ENVIRONMENTAL PROTECTION

SITE REMEDIATION and WASTE MANAGEMENT PROGRAM

Remediation Standards; Technical Requirements for Site Remediation

Proposed New Rules:	N.J.A.C. 7:26D
Proposed Amendments:	N.J.A.C. 7:26E-1.3
Proposed Repeal	N.J.A.C. 7:26E- 1.13
Authorized by:	Lisa P. Jackson, Commissioner Department of Environmental Protection
Authority:	N.J.S.A. 13:1D-1 et seq., 58:10-23.11a et seq., 58:10A-1 et seq., and 58:10B-1 et seq.

Calendar Reference: See Summary below for explanation of exception to calendar requirement.

DEP Docket Number: 07-07-04/46.

Proposal Number: PRN 2007-143.

A public hearing concerning this proposal will be held on

Date: June 7, 2007
Time: 2:00 PM
New Jersey Department of Environmental Protection
Public Hearing Room
401 East State Street
Trenton, NJ 08625

Submit written comments by July 6, 2007 to:

Leslie W. Ledogar, Esq.
Attention: DEP Docket No. 07-07-04/46.

Office of Legal Affairs

New Jersey Department of Environmental Protection

401 East State Street

P.O. Box 402

Trenton, New Jersey 08625

The Department of Environmental Protection (Department) requests that commenters submit comments on disk or CD as well as on paper. Submittal of a CD or disk is not a requirement. The Department prefers Microsoft Word™ 6.0 or above. Macintosh™ formats should not be used. Each comment should be identified by the applicable N.J.A.C. citation, with the commenter's name and affiliation following the comment.

This rule proposal can be viewed or downloaded from the Department's web site at http://www.state.nj.us/dep/rules.

The agency proposal follows:

Summary

As the Department has provided a 60-day comment period on this notice of proposal, this notice is excepted from the rulemaking calendar requirement pursuant to N.J.A.C. 1:30-3.3(a)5.

Opportunity for public comment on draft soil remediation standards

The Department published a notice of opportunity for public comment on the draft soil remediation standards in the New Jersey Register on July 19, 2004. See 36 N.J.R. 3395(a). A draft of the soil remediation standards and supporting documentation were made available on the Department's web site. The Department then extended the public comment period for an additional 30 days, until October 18, 2004.

The Department received over 300 comments on the draft soil standards from 73 commenters. Commenters included specific industries and industry groups, environmental consultants, law firms, and several environmental groups. The comments submitted covered a

broad range of topics ranging from technical issues related to the derivation of the numeric standards to concerns about the economic impacts of the rule and the impact of the rule on brownfield redevelopment.

In response to comments, several modifications to the procedures used to develop standards for the Impact to Ground Water Pathway and to the input parameters used to develop the non-residential inhalation remediation standards are appropriate. Formerly, the Department proposed the use of the Soil Water Partition Equation (SPE) for the development of the Impact to Ground Water Pathway standards. The commenters noted that mobility, which plays a key role in the pathway, differed greatly among contaminants, and that some contaminants are only mobilized under certain site-specific conditions. It was their opinion that the Department's use of SPE-generated standards is overly conservative for many contaminants. In response to these comments, the Department decided to modify the framework used to develop the standards by limiting the use of SPE to the development of standards for mobile contaminants; testing on-site leachability of a contaminant is proposed to be used for low mobility and inorganic contaminants.

Commenters questioned the validity of the assumptions that the Department used for truck traffic as part of the development of the non-residential inhalation remediation standard. In response to these comments the Department contracted with Rutgers University to conduct a study to better estimate the number and weight of vehicles that could be expected to drive on non-residential sites in New Jersey (Boile, M. 2006. Estimation of the Average Number of Trucks Visiting Non-Residential Sites in New Jersey). Based on the study, the Department revised the input parameters used to develop the non-residential inhalation remediation standards.

Background on proposed new soil remediation standards

The Brownfield and Contaminated Site Remediation Act ("Brownfield Act"), at N.J.S.A. 58:10B-12(a), directs the Department to adopt minimum remediation standards for soil, ground water, and surface water necessary for the remediation of contaminated sites. Consistent with this legislative directive, the Department previously established remediation standards for surface water and ground water, which are codified in the Technical Rules for Site Remediation, N.J.A.C. 7:26E (the Technical Rules), at N.J.A.C. 7:26E-1.13. The Technical Rules set forth the minimum requirements for the remediation of every contaminated site in New Jersey, including both the methodology that must be followed and the standards to which ground water and surface water must be remediated.

The Department is now proposing remediation standards for soil at new N.J.A.C. 7:26D-4. In addition, the Department proposes to recodify with amendments the existing remediation standards for surface water and ground water from the Technical Rules at N.J.A.C. 7:26E-1.13 to the proposed new Remediation Standards rules at N.J.A.C. 7:26D-2 and 3, respectively. The Department intends to apply these standards to contaminated sites according to all applicable New Jersey statutes. The Department intends that the new chapter containing the remediation standards for soil, ground water and surface water, in concert with the Technical Rules as amended, will form the minimum standards by which all sites in New Jersey are to be remediated.

The Department has prepared three basis and background documents for these proposed rules that contain additional technical detail regarding the soil remediation standards. The basis and background documents for the ingestion-dermal exposure pathway, the inhalation exposure pathway, and the impact to ground water pathway are available at http://www.nj.gov/dep/srp/regs/srs.

Background

On February 3, 1992, the Department proposed soil cleanup standards (see 24 N.J.R. 373(a)), but did not adopt the standards because the Department thought it prudent to wait for input from the Legislature, which was considering pertinent legislation at the time.

In 1993, the Hazardous Site Remediation Act, N.J.S.A. 58:10B-1 et seq., was enacted. This act was amended in 1997 and renamed the Brownfield and Contaminated Site Remediation Act (the Brownfield Act). In the Brownfield Act, the Legislature outlined State policies for many aspects of site remediation, and provided broad guidelines for the Department to use in developing minimum remediation standards for soil, ground water, and surface water. The Legislature specifically declared that "strict remediation standards are necessary to protect public health and safety and the environment" and that these standards "should be adopted based upon the risk posed by discharged hazardous substances." See N.J.S.A. 58:10B-1.2.

A multi-part section of the Brownfield Act, codified at N.J.S.A. 58:10B-12(a) through (o), outlines the principles for the Department to use in making site remediation decisions. N.J.S.A. 58:10B-12(a) provides that the Department "shall adopt minimum remediation standards for soil, ground water and surface water quality necessary for the remediation of contamination of real property." N.J.S.A. 58:10B-12(a) further provides that these standards "shall be developed to ensure that the potential for harm to public health and safety and to the environment is minimized to acceptable levels, taking into consideration the location, the surroundings, the intended use of the property, the potential exposure to the discharge and the surrounding ambient conditions, whether naturally occurring or man-made."

The Brownfields Act, at N.J.S.A. 58:10B-12(c), requires the Department to develop two sets of soil remediation standards based on the projected use of the remediated site, both of which must be protective of public health and safety: residential and nonresidential. However, the soil remediation standards at all sites must also be protective of ground water and surface water for contaminants that are mobile and transportable to ground water or surface water.

Residential soil remediation standards must be set at levels or concentrations of contamination that: (1) are based upon the use of the site for residential or similar uses; (2) will allow the unrestricted use of the site without the need of engineering devices or any institutional controls; and (3) do not exceed a health risk standard for human carcinogens, as categorized by the United States Environmental Protection Agency (EPA), that will result in an additional cancer risk of one in one million, and for noncarcinogens, that will limit the hazard index for any given effect to a value not to exceed one. See N.J.S.A. 58:10B-12c(1) and d.

Nonresidential soil remediation standards must be set at levels or concentrations of contaminants that recognize the lower likelihood of exposure to contamination on property that will not be used for residential or similar uses. These standards are to be designed to allow for the unrestricted use of that property for nonresidential purposes. See N.J.S.A. 58:10B-12c(1).

N.J.S.A. 58:10B-12a and 12c, subsections b and d provide technical and policy guidelines for developing generic numeric standards for soil. The Legislature directed the Department to:

1. Identify the hazards posed by a contaminant to determine whether exposure to that contaminant can cause an increase in the incidence of an adverse health effect and whether the adverse health effect may occur in humans (N.J.S.A. 58:10B-12d);

2. Base the standards on generally accepted and peer reviewed scientific evidence or methodologies (N.J.S.A. 58:10B-12b(1));

3. Base the standards upon reasonable assumptions of exposure scenarios as to amounts of contaminants to which humans or other receptors will be exposed, when and where those exposures will occur, and the amount of that exposure (N.J.S.A. 58:10B-12b(2));

4. Avoid the use of redundant conservative assumptions by the use of parameters that provide an adequate margin of safety, avoid the use of unrealistic conservative exposure parameters, and make use of the guidance and regulations for exposure assessment developed by

the United States Environmental Protection Agency pursuant to the "Comprehensive Environmental Response, Compensation, and Liability Act of 1980," 42 U.S.C. §§ 9601 et seq. and other statutory authorities as applicable (N.J.S.A. 58:10B-12b(3));

5. Establish, where feasible, the remediation standards as numeric or narrative standards, setting forth acceptable levels or concentrations for particular contaminants (N.J.S.A. 58:10B-12b(4)); and

6. Consider and utilize, in the absence of other standards used or developed by the Department of Environmental Protection and the United States Environmental Protection Agency, the toxicity factors, slope factors for carcinogens and reference doses for non-carcinogens from the United States Environmental Protection Agency's Integrated Risk Information System (IRIS) (N.J.S.A. 58:10B-12b(5)).

Technical Requirements for Site Remediation, N.J.A.C. 7:26E

As mentioned above, the proposed new Remediation Standards are designed to work in concert with the Technical Rules, which establish the minimum technical requirements for remediation of a contaminated site. The new Remediation Standards establish the minimum standards to which contaminated soil, surface water and ground water must be remediated. As a part of this proposal establishing the new remediation standards, the Department proposes to amend the Technical Rules. Specifically, the Department is proposing to add a new subsection (d) at N.J.A.C. 7:26E-1.3, Applicability, to establish a “phase in period” for the new Soil Remediation Standards. As a matter of course, the Department provides a six-month phase-in period for new remediation requirements. See N.J.A.C. 7:26E-1.3(c). Pursuant to proposed new N.J.A.C. 7:26E-1.3(d), a person responsible for conducting the remediation of contaminated sites who submits the required remedial action workplans or remedial action reports to the Department prior to the effective date of these amendments plus six months, will be able to use soil cleanup criteria that were approved for the site prior to the effective date of the new remediation standards. For example, if the effective date of the adopted new rules and amendments is January 1, 2008, any site for which a remedial action workplan or remedial action

report was submitted prior to June 30, 2008 may be remediated using the soil cleanup criteria that were developed for the site prior to the January 1, 2008 effective date.

An exception exists when a new standard is adopted that is lower than a cleanup criterion that was developed for the site prior to the effective date of the new remediation standards by an order of magnitude or more. When a new remediation standard is lower than a soil cleanup criterion by an order of magnitude or more, the Brownfield Act at N.J.S.A. 58:10B-12j mandates that the new standard must be used. For sites where a remedial action workplan or a remedial action report is not submitted to the Department prior to the effective date plus six months, the remediation must be conducted using the new standards, exclusively.

Remediation options for the remediation of contaminated sites

The options for the remediation of a site that are currently available will not change upon the adoption of N.J.A.C. 7:26D. Remediation options for soil for the direct contact pathways (ingestion-dermal and inhalation) include treatment, removal, control via institutional and/or engineering controls, or in limited situations, the development of site specific alternative remediation standards (ARS). Remediation options for the impact to ground water pathway include the development of an ARS for soil that is protective of the ground water, or treatment or removal of contaminated soil. Containment with engineering controls may be approved as part of a ground water/soil remedial action when removal or treatment is deemed to be technically impractical.

If contaminants in soil do not exceed or are remediated to a level that meets both the most stringent direct contact remediation standards and the impact to ground water standards, no further remediation is required. If contaminants in soil exceed the most stringent direct contact remediation standards, the person responsible for conducting the remediation may elect, with Department approval, to use institutional and/or engineering controls pursuant to the Technical Rules, N.J.A.C. 7:26E-8, instead of removing or treating the contaminated soil to achieve the remediation standard. If contaminants in soil exceed the impact to ground water standards, then the person responsible for conducting the remediation must either remove or treat the contaminated soil, or may request an alternative remediation standard.

The majority of the most stringent direct contact standards for soil are developed for the residential exposure pathway. For five contaminants, however, the most stringent standard is based on non-residential inhalation exposure. These contaminants are acenaphthylene, benzo(ghi)perylene, cobalt, manganese and phenanthrene. The non-residential inhalation standards for these particulate contaminants incorporate dust generated by vehicular traffic and have resulted in several instances where the non-residential standards are lower than the residential standards for the inhalation exposure pathway.

