III-A -- Major Aquitards
- Class III-B -- Naturally Unsuitable for Potable Use

1) **Class I** -- The two subclasses of Class I will protect the quality of ground waters which support special ecological resources. Class I-A protects exceptional ecological resources through a prohibition on degradation from natural quality, and replaces narrative language in the 1981 Standards which mandated nondegradation for all State and Federal parks, forests and wildlife management areas within New Jersey. Class I-A is more stringent, yet narrower in scope. It is more flexible in allowing new Class I-A areas to be classified by the Department over time, in response to petitions. FW1 watersheds and certain Natural Areas were selected for immediate designation because such areas are the focus of strict regulation by the Department to prevent ecological damage. The Natural Areas selected for inclusion contain ecosystems that are considered dependent directly or indirectly on ground water for their survival. Class I-A areas must be in permanent holdings for conservation. These areas are mapped by the Department through the Natural Areas regulations and the Surface Water Quality Standards.

Class I-PL expands the area protected by special Pinelands water quality criteria linked to the GW1 classification of the 1981 Standards, adding the Protection Area that is within the Pinelands Commission's jurisdiction. (The Preservation Area is nearly synonymous with the GW1 area.) The Preservation Area is a nondegradation area for ground water with the policy of achieving natural water quality, similar to Class I-A. The Protection Area is a nondegradation area for ground water, with the policy of maintaining existing background water quality. The Protection Area has been added to the Preservation Area as a nondegradation area to achieve compatibility with the Surface Water Quality Standards (N.J.A.C. 7:9-4 et seq.) which establishes the Preservation and Protection Areas as "outstanding national resource waters" subject to nondegradation, and with the regulations of the Pinelands Commission (N.J.A.C. 7:50-1.1 et seq.) which stringently restrict the degradation of ground water or surface water quality by new development, unless specifically authorized by Pinelands Commission regulations. The Pinelands Area is delineated by the Pinelands Protection Act of 1979, and mapped by the Pinelands Commission.

The primary designated use for both Class I subclasses is protection of water quality for ecological purposes, other water uses being secondary.

2) **Class II** -- includes all existing sources and potential sources of potable ground water (exclusive of Class I and III-A areas, Class III-B being non-potable) and replaces GW2 and parts of GW3 from the 1981 Standards, with a primary designated use of potable water or conversion to potable water. Other than Class I-PL, Class II applies to the vast majority of New Jersey's aquifers. This fact is supported by the high (49 percent) reliance of New Jersey on ground water for its potable water supplies, the history of ground water use in all parts of the state (including the most heavily urbanized areas such as Newark), and EPA designation of approximately 80 percent of the state as "sole source aquifers" pursuant to Section 1424(e) of the Federal Safe Drinking Water Act.

There are two subclasses for Class II. Class II-A includes the areas that are generally suitable for potable purposes without extensive or exotic treatment, though localized areas of pollution or nonpotable natural quality do exist. Class II-B includes areas where extensive pollution has effectively foreclosed the possibility of ground water quality restoration for potable use in the near future, and yet the natural characteristics of the area would support potable use (i.e., the water is not excessively saline, sulfurous, etc.). Ground water in such areas is not used for public community water supplies and only minimally (if at all) for non-community domestic supplies. The intent of Class II-B is to identify such areas through Department promulgation of rules and through a petition process. No further degradation is allowed and pollutant sources must be controlled, but the application of restoration technologies generally is not feasible (especially on a site-by-site basis). Periodic reviews will test whether the assumptions leading to Class II-B status are still valid. In this manner, case-by-case decisions are replaced by a regional decision. The draft Cleanup Standards (N.J.A.C. 7:26D, released as an Interested Party Review draft in May of 1991) specifically reference the Class II-B areas and provide for specific cleanup standards to protect surface water, existing water uses and human health (e.g., from vapor migration into structures). They also provide for a certain level of ground water cleanup that the Department has determined to be technologically practicable, so that passive attenuation of the remaining pollutants is more viable.

The proposed Standards identify five criteria for the selection of Class II-B areas. First, the area must exhibit common exceedence of ground water quality criteria, due to past discharges, such that a designated use of "potable water with conventional treatment" is not reasonable. Degradation of the entire area is not a required parameter, as any new, major well would be at high risk of induced pollutant flow to the well. Second, restoration of the designated use is commonly technologically impracticable from an engineering perspective. The Department has found that some ground water areas cannot feasibly be restored through site-by-site remedial actions, either because the individual site lacks a technologically feasible method or because each remedy has an effect on nearby sites (e.g., inducing the flow of pollution from other sites toward the remedial site), and that regional restoration is beyond the limits of current technology. Third, no public community water supply well or Zone of Contribution for such wells is included, nor any significant concentration of domestic wells. Class II-B areas should not include a Zone of Contribution for public community wells because, by definition, such wells will be at risk from any pollution contained within their Zone of Contribution. Likewise, the Department recognizes the importance of protecting domestic wells, and has determined that no municipality or portion suggested for Class II-B status shall be included in Class II-B that derives 5 percent or more of its potable water supply from domestic wells. Further, the Department intends to exclude concentrations of domestic wells from Class II-B even in municipalities that do not meet the 5 percent criterion, wherever possible. Therefore, Class II-B areas often will not conform to political boundaries, but rather will reflect hydrogeologic and ground water use considerations. The Department will protect existing, isolated domestic well users that are included in Class II-B areas through the Department's remedial program, so that either the wells are protected or alternative water supplies are ensured. The 5 percent rule is a policy choice, but the Department has selected this value as a de minimus ground water use, and further limits the application and implications of Class II-B through the two additional conditions.

Fourth, there must be no significant risk of pollution migration into Class I or II-A areas. The lack of risk can be based upon topographic or hydrologic boundaries, natural attenuation rates for the constituents, or other factors. Fifth, a reliance on natural or passive attenuation (subsequent to pollutant source control, free product removal, and cleanup of gross contamination in soils and ground water) must not pose a significant risk to human health or welfare or ecological systems. Human health or welfare concerns include the migration of toxic or hazardous vapors into structures, odor problems, and migration of pollution to potable water supply wells, industrial or commercial water supply wells, water supply rivers or watersheds, etc. The primary ecological concerns will be the migration of polluted ground water into surface water ecosystems that are sensitive to such pollutants.

Wherever these five criteria are met and an area is placed in Class II-B, the designated uses shall be any reasonable use other than potable use that does not exacerbate existing pollution, and eventual potable use or conversion to potable use. The Department intends that ground water with naturally potable character be restored to potable character over time. In Class II-B the primary mechanism will be source control and the cleanup of gross contamination, followed by "natural" or "passive" cleanup using the area's existing attenuation capacity, rather than the active ground water cleanup that will typify other areas of the state. Use of passive cleanup is dictated by the lack of technologically practicable remedial methods for such contaminated areas.

The Department intends to propose the first Class II-B areas by a separate proposal. Therefore, a paragraph of the Standards, at N.J.A.C. 7:9-6.5(e)3 has been reserved for later incorporation of the proposed rule. The Class II-B rule proposal will include a full basis and background for the selection process.

3) Class III -- Class III-A consists of ground water within major aquitards. The definition and justification for "aquitard" used for Class III-A is discussed in Section III.C. While not generally used as a significant supply for direct water uses of any sort, such aquitards often serve as significant sources of gradual recharge to adjacent aquifers. Therefore, they have been classified for protection, with designated uses of the most stringent adjacent classification area. However, if ground water from the aquitard flows toward another classification area (rather than the most stringent area) such that pollutants would not reach the most stringent area, then the designated uses and criteria of the downgradient area apply. Where the ground water pollutants are not expected to flow from the Class III-A area, decisions regarding protection are provided for on an area-by-area basis, including consideration of the potential for flow to surface waters. Class III-A areas were mapped for the Coastal Plain using available geologic information, but must be determined on a case-by-case basis in other areas, particularly in the glacial sediments of northern New Jersey.

Class III-B contains ground water which has such high concentrations of TDS, chloride or other natural constituents that potable use (and conversion to potable use) is impractical (as are most other water uses). The TDS and chloride levels chosen exceed those of concentrations in any known New Jersey wells supplying water for potable use, and so represent water quality that is not suitable for potable use, given commonly available treatment or mixing technologies. The choice of 5,000 mg/l TDS or 3,000 mg/l chloride is significantly lower than the prior threshold of 10,000 mg/l TDS for the GW-4 classification. Western states often use 10,000 mg/l TDS as a threshold for ground water that is usable for potable purposes, but the Department has decided that such a high level is not appropriate for New Jersey, where ground water is generally less affected by natural contaminants. Decisions regarding other natural constituents will be based upon the practicality of water supply treatment to bring the ground water quality into compliance with the Primary Drinking Water Quality Standards. Any reasonable use may be made of Class III-B water. Class III-B areas were mapped based on existing data regarding chloride concentrations in ground water. Other Class III-B areas with high natural contamination must be mapped on a site-by-site basis.

4) Exceptions to the Classification System -- The Standards provide for "Classification Exception Areas" in which individual constituent standards are modified or suspended either temporarily or permanently. These areas are defined where noncompliance with the normal Standards is expected and reasonable, specifically for the considerations in Section 6.6. The Classification Exception Areas meet a critical need for the Department's regulatory programs. When ground water in the immediate vicinity of a discharge is not expected to meet Standards due to that discharge (pursuant to an approved NJPDES permit for the discharge or a pollution remedy selected pursuant to the Cleanup Standards or other regulatory programs), a Classification Exception Area is automatically adopted that "excepts" the regulated area from application of particular constituent standards (which must be identified). For a NJPDES permitted discharge, the excursion from the Standards must cease when the approved discharge ceases. Two examples help illustrate this use. An industrial waste management unit generally must comply with the Standards at the compliance perimeter established through a NJPDES permit (generally at the edge of the waste management unit, not at the property boundary). The area within the compliance perimeter would be a Classification Exception Area under the NJPDES permit, recognizing the potential for temporary impacts. The Surface Water Quality Standards (N.J.A.C. 7:9-4.1 et seq.) have long contained a similar provision. Second, a ground water quality restoration action approved pursuant to the Cleanup Standards or another applicable regulatory program will specify the "contaminated site" including the entire area affected by the decision. This area is a Classification Exception Area and is regulated by the applicable program. In both cases, the Ground Water Quality Standards apply at and outside the boundaries of the Classification Exception Areas, and the exceptions are for specified constituents only (e.g., constituents expected to exceed the constituent standards because of the regulated discharge).

Likewise, where natural quality exceeds the criteria, the Standards provide a mechanism to except those areas for as long as the natural condition continues. Finally, there may be circumstances where a higher-than-normal constituent standard (such as an Alternative Concentration Limit granted pursuant to NJPDES) will be approved for a discharge or pollution plume. Section 6.6(d) provides for exception of such areas from the classification system. Further discussion of ACLs may be found in Section III.C, above.

In each case, the Department deems it preferable to clearly define exception areas. This policy recognizes where designated uses protected by the overall classification are not viable in localized areas, and the specific constituents of concern, rather than by addressing site-specific variances through the more cumbersome reclassification process.

E. GROUND WATER QUALITY CRITERIA

The Department has continued the practice of the 1981 Standards by specifying ground water quality criteria -- the numerical concentrations of constituents which will support the primary designated use within each classification area.

Class I-A criteria will be the natural quality of ground water, in order to protect the primary designated use of ecological preservation. Class I-PL(Preservation Area) also uses natural quality as criteria, retaining the zero degradation policy of the 1981 Standards, in furtherance of the Pinelands Protection Act policies and Pinelands Commission requirements for that area. In Class I-PL (Protection Area), the existing background water quality of a discharge site establishes the criteria. For Class I, the natural quality for Synthetic Organic Chemicals (SOCs) is specifically established at zero (0). This level is chosen because manufactured organic substances should not be discharged or allowed to remain the Classes I-A or I-PL.

However, it is recognized explicitly by the Standards that some organic chemicals that are SOCs are also created through natural processes.

Class II-A criteria are proposed that protect the potability of ground water in the Class II-A areas. The criteria are based on the protection of human health and welfare and the potability of water supplies, without regard for the analytical ability of laboratories to measure the criteria concentrations (see discussion of Practical Quantitation Levels regarding analytical techniques). This is the same practice used in the Surface Water Quality Standards regarding waters classified for potable use.

Class II-A criteria will also be used as the Class II-B criteria. These criteria will help ensure that conditions in the Class II-B areas are not worsened over time. The Department specifically has rejected concepts from the literature that would "write off" areas of the state and allow significant deterioration of ground water quality. The potential of potability will be maintained for all constituents that currently meet potable quality. Where constituents already exceed criteria, no further degradation should be allowed (in concentration or volume). The Cleanup Standards or other applicable regulations will be the regulatory mechanism for controlling pollutant sources, removing gross contamination and providing for the use of natural attenuation. NJPDES and other regulatory programs will be the mechanisms for controlling ongoing and future discharges.