Risk based remediation standards

The Department is proposing new soil remediation standards for the combined ingestion and dermal exposure pathway and for the inhalation exposure pathway based on residential and non-residential exposure scenarios. These standards are referred to as the direct contact remediation standards.

The Department is also proposing new remediation standards for the impact to ground water pathway. These remediation standards are based on the Ground Water Quality Standards, N.J.A.C. 7:9C. The only ground water classification for which numeric ground water quality standards are developed by the Department in N.J.A.C. 7:9C are for Class II ground water (ground water for potable water supply). As such, impact to ground water remediation standards that are protective of Class IIA ground water are being proposed herein. Ground water remediation standards and impact to ground water remediation standards for Class I (ground water of special ecological significance) and Class III ground water (ground water with uses other than potable water supply) will continue to be developed by the Department on a site-specific basis.

In addition, as discussed more fully below, the Department proposes to relocate with amendments remediation standards for surface water and ground water from the Technical Rules at N.J.A.C. 7:26E-1.13 to the Remediation Standards rules at N.J.A.C. 7:26D-2 and 3, so that all of the Department's remediation standards are located in one chapter.

The Department is proposing to allow a person responsible for conducting a remediation to develop an alternative soil remediation standard for a site using the procedures provided in N.J.A.C. 7:26D Appendices 5, 6 and 7. An alternative remediation standard is a site-specific standard that must be equally protective of human health as the soil remediation standards provided in N.J.A.C. 7:26D Appendix 1, Tables 1A, 1B, 2A, 2B and 2C of this chapter. If a person uses an alternative soil remediation standard at a site prior to receiving the Department's approval, this remedial work is considered to be conducted "at risk" and is subject to the Department's review and approval. The Department will not approve the use of an alternative standard if it is determined that the alternative soil remediation standard is not adequately protective of human health and safety.

Selection of contaminants

The Department is proposing soil remediation standards for 136 contaminants. The Department reviewed and compared the following contaminant or constituent lists to determine a list of contaminants for which it would develop remediation standards:

USEPA Contract Laboratory Program (CLP) Target Analyte List/Target Compound List
USEPA Priority Pollutant List
USEPA Soil Screening Levels
New Jersey Ground Water Quality Standards

In addition the Department reviewed soil cleanup criteria that were developed on a site-by-site basis pursuant to N.J.S.A. 58:10B-12. These criteria are listed in the document "NJDEP SRP – Soil Cleanup Criteria" and are posted on the Department's website at www.state.nj.us/dep/srp/regs/scc.

The Department did not develop a standard for every contaminant on all of the lists that were reviewed. The Department determined, based on its experience in remediating sites, that some of the contaminants on these lists are rarely found at contaminated sites in New Jersey. Therefore, the Department determined that it would not be an efficient use of resources to develop a health-based remediation standard for every chemical on every existing list of

contaminants. Instead, the Department focused on the 136 chemicals that are most often encountered at contaminated sites. If a contaminant is found for which the Department does not have a promulgated standard, the Department may develop an interim remediation standard using the equations and methods contained in N.J.A.C. 7:26D. The Department will make available to the public a listing of all interim remediation standards and the technical information used in their derivation. Technical information includes the human health risk information and toxicity data and the risk assessment methods used. The Department will also replace an interim remediation standard with a codified remediation standard as soon as is reasonably possible by rulemaking.

Toxicity hierarchy

Detailed information regarding the data sources used for the development of the soil remediation standards for each chemical are provided in the exposure pathway basis and background documents, available at http://www.nj.gov/dep/srp/regs/srs/proposed. For each contaminant for which the Department calculated a soil remediation standard, the Department utilized the following hierarchy of toxicity data sources for the carcinogenic slope factor variable for carcinogens or the reference dose variable for non-carcinogens: (1) information which forms the basis for drinking water standards adopted by the Department pursuant to the Safe Drinking Water Act (SDWA); (2) the USEPA's Integrated Risk Information System (IRIS); and (3) other pertinent health-based data.

SDWA toxicity data are first in the Department's hierarchy because the Legislature, in the 1984 amendments to the New Jersey Safe Drinking Water Act, N.J.S.A. 58:12A-13, directed the Department to develop maximum contaminant levels (MCLs) for certain chemicals based on Drinking Water Quality Institute (DWQI) recommendations. The SDWA data were peer reviewed through the DWQI's review process and the resultant MCLs and drinking water standards were subject to public comment during the promulgation of the Safe Drinking Water Act rules, N.J.A.C. 7:10. The Department also used these toxicity values to develop ground water quality standards and surface water quality standards. The Department determined, for consistency, to use these data in the development of the soil remediation standards.

IRIS is an electronic database (available at http://www.epa.gov/iris) that contains information on human health effects that may result from exposure to various chemicals in the environment. IRIS was initially developed by USEPA in response to a growing demand for consistent information on chemical substances for use in risk assessments, decision-making and regulatory activities. The heart of the IRIS system is descriptive and quantitative information on the oral reference doses (RfDs) and inhalation reference concentrations (RfCs) for chronic non-carcinogenic health effects, and hazard identification, oral slope factors, and oral and inhalation unit risks for carcinogenic effects of various chemical substances.

A group of USEPA health scientists reviewed each reference dose/concentration and carcinogenicity assessment in IRIS using consistent chemical hazard identification and dose-response assessment methods to achieve agency consensus. USEPA revises the information in IRIS periodically when additional health effects data become available. This process is explained more fully below in the Summary section entitled "Updating Remediation Standards."

Other toxicity data sources include, but are not limited to, the California Environmental Protection Agency, the USEPA National Center for Environmental Assessment (NCEA), and the USEPA Health Effects Assessment Summary Tables (HEAST, last revised in 1997). The Department uses these sources when data are not available from either the DWQI or IRIS.

Group C carcinogens

Different USEPA programs have employed different approaches to developing standards for Group C carcinogens. The Department evaluated the approaches used by both the USEPA Office of Drinking Water and the USEPA Superfund Program to assess the risk associated with Group C carcinogens. The Office of Drinking Water requires that the risk assessment be based on the reference dose for non-carcinogenic effects, with an additional uncertainty factor of 10 to protect from possible carcinogenic effects. However, if no reference dose is available, the risk assessment is based on the carcinogenic slope factor using a lifetime cancer risk level of 1×10^{-5}. In contrast, the Superfund program bases risk assessments for Group C carcinogens on the carcinogenic slope factor, if available, using a lifetime cancer risk level of 1×10^{-6}. If no

carcinogenic slope factor is available, the Superfund program requires that the reference dose for non-carcinogenic effects be used without the incorporation of an additional uncertainty factor.

To develop health-based soil remediation standards for Group C carcinogens, the Department proposes to use a revised approach that is protective of human health. The Department's proposed approach specifies the use of a carcinogenic slope factor with a lifetime cancer risk level of 1×10^{-6} if a slope factor is applicable. This approach is similar to the approach used by the USEPA Superfund Program and is mandated by the Brownfield Act. If no suitable slope factor is available, the risk assessment will be calculated using the applicable formula in N.J.A.C. 7:26D Appendices 2, 3 or 4, based on non-carcinogenic effects, using the reference dose and an additional uncertainty factor of 10 to protect for possible carcinogenicity (similar to the approach used by the USEPA Office of Water). This approach is also the approach established in the New Jersey Ground Water Quality Standards at N.J.A.C. 7:9C. For more information regarding specific Group C carcinogens, refer to the ingestion-dermal basis and background document.

Regional Natural Background

In developing the proposed soil remediation standards, the Department balanced several legislative mandates. In addition to requiring that soil remediation standards be health-based, the Brownfield Act at N.J.S.A. 58:10B-12(g)(4) precludes the Department from requiring the remediation of a discharge to levels that are lower than regional natural background levels for any particular contaminant. The Department reviewed regional natural background levels of inorganic chemicals in soil in relation to the health-based standards being proposed to ensure that the proposed soil remediation standards are not lower than frequently detected background levels in New Jersey. After an evaluation of a Statewide survey of background soil concentrations, the Department has determined that arsenic is usually present in New Jersey soil at concentrations that are higher than the health-based criterion. Therefore, the Department developed a soil remediation standard for arsenic based on background concentrations specific to New Jersey. The Department selected a state-wide generic soil standard for arsenic of 19 mg/kg because the health-based criterion (0.5 mg/kg) is lower than naturally occurring concentrations.

The Department based the State-wide background concentration for arsenic on a three-year study conducted by the Department to determine background values of selected metals throughout the State. See Sanders, P., 2002. Characterization of Ambient Levels of Selected Metals and Other Analytes in New Jersey Soils. This report is available at www.state.nj.us/dep/dsr/publications/pub.htm. A total of 248 soil samples were collected in areas of the State that were not directly affected by local discharges. The geographic provinces included in the study were the piedmont, ridge and valley, highlands, and the coastal plain. Samples were collected in urban and rural areas within the sampled regions

The Department ranked the background sample data by concentration and by distribution of the samples throughout the State, including geographical provinces and population density (urban or rural). The Department used the arsenic measured in these samples to represent the background arsenic concentrations in soil from the different geographic provinces throughout the State, although some additional concentration of arsenic may be present from diffuse anthropogenic sources. The Department used these data to develop the following table of the 95th percentile of the arsenic concentrations found in the different provinces of the State. The percentile evaluates a single value within the range of values in any given data set. The 95th percentile represents the concentration at which 95 percent of all the values in the data set are less than or equal to that concentration.

New Jersey Arsenic Concentrations

Geographic Province	Arsenic - 95th Percentile
Piedmont - urban	29 mg/kg
Ridge and Valley - rural	8 mg/kg
Highlands - rural	10 mg/kg
Coastal Plain - rural	15 mg/kg
Coastal Plain - rural	9 mg/kg
All areas	19 mg/kg

Based on these data, the Department proposes to establish a Statewide standard for arsenic. The Department does not believe that there are sufficient data on which to base a standard for the different geographical provinces, or for urban and rural areas of the State. The 95th percentile concentration (19 mg/kg) of all the sampled areas of the State has been selected as representative of background for the State. The Department selected 19 mg/kg as a reasonable background arsenic value that represents New Jersey soil that is not affected by local discharges.

Even though the Department is proposing a Statewide standard for arsenic, there is a wide variation in background concentrations of arsenic that exist across the State. Therefore, in those instances where the person responsible for conducting the remediation believes that naturally occurring levels of arsenic are greater than 19 mg/kg at a site, a site-specific background determination can be conducted as part of the remediation. The procedures to determine background on a site-specific basis are outlined in the Technical Rules at N.J.A.C. 7:26E-3.10.

Other factors affecting the development of soil remediation standards

The soil saturation level, or C_{sat} value, corresponds to the contaminant concentration in soil at which the absorptive limit of the soil particles, the solubility limit of the soil pore water, and saturation of soil pore air are reached. For some contaminants, the soil pore air concentration at C_{sat} is less than the calculated health based inhalation criterion. This means that, regardless of the concentration of the contaminant in soil, the calculated health based criterion can never be exceeded and, therefore, a health based standard is not needed for the inhalation exposure pathway for those contaminants. The Department determined not to establish numeric inhalation remediation standards for contaminants for which the calculated health-based criterion is greater than the contaminant's C_{sat} value.

There are instances when, in the calculation of a health based criterion, the calculated value is greater than one million parts per million. Because this cannot actually occur, the Department determined not to establish a numeric remediation standard in these instances.

Reporting of numeric standards

The numeric soil remediation standards are expressed as mg/kg. The Department rounded the standards to two significant figures for standards with a value greater than or equal to 10 mg/kg and to one significant figure for standards with a value less than 10 mg/kg, including those with a value less than one. This approach is used by the USEPA Office of Solid Waste and Emergency Response. See USEPA, 2001. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24.

The Department applied the following rounding rules from a standard statistics text, Hurlbert, R. T. (1994). Comprehending Behavioral Statistics. Brooks/Cole Publishers, Pacific Grove, CA. If the first number beyond the last significant figure is less than five, the last significant figure remains the same; and the remaining numbers are dropped. For example, if 4.438 is rounded to one significant figure, the result is four. If 44.38 is rounded to two significant figures, the result is 44.

If the first number beyond the last significant figure is more than five, the last significant figure increases by one and the remaining numbers are dropped. For example, if 4.638 is rounded to one significant figure, the result is five. If 46.68 is rounded to two significant figures, the result is 47.

If the first number beyond the last significant figure is exactly five, then the last significant figure is rounded to the closest even number. For example, if 4.5 is rounded to one significant figure, the result is four. If 45.5 is rounded to two significant figures, the result is 46.

Proposed new soil remediation standards rules

The following is a summary of the proposed new rules at N.J.A.C. 7:26D.

N.J.A.C. 7:26D-1 General Information

Proposed new Subchapter 1 contains the general information that applies to the remediation standards proposed herein.

Proposed new N.J.A.C. 7:26D-1.1 sets forth the purpose of these new rules and proposed new N.J.A.C. 7:26D-1.2 sets forth the scope. Proposed new N.J.A.C. 7:26D-1.1(a) and 1.2(a) state that the proposed rules establish minimum remediation standards for contaminated ground water, surface water, and soil in order to comply with the provisions of the Brownfield Act. N.J.A.C. 7:26D-1.1(b) explains that these rules supplement the requirements in the Technical Rules. N.J.A.C. 7:26D-1.2(b) provides that remediating ground water, surface water or soil to any applicable standard set forth in this chapter does not relieve a person from complying with more stringent requirements or provisions imposed by any other Federal, State, or local applicable statutes or regulations, or from obtaining any and all permits required by Federal, State, or local statutes or regulations, except as expressly provided herein.

Proposed new N.J.A.C. 7:26D-1.2(c) provides that the Department's authority to require additional remediation based upon site-specific conditions in order to protect human health, safety and the environment is not limited by any provisions of the new rules. Proposed new N.J.A.C. 7:26D-1.2(d) provides that the Department's authority to establish discharge limits for pollutants, or to prescribe penalties for violations of those limits pursuant to any statutory authority, or to require the complete removal of any illegally discharged hazardous substances, hazardous waste, or pollutants pursuant to law is not limited by any provisions of the proposed new rules.

Proposed new N.J.A.C. 7:26D-1.2(e) implements the provision of the Brownfield Act that states that the person responsible for conducting the remediation is not required to remediate soil, ground water or surface water to a level or concentration that is lower than the regional natural background level. This concept, as it pertains to ground water, is currently codified at N.J.A.C. 7:26E-1.13(c); it will be relocated to N.J.A.C. 7:26D-1.2(e).

Proposed new N.J.A.C. 7:26D-1.3, Construction and severability, states that the rules are to be liberally construed and if any subchapter, section, subsection, provision, clause, or portion of the chapter is rendered invalid, it shall not affect or impair the remainder of the rules.

Proposed new subsection (a) of N.J.A.C. 7:26D-1.4, Applicability, provides that the Remediation Standards apply to those sites that are subject to the listed statutes. Proposed new N.J.A.C. 7:26D-1.4(b) states that all remediation work conducted at any contaminated site in New Jersey must be conducted in compliance with the Technical Requirements for Site Remediation, N.J.A.C. 7:26E, and must achieve the remediation standards proposed herein, whether the remediation is conducted with or without the Department's oversight.

Proposed new N.J.A.C. 7:26D-1.4(c) implements the Brownfield Act provision at N.J.S.A. 58:10B-2.e that provides that remediation of real property located in the Pinelands must be consistent with the Pinelands Protection Act and its implementing rules and with section 502 of the National Parks and Recreation Act of 1978.

Proposed new N.J.A.C. 7:26D-1.5, Definitions, provides definitions for the words and terms used in these proposed new rules. The Department proposes to add a definition of the term "alternative remediation standard" or "ARS." The term was established in the Brownfield Act (see N.J.S.A. 58:10B-12f) and is the standard that a person responsible for conducting the remediation proposes to use to remediate contaminated soil in lieu of using the minimum soil remediation standards established in these proposed new rules. See N.J.S.A. 58:10B-12f. The Department proposes to establish the procedures for the development of alternative remediation standards in N.J.A.C. 7:26D-7, and Appendices 5 through 7 of this chapter.

The Department proposes to define "carcinogen." The Brownfield Act directs the Department to "consider and utilize, in the absence of other standards used or developed by the Department of Environmental Protection and the United States Environmental Protection Agency, the toxicity factors, slope factors for carcinogens and reference doses for non-carcinogens from the United States Environmental Protection Agency's Integrated Risk Information System (IRIS)." N.J.S.A. 58:10B-12b(5). The Department proposes to define

carcinogen consistent with the USEPA Guidelines for Carcinogen Risk Assessment, 51 Fed. Reg. 33932 (1986), as amended and supplemented.

Several words and terms used in this chapter are defined in the Technical Rules. The Department proposes to define the following terms by reference to the definition section of the Technical Rules at N.J.A.C. 7:26E-1.8: "contaminated site," "contamination" or "contaminant," "discharge," "effective solubility," "method detection limit" or "MDL," "person responsible for conducting the remediation," "practical quantitation level," or "PQL," "remediation" or "remediate," and "soil."

The Department proposes to define "exposure pathways" to describe the methods by which humans can come into contact with contamination, specifically the ingestion-dermal exposure pathway, the inhalation pathway, and the impact to ground water pathway.

The Department proposes to define "ground water" and "ground water quality criteria" by reference to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.4.

The Department proposes to define "impact to ground water remediation standard" as a soil remediation standard that is designed to limit the amount of contaminant that leaches from the soil vadose zone to ground water for the protection of ground water quality.

The proposed definitions of "ingestion-dermal exposure pathway" and "inhalation exposure pathway" describe process by which humans can come into contact with contamination. Ingestion-dermal exposure is the process of exposure through direct ingestion of contamination and the absorption of contamination through the skin. Inhalation exposure is the method of exposure through the direct inhalation of contamination.

The Department proposes to define "leachate criteria" as the remediation standards to use for the impact to ground water pathway for less mobile and inorganic contaminants that are based on the analysis of the leachate from soil using the synthetic precipitation leaching procedure.

The proposed definitions of "non-residential use" and "residential use" are based on standard exposure durations established by the USEPA Risk Assessment Guidance for Superfund Human Health Evaluation Manual, Part B (RAGS HHEM, Part B; USEPA, 1991).

"Non-residential direct contact soil remediation standard" and "residential direct contact soil remediation standard" are soil remediation standards that are designed to be protective of human health for the ingestion-dermal and inhalation exposure pathways, at non-residential use and residential use sites. The Department has determined that it is appropriate to apply residential soil remediation standards at sites that are used for schools (K-12) and childcare centers. These standards are appropriately protective of children in residential, school and childcare settings.

The Department proposes to define "oversight document" by reference to the Department Oversight of the Remediation of Contaminated Sites rules at N.J.A.C. 7:26C-1.3.

"Pollutant" is defined as any substance defined as such under the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.

The proposed definition of "regional natural background level" is based on the Brownfield Act, which provides that regional natural background level is the concentration of a contaminant that is consistently present in the environment in the region of the site and which has not been influenced by localized human activities. See N.J.S.A. 58:10B-12g(4).

The proposed definition of "remediation standards" is also based on the Brownfield Act. Remediation standards means the combination of numeric standards, adopted pursuant to this chapter, that establish a level or concentration, and narrative standards, to which contaminants must be treated, removed or otherwise cleaned for soil, ground water or surface water, as established by the Department. See N.J.S.A. 58:10B-12.

The Department proposes to define "surface water" by reference to the Surface Water Quality Standards, N.J.A.C. 7:9B.

N.J.A.C. 7:26D-2 Minimum Ground Water Remediation Standards

At proposed new N.J.A.C. 7:26D-2, the Department proposes to relocate the minimum standards to be used for the remediation of contaminated ground water from N.J.A.C. 7:26E-1.13(b). The Department is not proposing substantive changes to the regulations establishing ground water remediation standards; however, the Department incorporated portions of N.J.A.C. 7:26E-1.13 into different sections of these rules to be consistent with the format used for these rules, as described below.

Proposed new N.J.A.C. 7:26D-2.1, Purpose, states that the purpose of the subchapter is to set forth the minimum remediation standards for ground water.

Proposed new N.J.A.C. 7:26D-2.2(a)1 provides that the ground water remediation standards for Class II ground water are the ground water quality criteria established pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c) and (d). This paragraph conceptually relocates N.J.A.C. 7:26E-1.13(b)1i, ii and iii in these proposed new rules. The Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c) describe all the methods and procedures that the Department uses to develop ground water quality standards for Class II ground water. Appendix Tables 1 and 2 of the Ground Water Quality Standards contain ground water quality criteria for the listed constituents. The Ground Water Quality Standards also describe how the Department updates Tables 1 and 2 and derives an interim specific criterion for a constituent not listed in Appendix 1. When the Department develops a ground water quality criterion pursuant to the Ground Water Quality Standards rules as an Appendix, Table 1 criterion or an interim specific criterion, that criterion will become the ground water remediation standard for that constituent by operation of proposed new N.J.A.C. 7:26D-2.2(a)1.

Proposed new N.J.A.C. 7:26D-2.2(a)2 provides that the ground water remediation standards for Class I-A and Class I-PL ground water are the ground water quality criteria developed pursuant to N.J.A.C. 7:9C-1.7(a) and (b). The ground water quality criteria for Class I

ground water is a nondegradation classification where natural quality is to be maintained or restored.

Proposed new N.J.A.C. 7:26D-2.2(a)3 provides that the ground water remediation standards for Class III-A and Class III-B ground water are the ground water quality criteria developed pursuant to N.J.A.C. 7:9C-1.7(e) and (f). The ground water quality criteria for Class III ground water are determined on a case-by-case basis to ensure that that there is no significant migration of ground water pollution to adjacent to ground waters that are not Class III. In addition, the criteria for Class III shall ensure that there will be no impairment of the existing uses of ground water, resulting in violation of the Surface Water Quality Standards and release of pollutants to the ground surface, structures or air in concentrations that pose a threat to human health.

The Department proposes to relocate existing N.J.A.C. 7:26E-1.13(b)2 at proposed new N.J.A.C. 7:26D-2.2(a)4 with minor changes to the text. These provisions set forth the minimum narrative ground water remediation standards for all classes of ground water and include general ground water quality policies, N.J.A.C. 7:9C-1.2, narrative ground water quality criteria, N.J.A.C. 7:9C-1.7, the ground water quality antidegradation policy, N.J.A.C. 7:9C-1.8, and the remediation requirements of the Technical Rules, N.J.A.C. 7:26E. Additional narrative ground water remediation standards include the removal, treatment, or containment of free and residual product, N.J.A.C. 7:26E-6.1(d); no migration of contaminants to the ground surface, structures or air in concentrations that pose a threat to human health; and a set of narrative criteria for selecting an appropriate ground water remedial action based on site-specific use and conditions. The Department proposes to replace the word “release” at N.J.A.C. 7:26D-2.2(a)4iv with the word “migration” because the word migration more accurately reflects the transport mechanism for the movement of contamination from one environmental medium to another.

The Department proposes to relocate N.J.A.C. 7:26E-1.13(d) as new N.J.A.C. 7:26D-2.2(b). This provision states that the Department will not approve an alternative ground water remediation standard that is based on a site-specific risk assessment. Although the Legislature offered a procedure to establish an alternative numeric remediation standard for soil based upon

a site-specific risk assessment at N.J.S.A. 58:10B-12(f), the Legislature did not extend that procedure to ground water or surface water remediation standards. The use of site-specific risk assessments to develop alternative remediation standards for ground water and surface water would be inconsistent with the regulatory water classification systems already in place throughout the State. The Department has determined that allowing the development of alternative ground water or surface water remediation standards would not be consistent with either New Jersey's statutory or regulatory framework for protecting and remediating contaminated waters, or New Jersey's water supply management policies and principles.

N.J.A.C. 7:26D-3 Minimum Surface Water Remediation Standards

Proposed new Subchapter 3 sets forth the minimum standards to be used for surface water remediation at contaminated sites. The Department proposes to recodify the surface water remediation standards from the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.13(e) to proposed new N.J.A.C. 7:26D-3.2 with one significant change. The Department is not including the reference to the Federal Surface Water Criteria currently codified at N.J.A.C. 7:26E-1.13(e)1. The Federal Interim Final Rule, 60 CFR 22229 (May 4, 1995) and the National Toxics rule, 60 CFR 44120 (August 24, 1995) are collectively known as the National Toxics Rule (NTR). The Department adopted numerical criteria for toxics identified in the NTR applicable to New Jersey as the toxics criteria for New Jersey. See 37 N.J.R. 3487(a) (September 18, 2005) for the proposal, and 38 N.J.R. 4449(a) (October 16, 2006) for the adoption. Accordingly, the reference to the Federal Surface Water Criteria is redundant.

Proposed new N.J.A.C. 7:26D-3.1, Purpose, states that the purpose of Subchapter 3 is to establish minimum standards to be used for the remediation of surface water at contaminated sites.

At proposed new N.J.A.C. 7:26D-3.2, Minimum surface water remediation standards, the Department proposes to relocate N.J.A.C. 7:26E-1.13(e)1. This section establishes that the minimum surface water remediation standards are the numeric New Jersey Surface Water Quality Standards, N.J.A.C. 7:9B-1.14(c) and (d) and the narrative surface water remediation standards to be codified at proposed new N.J.A.C. 7:26D-3.2(a)2.