The Department recognizes that the requirements for new and continuing discharges may be perceived as more stringent than for past discharges, in Class II-B. There are several reasons for the proposed criteria and antidegradation policy. First and foremost, the policy regarding cleanup of past discharges is based upon the general conclusion that pollution remedies in Class II-B are technologically impracticable. The control of new or continuing discharges has been shown to be both practicable and feasible through the various discharge control and prevention programs of the Department. Second, use of the ground water may currently be possible with advanced treatment, and such use could be prohibited by further degradation. Third, the New Jersey Water Pollution Control Act has a clear intent of preventing significant deterioration of ground water quality, such that the existence of one pollutant or a suite of pollutants does not justify further degradation. Fourth, additional contamination may impair or destroy natural attenuation capabilities that the Class II-B area depends upon for eventual restoration to potable quality. Fifth, the state-of-the-art in ground water restoration is improving as more funds are dedicated to research and development. The potential exists for new technology capable of restoring ground water quality that currently is beyond restoration. Additional degradation will at the least increase the cost of implementing new technologies and may make them impracticable. For these reasons, the Department is proposing criteria that avoids the degradation of ground water beyond either the Class II-A criteria or current quality, whichever concentration is higher.

Where criteria are listed in the Standards, the criteria are called "specific criteria." The Standards also include a mechanism for the derivation at any time of "interim specific criteria" through the use of the same methodology used for "specific criteria" where sufficient scientific data are available regarding systemic toxicity, carcinogenicity or other limitations to potability. These interim specific criteria, because they are constituent-specific, will allow the Department to regulate ground water dischargers with a reduced potential for overly or insufficiently stringent regulation. The Department will make the interim specific criteria and the data used for their derivation available to the public, and propose them as specific criteria as soon as reasonably possible. The interim specific criteria will be derived for use in site-by-site decisions, and normal appeal and adjudication opportunities will be available. Finally, "interim generic criteria" are established for SOCs which lack specific or interim specific criteria. The interim generic criteria will be used where insufficient information exists for derivation of interim specific criteria.

Class III-A criteria will be the criteria of the appropriate adjacent classification, as discussed in Section III.D, above, so as to protect the quality of recharge water. In such cases, the Department shall determine the proper criteria for each area. In most instances, therefore, the Class III-A criteria will be Class I or II criteria, except for aquitards located between saline ground water formations in the deeper parts of the Coastal Plain area. In Class III-B, criteria will be developed and applied area by area.

1. Specific Criteria Development Process -- Class II-A

Ground water quality criteria are being proposed for a large number of constituents. Because of the interconnection of ground water and surface water in much of the state, this proposed rule includes criteria for parameters that will be proposed for the Surface Water Quality Standards as well. In view of the heavy dependance on ground water for potable use in New Jersey, the Department is proposing criteria for all constituents included in the existing or proposed New Jersey or Federal Safe Drinking Water Regulations (N.J.A.C. 7:10-1 et seq., 40 CFR Parts 141 and 143, USEPA (1991 a,b)). The remaining constituents either are currently regulated in N.J.A.C. 7:9-6.6 (within the current Ground Water Quality

Standards), are priority pollutants, or have been identified as requiring regulation by the Department's pollution control or remedial programs. As explained in detail below, health-based criteria for Class II-A are developed using scientific information derived from the New Jersey Drinking Water Quality Institute (for constituents regulated under N.J.A.C. 7:10-16.7, commonly known as the "A-280" hazardous contaminants), the USEPA Integrated Risk Information System (IRIS) (USEPA, 1987), or the Health Effects Assessment Summary Tables (HEAST; also developed by the USEPA) (USEPA, 1990b).

a. Human Health Considerations

(i) Introduction to Exposure Considerations

Class II-A ground waters of New Jersey are designated for uses which include drinking water and other potable (household) uses. Therefore, potential routes of human exposure to ground water contaminants are ingestion of potable water and contact through other household uses. These potential routes of exposure were evaluated in developing the human exposure considerations for specific criteria.

In developing the exposure scenarios, a human body weight of 70 kg was assumed, except 60 kg (women) for xylenes (NJDWQI, 1987a) and 4 kg (infants) for nitrates and nitrites (Dourson, 1990). This is a standard assumption utilized previously by New Jersey and U.S. EPA (NJDWQI, 1987a and U.S. EPA, 1980, 1985, 1989b).

(ii) Quantitation of Exposure From Drinking Water

Many of the specific criteria were derived using an exposure scenario based on ingestion of ground water as drinking water. It is assumed that the amount of drinking water ingested daily is two liters per day, except 1.5 liters per day in the case of barium (USEPA, 1989a) and 0.64 liters per day for infants in the case of nitrates and nitrite (Dourson, 1990). This widely accepted assumption is currently utilized by both New Jersey (NJDWQI, 1987a) and USEPA (1984a) 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 quantify these 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.

(iii) Introduction to Toxicity Considerations

The risk assessment for chemical-specific toxicity factor development was performed according to generally accepted procedures discussed more fully in NJDWQI (1987a). The process by which the toxicity evaluations were performed is described briefly below, except in the case of lead. Because of special considerations regarding health effects, lead is discussed separately in this section.

(iv) 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 (1985) as discussed in NJDWQI (1987a). Chemicals classified as "Human Carcinogens" or "Probable Human Carcinogens" (USEPA Groups A or B) were placed 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 classified as "Not 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 non-carcinogenic toxicity. For these chemicals, uncertainty factors were applied to doses at which toxic effects were evaluated in humans or experimental animals, to derive Reference Doses (RfDs, formerly called Acceptable Daily Intakes (NJDWQI 1987a)), which 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 in Category II were evaluated based on non-carcinogenic toxicity with an additional uncertainty factor of 10 applied to account for their unclear carcinogenicity status. This approach is used by the USEPA drinking water program. For chemicals in Category II for which an RfD has not been developed, criteria were developed based on potency slope factors as for USEPA Groups A and B chemicals (USEPA 1989a, 1990a).

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.

The A-280 Amendments to the New Jersey Safe Drinking Water Act (P.L. 1983, C.443) require that the MCLs for carcinogens shall permit cancer in no more than one in one million persons ingesting that chemical for a lifetime within the limits of technologic feasibility. Since Class II-A ground waters are designated to be protected for potable use, a lifetime risk level of one in one million ($1x10^{-6}$) was also chosen as the basis for the risk assessment for the human health-based criteria.

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 ($1X10^{-5}$) 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 (Group A or B) human carcinogens and more stringently than chemicals with insufficient or negative evidence of carcinogenicity (Group D or E) (NJDWQI, 1987a; USEPA, 1985). Since a risk level of $1X10^{-6}$ is utilized for Group A and B carcinogens, the use of a $1X10^{-5}$ risk level reflects a less stringent approach for these Group C chemicals.

(v) Toxicity Factors

For chemicals for which MCLs have been developed by the NJDWQI, the toxicity factors (potency slope factors for carcinogens and Reference Doses for non-carcinogens) which provide the health basis for the MCLs (NJDWQI, 1987b) were utilized as the basis for the human health-based criteria for ground water.

The NJDWQI (1987a) recommended to the NJDEP 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, ground water quality criteria in future revisions of the criteria, except for trans-1,2-dichloroethylene, the toxicity factor of which has been revised based on compelling evidence from a review of available data (USEPA, 1991a).

For chemicals which have not been addressed by the NJDWQI, but which the USEPA has incorporated into IRIS, the carcinogenicity classification and oral toxicity factors in IRIS were accessed by the Department for use when appropriate in derivation of the criteria. Toxicity factors were recalculated from toxicity data provided in IRIS (from information retrievals through 17 September 1990) and rounded to two significant figures for use in criteria derivation. For chemicals which have neither been addressed by the NJDWQI nor been incorporated into IRIS, the carcinogenicity status and toxicity factors in the USEPA HEAST (USEPA 1990b) were used in derivation of the ground water quality criteria.

Toxicity factors for carcinogenic polycyclic aromatic hydrocarbons (PAHs) are not available in IRIS or HEAST. The

Department used an oral slope factor of 11.5 (mg/kg/day)-1 calculated for benzo(a)pyrene (BaP) (USEPA, 1984b). As an alternative to assuming that all carcinogenic PAHs are equivalent in potency to BaP, the Department is adopting a relative potency approach where the other carcinogenic PAHs (Group A and B) are assumed to have one-tenth (0.1) the potency of BaP, except for dibenz(a,h)anthracene which is assumed to have the same potency as BaP. Studies have shown that actual toxicities vary from compound to compound but are generally an order of magnitude lower than those reported for BaP except for dibenz(a,h)anthracene (Clement Associates, 1988) with some studies reporting the potencies of carcinogenic PAHs as low as two orders of magnitude less than that of BaP.

The Department intends to review the criteria developed using various data bases on the same schedule as the readoption of the Standards, and will reflect any relevant alterations to these data bases at that time. The Department may also choose to review primary literature to supplement the data base review.

(vi) Derivation of Human Health-Based Criteria

The Human Health-Based Criteria were derived from the toxicity factor (carcinogenic potency slope or Reference Dose), the exposure assumptions for drinking water and a relative source contribution factor (for non-carcinogens) which is used to account for the contribution from other sources of exposure including air and food. The Department assumes a 20 per cent relative source contribution factor when sufficient quantitative data are not available on the contribution of each source of exposure. This is common assumption and is currently used by NJDEPE and USEPA in the drinking water programs. (NRC 1977, USEPA 1990a, and NJDEP 1987a). The final calculations are rounded to one significant figure (USEPA 1990) for deriving the criteria for each chemical using the following equations:

For Carcinogens:

$$\text{Criterion} = \frac{(1 \text{ X } 10^{-6}) \text{ x } 70 \text{ kg x } 1000 \text{ ug/mg}}{q_1^* \text{ (mg/kg/day)}^{-1} \text{ x } (2 \text{ L/day})}$$

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

For chemicals for which MCLs have been developed by the NJDWQI ("A-280" chemicals), 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 was derived from human epidemiological data. The full derivation of the human dose from which the potency factor was derived, is presented in NJDWQI (1987b).

$$q_1* = \text{Risk/Dose}$$

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

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:

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

Where:

RfD = Reference Dose
70 kg = assumed weight of average adult
RSC = relative source contribution
2 L/day = assumed daily water consumption

In this document, the carcinogenicity classification and toxicity factors are summarized in Table 1 as a basis for development of criteria following the methodology discussed above. For a detailed discussion of the basis for the risk assessment for the A-280 chemicals, the reader is referred to the Health-Based Maximum Contaminant Level Support Documents for the Maximum Contaminant Levels developed by the New Jersey Drinking Water Quality Institute (NJDWQI, 1987b) which are available from the Bureau of Safe Drinking Water, Water Supply Element, NJDEPE. These Support Documents provide the basis for the carcinogenicity categorization and choice of study and endpoint for the risk assessment, and background information relevant to the health effects of the chemical.

For chemicals where updated USEPA toxicity data were used in deriving the criteria, the reader is referred to IRIS or HEAST for carcinogenic classification, choice of study, toxic endpoints, slope factors and RfDs. In some cases, final Maximum Contaminant Level Goals (MCLGs) were used where IRIS and HEAST lack sufficient toxicity data.

(vii) Lead

Currently, the ground water criterion for lead is 50 ug/l. This value is based on the previous USEPA MCL for drinking water. There is general agreement that this MCL was not protective of human health, since recent data indicate that adverse effects occur at levels below those previously believed to cause toxicity (USEPA, 1988).

At this time, it is not possible to derive a toxicity factor to form the numerical basis of the lead criterion, because of considerations which are unique to lead. Available studies indicate that no threshold exists even for some of the non-carcinogenic effects of lead, in particular neurotoxicity (USEPA, 1988). In contrast, for non-carcinogenic toxicity of most other chemicals, thresholds exist below which no adverse effects are expected to be identified. Additionally, lead has been classified as a probable human carcinogen (B2) by the USEPA (USEPA, 1988). However, 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 because of pharmacokinetic considerations particular to lead (USEPA, 1988). For these reasons, the USEPA has recommended a health-basis for the drinking water MCL (i.e., Maximum Contaminant Level Goal, or MCLG) of zero for lead (USEPA, 1988; USEPA, 1991c).

The primary source of lead in drinking water is not source water (i.e., surface water or ground water), but is corrosion within the distribution system after the water leaves the treatment plant. For this reason, USEPA had proposed an MCL of 5 ug/L for water entering the distribution system after treatment (USEPA, 1988). The drinking water rule for lead recently finalized by USEPA (May 7, 1991) specified that 90 percent of monitored household water should have lead levels of 15 ug/L or below, anticipated to correspond to an average level at the tap of approximately 5 ug/L. Lead intake through drinking water can be related to blood lead levels through a correlation coefficient. The coefficient used by USEPA (1988) was 0.2 ug/dl blood per ug/L drinking water. Using this coefficient, a lead concentration of 10 ug/L in drinking water would result in a 2 ug/dl level in blood. Thus, the drinking water values proposed by USEPA are protective at the level of concern (10-15 ug/dl) even with consideration of contributions from other important sources of lead exposure such as air, food, soil or paint chips.