The Department proposes to relocate existing N.J.A.C. 7:26E-1.13(e)2 at proposed new N.J.A.C. 7:26D-3.2(a)2. This paragraph establishes narrative surface water remediation standards. Narrative surface water remediation standards are the general and narrative surface water quality policies and criteria included in N.J.A.C. 7:9B-1.5 and 1.14. Narrative standards also are the remediation requirements of the Technical Rules, N.J.A.C. 7:26E-1 through 8, and the removal, treatment or containment of free and residual product, N.J.A.C. 7:26E-6.1(d). N.J.A.C. 7:26D-3.2(a)2v provides narrative criteria that may be used for selecting an appropriate surface water remedial action that includes, but is not limited to, the location of the site and the present and projected use of the surface water.

The Department proposes to relocate N.J.A.C. 7:26E-1.13(f) at proposed new N.J.A.C. 7:26D-3.2(b). This provision states that the Department will not allow the use of a site specific risk assessment to develop an alternative surface water remediation standard. This rule provision parallels N.J.A.C. 7:26D-2.2(b) for ground water. See the discussion regarding site specific risk assessment for alternative ground water remediation standards above.

N.J.A.C. 7:26D-4 Minimum Soil Remediation Standards

Proposed new Subchapter 4 sets forth the minimum standards to be used for soil remediation at contaminated sites. As previously mentioned, the Brownfield Act at N.J.S.A. 58:10B-12.c(1) sets forth guidelines for the Department to follow in developing health-based remediation standards for soil, such as distinguishing between residential and non-residential soil remediation standards to reflect the current use of the property.

The Brownfield Act at N.J.S.A. 58:10B-12c(1) requires the Department to "develop residential and nonresidential soil remediation standards that are protective of human health and the environment" and "for contaminants that are mobile and transportable to ground water or surface water, the residential and nonresidential soil remediation standards shall be protective of ground water and surface water." Accordingly, proposed new N.J.A.C. 7:26D-4.1, Purpose, provides that the purpose of the subchapter is to establish residential direct contact soil

remediation standards, non-residential direct contact soil remediation standards and impact to ground water soil remediation standards.

The Brownfield Act at N.J.S.A. 58:10B-12c(1) further requires that residential soil remediation standards be set at "levels or concentrations of contamination for real property based upon the use of that property for residential or similar uses and which will allow the unrestricted use of that property without the need of engineering devices or any institutional controls" and without exceeding a health risk standard for carcinogens that "will result in an additional cancer risk of one in one million," and for noncarcinogens, that "will limit the Hazard Index for any given effect to a value not exceeding one." Accordingly, proposed new N.J.A.C. 7:26D-4.2, Residential direct contact soil remediation standards, establishes soil remediation standards that are appropriate for residential site use for the direct contact pathways. The residential direct contact soil remediation standards are listed in Appendix 1 Table 1A. As explained in proposed new N.J.A.C. 7:26D-4.2(a), the Department developed the residential direct contact human health-based criteria based on the equations, data sources, and conventions provided in Appendices 2 and 3 of these rules.

Proposed new N.J.A.C. 7:26D-4.2(b) establishes that for the contaminants listed in Table 1A, the residential direct contact remediation standard is the more stringent of either the ingestion dermal human health-based criterion or the inhalation human health-based criterion as applicable, or the PQL for that chemical if the PQL is less stringent than the corresponding ingestion-dermal or the inhalation human health based criterion. The Department defaults to the PQL so that compliance with the numeric standard can be reliably measured using commonly used certified laboratory methods.

The residential direct contact soil remediation standards in Appendix 1, Table 1A are based on the human health criteria for the ingestion-dermal and the inhalation pathways that are protective of human exposure based on residential exposure scenarios. The residential exposure scenario is based on the following USEPA calculations and assumptions: Risk Assessment Guidance for Superfund Human Health Evaluation Manual, Part B (RAGS HHEM, Part B; USEPA, 1991), Soil Screening Guidance: Technical Background Document (USEPA, 1996a),

and Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites (USEPA, 2001). For more detailed information on the procedure used for the development of the residential direct contact soil remediation standards, see the ingestion-dermal and the inhalation basis and background documents.

The Brownfield Act at N.J.S.A. 58:10B-12.c(1) also mandates that the Department set non-residential soil remediation standards "at levels or concentrations of contaminants that recognize the lower likelihood of exposure to contamination on the property that will not be used for residential or similar uses, which will allow for the unrestricted use of that property for nonresidential purposes, and that can be met without the need of engineering controls." N.J.S.A. 58:10B-12(d) requires that soil standards established for non-residential use is the same as the health risk standards for residential uses described above. Accordingly, proposed new N.J.A.C. 7:26D-4.3, Non-residential direct contact soil remediation standards, establishes soil remediation standards for non-residential site use for the direct contact pathways. The non-residential exposure scenario is based on the same USEPA calculations and assumptions noted in the USEPA documents referenced above, for the outdoor worker. As provided in proposed new N.J.A.C. 7:26D-4.3(a), the Department developed the non-residential direct contact human health-based criteria based on the equations, data sources, and conventions provided in Appendices 2 and 3 of these new rules.

Proposed new N.J.A.C. 7:26D-4.3(a) explains that non-residential direct contact remediation standards, listed in Appendix 1, Table 1B, were developed by the Department for the ingestion-dermal exposure pathway and the inhalation exposure pathway. The health-based criteria for the ingestion-dermal exposure pathway are based on the equations, data sources and conventions provided in Appendix 2 of these rules. The health-based criteria for the inhalation exposure pathway are based on the equations, data sources and conventions provided in Appendix 3 of these rules.

Proposed new N.J.A.C. 7:26D-4.3(b) establishes that, for the contaminants listed in Appendix 1, Table 1B, the non-residential direct contact remediation standard is the more stringent of either the ingestion dermal human health-based criterion or the inhalation human

health-based criterion as applicable, or the PQL for that chemical if the PQL is less stringent than either the ingestion-dermal or the inhalation human health based criterion. The Department defaults to the PQL so that compliance with the numeric standard can be reliably measured using commonly used certified laboratory methods.

Proposed new N.J.A.C. 7:26D-4.4, Impact to ground water soil remediation standards, establishes soil remediation standards for the impact to ground water pathway, which are listed in Appendix 1 Tables 2A, 2B and 2C. These soil remediation standards are protective of the ground water remediation standards for Class II ground water as defined in the Ground Water Quality Standards at N.J.A.C. 7:9C. These standards apply to sites that are being remediated for residential and non-residential use.

As explained in proposed new N.J.A.C. 7:26D-4.4(a), soil criteria for the impact to ground water pathway were developed based on the equations, data sources, and conventions provided in Appendix 4. The Department has developed impact to ground water soil remediation standards in two different ways based on whether the contaminant is likely to leach into ground water. Impact to ground water standards developed for mobile contaminants that are likely to be transported from soil to ground water are listed in Appendix 1, Table 2A. The impact to ground water remediation standards for mobile contaminants are directly measured as the concentrations of contaminants in soil and are compared to the impact to ground water soil remediation standards listed in Table 2A. This group of contaminants includes volatile organic chemicals that are very likely to impact ground water.

Impact to ground water standards developed for less mobile contaminants, which are less likely to be transported from soil to ground water, are listed as leachate standards in Appendix 1, Tables 2B and 2C. Compliance with these standards will require the person responsible for conducting the remediation to conduct a synthetic precipitate leaching procedure (SPLP) on contaminated soils from the site. The leachate must be analyzed for the contaminants of concern. The concentrations measured in the leachate are then compared to the impact to ground water leachate remediation standards listed in Table 2A. The SPLP leaching procedure is a

direct measure of the ability of a contaminant to leach from the soil and migrate to the ground water.

N.J.A.C. 7:26D-4.4(b) establishes that for the contaminants listed in Tables 2A, 2B and 2C, the impact to ground water soil remediation standard is the health-based criterion unless the PQL listed in Tables 2A, 2B and 2C is less stringent. If the PQL is less stringent than the health-based criterion, the impact to ground water soil remediation standard is set at the PQL. The Department defaults to the PQL so that compliance with numeric standards can be reliably measured using commonly used certified laboratory methods.

N.J.A.C. 7:26D-5 Interim Soil Remediation Standards

As described at proposed new N.J.A.C. 7:26D-5.1, Purpose, proposed new Subchapter 5 sets forth the procedures that the Department proposes to use to develop interim remediation standards for soil.

Proposed new N.J.A.C. 7:26D-5.2, Development of an interim soil remediation standard, establishes the methods and circumstances under which the Department may develop an interim standard for soil.

Proposed new N.J.A.C. 7:26D-5.2(a) provides that the Department may establish an interim soil remediation standard for any contaminant that is not listed in Appendix 1, Tables 1A, 1B, 2A, 2B or 2C of this chapter.

Proposed new N.J.A.C. 7:26D-5.2(b) sets forth the Department's procedures for developing interim soil remediation standards. Interim soil remediation standards will be developed using the criteria development procedures set forth in Appendices 2 through 4 of these rules as applicable. Additionally, the person responsible for conducting the remediation may request that the Department develop an interim remediation standard pursuant to N.J.A.C. 7:26D-5.2(c).

Proposed new N.J.A.C. 7:26D-5.3, Publication of interim soil remediation standards; promulgation, provides that the Department will publish interim remediation standards on the Department's web site, along with the technical basis that is used for their derivation. The technical basis will focus on the human health risk assessment for the contaminant and include information on the toxicity data and the risk assessment approach used. Interim soil remediation standards are to be replaced with duly promulgated remediation standards as soon as reasonably possible.

N.J.A.C. 7:26D-6 Updating Soil Remediation Standards

Proposed new Subchapter 6 sets forth the procedures that the Department proposes to use to update remediation standards for soil under certain circumstances. N.J.A.C. 7:26D-6.1, Purpose, establishes the purpose of this subchapter.

Proposed new N.J.A.C. 7:26D-6.2, Notice of administrative change process, describes the process that the Department will use to update a soil remediation standard. The Department will publish a notice of administrative change in the New Jersey Register to update a soil remediation standard for any contaminant subsequent to the effective date of these rules under the two circumstances described in proposed new N.J.A.C. 7:26D-6.2(a). The first circumstance occurs when the Department updates a soil remediation standard as a result of a change in the carcinogenic slope factor or reference dose data contained in the EPA's Integrated Risk Information System (IRIS) database on which the promulgated soil remediation standard is based. The second circumstance occurs when the Department updates an impact to ground water soil remediation standard as a result of the promulgation of a new Ground Water Quality Standard under N.J.A.C. 7:9C.

USEPA's revisions to IRIS are subject to a comprehensive internal and external peer review process prior to their inclusion in the database. This process consists of: (1) an annual announcement in the Federal Register of USEPA's IRIS agenda and a call for scientific information from the public on the selected chemical substances; (2) a search of the current scientific literature; (3) development of health assessments and draft IRIS summaries; (4) peer review of the health assessments and draft IRIS summaries within USEPA; (5) peer review of

the health assessments and draft IRIS summaries outside USEPA; (6) USEPA consensus review and management approval; (7) preparation of final IRIS summaries and supporting documents; and (8) entry of summaries and supporting documents into the IRIS database.

The public may obtain information regarding the IRIS database from several sources. First, as previously mentioned, USEPA maintains an IRIS web site at http://www.epa.gov/iris. Second, the National Center for Environmental Assessment, the IRIS Hotline that fields questions regarding the IRIS database. Webmaster and Hotline contact information are provided on the IRIS web site. Third, the central IRIS file and public reading room, located at the IRIS Hotline contractor facility, serves as the repository for the peer review record for the assessment of each chemical in the IRIS database, the summary of the consensus review, the final consensus memorandum, copies of key references (documenting "principal studies" used in the assessment), any difficult-to-find reference material including unpublished studies, USEPA reports, and foreign translations, and any public submissions pertinent to the assessment.

The soil remediation standards for the impact to ground water pathway are to be updated when the Ground Water Quality Standards are revised because the impact to ground water soil remediation standards are developed to be protective of ground water and are back-calculated from the Ground Water Quality Standards. Therefore, when the Department adopts a change in a numeric ground water quality standard the impact to ground water soil remediation standard must also be updated.

The Department is not proposing to include provisions in this rule to update ground water remediation standards via the notice of administrative change process. The Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c)5 permit the Department to update the ground water quality standards via a notice of administrative change. As the ground water remediation standards are the ground water quality standards pursuant to N.J.A.C. 7:26D-2.2(a), there is no need to include a notice of administrative change for ground water remediation standards.

Proposed new N.J.A.C. 7:26D-6.2(b) establishes the content of the notice of administrative change for updated soil remediation standards. the department will identify in the

notice the contaminant that is being updated, the basis for the change, and the revised criterion that will be listed in Tables 1A, 1B, 2A, 2B or 2C. Proposed new N.J.A.C. 7:26D-6.2(c) states that the Department will make the notice of administrative change available to the public on its web site.

N.J.A.C. 7:26D-7 Alternative Soil Remediation Standards

The Brownfield Act at N.J.S.A. 58:10B-12(f)1 provides that a person responsible for conducting soil remediation may submit an application to the Department for the development of an alternative remediation standard. Alternative remediation standards for soil may be developed for residential use or non-residential use or for the impact to ground water pathway. A person performing a remediation of contaminated real property, in lieu of using the promulgated minimum numeric soil remediation standard for either residential use or non-residential use, may submit a request to use an alternative numeric residential use or non-residential use soil remediation standard. The person responsible for conducting the remediation is required to use appropriate institutional controls when non-residential remediation standards are applied at a site pursuant to N.J.A.C. 7:26E-8.

Additionally, the Department may, of its own initiative, develop an alternative numeric soil remediation standard for a particular contaminant for a specific real property site, in lieu of using the promulgated minimum residential use or non-residential use soil remediation standard. The Brownfield Act at N.J.S.A. 58:10B-12.f.(2) provides that the Department may require the use of an alternative numeric soil remediation standard when it determines, based on the weight of the scientific evidence, that the use of the adopted residential use or non-residential use soil remediation standards would not be protective, or would be unnecessarily overprotective, of public health or safety or of the environment, as appropriate.

Accordingly, the Department proposes new Subchapter 7 to implement N.J.S.A. 58:10B-12(f)1 and 2 concerning the circumstances under which the Department or the person responsible for conducting the remediation may develop an alternative remediation standard. Proposed new N.J.A.C. 7:26D-7.1, Purpose, sets forth the purpose of the subchapter. Proposed new N.J.A.C.

7:26D-7.2, Applicability, states that an alternative numeric soil remediation standard may be used only at the site for which it is approved and is not applicable at any other site.

Proposed new N.J.A.C. 7:26D-7.3, Basis for an alternative soil remediation standard, describes the circumstances under which alternative soil remediation standards may be established as mandated by the Brownfield Act and described above.

Proposed new N.J.A.C. 7:26D-7.3(a) describes the procedures a person responsible for conducting the remediation must follow when applying for an alternative soil remediation standard for each listed exposure pathway.

Proposed new N.J.A.C. 7:26D-7.3(b) describes some of the bases for a request for an alternative soil remediation standard.

Proposed new N.J.A.C. 7:26D-7.3(c) establishes the circumstances under which the Department may require the person responsible for conducting the remediation to develop an alternative soil remediation standard that is more stringent than the minimum standards provided in this chapter when the Department determines that a more stringent standard is necessary to protect human health. The Brownfield Act enables the Department to require the more stringent standard based upon the number or magnitude of the discharges being investigated, the nature of the substance(s) discharged, the distance to and sensitivity of exposed populations and any other site-specific conditions the Department identifies which necessitate the need for an alternative numeric soil remediation standard.

Proposed new N.J.A.C. 7:26D-7.4, Alternative soil remediation standards application and approval process, contains the procedural requirements concerning the application for and Department approval of a request for an alternative soil remediation standard.

Proposed new N.J.A.C. 7:26D-7.4(a) requires the person responsible for conducting the remediation who is seeking Department approval of an alternative soil remediation standard to

complete an application, which is to be codified at proposed new Appendix 8, and submit it to the Department.

Proposed new N.J.A.C. 7:26D-7.4(b) requires the person responsible for conducting the remediation to submit the application for the alternative soil remediation standard as part of an oversight document as described in the Department Oversight of the Remediation of Contaminated Sites Rule, N.J.A.C. 7:26C. An oversight document is an agreement between the Department and the person responsible for conducting the remediation, wherein the Department agrees to review a submittal, such as an application for an alternative soil remediation standard, and the person agrees to pay the Department's costs to review the submittal. The Department is requiring that applications for an alternative soil remediation standard are submitted under an oversight document to ensure that it receives payment for the cost to review the application.

Proposed new N.J.A.C. 7:26D-7.4(c) states that the person responsible for conducting the remediation shall submit the application for the alternative remediation standard to the Department.

Proposed new N.J.A.C. 7:26D-7.4(d) describes the process for the Department's review and approval or denial of the alternative soil remediation standard application. The process includes the provision that the person responsible for conducting the remediation may not remediate soil to an alternative numeric standard at a site until the Department approves the alternative numeric standard in writing. This provision ensures that an alternative numeric remediation standard will not be used at a site until the Department determines that the standard is protective of human health.

Appendix 8 contains the application that the person responsible for conducting the remediation of a contaminated site shall use to apply for an alternative soil remediation standard. The application requires submittal of information that the Department uses in the determination of whether the proposed alternative soil remediation standard is protective of human health. The required information includes the name and the chemical abstract services registry number of the contaminant for which alternative numeric remediation standard is being sought; the exposure

pathway for which the alternative numeric remediation standard is being sought; and the proposed numeric alternative numeric remediation standard. The person responsible for conducting the remediation must submit documentation to support the proposed alternative soil remediation standard. Documentation may include, but is not limited to, new chemical toxicity data, new risk assessment methodology or models, alternative land use planned for the site, or site specific conditions that support the modification of input parameters for models used to develop remediation standards pursuant to Appendices 5 through 7.

Technical Rules

In addition to the new rules proposed at N.J.A.C. 7:26D, the Department is proposing to amend the Technical Rules at N.J.A.C. 7:26E-1.3, Applicability, to add a new subsection (d) that requires the person responsible for conducting the remediation of a contaminated site to remediate the site in full compliance with the Remediation Standards in N.J.A.C. 7:26D. The exception to this requirement is proposed at N.J.A.C. 7:26D-1.3(d)2. A person may conduct the remediation of the site pursuant to the Department's cleanup criteria in effect prior to the effective date of N.J.A.C. 7:26D if the person submitted a remedial action workplan to the Department prior to the effective date plus six months, and the submitted remedial action workplan is prepared pursuant to N.J.A.C. 7:26E-6. In this case, the person may apply the numeric cleanup criteria that were applicable prior to the effective date unless the promulgated remediation standard in N.J.A.C. 7:26D is lower, by an order of magnitude or more, than the cleanup criteria applicable prior to the effective date of N.J.A.C. 7:26D plus six months.

The Department is proposing to repeal N.J.A.C. 7:26E-1.13, Minimum ground water and surface water remediation standards and relocate those requirements with amendments as described above, at N.J.A.C. 7:26D-2 and 3, so that the Department's remediation standards are codified in one chapter.

Social Impact

The remediation of contaminated sites and the resulting protection of human health and the environment has wide ranging social benefits. The proposed new rules are the Department's

standards for remediating contamination at sites throughout the State. These rules provide predictable, consistent and flexible remediation goals to responsible parties, volunteers and developers, and to the Department for the investigation and remediation of contaminated sites. These rules ensure that the remediation of contaminated sites is protective of human health. With the adoption of the soil remediation standards, the Department will improve the process of remediating sites by making remediation requirements as complete, clear and flexible as possible.

Those affected by these rules include anyone who discharged hazardous substances and is responsible for the remediation of the discharge, whether they are doing so under the Department's oversight or they are conducting a self-directed remediation, or any person conducting remediation of a contaminated site.

The only social impact that the recolocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have is to provide a centralized location for all of the remediation standards, thereby making these standards more accessible and easier to understand.

Economic Impact

The proposed remediation standards will have an economic impact primarily on persons responsible for conducting remediation of contaminated sites. The level of impact will vary depending upon the type and complexity of contamination that a person is remediating.

The proposed new soil remediation standards will provide the regulated community with the means to calculate new standards as science changes over time. Currently, the Department uses guidance in the form of the soil cleanup criteria to determine the soil remediation standard at a site, on a case-by-case basis. The promulgation of soil remediation standards will provide the regulated community with uniform standards to which any site must be remediated in order to be protective of human health. These proposed rules will continue to encourage parties to come forward and remediate sites voluntarily using private funds, but the fact that the standards

are uniform (as opposed to being calculated on a site-by-site basis) should help persons responsible for remediation more accurately anticipate and plan for their costs associated with remediation projects. This will have a positive economic impact on the State as a whole.

It is difficult to assign a specific dollar value to the economic impact of the proposed new soil remediation standards due to the variety in the complexity of contaminated sites throughout the state, including such factors as historical use of the site and the selected remedy. The Department estimates that the cost of a simple site investigation may range from $1,000 to $18,000 as a result of the new standard depending on the number of areas of concern at the site and the nature of the contamination. At a more complex site (one at which there are twenty or more areas of concern) the cost of a site investigation may range from $20,000 to $3,500,000. The costs for a remedial investigation range from $17,000 to $40,000 at a site with one to three areas of concern to $170,000 to $500,000 at more complex sites. However, as a general rule, when the Department adopts a standard that is more stringent than an existing soil cleanup criterion, it may cost the person responsible for conducting the remediation more to investigate and remediate a contaminated site. Conversely, if the Department adopts a standard that is less stringent than an existing soil cleanup criterion, it will likely cost less to complete delineation and remediation.

A comparison of the proposed residential direct contact soil remediation standards to the residential soil cleanup criteria shows that Department is proposing less stringent standards for 44 contaminants, more stringent standards for 51 contaminants and proposes standards for eight contaminants at the same level as the corresponding cleanup criteria. A comparison of the proposed non-residential direct contact soil remediation standards to the non-residential soil cleanup criteria shows that Department is proposing less stringent standards for 45 contaminants. more stringent standards for 55 contaminants and proposes a standard for one contaminant at the same level as the corresponding cleanup criterion.

An example of a more stringent proposed standard is benzo(a)pyrene. Benzo(a)pyrene is a polycyclic aromatic hydrocarbon (PAH) that is very commonly found in the environment since it is formed as a result of incomplete combustion of organic materials. Currently, the residential

soil cleanup criterion for benzo(a)pyrene is 0.66 mg/kg. The proposed residential soil remediation standard is 0.2 mg/kg. Although the proposed standard is more stringent than the soil cleanup criteria for this contaminant, it is unlikely that the cost to remediate to the more stringent standard will be greater because the difference between the new standard and the current criterion is quite small. However, because the standard is more stringent it is likely that the standard will be exceeded more often, and therefore remediation will be required at more sites.

Another example of a more stringent proposed standard is 4-chloroaniline. This chemical is used as an intermediate in the production of number of products, including agricultural chemicals, azo dyes and pigments. Currently, the residential soil cleanup criterion for 4-chloroaniline is 230 mg/kg. The proposed residential soil remediation standard is nine mg/kg. The proposed standard is significantly more stringent and it is possible that the cost to remediate a contaminated site to the more stringent standard would be considerably greater because of additional delineation and remedial action costs. However, the Department anticipates that the overall impact of the change to the more stringent standard will be small because 4-chloroaniline is not frequently detected at contaminated sites in the State.

In addition, the economic impact of the proposed soil remediation standards will vary depending on whether the person responsible for conducting the remediation elects to apply for an alternative numeric remediation standard pursuant to proposed N.J.A.C. 7:26D-7.

Alternative Numeric Soil Remediation Standards

The costs associated with the development of an alternative soil remediation standard (ARS) generally involve the collection of additional site specific data, the calculation of a standard through the use of formulas or more complex computer modeling, the preparation of reports and the payment of the Department's oversight costs associated with the review of the reports. The Department anticipates that the cost of obtaining an ARS will vary widely depending on the level of complexity of the ARS option. An example of a simple ARS option (such as Option I in Appendix 7) would be the development of an ARS based on site specific soil

pH, which could cost as little as $100.00. The cost of measuring soil pH as part of the collection of samples and the chemical analysis is minimal and would cost only a few dollars per sample. A site specific distribution coefficient is developed using the site specific pH to generate an ARS using the soil-water partitioning equation. The Department plans to provide on its web site, free of charge, a spread sheet that will enable parties to calculate an ARS in this manner.

Option IV in Appendix 7, Development of an ARS using Vadose Zone and Ground Water Modeling (SESOIL/AT123D), is a more complex and intensive approach to develop a site specific ARS for the impact to ground water pathway, which could cost from $2,000 to $5,000 to complete. However, much of the information required to complete this ARS option is already required by existing Technical Rule provisions, such as the requirements to determine ground water flow velocity and direction, and the complete vertical and horizontal delineation of ground water contamination. These requirements can be costly and time consuming but should not require additional expenditures since they are existing provisions that form some of the most basic remediation requirements. The person responsible for conducting the remediation will need to collect and use additional site specific parameters such as soil texture and soil organic carbon content. Additional costs per sample could range from $25.00 to $100.00 per sample for these additional analyses. The site specific measurements are entered into the SESOIL model to generate the site specific source input data for the AT123D model. In addition to owning a copy of the software, a person trained to run the SESOIL and AT123D models is needed. Additional costs will be incurred in the preparation of a report for submittal to the Department. However, the Department anticipates that the cost of developing an alternative numeric remediation standard could be minimal compared to the cost of a remediation conducted to a lower alternative numeric remediation standard.