After consideration of the above information, the Department has decided to propose a human health-based ground water criterion for lead of 5 ug/L. It is felt that 5 ug/L is a conservative value, since the proposed USEPA MCL for water after treatment was 5 ug/L. For domestic supplies, the minimal distance and time between the well and ingestion should minimize the addition of lead to the drinking water.

(viii) <u>Ground Water Criteria Derived for Protection of Human Health</u>

The Department proposes to adopt all human health-based criteria presented below in Tables 1 and 2 of the proposed Ground Water Quality Standards. Table 1 of this document contains supporting data such as toxicity factors, carcinogen classifications and relative source contributions from which these criteria were developed.

(ix) <u>References for Human Health Considerations</u>

Clement Associates, Inc. (1988). Comparative Potency Approach for Estimating the Cancer Risks Associated with Exposure to Mixtures of Polycyclic Aromatic Hydrocarbons. Interim Final Report. Contract No. 68-02-4403. ICF-Clement Associates, 9300 Lee Highway, Fairfax, Virginia 22031.

Dourson, M. (1990). USEPA-Environmental Criteria and Assessment Office, Cincinnati, OH. Private communication. 21 December 1990.

NJDWQI (1987a). New Jersey Drinking Water Quality Institute. Maximum Contaminant Level Recommendations for Hazardous Contaminants in Drinking Water. Submitted to New Jersey Department of Environmental Protection.

NJDWQI (1987b). New Jersey Drinking water Quality Institute. Maximum Contaminant Level Recommendations for Hazardous Contaminants in Drinking Water. Appendix B: Health-Based Maximum Contaminant Level

Support Documents. Submitted to New Jersey Department of Environmental Protection.

NRC (1977). National Research Council, 1977. Drinking Water and Health. National Academy of Sciences, Washington, D.C.

USEPA (1980). Water Quality Criteria Documents; Availability (Inter alia). United States Environmental Protection Agency. Fed. Reg. 45(231): 79318-79379.

USEPA (1984a). National Primary Drinking Water Regulations; Volatile Synthetic Organic Chemicals. United States Environmental Protection Agency. Fed. Reg. 49(114):24330-24355.

USEPA (1984b). Health Effects Assessment for Polynuclear Aromatic Hydrocarbons (PAH). United States Environmental Protection Agency. Environmental Criteria and Assessment Office, Cincinnati, Ohio, for the Office of Emergency and Remedial Response, Washington, D.C. EPA 540/1-86-013.

USEPA (1985). National Primary Drinking Water Regulations; Volatile Synthetic Organic Chemicals. United States Environmental Protection Agency. Fed. Reg. 50(219):46880-46901.

USEPA (1986). Quality Criteria for Water 1986. United States Environmental Protection Agency. Office of Water Regulations and Standards, Criteria and Standards Division, Washington, DC. EPA/440/5-86-001.

USEPA (1987). Integrated Risk Information Supportive Documentation (Volume 1). Integrated Chemical Files (Volume II). United States Environmental Protection Agency. Office of Health and Environmental Assessment. Office of Research and Development. EPA 600/8-86/032a, 600/8-86/032b and periodic data updates through March 1990.

USEPA (1988). Drinking Water Regulations; Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper; Proposed Rule. United States Environmental Protection Agency. Fed. Reg. 53(160):31513-31578.

USEPA (1989a). National Primary and Secondary Drinking Water Regulations: Proposed Rule. United States Environmental Protection Agency. FR 54 (97):22062-22160.

USEPA (1989b). Exposure Factors Handbook. United States Environmental Protection Agency. Office of Health and

Environmental Assessment. Washington, D.C. EPA/600/8-89/043.

USEPA (1990a). National Primary and Secondary Drinking Water Regulations; Synthetic Organic Chemicals and Inorganic Chemicals, Proposed Rule. United States Environmental Protection Agency. Fed. Reg. 55(143):30370-30448.

USEPA (1990b). Health Effects Assessment Summary Tables, Fourth Quarter, FY 1990. United States Environmental Protection Agency--OSWER (OS-230). NTIS No. PB90-9211 04. September 1990.

USEPA (1991a). National Primary Drinking Water Regulations-Synthetic Organic Chemicals and Inorganic Chemicals; Monitoring for Unregulated Contaminants; National Primary Drinking Water Regulations Implementation; National Secondary Drinking Water Regulations. Final Rule. United States Environmental Protection Agency. Fed. Reg. 56(20):3526-3597.

USEPA (1991b). National Primary Drinking Water Regulations-Monitoring for Synthetic Organic Chemicals; MCLGs and MCLs for Aldicarb, Aldicarb Sulfoxide, Aldicarb Sulfone, Pentachlorophenol, and Barium. Proposed Rule. United States Environmental Protection Agency. Fed. Reg. 56(20):3600-3614.

USEPA (1991c). "EPA Tightens Standards for Lead in Drinking Water," EPA Environmental News (press release, May 7).

b. Organoleptic and Welfare Considerations

Information is available for a few constituents regarding non-health concerns, such as organoleptic and public welfare concerns, where sufficient reliable data were not available for developing human health-based criteria. These constituents and the relevant criteria regarding these effects are listed in Table 2. Information regarding the source of the criteria is included; primarily the available secondary drinking water standards (State at N.J.A.C. 7:10-7, or Federal (USEPA, 1991a)) or similarly derived criteria will be adopted as ground water quality criteria for Class II-A waters. A modification has been made in the use of such criteria from the existing Ground Water Quality Standards. The Department has determined that such constituents should not be discharged to ground water in concentrations that impair the potable uses of the ground water, whether or not any human health impacts are likely. Therefore, the terms "primary" and "secondary" criteria, which had their origin in the drinking water quality program, are deleted and all criteria have the same force. As with the other criteria, criteria for organoleptic and welfare considerations are not applied when the natural quality exceeds these levels (see discussion on Antidegradation Policies in III.F.)

2. Interim Criteria

Two categories of interim criteria are proposed. Both types will provide the Department and the regulated universe with an understandable, consistent mechanism for determining the appropriate constituent standards for constituents that lack specific criteria.

a. Interim Specific Criteria -- Where specific criteria are lacking or where the Department believes that the criteria no longer are appropriate in light of current scientific information, the Department may develop interim specific criteria. The interim specific criteria shall be based on a Department analysis of available scientific information. The method of deriving interim specific criteria shall be the same method used to derive the specific criteria in Section 6.7, as discussed in Section III.E.1 of this document. The Department may choose to consult either or both of the primary literature and the USEPA IRIS and HEAST data bases, as appropriate. When specific criteria are adopted by the Department within this subchapter (for constituents regulated at that time through interim specific criteria), the interim specific criteria shall be superseded for those constituents.

Interim Generic Criteria -- Where specific criteria for SOCs have not been defined and the Department determines that insufficient information exists to derive interim specific criteria, the Department will apply interim generic criteria. The use of interim generic criteria applies only to those substances positively identified through an standardized analytical method promulgated by EPA or the Department. The interim generic criteria will be used unless and until a specific or interim specific criterion is developed. Four interim generic criteria are proposed:

a) SOCs With Evidence of Carcinogenicity That Lack Specific or Interim Specific Criteria -- The criterion for Class II is based upon a review of USEPA and New Jersey maximum contaminant levels (MCLs) for carcinogens in drinking water, which are reasonably comparable to the 5 ug/l concentration. Because insufficient information exists to group these compounds based on the USEPA "weight of evidence" approach, the Department will determined whether any evidence of carcinogenicity exists. This criterion is also derived in part from a preproposal for the State Drinking Water Quality Standards (N.J.A.C. 7:10-16.15 as proposed in 19 NJR 2233), proposing a criterion of 5 micrograms per liter (ug/l) for each volatile organic substance which is classified as a Group A or Group B constituent by the USEPA. The Department intends to apply the 5 ug/l generic criterion to all categories of SOCs (not just volatile organic chemicals) in the Ground Water Quality Standards. USEPA compared the 5 mg/l criterion to existing health-based criteria for carcinogenic substances that have potency slopes listed in IRIS, and determined that most carcinogens (63 of 70 listed) have <u>lower</u> criteria. However, many Practical Quantitation Levels are significantly above the health-based levels, and the Department has decided to propose 5 ug/l to incorporate consideration of analytical practicality.

b) SOCs Without Evidence of Carcinogenicity That Lack Specific or Interim Specific Criteria -- The criterion for Class II is based upon a review of USEPA and New Jersey maximum contaminant levels (MCLs) for non-carcinogens in drinking water and the specific criteria proposed in the Standards for non-carcinogens. These chemicals are not considered carcinogens generally because of a lack of significant evidence of carcinogenicity. The Department also considered the preproposal for the State Drinking Water Quality Standards (N.J.A.C. 7:10-16.15 as proposed in 19 NJR 2233), proposing a criterion of 50 ug/l for each volatile organic substance which is not classified as a Group A or Group B carcinogen by the USEPA. The Department reviewed additional criteria for noncarcinogens beyond the criteria available at the time of the preproposal, in reconsidering this value. A concentration of 100 ug/l now is considered more representative of the anticipated health effects. The Department intends to apply the 100 ug/l generic criterion to all categories of SOCs (not just volatile organic chemicals) in the Ground Water Quality Standards. USEPA reviewed this criterion against Group D and E chemicals in IRIS and concluded that the 100 ug/l concentration is at the 30th percentile (i.e., where 70 percent of the noncarcinogenic SOCs have higher criteria and 30 percent have criteria at or below the 100 ug/l concentration). The Department believes that a conservative approach to systemic toxicity is valid, and considers this level appropriately protective of human health in the absence of firm evidence to the contrary.

c) Total SOCs With Evidence of Carcinogenicity That Lack Specific or Interim Specific Criteria -- The criterion is based upon Department judgment that the potential for uncertain human health effects must be minimized. Concerns include the potential for additive, synergistic health impacts from exposure to multiple SOCs that have evidence of carcinogenicity, and for exposure to degradation products. Therefore, the Department is proposing a criterion of 25 micrograms per liter (ug/l) for total concentration of carcinogenic SOCs for which there are no interim specific criteria or specific criteria. This proposal is a change from the draft Standards, which recommended a concentration of 100 ug/l for all SOCs lacking specific or interim specific criteria. The 100 ug/l was primarily driven by a concern for the presence of multiple carcinogens, and resulted in a situation where the Total SOC value was the same as the single SOC value for noncarcinogens, while allowing for twenty carcinogens at the 5 ug/l concentration. By adopting two criteria for Total SOCs (carcinogen vs. no evidence of carcinogenicity), the Department achieves a more even treatment of the two classes of constituents, reducing the risk of carcinogenicity while allowing a more reasonable approach to noncarcinogens.

d) Total SOCs Without Evidence of Carcinogenicity That Lack Specific or Interim Specific Criteria -- The criterion is based upon Department judgment that the potential for uncertain human health effects must be minimized. Concerns include the potential for additive, synergistic health impacts from exposure to multiple SOCs that have no evidence of carcinogenicity, and for exposure to degradation products. Therefore, the Department is proposing a criterion of 500 micrograms per liter (ug/l) for total concentration of carcinogenic SOCs for which there are no interim specific criteria or specific criteria. As noted above, this level is a change from the draft Standards as a result of public comments.

3. Constituent Mixtures

Section 6.7(g) establishes the methodology by which the Department will consider the potential for additive risks due to mixtures of constituents in ground water. Where the additive risk of carcinogens in the ground water due to a discharge exceeds $1x10^{-4}$ additional risk of cancer, or where the risk of noncarcinogens exceeds a Hazard Index of 1, the Department may consider additional restrictions. The policy stated is consonant with USEPA policy. The Hazard Index developed by USEPA includes consideration of the site of activity for the noncarcinogen (i.e., the target organ).

F. ANTIDEGRADATION POLICY AND CRITERIA EXCEPTIONS

In each case where background quality is better than the criteria, the Department shall protect ground water such that constituent concentrations result that are at or better than an "antidegradation limit." The antidegradation limit is a constituent standard that applies such that the resulting quality of ground water downgradient of a discharge is no worse than some increment higher than background quality concentrations, and always lower than the criteria (i.e., the background concentrations plus some percentage of the difference between background quality and the criteria, for each constituent). The percentage varies by classification, with the more stringent in Classes I-A and I-PL (zero percent) and the less stringent in Class II-A (50 percent) and Class II-B (100 percent). The antidegradation policy is not applicable directly to Class III-A (which takes on the constituent standards of the downgradient classification area) or to Class III-B (for which criteria are adopted as the need arises). The percentages are based upon the sensitivity of the use (e.g., for exceptional ecological resources or drinking water) to water quality impairment. USEPA reviewed these policies in the draft Standards and found no conflict with USEPA policies and classification system.

Class I-A areas have been designated by the Department as containing invaluable ecological resources that must be maintained for posterity. Similarly, the Pinelands Protection Act defined the Pinelands Preservation and Protection Areas as containing unique and irreplaceable ecological resources that must be preserved and protected. Therefore, nondegradation policies for Class I are appropriate.