Impact to ground water leachate criteria

The Department is proposing new standards for certain contaminants for the impact to ground water pathway. The standards for low mobility and inorganic contaminants will be based on leachate criteria. The person conducting the remediation will be required to use additional testing procedures to determine compliance with impact to ground water standards provided in Appendix 1, Tables 2B and 2C. In addition to directly analyzing the concentration of a

contaminant in soil to determine compliance with the direct contact standards, the synthetic precipitation leaching procedure (SPLP) is conducted on an additional soil sample. The resulting leachate is then analyzed for low mobility and inorganic contaminants of concern at the site. The concentration measured in the leachate is then compared with the leachate standards provided in Tables 2B and 2C.

The cost of a SPLP test is approximately $100.00, and the analysis for the contaminants of concern will vary from $60.00 to $500.00 per sample, based on the number and types of contaminants present. The Department believes that the additional cost associated with the leaching step and the additional analysis is warranted. The Department is proposing this new approach to determine the impact to ground water from certain contaminates in soil because it is the quickest and most accurate way to ensure the protection of ground water from contaminated sites. This approach provides a direct measure of the ability for a contaminant to leach from soil to the ground water.

The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no economic impact as these are not new remediation standards.

Environmental Impact

The proposed rules will have a positive environmental impact by providing the regulated community with predictable and consistent minimum standards for the remediation of contaminated sites. The latest toxicological information and methodologies are used to develop the proposed remediation standards. The resulting standards meet the human health criteria set by the Legislature at one-in-one-million additional cancer risk for carcinogens and a hazard quotient of 1 for non-carcinogens.

The proposed standards are designed to be protective of human health. Consistent with EPA, the Department is proposing to include consideration of dermal exposure as part of the ingestion exposure pathway. The Department makes the assumption that people can be exposed

to contamination through the ingestion of contaminated soil and through the absorption of contamination through the skin during any hand to mouth activity. In addition, remediation standards are protective of people who may be exposed through the inhalation of contamination. As such, the remediation standards provide protection of human health via direct contact exposure to contaminants in soil.

The impact to ground water standards are derived from updated contaminant fate and transport modeling and will be protective of Class II ground water. The standards proposed for the impact to ground water pathway are improved over the draft soil cleanup criteria that are currently being used.

The Department is proposing several different methods that may be used for the development of site specific alternative soil remediation standards. These methods will allow for the development of standards that are designed to be protective of human health and safety, and ground water when applied at a specific site. Standards developed using site specific conditions and input parameters will protect ground water at that particular site. With the ability to develop alternative remediation standards, the Department has provided a person conducting remediation with needed flexibility and clear remediation goals for the impact to ground water pathway.

The remediation standards being proposed will have a positive environmental benefit. Applying these standards to the remediation of contaminated sites will ensure that New Jersey's soils and extensive ground water resources are protected from further contamination. Protection of these resources is important to ensure high quality ground water for commercial, domestic, industrial and environmental uses.

The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no environmental impact as these are not new remediation standards.

Federal Standards Analysis

Executive Order No. 27 (1994) and N.J.S.A. 52:14B-1 et seq. require State agencies which adopt, readopt or amend State regulations that exceed any Federal standards, or requirements to include a Federal Standards Analysis in the rulemaking document.

The Remediation Standards, N.J.A.C. 7:26D, are proposed under the authority of the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq., the Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq., and the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq. These State statutes all refer to or incorporate Federal law, Federal standards or Federal requirements. Thus, in accordance with N.J.S.A. 52:14B-22 through 24 and Executive Order No. 27, the Department compared the proposed rules to the Federal rules and associated guidance documents issued pursuant to the following Federal laws: the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA) 42 U.S.C.§§ 9601 et seq., the Resource Conservation and Recovery Act (RCRA) of 1980; 42 U.S.C. § 6901, 42 U.S.C. §§ 6991 et seq. and the Federal Safe Drinking Water regulations 40 U.S.C. § 141, 142 and 143.

The soil remediation standards are not promulgated under the authority of, or in order to implement, comply with, or participate in any program established under Federal law. However, the Department compared the proposed soil remediation standards with the contaminants on EPA's list of Soil Screening Levels (SSL) (Draft Final, March 2001). The USEPA has not promulgated soil standards but has developed Soil Screening Levels under the CERCLA program, which are provided as guidance. The list of contaminants for which the Department is proposing to adopt remediation standards and the Federal list of generic SSLs are not the same. The Department is proposing remediation standards for 136 contaminants as compared with the SSL list which contains 108 contaminants. The Department included additional contaminants on the list because these contaminants are found at sites in New Jersey and thus require remediation standards. Similarly, USEPA has SSLs for contaminants for which the Department is not proposing remediation standards at this time.

Ingestion-Dermal Exposure Pathway

For the residential ingestion-dermal pathway, the Department compared the residential soil remediation standards (Appendix 1, Table 1A) with the EPA's SSLs for the residential exposure scenario. For the non-residential ingestion-dermal pathway, the Department compared the non-residential soil remediation standards (Appendix 1, Table 1B) with the EPA's SSLs for the commercial/industrial scenario, for the outdoor worker receptor. The Department determined that the majority of the proposed residential and non-residential soil remediation standards are the same or are less stringent than the USEPA soil screening levels. The Department is proposing remediation standards for 19 contaminants that are more stringent than EPA's soil screening levels for the ingestion dermal exposure pathway. These contaminants are as follows:

Benzene	1,1-Dichloroethane	Thallium
Beryllium	1,2-Dichloroethane	Toluene
Butyl benzyl phthalate	1,1-Dichloroethene	1,2,4-Trichlorobenzene
Chlordane	1,2-Dichloroethene	2,4,6-Trichlorophenol
Chlorobenzene	Methylene chloride	Vanadium
1,2-Dichlorobenzene	2-Methylphenol	Xylenes

There are two primary reasons that the Department's proposed remediation standards could be more stringent then EPA's SSLs. First, the Department determined by policy to prioritize the toxicity information which forms the basis for drinking water standards adopted by the Department pursuant to the Safe Drinking Water Act (SDWA) which is in some cases different than the toxicity information used to develop the SSLs. Second, some of the proposed standards are more stringent due to the implementation of the Department's Group C carcinogen policy. The use of SDWA toxicity data and the Department's Group C carcinogen policy are discussed in further detail above.

For example, the proposed ingestion-dermal remediation standard for beryllium for the residential exposure scenario is 16 mg/kg as compared with the USEPA SSL of 160 mg/kg. The Department's proposed non-residential standard for beryllium is 230 mg/kg as compared to EPA's SSL of 2,300 mg/kg. The more stringent proposed standard is the result of the application of the Department's Group C carcinogen policy. Because beryllium is a Group C carcinogen, the Department applied a safety factor of 10 which results in a remediation standard that is an order of magnitude more stringent than the USEPA SSL.

The Department's proposed residential ingestion-dermal soil remediation standard for benzene of three mg/kg for the ingestion-dermal exposure pathway, as compared to EPA's SSL for benzene which is 12 mg/kg. The Department's proposed non-residential standard for benzene is 14 mg/kg as compared to EPA's SSL of 58 mg/kg. The Department's standard for benzene is more stringent than EPA's SSL because the toxicity factor used to develop the remediation standard is based on the toxicity factor that the Department uses to develop drinking water maximum contaminant levels (MCL), which is more stringent than the slope factor provided by IRIS which USEPA used. The cost-benefit analysis provided at the end of the Federal Standards Analysis discusses the costs and benefits for the soil remediation standards in general, including the Ingestion-Dermal Exposure and the Inhalation Exposure Pathways and the Impact to Ground Water Pathway.

Inhalation Exposure Pathway

For the residential exposure scenario, the Department compared the residential inhalation soil remediation standards (Table 1A) to EPA's SSLs for the residential scenario. For the non-residential exposure scenario, the Department compared the non-residential inhalation soil remediation standards for sites that are less than two acres in size (Table 1B) to EPA's SSLs for the commercial/industrial scenario for the outdoor worker receptor. The Department determined that is was appropriate to use the standards developed for sites that are less than two acres in size for comparison because these standards are based solely on wind generation of dust as are the EPA's inhalation exposure pathway SSLs.

EPA's list of SSLs and the Department's list of proposed remediation standards are not identical. EPA's list contains contaminants that Department's list does not and the Department's list contains contaminants that EPA's list does not.

For 50 contaminants, the Department is proposing residential inhalation standards that are more stringent than EPA's SSLs. Of the 50, the Department is proposing standards for 44 contaminants for which EPA has no standards. Six of the Department's proposed standards are more stringent than EPA's SSLs.

Contaminant	DEP Residential Inhalation Health Based Criterion	EPA Residential Inhalation SSLs
Acetophenone	2	NA
Acrolein	0.5	NA
Acrylonitrile	0.9	NA
Anthracene	380,000	NA
Antimony	36,000	NA
Benzidine	0.004	NA
Benzo(a)anthracene	38,000	NA
Benzo(a)pyrene	3,800	NA
Benzo(b)fluoranthene	38,000	NA
Benzo(ghi)perylene	380,000	NA
Benzo(k)fluoranthene	38,000	NA
Bis(2-chloroisopropyl)ether	23	NA
Bromodichloromethane	1	NA
Bromomethane	25	NA
Cadmium	1,000	1,800
Carbazole	740,000	NA
4-Chloroaniline	26	NA
Chloroform	0.6	NA
Chloromethane	4	NA
2-Chlorophenol	910	NA
Chrysene	380,000	NA
Cobalt	9,100	NA
4,4'-DDD	61,000	NA
4,4'-DDE	670	NA
4,4'-DDT	44,000	NA
Dibenz(a,h)anthracene	3,500	NA
Dibromochloromethane	3	NA
1,2-Dibromo-3-chloropropane	0.08	NA
1,2-Dibromoethane	0.1	NA
1,4-Dichlorobenzene	5	NA
3,3'-Dichlorobenzidine	3	NA
Dichlorodifluoromethane	490	NA
1,1-Dichloroethane	8	1,200
1,2-Dichloroethene	230	NA
1,2-Dichloroethene	300	NA
1,2-Dichloropropane	2	15
4,6-Dinitro-2-methylphenol	730,000	NA
2,4-Dinitrotoluene	6	NA
2,6-Dinitrotoluene	2	NA
1,2-Diphenylhydrazine	5	NA
Methyl tert-butyl ether	110	NA
Naphthalene	6	170

2-Nitroaniline	39	NA
N-Nitrosodimethylamine	0.02	NA
N-Nitrosodi-n-propylamine	0.2	NA
Polychlorinated biphenyls	20	NA
Styrene	90	1,500
Tertiary butyl alcohol	4,800	NA
Thallium	360,000	NA
Toxaphene	70	87

NA = No Standard Developed

For 74 contaminants, the Department is proposing non-residential inhalation standards that are more stringent than EPA's SSLs. Of the 74, the Department is proposing standards for 65 contaminants for which EPA has no standards. Nine of the Department's proposed standards are more stringent than EPA's SSLs.