For Class II-A, the Standards strike a balance between the desire to prevent degradation of potable ground water and a recognition that New Jersey is a heavily urbanized state that also contains significant agricultural activity. Human activities have a major potential to degrade ground water quality, but this degradation must be limited. The 50 percent antidegradation policy for Class II-A provides a clear, numerical definition of "significant degradation" beyond which discharges may not degrade existing ground water quality (where the quality is better than the criteria). The Department is finding, through the analysis and mitigation of pollution at hundreds of sites, that the control of pollution sources (including gross subsurface concentrations of hazardous substances) is critical to the restoration of ground water quality. As the remedial program results in pollution source control and mitigation actions, cleaner background water quality should result. Because the antidegradation limits for discharges are linked to background water quality, this enhances the control of new or continuing discharges.

Finally, for Class II-B, the criteria (as established for the classification area) themselves serve as the antidegradation policy. For constituents that are now in compliance with the criteria, the Standards seek to maintain the concentrations at or below the criteria. For other constituents, the antidegradation policy is no further degradation beyond current quality.

The Department examined antidegradation and nondegradation policies from other states in the process of developing the proposed policy. Some states have statewide nondegradation policies. Nearly all of these policies (other than for pristine natural areas) have extensive exceptions allowed through permit processes. In essence, all regulated pollutant sources become conditional uses, but degradation can be and is in fact allowed. A more promising scheme is that of Wisconsin, where the antidegradation policy establishes specific percentages of the criteria as planning targets and enforcement limits. The planning targets are strict, and trigger planning and regulatory efforts to ensure that further degradation does not exceed the enforcement limits. The enforcement limits are higher percentages and are the basis for regulatory action and the initiation of mitigation efforts. The Wisconsin system was not accepted for New Jersey because the targets and limits do not recognize the variable quality and utility of ground water. Using the policy proposed in the Standards, no single discharge or combination of discharges will be allowed to pollute ground water or endanger designated uses. The average regional quality of ground water will be very close to the water quality outside of discharge areas, because discharges in most areas affect only a minor portion of the total resource.

The antidegradation policy is protective of human health and potability, and allows for the consideration of background water quality and discharge characteristics in each site. Neither underprotection nor overprotection of the ground water resource will occur. The Department recognizes that this policy is more stringent than policies of the USEPA. However, USEPA has adopted a major ground water policy initiative that would allow federal use of state standards, even where these are more stringent, to the extent allowed by law (Protecting The Nation's Ground Water: EPA's Strategy for the 1990's, The Final EPA Ground Water Task Force Report, July, 1991).

Exceptions to the criteria and antidegradation limits (constituent standard modifications) are expressly allowed in three instances by Section 6.9. First, a discharger may show that its discharge is to the same zone of ground water from which its source water is derived (e.g., through a private well), and that the source water has constituent concentrations which exceed the criteria. Second, the background quality of ground water flowing onto the discharger's property could already exceed the criteria. In both cases, the constituent standards shall reflect the extenuating circumstance, though the concentration and volume of an existing pollution problem may not be increased by a new discharge. Further, the discharger must not be the cause of the background water quality.

Third, criteria exceptions may be provided through a Classification Exception Area, as discussed above regarding Alternative Concentration Limits, natural quality constraints, and the localized effects of discharges, with regard to specified constituents. The compliance area for NJPDES permits and the contamination sites established pursuant to the Cleanup Standards and other applicable regulatory programs are automatically defined as Classification Exception Areas, within which specified constituent standards (including the antidegradation limits) do not apply. The antidegradation limits must be met outside the regulated areas for the specified constituents, and must be met for all other constituents.

Finally, the Department proposes that no enforceable requirement or constituent standards be applied at a specific site or facility regulated pursuant to applicable programs that would require compliance with concentrations lower than the Practical Quantitation Limit (PQL) for any particular constituent, such as where the criteria, antidegradation limits or criteria exceptions are more stringent. The PQL concept was defined and discussed above, and is discussed in detail below. The net impact is that dischargers will not be regulated to such an extent that proof of compliance is impossible (due to imprecision or inaccuracy of the analytical technique). For discharges regulated pursuant to NJPDES, the Cleanup Standards and other applicable regulatory programs, the PQL would apply at the boundaries of Classification Exception Areas. Any confirmed detection of an unauthorized discharge (for a constituent not regulated pursuant to an approved discharge decision), may be subject to additional regulatory action. The PQL policy does not impair the use of ground water resources, including for potable purposes. The N.J. Safe Drinking Water Act explicitly recognizes the need to establish drinking water quality standards that are measurable; the Ground Water Quality Standards use the same concept, so the results are compatible regarding the protection or restoration of ground water potability. Further, ground water pollutants that are maintained at or restored to the PQLs will likely degrade or otherwise be attenuated through natural processes, further reducing concerns regarding potability.

G. PROCEDURES FOR RECLASSIFICATION OF GROUND WATER

Ground water may be reclassified to more or less stringent designated uses, through normal rule-making procedures. A petition is required which shall be assessed by the Department. The Department also may decide to propose a reclassification by rule. Reclassification to less or more stringent uses may be requested by any interested person. Because the difficulty of reclassification reviews will vary greatly, no requirements are established regarding review schedules. The revision process will be subject to the Administrative Procedure Act.

The Standards do not allow the reclassification of ground waters to address localized or site-specific water quality problems, either of natural or human origin. Such areas are addressed through the use of Classification Exception Areas. Nor may the reclassification process be used to avoid ground water restorations that are feasible. Reclassification petitions for more stringent classifications must show that the subject area meets the characteristics of the more stringent classification. Petitions for less stringent classifications must show that designated use of the original classification cannot be maintained due to widespread exceedance of one or more criteria (due to natural attributes of the ground water resource or pollution), that a remedy is not technologically feasible, that the reclassification will not endanger existing ground water uses or downgradient classification areas and receptors, and that the subject area has the characteristics of the proposed classification.

H. REVISION OF THE GROUND WATER QUALITY STANDARDS

The Department has modified the requirement for public hearings and revisions of regulations from a minimum of once every three years to a minimum of once every five years. As the ground water quality criteria and reclassifications may be adopted by rule in the interim, revision every five years is sufficient.

I. DETERMINATION OF PRACTICAL QUANTITATION LEVELS IN GROUND WATER

The New Jersey Department of Environmental Protection is proposing to set ground water quality criteria at levels designed to protect human health, environmental biota, and the aesthetic quality of the natural environment. The State authority for establishment of these ground water criteria is derived from the New Jersey Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq. and its amendments. The Department believes that most ground water is a matrix analytically similar to drinking water and is frequently a source of potable water. Therefore the contaminants listed in the state and federal Safe Drinking Water Acts (SDWA and NJSDWA) will be regulated. The State also will regulate other contaminants or parameters that are known or suspected to be discharged presently or in the past to ground water. As discussed above, the Department will allow dischargers to prove that an alternative PQL should be allowed with respect to monitoring and compliance verification due to site-specific matrix interferences.

The SDWA test methods are promulgated by the United State Environmental Protection Agency (USEPA) in 40 Code of

Federal Register Parts 141, 142 and 143 (1). For the analysis of organic compounds these methods are commonly known as the 500 series methods. In addition to these methods there are others that the USEPA Environmental Monitoring and Support Laboratories (EMSL)-Cincinnati have developed and validated to support various water program needs (2).

This proposal provides the basis and background for the establishment of a Practical Quantitation Level (PQL) that the Department can use in regulating discharges to ground water. The Ground Water Quality Criteria (GWQC) included in this proposal are based upon human health considerations. The GWQC will occasionally result in a concentration that is lower than can be measured using approved analytical methods. Since the regulatory requirements of the Department contain enforcement provisions, accurate pollutant discharge test results are essential. The Department has decided to assure the accuracy of the measurement by choosing a PQL that is routinely achievable by the certified laboratory community using the appropriate analytical methods. The following discussion supports the determination of the PQL for the listed contaminants.

1. The Practical Quantitation Level Concept

The Practical Quantitation Level (PQL) is an interlaboratory concept that defines measurements that are method and matrix specific. The PQL can be determined directly by conducting an interlaboratory study or estimated by using the Method Detection Limit (MDL)(4). Ideally, a PQL determination would be an interlaboratory study of samples at various low concentrations to establish statistical limits around a PQL value. It would include certified laboratories and would provide routine performance goals that the laboratories must strive to achieve. Additionally, the Department feels that it is appropriate to check with chemists who are performing the method to determine whether the estimated PQL can be used as a standard or a point on the calibration curve.

The Department has accepted the EPA's concept of Practical Quantitation Level and its definition (5). In order to apply the definition to permit program objectives the Department provides the following interpretation.

a. EPA Definition of PQL

"Practical Quantitation Level (PQL), is the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions" (5).

b. New Jersey Department of Environmental Protection Operational Interpretation of PQL

The "lowest level" is the lowest quantitative point that can be achieved after making an attempt to use the method near the lower limit of detection for a given analyte. For example, when determining PQLs, the data evaluated should be derived from instruments that include a calibration point near the lower range of detection. The lower range is nominally defined as less than five or ten times the MDL. (8)

"Reliably achieved" is defined as assuring the measurements can be achieved by most, but not necessarily all laboratories, and on most samples. For example, when deriving the estimated PQL the data shall be obtained only from certified laboratories.

"Specified limits of precision and accuracy" are the calibration criteria that have been included in the regulations or are listed in the quality control sections of the method. Specified regulatory limits shall supersede method limits. There may be differences in the accuracy and precision for various contaminants. For example, Method 524.2 has the following calibration criteria: the response factors (RF) for each compound over the working range must have a relative standard deviation of less than 35 percent. However, the atomic absorption flame method for metals has the following criteria: the calibration check concentration of each metal must be within plus or minus 10 percent of the initial calibration concentration. All points within an acceptable calibration curve are by definition "practically" quantified.

"Routine" laboratory operating conditions are those where analysis follows an approved standard operating procedure and where the sample receives no extraordinary attention (11,13).

2. Selection of Constituent PQLs

The Department selected PQLs from several sources listed below. The Department A-280 PQL study is the primary source (4). If a constituent (parameter, contaminant, analyte) was not found in the primary source, the value from a secondary source was chosen. The data sources are listed in order of preference for use by the Department. Table 3 of this document lists the method used for PQL derivation regarding each constituent. If multiple methods are available from the same data source (e.g., published EPA PQLs), the most sensitive method is used.

a. Department A-280 PQL Study (1987)

The Department conducted an interlaboratory PQL study for the "A-280" Safe Drinking Water Program in 1987, and determined the PQL values for the PCB Aroclor 1254 and chlordane using method 608 (Section III.1 Table 1) (3). The values (0.5 ug/L) for PCBs and chlordane determined in this study were used because the 500 series data were not available. Also included in that study was a PQL determination of volatiles by methods 502.1, 503.1 and 524.1 (4). No other PQL studies were known to exist in 1987 for the 500 or 600 series methods. The PQLs for the most sensitive methods are used.

b. EPA PQL Values

The EPA issued the "National Primary Drinking Water Regulations; Final Rule" on January 30, 1991. The Regulations contained PQLs based on the results of the EPA Water Study Performance Samples (1,5). The Department intends to use these PQLs for all non-volatile organic contaminants listed in the Rule except for the contaminants determined by Methods 525 and 505. These methods are not currently in use by the contract laboratory community.

c. Department Interlaboratory Determination of PQLs

The Department solicited actual MDL data from New Jersey certified laboratories. MDLs for organic and inorganic contaminants were evaluated. The PQLs were calculated from these MDLs.

d. Estimating the PQL from the EPA Analytical Method MDLs

In the absence of interlaboratory data, the recommended method of determining PQLs is to multiply the MDL by a factor (5, 7). MDL data from EPA published analytical methods were chosen (1, 9, 20).

e. EPA Office of Solid Waste

A few compounds are only listed in methods published by the EPA Office of Solid Waste in "Test Method for Evaluating Solid Waste" (6). The methods include PQLs for aqueous matrices.

3. Ground Water Quality Criteria

The Ground Water Quality Criteria (GWQC) are target values for ground water quality control decisions of the Department. In assessing whether a discharge is in compliance, the Department will consider PQLs to be equivalent to GWQC, where the GWQC is lower. Figure 1

Section III.I Table 1

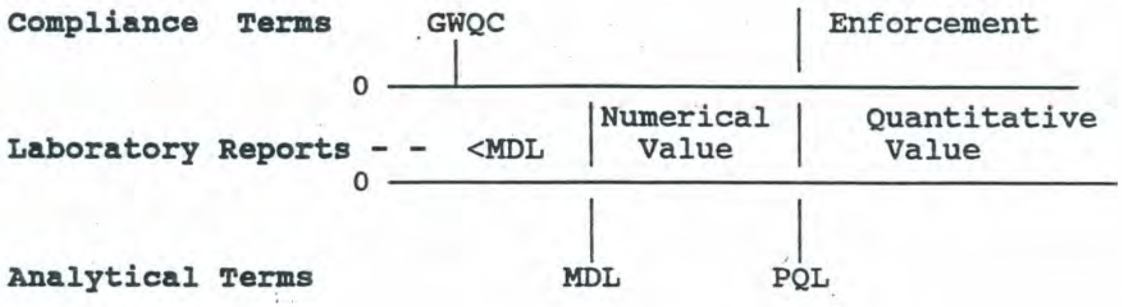
Practical Quantitation Limits (ug/L)
Method 608

Parameter	NJDWQI (1987)	Estimated PQL (1991)
Chlordane	0.5	0.14
PCB- 1016	0.5*	0.75
PCB- 1221	0.5*	0.5
PCB- 1232	0.5*	0.65
PCB- 1242	0.5*	0.55
PCB- 1248	0.5*	2.6
PCB- 1254	0.5	1.0
PCB- 1260	0.5*	0.6

*** Estimate based upon PQL determined for PCB Aroclor 1254.**

Figure 1

Relationship Between Analytical and Compliance Terms



Terms:
MDL - Method Detection Limit
PQL - Practical Quantitation Level
GWQC - Ground Water Quality Criteria

diagrams the relationship between the GWQC and the PQL. When a GWQC is less than the PQL and two or more analytical methods are available for a parameter, the method with the lowest MDL is used for PQL derivation. **For each parameter, any method with a PQL less than the GWQC can be used for compliance reporting.** The laboratory shall always report numerical values down to the MDL for the method even when the GWQC is above the PQL. The laboratory is expected to demonstrate the ability to quantitate to the PQL for samples submitted under these regulations. This can be accomplished by including a point at or below the PQL in a standard or calibration curve. The approved EPA methods for the analysis of these samples are found in 40 CFR 141, 142, 143 or from the New Jersey Department of Environmental Protection and Energy (NJDEPE) Office of Quality Assurance. Figure 1 illustrates the relationship between the analytical and compliance terms that will be used in the proposed regulations. The PQLs and background information for the GWQC contaminants are listed in Table 3.

4. Estimating the PQL From an MDL

A method of determining PQLs is to multiply the Method Detection Limit (MDL) by a factor (5, 7). The EPA has conducted interlaboratory method detection limit (IMDL) and performance evaluation studies for the recently published 500 series methods. They have determined the multiplier factor to be either five or ten for a water matrix. The factor of five is used for highly toxic compounds and ten for less toxic compounds. The factor of five was chosen by the EPA for the more toxic substances based upon risk assessment concerns. In order to protect human health at levels that are sometimes significantly higher than the health based criteria the Department selects the factor of five times the MDL to calculate the PQL. The Department recognizes there is no statistic that uniformly supports the selection of five as a factor to estimate the PQL. References cite the range of the PQL factor as 3.3 to 10 times the MDL. This point is illustrated in Table 2. The data from the Department's A-280 PQL study show the PQL ranges from 3 to 12 times the MDL (4).

Additional support for a multiplier of five comes from the latest edition of <u>Standard Methods for the Examination of Water and Wastewater</u> (7). This work accepts the EPA policy of estimating the PQL by multiplying the MDL by five (10). The American Chemical Society does not use the term PQL, but uses a different term, the Limit Of Quantitation (LOQ). LOQ is defined as the signal blank plus ten times the standard deviation (8). This is 3.3 times the Limit Of Detection (LOD) which is comparable to the MDL. The LOQ is comparable to PQL. Both Miller and Taylor cite limits of quantitation as 3.3 times the limit of detection (see Section III.1 Table 2) (16,17).

Section III.I. Table 2

Comparison of MDL and PQL Ratios

Citation	Ratio PQL/MDL	Date	Term
Glaser/EPA	**5 or 10** (a)	**1982**	**MDL/PQL**
Clesceri/AWWA	**5**	**1989**	**MDL/PQL**
Miller	**3.3**	**1984**	**LOD/LOQ**
Taylor	**3.3**	**1987**	**LOD/LOQ**
MacDougall/ACS	**3.3**	**1980**	**LOD/LOQ**
Oxenford/DEP	**3 to 12**	**1989**	**MDL/PQL**

(a) Value depends upon a policy decision based on toxicity; highly toxic are 5, others are 10.

The Department has reviewed recently published articles by Clayton et al., Grant et al., and Grams that discuss a detection limit model that protects equally against type I errors (false positives) and type II errors (false negatives) (12,13,15). The concern that the EPA MDL determination is biased to protect against false positives and is less sensitive to false negatives is raised by these authors. This criticism loses impact in the context of the PQL since for values greater than the PQL it is assumed the detection decision is completed. As Grams correctly points out, when determining the PQL one is not concerned whether the substance is or is not present (testing the null hypothesis), but at what point can it be quantitated accurately (12). An article by Gibbons provides a critical review of several approaches to the problem of estimating method detection limits (14). The Glaser et. al. MDL model that was adopted by the EPA is criticized by Gibbons for making faulty assumptions that underestimate the MDL (18). The Department recognizes this criticism but does not consider the error to be great enough to significantly affect the MDL. Furthermore, the only MDL data available are from environmental laboratories that have calculated the MDLs using the EPA convention. The MDL also serves the purpose of writing requirements by estimating the level at which a method response provides a 99 percent chance that the substance is present. In the absence of robust study data the Department adopts by convention an estimated PQL value of five times the MDL. This satisfies the goal of determining the point at which accurate quantitative determinations can be made in reagent water. The Department believes that insufficient laboratory experience exists among Department-certified laboratories for Methods 507, 515.1, 525 and 531.1 to use the factor of five, and has chosen a factor of ten for these methods instead. EPA MDLs for these methods are not believed to be representative of the MDLs that would result from certified laboratories.

5. The Interlaboratory Determination of the PQL

All PQLs except those noted were calculated in the following manner and are listed in Table 3.

a. Certified laboratories were solicited for experimentally determined MDLs for each analytical method. Values were requested for each contaminant with a GWQC. The values were tabulated by contaminant. The mean and the median were calculated. The low point of the calibration curve and the MDL spiking value were obtained, by method, from each laboratory. This was done to insure the laboratory was operating near the lower limit of detection.

b. Laboratories were called to verify that the 40 CFR 136 Appendix B method for MDL determination was followed (2). Excluded from the calculation were values that were identical for all the contaminants in the method. This indicated the laboratory was not reporting actual experimental data.

c. The means and medians were compared to determine if there were significant differences that would suggest a skewed distribution. In most cases there were differences greater than 50%, resulting in the median being selected as a measure of central tendency. This is the proper statistic when most values are close to, but greater than zero (16, 17). For example, the central tendency of a cluster of data around 1.0 would be adversely affected by one or two values above 50 if the mean were chosen.

d. The median MDL value was chosen and multiplied by five to determine the PQL.

e. The PQLs were reviewed against the initial information the laboratories provided on low calibration points to insure that some laboratories are able to quantitate to the PQL.

f. All PQL data are reported to one significant figure.

Over 10 laboratories were solicited for data on organic chemicals. Table 3 notes for each constituent the number of laboratories that provided data. The Department selected methods 502.2, 524.2, 624, 625 and 608 to estimate the PQLs for organic compounds. These methods are common, practical, sensitive, and have a history of successful operation. Other 500 series methods can be used to quantitate the contaminants, however they can be subject to interferences or have lower sensitivities.

The Department does not certify laboratories for method 603 and therefore could not apply the operational criteria to estimate the PQL for acrolein and acrylonitrile. The contract laboratory community uses modifications of Method 603 or Method 624 for the limited number of requests for acrolein and acrylonitrile. The laboratories do not achieve the EPA MDLs. The Department has reviewed the two methods and adopts Method 603 because of its higher sensitivity. The few laboratories found report a range of MDLs (2-5 ug/L). Because the laboratories use a modification of Method 603, the Department adopts a PQL of 50 ug/L for acrolein and acrylonitrile, using a derivation method of the MDL times a factor of ten.

Two general SDWA methods for volatile organic compounds (VOCs) were evaluated that are promulgated by EPA: Method 502.2, purge and trap, capillary column, gas chromatography; and Method 524.2, purge and trap, capillary column, gas chromatography/mass spectroscopy (1,19). Median interlaboratory method detection limits (IMDLs) were calculated for 31 volatile contaminants using both analytical methods. The PQLs for nine contaminants were determined using these IMDLs. The GC and GC/MS PQLs for eight contaminants were the same, to one significant figure. The PQL for 1,1,2-trichloroethane was 0.8 ug/l for the GC method versus 1 ug/l for GC/MS. Many compounds analyzed by Method 502.2 can have overlapping chromatographic peaks (coelution). Since Method 502.2 cannot positively identify or quantify coeluting compounds, and there is little difference in the PQLs derived, Method 524.2 was chosen for VOC PQLs.

Method 525, "Determination of Organic Compounds in Drinking Water by Liquid-Solid Extraction and Capillary Column Gas Chromatography/Mass Spectroscopy" is not a Department certified method. EPA promulgated Method 525 in the Federal Code on January 30, 1991 (1). The regulation becomes effective July 30, 1992. The method is not routinely used by commercial or government laboratories. The Department will use Method 625 for PQL development until Method 525 is certified by the Department (July 30, 1992).

The Department has estimated the PQLs for metals by selecting the most sensitive atomic absorption, graphite furnace, and ICP methods that achieve the health based levels. The Department solicited MDL information from over 30 sources including 8 instrument manufacturers and 25 Federal, State, and State certified commercial laboratories.

For asbestos the Department accepts the EPA detection limit of 10,000 fibers per liter and the PQL of 100,000 fibers per liter (1). This standard was based on reducing possible human cancer risks from drinking water. The ground water quality criterion for asbestos is proposed at 700,000 fibers per liter above 10 micrometers, so the PQL should not be a significant health protection issue. The Department has not been able to obtain detection limit information for some of the compounds because it either does not certify the method for the contaminant or the certified laboratories are not currently using the method. PQLs for these contaminants have been obtained from EPA published documents (1,6,9). Those with no method have no value for the PQL. These are also listed in Table 3.

There are some conventional parameters that are qualitative by nature to which the concept of a practical quantitation value does not apply. No PQLs are listed for the following parameters:

a. Odor
b. Corrosivity
c. pH

The Department recognizes that the values provided in the proposal are estimates and should be reviewed when additional data are available. A continuing effort to determine a more precise definition and a more exact value of the PQLs will be pursued by the Department.

6. PQL References

1. Federal Register, "National Primary Drinking Water Regulations; Final Rule" EPA, 40 CFR Parts 141, 142, and 143, January 30, 1991.

2. Federal Register, "Guidelines Establishing Test Procedures for the analysis of Pollutants," EPA, 40 CFR Part 136, Appendix B, February 19, 1988.

3. New Jersey Drinking Water Quality Institute, "Maximum Contaminant Level Recommendations for Hazardous Contaminants in Drinking Water," March 26, 1987..

4. Oxenford, J.L.; McGeorge, L.J.; Jenniss, S.W.; Determination of Practical Quantitation Levels for Organic compounds in Drinking Water; J. Am. Water Works Assoc.; 81(4), 149-154, 1989.

5. Federal Register; "National Primary and Secondary Drinking Water Standards;" EPA, 40 CFR Parts 141,142,143; May 22, 1989.

6. U.S.EPA; Office of Solid Waste and Emergency Response, Test Methods for Evaluating Solid Waste, Publication SW-846-Third Edition; November 1986.

7. Clesceri, Lenore S.; Greenberg A.E.; Trussell R.R.; Standard Methods for the Examination of Water and Wastewater; Seventeenth Edition, 1989; APHA, AWWA, WPCF, Washington, D.C., 1989.

8. MacDougall, Daniel; et. al. Guidelines for Data Acquisition and Data quality Evaluation in Environmental Chemistry; Anal. Chem., 52, 2242-2249, 1980.

9. U.S. EPA, "Methods for the Determination of Organic Compounds in Drinking Water," Environmental Monitoring and Support Laboratory, EPA-600/4-79-020; March 1983.

10. U.S. EPA, National Primary Drinking Water Regulations; Volatile Synthetic Organic Chemicals; Fed. Reg. 50(219) 46906-46909, Nov. 13, 1985.

11. U.S. EPA, Drinking Water Regulations; Maximum Contaminant Level Goals, National Primary Drinking Water Regulations for Lead and Copper; Fed. Reg. 55 (160), 31516, 1988

12. Grams, N.E., Statistical Method for Determining Practical Quantitation Limits and Application to Volatile Organics; Presentation at the Water Quality Technology Conference on Practical Quantitation Limits, Phila., PA, Nov. 1989.

13. Clayton, C.A., Hines, J.W., Elkins, P.D., Detection Limits with Specified Assurance Probabilities; Analytical Chemistry, 59, 2506-2514, 1987.

14. Gibbons, R.D., Practical Quantitation Limits; Presented at the USEPA Waste Testing and Quality Assurance Symposium, 1990.

15. Grant, C.L., Hewitt, A.D., Jenkins, T.F., Experimental comparison of EPA and USATHEMA Detection and Quantitation Capability Estimators; Amer. Lab., 15-33, Feb. 1991.

16. Miller, J.C., Miller, J.M., Statistics for Analytical Chemistry, J. Wiley and Sons NY, NY, 1984.

17. Taylor, J.K., Quality Assurance of Chemical Measurements, Lewis Publishers, Chelsea, MI, 1987.

18. Glaser, J.A., Foerst, D.L., McKee, G.D., Quave, S.A., Budde, W.L., "Trace Analyses for Waste Waters," Environmental Science & Technology, Vol.15:1426, 1981.