Contaminant	DEP Inhalation Health Based Criterion	EPA Inhalation SSLs
Acenaphthene	300,000	NA
Acenaphthylene	300,000	NA
Acetophenone	4	NA
Acrolein	1	NA
Acrylonitrile	2	NA
Anthracene	30,000	NA
Antimony	23,000	NA
Arsenic	76	1,400
Barium	59,000	1,000,000
Benzidine	0.01	NA
Benzo(a)anthracene	3,000	NA
Benzo(a)pyrene	300	NA
Benzo(b)fluoranthene	3,000	NA
Benzo(ghi)perylene	30,000	NA
Benzo(k)fluoranthene	3,000	NA
Beryllium	140	2,600
Bis(2-chloroisopropyl)ether	60	NA
Bis(2-ethylhexyl) phthalate	140,000	NA
Bromodichloromethane	3	NA
Bromomethane	53	NA
Cadmium	78	3,400
Carbazole	58,000	NA

Contaminant	DEP Inhalation Health Based Criterion	EPA Inhalation SSLs
Chlordane	3,300	NA
4-Chloroaniline	66	NA
Chloroform	2	NA
Chloromethane	11	NA
2-Chlorophenol	2,000	NA
Chrysene	30,000	NA
Cobalt	590	NA
Copper	280,000	NA
4,4'-DDD	4,800	NA
4,4'-DDE	3,400	NA
4,4'-DDT	3,400	NA
Dibenz(a,h)anthracene	270	NA
Dibromochloromethane	7	NA
1,2-Dibromo-3-chloropropane	0.2	NA
1,2-Dibromoethane	0.3	NA
1,4-Dichlorobenzene (p-Dichlorobenzene)	12	NA
3,3'-Dichlorobenzidine	960	NA
1,1-Dichloroethane	21	1,700
1,2-Dichloroethane	2	NA
1,1-Dichloroethene	130	410
1,2-Dichloroethene	500	NA
1,2-Dichloroethene	650	NA
1,2-Dichloropropane	5	21
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	47,000	NA
2,4-Dinitrophenol	820,000	NA
2,4-Dinitrotoluene	15	NA
2,6-Dinitrotoluene	6	NA
1,2-Diphenylhydrazine	12	NA
Endrin	120,000	NA
Fluoranthene	300,000	NA
Fluorene	300,000	NA
beta-HCH (beta-BHC)	620	NA
Indeno(1,2,3-cd)pyrene	3,000	NA

Contaminant	DEP Inhalation Health Based Criterion	EPA Inhalation SSLs
Lead	12,000	NA
Lindane	9	NA
Manganese	5,900	NA
2-Methylnaphthalene	250,000	NA
Methyl tert-butyl ether	290	NA
Naphthalene	16	240
2-Nitroaniline	83	NA
N-Nitrosodimethylamine	0.04	NA
N-Nitrosodi-n-propylamine	130,000	NA
N-Nitrosodiphenylamine	1,500	NA
Pentachlorophenol	300,000	NA
Phenanthrene	300,000	NA
Polychlorinated biphenyls	52	NA
Pyrene	300,000	NA
Styrene	230	1,500
Tertiary butyl alcohol	10,000	NA
Thallium	23,000	NA
Vanadium	470,000	NA
Zinc	110,000	NA

NA = No standard developed

The differences between the Department's proposed standards and USEPA SSLs are due, in part, to the use of sandy loam soil as the default soil type appropriate for New Jersey as compared with EPA's use of loam soil. The selection of sandy loam results in different soil input parameters including the values for soil texture, organic soil content and soil porosity. The Department also used local weather conditions in the calculations used to develop inhalation standards as opposed to weather conditions measured in the mid-west that were used by EPA.

The toxicity hierarchy used by the Department for the inhalation pathway is similar to the one used for the other exposure pathways except that the Department did have a preference for inhalation-based toxicity data as opposed to oral-based data. In several cases the Department

chose to use a different toxicity source than EPA. Some of the proposed standards are more stringent due to the implementation of the Department's Group C carcinogen policy. The Department's Group C carcinogen policy is discussed in further detail above.

By way of example, the proposed residential inhalation standard for heptachlor epoxide is four mg/kg as compared with EPA's SSL of five mg/kg. The difference in the standard is due to the different soil parameters and weather conditions. The differences between the proposed residential standard for naphthalene is six mg/kg as compared with EPA's SSL of 170 mg/kg is due to both different soil parameters and the Department's Group C carcinogen policy.

Two of the Department's proposed standards, for 1,1-dichloropropane and styrene, are more stringent because the Department determined, based on a review of pertinent toxicological studies, that it is appropriate to consider these contaminants as carcinogens as compared with EPA's decision to use non-carcinogenic end points.

Impact to Ground Water

The Department compared the impact to ground water soil remediation standards provided in Table 2A for mobile contaminants to the USEPA SSLs developed with a dilution attenuation factor (DAF) of 20. No analysis was conducted for the less mobile and inorganic contaminants provided in Tables 2B and 2C because these standards are applicable for leachate resulting from the SPLP test and thus are not comparable to the USEPA soil numbers.

EPA has standards for 56 of those contaminants. Of the 56 the Department is proposing more stringent standards for 53 contaminants. Of the remaining three contaminants the standard for N-Nitrosodi-n-propylamine is the same and Pentachlorophenol and 1,1,2,-Tetrachloroethane are slightly less stringent. For the remaining 22 contaminants, the Department is proposing standards for which EPA has no standard; thus, for these contaminants, the Department is more stringent. The table below lists the contaminants for which the Department is more stringent than EPA.

Contaminant	DEP Impact to Ground Water Soil Criterion	EPA Migration to Ground Water SSLs DAF = 20
Acenaphthene	74	570
Acetone	12	16
Acetophenone	2	NA
Acrolein	0.008	NA
Acrylonitrile	0.0001	NA
Atrazine	0.03	NA
Benzene	0.0008	2
Benzidine	0.0000006	NA
1,1'-Biphenyl	90	NA
Bis(2-chloroethyl)ether	0.00007	0.0004
Bis(2-chloroisopropyl)ether	3	NA
Bromodichloromethane	0.002	0.6
Bromoform	0.02	0.8
Bromomethane	0.03	0.2
2-Butanone	0.6	NA
Carbon disulfide	4	32
Carbon tetrachloride	0.003	0.07
4-Chloroaniline	0.1	0.7
Chlorobenzene	0.4	1
Chloroform	0.2	0.6
2-Chlorophenol	0.5	4
Dibromochloromethane	0.001	0.4
1,2-Dibromo-3-chloropropane	0.00008	NA
1,2-Dibromoethane	0.000001	NA
1,2-Dichlorobenzene	11	17
1,3-Dichlorobenzene	12	NA
1,4-Dichlorobenzene	1	2
3,3'-Dichlorobenzidine	0.002	0.007
Dichlorodifluoromethane	25	NA
1,1-Dichloroethane	0.2	23
1,2-Dichloroethane	0.0008	0.02
1,1-Dichloroethene	0.005	0.06
1,2-Dichloroethene	0.2	0.4
1,2-Dichloroethene	0.4	0.7
2,4-Dichlorophenol	0.1	1
1,2-Dichloropropane	0.002	0.03
1,3-Dichloropropene	0.002	0.004
Diethyl phthalate	57	470
2,4-Dimethyl phenol	0.7	9
2,4-Dinitrophenol	0.02	0.2
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	0.0002	0.0007
1,2-Diphenylhydrazine	0.0008	NA
Endosulfan I and Endosulfan II	2	18

Contaminant	DEP Impact to Ground Water Soil Criterion	EPA Migration to Ground Water SSLs DAF = 20
Endosulfan sulfate	1	NA
Endrin	0.6	1
Ethyl benzene	8	13
Fluorene	110	560
alpha-HCH	0.0002	0.0005
beta-HCH	0.0007	0.003
Hexachloroethane	0.1	0.5
Isophorone	0.1	0.5
Lindane	0.0009	0.009
Methyl acetate	14	NA
2-Methylnaphthalene	5	NA
Methylene chloride	0.007	0.02
2-Methylnaphthalene	5	NA
Methyl tert-butyl ether	0.2	NA
Naphthalene	16	84
Nitrobenzene	0.01	0.1
N-Nitrosodimethylamine	0.000001	NA
N-Nitrosodiphenylamine	0.2	1
Pentachlorophenol	0.04	0.03
Phenol	5	100
Styrene	2	4
Tertiary butyl alcohol	0.2	NA
Tetrachloroethene	0.003	0.06
Toluene	4	12
1,2,4-Trichlorobenzene	0.4	5
1,1,1-Trichloroethane	0.2	2
1,1,2-Trichloroethane	0.01	0.02
Trichloroethene	0.007	0.06
Trichlorofluoromethane	22	NA
2,4,5-Trichlorophenol	44	270
2,4,6-Trichlorophenol	0.03	NA
Vinyl chloride	0.0003	0.01
Xylenes	12	200

NA = Standard not developed

Generally, there are three basic reasons that the Department's remediation standards for the impact to ground water pathway could be more stringent than EPA's SSLs.

To develop impact to ground water standards the Department used a dilution attenuation factor (DAF) of 13 which is appropriate because it is based on New Jersey soils and

environmental conditions. USEPA generated SSLs based on DAFs of 1 and of 20 for silty and sandy soils respectively. The Department appropriately based the impact to ground water standards on the New Jersey Ground Water Quality Criteria (GWQC). The GWQC are in turn affected by the Department's A-280 and Group C carcinogen toxicity policies that are discussed in more detail above. USEPA based their impact to ground water SSLs on federal drinking water maximum contaminant levels (MCLs). The Federal MCLs take into consideration factors such as analytical PQLs and treatability. Third, the Department used values for soil parameters such as pH and soil texture that are appropriate for New Jersey but are different than the soil parameters used by EPA.

As an example, the Department is proposing an impact to ground water soil remediation standard of 11 mg/kg for 1,2-Dichlorobenzene as compared to EPA's impact to ground water SSL which is 17 mg/kg. The standard proposed by the Department is more stringent due to the application of a DAF of 13 that is appropriate for New Jersey soil and ground water conditions.

Another example is that the Department is proposing an impact to ground water soil remediation standard of 16 mg/kg for naphthalene as compared to EPA's impact to ground water SSL which is 84 mg/kg. The standard for naphthalene is back calculated from the New Jersey Ground Water Quality Criteria that is set at 0.3 mg/l as compared with EPA's target ground water concentration of one mg/l. The standard for naphthalene is also affected by the application of a DAF of 13 that is appropriate for New Jersey ground water conditions.

More stringent remediation standards may increase the cost of remediation to the regulated community. It is difficult to assign a specific dollar value to the economic impact of the proposed rules due to the variability in the complexity of contaminated sites throughout the state, including such factors as historical use of the site and the selected remedy. The Department believes that additional costs associated with the more stringent standards is necessary to satisfy the statutory requirement that the Department develop remediation standards that are protective of human health. The more stringent standards have resulted from the application of current scientific information and models which are appropriate for New Jersey soils, weather conditions, and ground water quality.

Ground Water Remediation Standards

The Department is proposing to relocate N.J.A.C. 7:26E-1.13(b) from the Technical Requirements for Site Remediation to N.J.A.C. 7:26D-2. The ground water remediation standards are linked directly to New Jersey's Ground Water Quality Standards (GWQS). The GWQS provide the basis for protection of ambient ground water quality in New Jersey by establishing constituent standards for ground water pollutants. These constituent standards are applicable to the development of effluent limitations and discharge requirements pursuant to the New Jersey Pollutant Discharge Elimination System (NJPDES), N.J.A.C. 7:14A; to develop minimum ground water remediation standards pursuant to the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq.; and other requirements and regulatory actions applicable to discharges that cause or may cause pollutants to enter the ground waters of the State. The authority for setting these standards comes solely from New Jersey law and has no Federal counterpart. The GWQS are not promulgated under the authority of, or in order to implement, comply with, or participate in any program established under Federal law or under a State statute that incorporates or refers to Federal law, Federal standards or Federal requirements. The GWQS do not contain any standards or requirements that exceed those required by Federal law. The GWQS provides the associated ground water standards that are relevant to the New Jersey Underground Injection Control program, RCRA D, and RCRA C ground water monitoring programs at 40 CFR 144-146, 258, and 264. These Federal programs are implemented through the NJPDES program.

Surface Water Remediation Standards

The Department is proposing to recodify N.J.A.C. 7:26E-1.13(e) from the Technical Requirements for Site Remediation to N.J.A.C. 7:26D-3. The surface water remediation standards are linked directly to New Jersey's Surface Water Quality Standards (SWQS). Subchapter 3 references the State criteria and establishes the minimum surface water remediation standards for New Jersey. The Department reviewed the Federal regulation and guidance concerning surface water and provides the following analysis.

The Federal Interim Final Rule, 60 CFR 22229 (May 4, 1995) and the National Toxics rule, 60 CFR 44120 (August 24, 1995) are collectively known as the National Toxics Rule (NTR). The Department adopted numerical criteria for toxics identified in the NTR applicable to New Jersey as the toxics criteria for New Jersey. See 37 N.J.R. 3487(a) (September 18, 2005) for the proposal, and 38 N.J.R. 4449(a) (October 16, 2006) for the adoption. Therefore, no further analysis under Executive Order 27 No. or (1994) N.J.S.A. 52:14B-1 et seq. is required.

The Department's analysis comparing State and Federal standards concluded that while there are differences in numeric criteria, the use of more stringent criteria will not result in significantly increased cost to the regulated community. The benefit of including these more stringent State standards in these rules is to ensure the consistent application of the standards and to further the Department's goal of clean and plentiful water. For a more detailed discussion of this issue see at 30 N.J.R. 1778 (May 18, 1998) and 32 N.J.R. 4397 (December 18, 2000).

Jobs Impact

The Department anticipates that the promulgation of these rules will increase the number of jobs for people who are skilled in engineering, laboratory analysis and environmental technology. Additional jobs in the technical consulting field may be generated when the person responsible for conducting the remediation chooses to develop a site specific alternative remediation standard. Technical personnel will be needed to conduct the work to support the development of alternative remediation standards. While the Department believes that there will be an increase in the number of jobs as the result of these rules, an accurate number of jobs cannot be determined because it is difficult to quantify the number of sites that will pursue remediation where the development of site specific alternative remediation standards will be necessary.