19. U.S. EPA, "Methods for the Determination of Organic Compounds in Drinking Water," Environmental Monitoring and Support Laboratory, EPA 600/4-88/039, December 1988.

20. Federal Register; "National Primary Drinking Water Standards; Synthetic Organic Chemicals; Monitoring for Unregulated Chemicals" EPA, 40 CFR Parts 141 and 142, p.25699, July 8, 1987.

21. American Chemical Society Committee Report, "Principles of Environmental Analysis," Analytical Chemistry, Vol.55:2210-2218, 1983.

TABLE
GROUND WATER QUALITY CRITERIA -- DERIVATION FACTORS FOR HUMAN HEALTH CONCERNS

Constituent	CASRN	Oral RfD[1] (mg/kg/day)	Oral Slope Factor[1] 1/(mg/kg/day)	Carcinogen Class[1] (oral)	Relative Source Contribution[2] (percent)	Criteria[3] (ug/L)
Acenaphthene	83-32-9	0.06			20	400
Acetone	67-64-1	0.1		D	20	700
Acrylamide	79-06-1		4.5	B2		0.008
Acrylonitrile	107-13-1		0.54	B1		0.06
Adipates (Di(ethylhexyl)adipate)	103-23-1	0.7			20	5,000
Alachlor	15972-60-8		0.081[a]	B2[a]		0.43
Aldicarb sulfone	1646-88-4	0.00033			20	2
Aldrin	309-00-2		17	B2		0.002
Anthracene	120-12-7	0.3			20	2000
Antimony	7440-36-0	0.00035			20	2
Arsenic (Total)	7440-38-2	pending	1.8	A		0.02
Asbestos	1332-21-4			A		$7X10^6$ f/L >10 um[b]
Atrazine	1912-24-9					3[b]
Barium	7440-39-3	0.07		D		2,000
Benz(a)anthracene	56-55-3		1.15[e]	B2[a]		0.03
Benzene[4]	71-43-2		0.23	A		0.2
Benzidine	92-87-5	0.0027	230	A		0.0002
Benzo(a)pyrene (BaP)	50-32-8		11.5[e]	B2		0.003
3,4-Benzofluoranthene (Benzo(b)fluoranthene)	205-99-2		1.15[e]	B2[a]		0.03
Benzo(k)fluoranthene	207-08-9		1.15[e]	B2[a]		0.03
Benzyl alcohol	100-51-6	0.3			20	2000
Beryllium	7440-41-7		4.3	B2		0.008
alpha-BHC (alpha-HCH)	319-84-6		6.3	B2		0.006
beta-BHC (beta-HCH)	319-85-7		1.8	C		0.2
gamma-BHC (gamma-HCH/Lindane)	58-89-9					0.2[b]
Bis(2-chloroethyl) ether	111-44-4		1.1	B2		0.03
Bis(2-chloroisopropyl) ether	39638-32-9	0.036			20	300
Bis(2-ethylhexyl) phthalate	117-81-7		0.014	B2		3
Bromodichloromethane (Dichlorobromomethane)	75-27-4		0.13[a]	B2[a]		0.3
Bromoform	75-25-2		0.0079	B2		4
Butylbenzyl phthalate	85-68-7	0.16		C	20	100
Cadmium	7440-43-9	0.0005			25	4
Carbofuran	1563-66-2	0.005			20	40
Carbon tetrachloride[4]	56-23-5		0.091	B2		0.4
Chlordane[4]	57-74-9		2.7	B2		0.01
Chlorobenzene	108-90-7	0.00065[c]		C	20	5
Chloroform	67-66-3		0.0061	B2		6
2-Chlorophenol	95-57-8	0.005			20	40
Chlorpyrifos	2921-88-2	0.003			20	20
Chromium (Total)	7440-47-3[d]	0.0048[d]			70	100
Chrysene	218-01-9		1.15[e]	B2[a]		0.03
Cyanide	57-12-5	0.022		D	20	200
2,4-D	94-75-7	0.01			20	70
Dalapon	75-99-0	0.028		D	20	200
4,4'-DDD (p,p'-TDE)	72-54-8		0.24	B2		0.1
4,4'-DDE	72-55-9		0.34	B2		0.1
4,4'-DDT	50-29-3		0.34	B2		0.1
Demeton	8065-48-3	0.00004			20	0.3
Dibenz(a,h)anthracene	53-70-3		11.5[e]	B2[a]		0.003
Dibromochloromethane (Chlorodibromomethane)	124-48-1	0.021		C[a]		10
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8		22[a]	B2[a]		0.002

TABLE 1 (Cont'd)

GROUND WATER QUALITY CRITERIA -- DERIVATION FACTORS FOR HUMAN HEALTH CONCERNS

Constituent	CASRN	Oral RfD[1] (mg/kg/day)	Oral Slope Factor[1] 1/(mg/kg/day)	Carcinogen Class[1] (oral)	Relative Source Contribution[2] (percent)	Criteria[3] (ug/L)
1,2-Dichlorobenzene[4]	95-50-1	0.086		D	20	600
1,3-Dichlorobenzene[4]	541-73-1	0.086		D	20	600
1,4-Dichlorobenzene[5]	106-46-7	0.1		C	20	75[b]
3,3'-Dichlorobenzidine	91-94-1		0.45	B2		0.08
1,1-Dichloroethane	75-43-3	0.1		C	20	70
1,2-Dichloroethane[4]	107-06-2		0.12	B2		0.3
1,1-Dichloroethylene[4]	75-35-4	0.00014[c]		C	20	1
cis-1,2-Dichloroethylene[4]	156-59-2	0.0014			20	10
trans-1,2-Dichloroethylene[4]	156-60-5	0.02			20	100
2,4-Dichlorophenol	120-83-2	0.003			20	20
1,2-Dichloropropane	78-87-5		0.068[a]	B2[a]		0.5
1,3-Dichloropropene (cis and trans)	542-75-6		0.18[a]	B2		0.2
Dieldrin	60-57-1		16	B2		0.002
Diethyl phthalate	84-66-2	0.75		D	20	5,000
2,4-Dimethylphenol	105-67-9	0.02			20	100
Dimethyl phthalate	131-11-3	1[a]		D	20	7,000
Di-n-butyl phthalate	84-74-2	0.13		D	20	900
2,4-Dinitrophenol	51-28-5	0.002			20	10
2,4-Dinitrotoluene/2,6-Dinitrotoluene mixture	121-14-2		0.68	B2		0.05
Di-n-octyl phthalate	117-84-0	0.02			20	100
Dinoseb	88-85-7	0.001		D	20	7
1,2-Diphenylhydrazine	122-66-7		0.8	B2		0.04
Diquat	85-00-7	0.0022		pending	20	20
Endosulfan	115-29-7	0.00005			20	0.4
alpha-Endosulfan (Endosulfan I)	959-98-8	....	..see Endosulfan..			0.4
beta-Endosulfan (Endosulfan II)	33213-65-9	....	..see Endosulfan..			0.4
Endosulfan sulfate	1031-07-8	....	..see Endosulfan..			0.4
Endothall	145-73-3	0.02			20	100
Endrin	72-20-8	0.00025		D	20	2
Epichlorohydrin	106-89-8	0.0022	0.0099	B2		4
Ethylbenzene	100-41-4	0.097		D	20	700
Ethylene dibromide	106-93-4		85	B2		0.0004
Fluoranthene	206-44-0	0.042		pending	20	300
Fluorene	86-73-7	0.04			20	300
Fluoride	16984-48-8					4000[b]
Glyphosate	1071-83-6	0.1		D	20	700
Heptachlor	76-44-8		4.5	B2		0.008
Heptachlor epoxide	1024-57-3		9.1	B2		0.004
Hexachlorobenzene	118-74-1		1.6[a]	B2[a]		0.02
Hexachlorobutadiene	87-68-3	0.002		C	20	1
Hexachlorocyclopentadiene	77-47-4	0.0071		D	20	50
Hexachloroethane	67-72-1	0.001		C	20	0.7
Hydrogen sulfide	7783-06-4	0.003			20	20
Indeno(1,2,3-cd)pyrene	193-39-5		1.15[e]	B2[a]		0.03
Isophorone	78-59-1	0.17		C	20	100
Lead (Total)	7439-92-1			B2		5
Malathion	121-75-5	0.023			20	200
Mercury (Total)	7439-97-6	pending		D	20	2[b]
Methoxychlor	72-43-5	0.005		D	20	40

TABLE 1 (Cont'd)

GROUND WATER QUALITY CRITERIA -- DERIVATION FACTORS FOR HUMAN HEALTH CONCERNS

Constituent	CASRN	Oral RfD[1] (mg/kg/day)	Oral Slope Factor[1] 1/(mg/kg/day)	Carcinogen Class[1] (oral)	Relative Source Contribution[2] (percent)	Criteria[3] (ug/L)
Methyl bromide (bromomethane)	74-83-9	0.0014		D	20	10
Methyl chloride (chloromethane)	74-87-3		0.013[a]	C[a]		30
Methylene chloride[4]	75-09-2		0.014	B2		2
Methyl ethyl ketone	78-93-3	0.039			20	300
4-Methyl-2-pentanone	108-10-1	0.05			20	400
Mirex	2385-85-5	0.000005		pending	20	0.01
Nickel (Soluble salts)	7440-02-0	0.017			20	100
Nitrate (as N)	14797-55-8	0.16[f]				10,000
Nitrite (as N)	14797-65-0	0.16[f]				1,000
Nitrate and Nitrite (as Total N)						10,000 (as N)[b]
Nitrobenzene	98-95-3	0.00046		pending	20	3
N-Nitrosodimethylamine	62-75-9		51	B2		0.0007
N-Nitrosodiphenylamine	86-30-6		0.0049	B2		7
N-Nitrosodi-n-propylamine	621-64-7		7	B2		0.005
Oxamyl	23135-22-0	0.025			20	200
PCBs[4] (Polychlorinated biphenyls)	1336-36-3		1.4	B2		0.02
Pentachlorophenol	87-86-5		0.12[a]	B2[a]		0.3
Phenol	108-95-2	0.6		pending	20	4,000
Picloram	1918-02-1	0.07		pending	20	500
Pyrene	129-00-0	0.025		pending	20	200
Selenium (Total)	7782-49-2					50[b]
Silver	7440-22-4	0.0026		D	20	20
Simazine	122-34-9	0.0017		C[a]	20	1
Styrene	100-42-5	0.2		pending	20	100
TCDD (2,3,7,8-Tetrachlorodibenzo-p-dioxin)	1746-01-6		150000[a]	B2[a]		0.0000002
1,1,1,2-Tetracholorethane	630-20-6		0.026	C		10
1,1,2,2-Tetrachloroethane	79-34-5		0.2	C		2
Tetrachloroethylene[4]	127-18-4		0.082	B2		0.4
Thallium	7440-28-0	0.000067		D	20	0.5
Toluene	108-88-3					1,000[b]
Toxaphene	8001-35-2		1.1	B2		0.03
2,4,5-TP	93-72-1	0.0075		D	20	50
1,2,4-Trichlorobenzene[4]	120-82-1	0.0012		D	20	9
1,1,1-Trichloroethane[4]	71-55-6	0.0037		D	20	30
1,1,2-Trichloroethane	79-00-5	0.0039		C	20	3
Trichloroethylene[4]	79-01-6		0.031	B2		1
2,4,5-Trichlorophenol	95-95-4	0.1			20	700
2,4,6-Trichlorophenol	88-06-2		0.011	B2		3
Vinyl chloride[4]	75-01-4		0.42	A		0.08
Xylenes (Total)[4]	1330-20-7	0.0073		D	20	40
Microbiological criteria, Radionuclides & Turbidity	prevailing Safe Drinking Water Act Regulations (N.J.A.C. 7:10-1 et seq.)					

TABLE 1 (Cont'd)

GROUND WATER QUALITY CRITERIA -- DERIVATION FACTORS FOR HUMAN HEALTH CONCERNS

Explanation of Terms

kg = kilograms mg = milligrams ug = micrograms L = liter f = fibers ND = Non detectable

1 = data retrieved from U.S. EPA Integrated Risk Information System (IRIS) through September 17, 1990 except for RfDs or slope factors for A-280 chemicals (see 4). Where IRIS information was not available, appropriate data listed in the USEPA Health Effects Assessments Tables (HEAST) (see a) were used. Slope factor for arsenic was derived from unit risk retrieved from IRIS. For slope factors for PAHs which are Group B2 carcinogens, see (e).

2 = 20% drinking water contribution unless adequate data are cited in 54 FR 22062 (May 22, 1989), 55 FR 30370 (July 25, 1990) or 56 FR 3526,3600 (January 30, 1991)

3 = Criteria excluding lead are based on daily ingestion of two liters of water except 0.64 liter per day was used for nitrate and nitrite and one and one half liters per day for barium. Body weight was assumed to be 70 kg (adult) except a body weight of 4 kg (infant) was used for nitrate and nitrite and 60 kg (woman) for xylenes. For criteria development for lead, see text of Basis & Background document.

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 is indicated, criteria were based on RfDs modified by relative source contribution. An additional uncertainty factor of 10 was applied to group C carcinogens. Where RfDs were not available for group C carcinogens (beta-BHC, methyl chloride, 1,1,2,2-tetrachloroethane), criteria were calculated using slope factors at the 10^{-5} risk level. For chemicals whose carcinogen classifications are pending, criteria were developed on the basis of the best available information.

4 = A-280 chemicals (N.J.A.C. 7:10-16.7). Oral RfDs or slope factors used for calculating criteria were developed by the Department. Criteria are the health-based levels cited in NJ DEP, "Maximum Contaminant Level Recommendations for Hazardous Contaminants in Drinking Water" (March 26, 1987).

5 = A-280 chemical. Criterion is existing drinking water Maximum Contaminant Level Goal (MCLG). (CFR Part 141 -- National Primary Drinking Water Regulations.

a = from USEPA, Health Effects Assessments Summary Tables (Fourth Quarter FY 1990), OSWER (OS-230), NTIS No. PB90-921104.
b = existing drinking water MCLG (CFR Par 141 - National Primary Drinking Water Regulations)
c = including an additional safety factor of 10 for Class C carcinogen
d = CASRN & RfD of chromium VI
e = from USEPA "Health Effects Assessment for Polynuclear Aromatic Hydrocarbons (PAH)." USEPA, Environmental Criteria and Assessment Office, Cincinnati, Ohio. EPA 540/1-86-013. For PAHs which are Group B2 carcinogens, a slope factor of 1.15 $(mg/kg/day)^{-1}$ which is one tenth (0.1) of the slope factor of benzo(a)pyrene was used for criteria development, except that the slope factor of 11.5 $(mg/kg/day)^{-1}$ was used for dibenz(a,h)anthracene.
f = private communication, Michael L. Dourson, USEPA, Office of Research & Development, December 21, 1990

TABLE 2
GROUND WATER QUALITY CRITERIA: ORGANOLEPTIC AND WELFARE CONSIDERATIONS

Constituent	CASRN	Criteria (mg/L)	Reference
Aluminum[1]	7429-90-5	0.05 to 0.2	AB
Ammonia[1]		500 ug/l	C
Chloride[1]	16887-00-6	250	ABC
Color[1]		10color units	A
Copper[1]	7440-50-8	1	ABC
Corrosivity[1]		Non-corrosive	B
Fluoride	16984-48-8	2	ABC
Foaming agents (ABS/LAS)[1]		0.5	ABC
Hardness[1] (as $CaCO_3$)		$50 < H < 250$	A
Iron[1]	7439-89-6	0.3	ABC
Manganese[1]	7439-96-5	0.05	ABC
Odor[1]		3^I	AB
Oil & Grease/Petroleum Hydrocarbons (PHC)[1]		NoneNoticeable	C
pH[1]		6.5-8.5	AB
Silver	7440-22-4	0.1	AB
Sodium[1]	7440-23-5	50	AC
Sulfate[1]	14808-79-8	250	ABC
Taste[1]		NoneNoticeable	C
Total dissolved solids (TDS)[1]		500	ABC
Zinc[1]	7440-66-6	5	ABC

Explanation of Terms

A = Recommended upper limits listed in New Jersey Secondary Drinking Water Regulations (N.J.A.C. 7:10-7:2).

B = Secondary Maximum Contaminant Levels, CFR Part 143 -- National Secondary Drinking Water Regulations, also 56 FR 3597, January 30, 1991.

C = Existing Ground Water Quality Criteria (N.J.A.C. 7:9-6.6)

H = Hardness

I = Threshold Odor Number

1 = proposed for adoption as Specific Criterion

TABLE 3
GROUND WATER PRACTICAL QUANTITATION LEVELS

CONSTITUENT	CASRN	ANALYTICAL METHOD	MDL SOURCE	imdl (ug/L)	Rounded IMDL	PQL SOURCE	actual pql	Prop.PQL (ug/L)
Acenapthene	83-32-9	625	MEDIAN(12	2.55	2	MEDIANx5	12.75	10
Acenapthylene	208-96-8	625	MEDIAN(12	2.42	2	MEDIANx5	12.1	10
Acrolein	107-02-8	603	DEP	5	5	MDLx10	50	50
Acrylamide	79-06-1	NA	NA	NA	NA	NA	NA	NA
Acrylonitrile	107-13-1	603	DEP	5	5	MDLx10	50	50
Adipates (Di(ethylhexyl)adipate)	103-23-1	525	METH. 525	0.6	0.6	MDLx10	6	6
Alachlor	15972-60-8	505	Table 24	0.2	0.2	Table 18	1	2
Aldicarb sulfone	1646-88-4	531.1	Table 24	0.6	0.6	Table 18	3	3
Aldrin	309-00-2	608	MEDIAN(18	0.008	0.008	MEDIANx5	0.04	0.04
Aluminum	7429-90-5	200.7	MEDIAN(2)	32	30	MEDIANx5	160	200
Ammonia	7764-41-7	350.1	NJDOH	30	30	MEDIANx5	150	200
Anthracene	120-12-7	625	MEDIAN(12	2.70	3	MEDIANx5	13.5	10
Antimony	7440-36-0	204.2	MEDIAN(3)	3	3	MEDIANx5	15	20
Arsenic (Total)	7440-38-2	206.2	MEDIAN(3)	1.63	2	MEDIANx5	8.15	8
Asbestos (f/L < 10 um)	1332-21-4	TEM	141.23(4)	10000	10,000	DEP	50000	100,000
Atrazine	1912-24-9	507	Table 24	0.1	0.1	Table 18	0.5	1
Barium	7440-39-3	208.1	141.23(4)	600	600	Table 16	150	200
Benz(a)anthracene	56-55-3	625	MEDIAN(12	2.99	3	MEDIANx5	14.95	10
Benzene	71-43-2	5xx	A-280	0.32	0.3	A-280	1.6	1
Benzidine	92-87-5	625	MEDIAN(3)	10	10	MEDIANx5	50	50
Benzo(a)pyrene (BaP)	50-32-8	625	MEDIAN(12	3.1	3	MEDIANx5	15.5	20
3,4 Benzofluoranthene (Benzo(b)fluoranthene)	205-99-2	625	MEDIAN(12	2.6	3	MEDIANx5	13	10
Benzo(ghi)perylene	191-24-2	625	MEDIAN(12	3.53	4	MEDIANx5	17.65	20
Benzo(k)fluoranthene	207-08-9	625	MEDIAN(12	3.82	4	MEDIANx5	19.1	20
Beryllium	7440-41-7	200.7	MEDIAN(2)	3	3	MEDIANx5	15	20
alpha-BHC (alpha-HCH)	319-84-6	608	MEDIAN(19	0.005	0.005	MEDIANx5	0.025	0.02
beta-BHC (beta-HCH)	319-85-7	608	MEDIAN(19	0.007	0.007	MEDIANx5	0.035	0.04
gamma-BHC (gamma-HCH/Lindane)	58-89-9	505	Table 14*	0.02	0.02	Table 18	0.1	0.2
Bis(2-chloroethyl) ether	111-44-4	625	MEDIAN(12	2.62	3	MEDIANx5	13.1	10
Bis(2-chloroisopropyl) ether	108-60-1	625	MEDIAN(12	2.96	3	MEDIANx5	14.8	10
Bis(2-ethylhexyl) phthalate	117-81-7	625	MEDIAN(11	5.53	6	MEDIANx5	27.65	30
Bromodichloromethane (Dichlorobromomethane)	75-27-4	524.2	MEDIAN(9)	0.23	0.2	MEDIANx5	1.15	1
Bromoform	75-25-2	524.2	MEDIAN(9)	0.16	0.2	MEDIANx5	0.8	0.8
Butylbenzyl phthalate	85-68-7	625	MEDIAN(12	3.40	3	MEDIANx5	17	20
Cadmium (total)	7440-43-9	213.2	MEDIAN(4)	1.5	1	Table 16	4.5	2
Carbofuran	1563-66-2	531.1	Table 24	0.9	0.9	Table 18	4.5	7
Carbon tetrachloride	56-23-5	5xx	A-280	0.32	0.3	A-280	1.6	2
Chlordane	57-74-9	608	A-280	0.043	0.04	A-280	0.215	0.5
Chloride	16887-00-6	407A	NJDOH	500	500	MDLx5	2500	2,000
Chlorobenzene	108-90-7	5xx	A-280	0.33	0.3	A-280	1.65	2
Chloroform	67-66-3	524.2	MEDIAN(9)	0.2	0.2	MEDIANx5	1	1
4-Chloro-3-methyl (o-chloro-m-cresol)	59-50-7	625	MEDIAN(12	3.50	4	MEDIANx5	17.5	20
2-Chlorophenol	95-57-8	625	MEDIAN(11	3.72	4	MEDIANx5	18.6	20
Chlorpyrifos	2921-88-2	508	METH. 508	0.04	0.04	MDLx5	0.2	0.2
Chromium (total)	7440-47-3^	218.2	MEDIAN(3)	2	2	Table 16	10	10
Chrysene	218-01-9	625	MEDIAN(12	3.2	3	MEDIANx5	16	20
Color (Platinum-cobalt units)	NA	110.3	NJDOH	5	5	MDLx5	25	20
Copper	7440-50-8	220.2	MEDIAN(2)	1.9	2	MEDIANx5	9.5	10
Corrosivity	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	57-12-5	335.2&.3	MEDIAN(10	7.8	8	MEDIANx5	39	40
2,4-D	94-75-7	515.1	Table 24	0.1	0.1	Table 18	0.5	5
Dalapon	75-99-0	515.1	METH515.1	1.3	1	EDLx10	13	10
4,4'-DDD (p,p' TDE)	72-54-8	608	MEDIAN(19	0.009	0.009	MEDIANx5	0.045	0.04
4,4'-DDE	72-55-9	608	MEDIAN(19	0.007	0.007	MEDIANx5	0.035	0.04
4,4'-DDT	50-29-3	608	MEDIAN(18	0.011	0.01	MEDIANx5	0.055	0.06
Demeton	8065-48-3	NA	NA	NA	NA	NA	NA	NA
Dibenz(a,h)anthracene	53-70-3	625	MEDIAN(12	5.12	5	MEDIANx5	25.6	20
Dibromochloromethane (Chlorodibromomethane)	124-48-1	524.2	MEDIAN(9)	0.27	0.3	MEDIANx5	1.35	1
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	524.2	MEDIAN(3)	0.494	0.5	MEDIANx5	2.47	2
Di-n-butyl phthalate	84-74-2	625	MEDIAN(12	3.46	3	MEDIANx5	17.3	20
1,2-Dichlorobenzene	95-50-1	5xx	A-280	1.52	2	A-280	7.6	5
1,3-Dichlorobenzene	541-73-1	5xx	A-280	0.83	0.8	A-280	4.15	5
1,4-Dichlorobenzene	106-46-7	5xx	A-280	0.86	0.9	A-280	4.3	5
3,3'-Dichlorobenzidine	91-94-1	625	MEDIAN(10	11.6	10	MEDIANx5	58	60

|| MDLs and PQLs rounded to one significant figure

TABLE 3
GROUND WATER PRACTICAL QUANTITATION LEVELS

CONSTITUENT	CASRN	ANALYTICAL METHOD	MDL SOURCE	imdl (ug/L)	Rounded IMDL	PQL SOURCE	actual pql	Prop.PQL (ug/L)
1,2-Dichloroethane	107-06-2	524.1	BSDW	0.72	0.7	BSDW	3.6	2
1,1-Dichloroethylene	75-35-4	524.1	BSDW	0.34	0.3	BSDW	1.7	2
cis-1,2-Dichloroethylene	156-59-2	524.1	BSDW	0.18	0.2	BSDW	0.9	2
trans-1,2-Dichloroethylene	156-60-5	524.1	BSDW	0.18	0.2	BSDW	0.9	2
2,4-Dichlorophenol	120-83-2	625	MEDIAN(12	2.88	3	MEDIANx5	14.4	10
1,2-Dichloropropane	78-87-5	524.2	MEDIAN(5)	0.27	0.3	MEDIANx5	1.35	1
1,3-Dichloropropene (cis and trans)	542-75-6	NA	NA	NA	NA	NA	NA	NA
cis-1,3-Dichloropropene	10061-01-5	624	MEDIAN(8)	1.0	1	MEDIANx5	5	5
trans-1,3-Dichloropropene	10061-02-6	624	MEDIAN(8)	1.40	1	MEDIANx5	7	7
Dieldrin	60-57-1	608	MEDIAN(19	0.0059	0.006	MEDIANx5	0.0295	0.03
Diethyl phthalate	84-66-2	625	MEDIAN(12	2.90	3	MEDIANx5	14.5	10
2,4-Dimethyl phenol	105-67-9	625	MEDIAN(12	3.77	4	MEDIANx5	18.85	20
Dimethyl phthalate	131-11-3	625	MEDIAN(12	2.68	3	MEDIANx5	13.4	10
4,6-Dinitro-o-cresol	534-52-1	625	MEDIAN(9)	12.0	10	MEDIANx5	60	60
2,4-Dinitrophenol	51-28-5	625	MEDIAN(10	9	9	MEDIANx5	45	40
2,4-Dinitrotoluene/2,6-Dinitrotoluene mixture	121-14-2	NA	NA	NA	NA	NA	NA	NA
2,4-Dinitrotoluene	121-14-2	625	MEDIAN(12	2.24	2	MEDIANx5	11.2	10
2,6-Dinitrotoluene	606-20-2	625	MEDIAN(12	2.26	2	MEDIANx5	11.3	10
Dinoseb	88-85-7	515.1	METH515.1	0.19	0.2	EDLx10	1.9	2
1,2-Diphenylhydrazine	122-66-7	NA	NA	NA	NA	NA	NA	NA
Diquat	85-00-7	NA	NA	NA	NA	NA	NA	NA
Endosulfan	115-29-7	NA	NA	NA	NA	NA	NA	NA
alpha-Endosulfan (Endosulfan I)	959-98-8	608	MEDIAN(18	0.005	0.005	MEDIANx5	0.025	0.02
beta-Endosulfan (Endosulfan II)	33213-65-9	608	MEDIAN(16	0.009	0.009	MEDIANx5	0.045	0.04
Endosulfan sulfate	1031-07-8	608	MEDIAN(16	0.015	0.02	MEDIANx5	0.075	0.08
Endothall	145-73-3	NA	NA	NA	NA	NA	NA	NA
Endrin	72-20-8	608	MEDIAN(19	0.009	0.009	MEDIANx5	0.045	0.04
Epichlorohydrin	106-89-8	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	100-41-4	524.2	MEDIAN(9)	0.21	0.2	Table 23	1.05	5
Eth[illegible]ne dibromide	106-93-4	504	Table 24	0.01	0.01	Table 18	0.05	0.05
Fl[illegible]nthene	206-44-0	625	MEDIAN(12	2.80	3	MEDIANx5	14	10
Fluorene	86-73-7	625	MEDIAN(12	2.42	2	MEDIANx5	12.1	10
Fluoride	16984-48-8	340.2	NJDOH	100	100	MDLx5	500	500
Foaming agents (ABS/LAS)	NA	512A	NJDOH	0.1	0.1	MDLx5	0.5	0.5
Glyphosate	1071-83-6	NA	NA	NA	NA	NA	NA	NA
Hardness (as CaCO3)	NA	130.2	MEDIAN(2)	2	2	MEDIANx5	10	10
Heptachlor	76-44-8	505	Table 24	0.04	0.04	Table 18	0.2	0.4
Heptachlor epoxide	1024-57-3	505	Table 24	0.02	0.02	Table 18	0.1	0.2
Hexachlorobenzene	118-74-1	625	MEDIAN(12	2.9	3	MEDIANx5	14.5	10
Hexachlorobutadiene	87-68-3	524.2	MEDIAN(9)	0.259	0.2	MEDIANx5	1.295	1
Hexachlorocyclopentadiene	77-47-4	625	MEDIAN(11	2.98	3	MEDIANx5	14.9	10
Hexachloroethane	67-72-1	625	MEDIAN(12	2.53	2	MEDIANx5	12.6	10
Hydrogen sulfide	7783-06-4	NA	NA	NA	NA	NA	NA	NA
Indeno(1,2,3-cd)pyrene	193-39-5	625	MEDIAN(12	4.20	4	MEDIANx5	21	20
Iron	7439-89-6	200.7	MEDIAN(3)	20	20	MEDIANx5	100	100
Isophorone	78-59-1	625	MEDIAN(12	2.36	2	MEDIANx5	11.8	10
Lead (total)	7439-92-1	239.2	MEDIAN(5)	2	2	MEDIANx5	10	10
Malathion	121-75-5	p.25	NJDOH	1	1	MDLx5	5	5
Manganese	7439-96-5	200.7	MEDIAN(2)	1.2	1	MEDIANx5	6	6
Mercury (total)	7439-97-6	245.1/.2	MEDIAN(3)	0.2	0.2	Table 16	1	0.5
Methoxychlor	72-43-5	505	Table 24	0.1	0.1	Table 18	0.5	10
Methyl bromide (bromomethane)	74-83-9	524.2	MEDIAN(9)	0.32	0.3	MEDIANx5	1.6	2
Methyl chloride (chloromethane)	74-87-3	524.2	MEDIAN(9)	0.36	0.4	MEDIANx5	1.8	2
3-Methyl-4-chlorophenol	59-50-7	625	MEDIAN(12	3.50	5	MEDIANx5	17.5	20
Methylene chloride	75-09-2	5xx	A-280	0.34	0.3	A-280	1.7	2
Mirex	2385-85-5	NA	NA	NA	NA	NA	NA	NA
Nickel (soluble salts)	7440-02-0	249.2	MEDIAN(3)	2.5	2	MEDIANx5	12.5	10
Nitrate (as N)	14797-55-8	353.1	141.23(4)	10	10	Table 16	50	400
Nitrite (as N)	14797-65-0	300.0	141.23(4)	4	4	Table 16	20	400
Nitrobenzene	98-95-3	625	MEDIAN(12	2.55	2	MEDIANx5	12.75	10
N-Nitrosodimethylamine	62-75-9	625	MEDIAN(10	3.8	4	MEDIANx5	19	20
N-Nitrosodiphenylamine	86-30-6	625	MEDIAN(12	3.60	4	MEDIANx5	18	20
N-[illegible]osodi-n-propylamine	621-64-7	625	MEDIAN(12	3.29	3	MEDIANx5	16.45	20
Odo[illegible]	NA	NA	NA	NA	NA	NA	NA	NA
Oil & Grease	NA	413.1	DEP	5000	5000	DEP	25000	20000

ll MDLS and PQLs rounded to one significant figure

TABLE 3
GROUND WATER PRACTICAL QUANTITATION LEVELS

CONSTITUENT	CASRN	ANALYTICAL METHOD	MDL SOURCE	imdl (ug/L)	Rounded IMDL	PQL SOURCE	actual pql	Prop.PQL (ug/L)
Oxamyl	23135-22-0	531.1	METH531.1	2.0	2	EDLx10	20	20
Petroleum Hydrocarbons (PHC)	NA	418.1	DEP	500	500	DEP	2500	2000
Polychlorinated biphenyls (PCBs)	1336-36-3	608	A-280	0.16	0.2	A-280	0.8	0.5
Pentachlorophenol	87-86-5	515.1	Table 24	0.01	0.01	Table 18	0.05	1
pH	NA	NA	NA	NA	NA	NA	NA	NA
Phenanthrene	85-01-8	625	MEDIAN(12	2.38	2	MEDIANx5	11.9	10
Phenol	108-95-2	625	MEDIAN(12	2.36	2	MEDIANx5	11.8	10
Phosphorus	7723-14-0	365.1	MEDIAN(2)	16	16	MEDIANx5	80	80
Picloram	1918-02-1	515.1	METH515.1	0.14	0.1	EDLx10	1.4	1
Pyrene	129-00-0	625	MEDIAN(12	3.70	4	MEDIANx5	18.5	20
Selenium (Total)	7782-49-2	270.2	MEDIAN(6)	2.2	2	Table 16	11	10
Silver (total)	7440-22-4	272.2	MEDIAN(3)	0.5	0.5	MEDIANx5	2.5	2
Simazine	122-34-9	507	METH 507	0.075	0.08	EDLx10	0.75	0.8
Sodium	7440-23-5	200.7	MEDIAN(2)	80	80	MEDIANx5	400	400
Styrene	100-42-5	524.2	MEDIAN(9)	0.22	0.2	Table 23	1.1	5
Sulfate	14808-79-8	375.4	NJDOH	1,000	1,000	MDLx5	5000	5,000
Taste	NA	NA	NA	NA	NA	NA	NA	NA
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6	613	METH. 613	0.002	0.002	MDLx5	0.01	0.01
1,1,2,2-Tetrachloroethane	79-34-5	524.2	MEDIAN(9)	0.26	0.3	MEDIANx5	1.3	1
Tetrachloroethylene	127-18-4	5xx	A-280	0.19	0.2	A-280	0.95	1
2,3,4,6-Tetrachlorophenol	58-90-2	8270	8270	2	2	MDLx5	10	10
Thallium	7440-28-0	279.2	MEDIAN(3)	2	2	MEDIANx5	10	10
Toluene	108-88-3	524.2	MEDIAN(9)	0.18	0.2	Table 23	0.9	5
Total Dissolved Solidd (TDS)	NA	160.1	NJDOH	2,000	2,000	MDLx5	10000	10,000
Toxaphene	8001-35-2	505	Table 24	1	1	Table 18	5	3
2,4,5-TP	93-72-1	515.1	Table 24	0.2	0.2	Table 18	1	5
1,2,4-Trichlorobenzene	120-82-1	524.2	MEDIAN(9)	0.26	0.3	MEDIANX5	1.3	1
1,1,1-Trichloroethane	71-55-6	5xx	A-280	0.38	0.4	A-280	1.9	1
1,1,2-Trichloroethane	79-00-5	524.2	MEDIAN(9)	0.3	0.3	MEDIANx5	1.5	2
Trichloroethylene	79-01-6	5xx	A-280	0.38	0.4	A-280	1.9	1
2,4,5-Trichlorophenol	95-95-4	8270	8270	2	2	MDLx5	10	10
2,4,6-Trichlorophenol	88-06-2	625	MEDIAN(12	4.45	4	MEDIANx5	22.25	20
Vinyl chloride	75-01-4	5xx	A-280	0.66	0.7	A-280	3.3	5
Xylenes (total)	1330-20-7	524.2	MEDIAN(10	0.26	0.3	BSDW	1.3	2
m&p-Xylenes	NA	524.2	MEDIAN(3)	0.41	0.4	MEDIANx5	2.05	2
o-Xylene	NA	524.2	MEDIAN(5)	0.23	0.2	MEDIANx5	1.15	1
Zinc	7440-66-6	200.7	MEDIAN(2)	6	6	MEDIANx5	30	30
Microbiological criteria, Radionuclides & Turbidity		NA	NA	NA	NA	NA	NA	NA

ll MDLS and PQLs rounded to one significant figure

TABLE 3
GROUND WATER PRACTICAL QUANTITATION LEVELS

Explanation of Terms

* = ug/L unless otherwise noted.
ug = micrograms
mg = milligrams
L = liter
f = fibers
^ = CASRN of chromium VI
H = hardness
141.23(4)i = section 141.23(4)i of 40 CFR 141 (56 FR 3526, January 30, 1991)
5## = USEPA 500 series methods referenced in 40 CFR 141 (56 FR 3526, January 30, 1991)
5xx = Methods 502.1, 503.1 and 524.1 used to calculate MDLs in A-280 study
###A = Standard Methods for the Examination of Water and Wastewater, 16th edition
6## = USEPA 600 series methods referenced in 40 CFR 136 (##FR ####, July 1, 1990)
A-280 = New Jersey Drinking Water Quality Institute. Maximum Contaminant Level Recommendations for Hazardous Contaminants in Drinking Water. 26 March 1987. For vinyl chloride, the Department accepts EPA's PQL of 2 ug/L.
Oxenford, J.L.; McGeorge, L.J.; Jenniss, S.W.; Determination of the Practical Quantitation Levels for Organic Compounds in Drinking Water; J. Am. Water Works Assoc.; 81(4), 149-154, 1989
CASRN = Chemical Abstracts System Registry Number
DEP = Decision by NJDEP Office of Quality Assurance (see Basis and Background Document)
DL = Detection Limit as defined in 40 CFR 141 (56 FR 3526, January 30, 1991)
EDL = Estimated Detection Limit cited in individual method
IMDL = Interlaboratory Method Detection Limit
MDL = Method Detection Limit
MEDIAN(##) = Median MDL of ## laboratories surveyed by NJDEP staff
NA = Not Applicable/Not Available
NJDOH = MDl for New Jersey State Department of Health laboratory
p. # = "Methods for Benzidine, Chlorinated Organic Compounds, Pentachlorophenol, and Pesticides in Water and Wastewater," Environmental Monitoring and Support Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH, 1978
PQL = Practical Quantitation Level
RL = Reporting Level, as established by NJDEP Office of Quality Assurance (see Basis and Background Document)
Table ## = Table ## in 40 CFR 141 (56 FR 3526, January 30, 1991)
Table ##* = Table ## in 40 CFR 141 (55 FR 30370, July 25, 1990)
Table ##** = Table ## in 40 CFR 141 (54 FR 22104, May 22, 1989)
TEM = Transmission Electron Microscopy as referenced in "Analytical Method for Determination of Asbestos in Water," EPA-600/4-83-043, September, 1983, U.S. Environmental Research Laboratory, Athens, GA, 30613
8270 = "Test Method for Evaluation Solid Waste" from Solid Waste and Emergency Response, 3rd edition, Publication SW846, U.S. Environmental Protection Agency, Office of Solid Waste, November 1986.