In addition, the proposed new rules will continue to encourage the remediation of abandoned and underutilized properties known as Brownfield sites. The remediation of Brownfield sites will potentially result in the use of these sites for viable businesses, thus creating more jobs associated with the staffing of these businesses.

The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no impact on jobs as these are not new remediation standards.

Agricultural Impact

In accordance with N.J.S.A. 4:1C-10.3, the Right to Farm Act, the Department has determined that the proposed remediation standards will impact State agriculture only when a discharge occurs and impacts a farm. A discharge at a farm has the ability to harm human health and the environment. The presence of leaking underground storage tanks and storage areas for pesticides and fertilizers are sources of contamination on some farms. As for all other contaminated sites, the remediation standards for discharges at farms will ensure that any remedial action conducted on agricultural land is protective of human health. The rules provide the State's minimum standards for the remediation of all sites without regard to the origin of the discharge or the use of the site.

The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no agricultural impact as these are not new remediation standards.

Regulatory Flexibility Analysis

In accordance with the Regulatory Flexibility Act, N.J.S.A. 52:14B-16 et seq., the Department has determined that the proposed new rules to establish remediation standards for ground water, surface water and soil are not anticipated to have a significant impact on small businesses as defined in the Act. The remediation standards are not implementing rules and, therefore, they do not directly compel any recordkeeping or reporting requirements nor, except as discussed below, do they require the use of professional services for compliance.

N.J.A.C. 7:26D-7, Alternative Soil Remediation Standards, establishes the procedures and compliance requirements if a person responsible for conducting the remediation (including a small business) seeks an alternative soil remediation standard. The rules require the application

for an alternative standard to comply with N.J.S.A. 58:10B-12(f) and N.J.A.C. 7:26D-7 and to include certain information as part of the application. Should the person responsible for conducting the remediation decide to pursue an optional alternative soil remediation standard, additional professional services would be required to demonstrate that the proposed standard would be protective of human health and the environment. The costs that might be incurred in pursuing an alternative standard would vary widely depending on the specifics of the alternative standard sought and whatever costs would be charged for the professional services employed by the petitioner.

Small businesses will be affected through the administration of the Site Remediation and Waste Management Program to the extent that these businesses are regulated under the Industrial Site Recovery Act, N.J.S.A. 13:1K-6 et seq., the New Jersey Underground Storage of Hazardous Substances Act, N.J.S.A. 58:10A-21 et seq., or the Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq. The Site Remediation and Waste Management Program requires contaminated sites to be remediated to levels that are protective of public health and the environment. However, the extent of remediation of a contaminated site is dependent on the nature and extent of contamination, not the size of the business. In the instances where the ground water quality standard, the surface water standard or the soil remediation standard was increased, compliance and/or remediation costs may decrease. In cases where the standard was reduced, the costs of compliance/remediation may be increased.

Smart Growth

Executive Order No. 4 (2002) requires State agencies that adopt, amend or repeal any rule to describe the impact of the proposed rule on the achievement of smart growth and implementation of the New Jersey State Development and Redevelopment Plan (State Plan). The proposed remediation standards do not involve land use policies or infrastructure development and, therefore, will not have an impact on the achievement of smart growth. The new rules and amendments are intended to ensure the protection of the State's natural resources which is one of the overall goals of the State Plan. Accordingly, the protection and preservation of the soil, surface water and ground water resources is supportive of the goals of the State Plan.

The relocation of the surface water and ground water remediation standards from N.J.A.C. 7:26E-1.13 to N.J.A.C. 7:26D will have no impact on the achievement of smart growth nor the implementation of the State Plan as these are not new remediation standards.

Full text of the rule proposed for repeal may be found in the New Jersey Administrative Code at N.J.A.C. 7:26E-1.13.

Full text of the proposed new rules and amendment follows (additions indicated in boldface thus; deletions indicated in brackets [thus]):

REMEDIATION STANDARDS CHAPTER 26D

SUBCHAPTER 1 GENERAL INFORMATION

7:26D-1.1 Purpose

(a) This chapter implements the provisions of the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1.1 et seq., and other statutes, by establishing minimum standards for the remediation of contaminated ground water, surface water, and soil.

(b) This chapter supplements the requirements in the Technical Requirements for Site Remediation rules, N.J.A.C. 7:26E.

7:26D-1.2 Scope

(a) Unless otherwise provided by rule or statute, this chapter shall constitute the rules of the Department concerning minimum standards for the remediation of ground water, surface water and soil.

(b) Remediating ground water, surface water, or soil to any applicable standard set forth in this chapter shall not relieve any person from:

1. Complying with more stringent requirements or provisions imposed under any other Federal, State, or local applicable statutes or regulations; and

2. Obtaining any and all permits required by Federal, State or local statutes or regulations.

(c) No provision of this chapter shall be construed to limit the Department's authority to require additional remediation based upon site-specific conditions in order to protect human health, safety and the environment.

(d) Nothing in this chapter shall be construed to limit the authority of the Department to establish discharge limits for pollutants, or to prescribe penalties for violations of those limits pursuant to any statutory authority, or to require the complete removal of any illegally discharged hazardous substances, hazardous waste, or pollutants pursuant to law.

(e) The person responsible for conducting the remediation shall not be required to remediate to a level or concentration that is lower than the regional natural background level.

7:26D-1.3 Construction and severability

(a) This chapter shall be liberally construed to permit the Department to effectuate the purposes of the statutes listed in N.J.A.C. 7:26D-1.4(a).

(b) If any subchapter, section, subsection, provision, clause, or portion of this chapter, or the application thereof to any person, is adjudged unconstitutional or invalid by a court of competent jurisdiction, such judgment shall be confined in its operation to the subchapter, section, subsection, provision, clause, portion, or application directly involved in the controversy in which such judgment shall have been rendered and it shall not affect or impair the remainder of this chapter or the application thereof to other persons.

7:26D-1.4 Applicability

(a) This chapter establishes the minimum remediation standards for ground water, surface water and soil for any contaminated site in New Jersey including, without limitation, those sites subject to:

1. The Industrial Site Recovery Act (ISRA), N.J.S.A. 13:1K-6 et seq.;

2. The New Jersey Underground Storage of Hazardous Substances Act (UST), N.J.S.A. 58:10A-21 et seq.;

3. The Spill Compensation and Control Act, N.J.S.A. 58:10-23.11a et seq.;

4. The Solid Waste Management Act, N.J.S.A. 13:E-1 et seq.;

5. The Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.;

6. The Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq.;

7. The Comprehensive Regulated Medical Waste Management Act, N.J.S.A. 13:1E-48.1 et seq.;

8. The Major Hazardous Waste Facilities Siting Act, N.J.S.A. 13:1E-49 et seq;

9. The Sanitary Landfill Facility Closure and Contingency Fund Act, N.J.S.A. 13:1E-100 et seq.; and

10. The Regional Low-Level Radioactive Waste Disposal Facility Siting Act, N.J.S.A. 13:1E-177 et seq.

(b) The requirements of this chapter shall be applied pursuant to N.J.A.C. 7:26E-1.3(c) regardless of whether remediation is conducted with Department oversight pursuant to N.J.A.C. 7:26C.

(c) Notwithstanding any other provision of this chapter, all applicable remediation standards and remedial actions that involve real property located in the Pinelands area shall be consistent with the provisions of the Pinelands Protection Act, N.J.S.A. 13:18A-1 et seq., and any rules

promulgated pursuant thereto, and with Section 502 of the National Parks and Recreation Act of 1978, 16 U.S.C. §4711.

7:26D-1.5 Definitions

The following words and terms, when used in this chapter, shall have the following meanings unless the context clearly indicates otherwise:

"Alternative remediation standard" or "ARS" means a residential use or non-residential use soil remediation standard that is established using site specific factors following the procedures set forth in N.J.A.C. 7:26D-7 Appendices 5 through 7, pursuant to this chapter.

"Carcinogen" means a contaminant capable of inducing a cancer response, including Group A (Human Carcinogen), Group B (Probable Human Carcinogen) and Group C (Possible Human Carcinogen) categorized in accordance with the USEPA Guidelines for Carcinogen Risk Assessment, 51 Fed. Reg. 33932 (1986), as amended and supplemented.

"Contaminated site" means a contaminated site as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Contamination" or "contaminant" means contamination or a contaminant as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Department" means the New Jersey Department of Environmental Protection.

"Discharge" means a discharge as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Effective solubility" means effective solubility as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"EPA" means the United States Environmental Protection Agency.

"Exposure pathways" means the methods by which humans can come into contact with contamination including, but not limited to, the ingestion-dermal exposure pathway, the inhalation exposure pathway, and the impact to ground water pathway.

"Ground water" means ground water as defined pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.6, which includes Class I, Class II and Class III ground water.

"Ground water quality criteria" means any human health-based ground water quality criteria as defined pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.6.

"Impact to ground water pathway" means process by which soil contamination is transported to ground water, which is then ingested by humans.

"Impact to ground water remediation standard" means a vadose zone soil remediation standard established or developed pursuant to this chapter that is designed to limit the amount of contaminant that leaches from the vadose zone to ground water such that the resulting ground water concentration will not exceed the applicable ground water remediation standard.

"Ingestion-dermal exposure pathway" means the process by which humans can come into contact with contamination through the direct ingestion of contamination and the absorption of contamination through the skin.

"Inhalation exposure pathway" means the process by which humans can come into contact with contamination through the inhalation of contamination.

"Leachate criteria" means the human health-based criteria for the impact to ground water pathway that are evaluated from the analysis of the leachate of the less mobile and inorganic contaminants from the synthetic precipitation leaching procedure.

"Method detection limit" or "MDL" means a method detection limit or MDL as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Non-residential use" means an exposure assumption based on exposure of adult outdoor workers to contaminated media during an eight-hour work day, 225 days a year, for 25 years.

"Non-residential direct contact soil remediation standard" means a soil remediation standard for the ingestion-dermal and inhalation exposure pathways established or developed pursuant to this chapter that is designed to protect human health at non-residential use sites.

"Oversight document" means any document defined as an oversight document pursuant to the Department Oversight of the Remediation of Contaminated Sites rules at N.J.A.C. 7:26C-1.3.

"Person responsible for conducting the remediation" means the person responsible for conducting the remediation as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Pollutant" means any substance defined as such pursuant to the Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq.

"Practical quantitation level" or "PQL" means a practical quantitation level or PQL as defined pursuant to Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Regional natural background level" means the concentration of a contaminant consistently present in the environment in the region of the site and which has not been influenced by localized human activities.

"Remediation" or "remediate" means remediation or remediate as defined pursuant to the Technical Requirements for Site Remediation rules at N.J.A.C. 7:26E-1.8.

"Remediation standards" means the combination of numeric standards that establish a level or concentration, and narrative standards, to which contaminants must be treated, removed or otherwise cleaned for soil, ground water or surface water, as established by the Department pursuant to the Brownfield and Contaminated Sites Remediation Act at N.J.S.A. 58:10B-12 and this chapter.

"Residential direct contact soil remediation standard" means a soil remediation standard for the ingestion-dermal and inhalation exposure pathways established or developed pursuant to this chapter that is designed to protect human health at residential use sites, schools (K-12) and childcare centers.

"Residential use" means a land use scenario based on exposure to contaminated media for 24 hours a day, 350 days a year for 30 years by children and adults living on a site.

"Surface water" means "surface water" as defined pursuant to the Surface Water Quality Standards, N.J.A.C. 7:9B.

SUBCHAPTER 2. MINIMUM GROUND WATER REMEDIATION STANDARDS

7:26D-2.1 Purpose

This subchapter establishes the minimum remediation standards for ground water.

7:26D-2.2 Minimum ground water remediation standards

(a) The minimum remediation standards to which ground water shall be remediated are:

1. For Class II ground water, the Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(c) and (d);

2. For Class I-A and Class I-PL, Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(a) and (b);

3. For Class III-A and Class III-B, Ground Water Quality Standards developed pursuant to N.J.A.C. 7:9C-1.7(e) and (f); and

4. For all ground water, regardless of classification, each of the following narrative ground water remediation standards, as applicable:

i. The general ground water quality policies in N.J.A.C. 7:9C-1.2;

ii. The narrative ground water quality criteria in N.J.A.C. 7:9C-1.7;

iii. The ground water quality antidegradation policy in N.J.A.C. 7:9C-1.8;

iv. The remediation requirements in N.J.A.C. 7:26E-1 through 8 in order to both:

(1) Address the adverse impact of the contamination on the ground water itself; and

(2) Limit additional risks posed by the contamination to the human health and safety and to the environment;

v. The free and residual product removal, treatment, or containment requirements of N.J.A.C. 7:26E-6.1(d);

vi. The contaminants have not migrated to the ground surface, structures, or air in concentrations that pose a threat to human health; and

vii. The following factors, as applicable on a site-specific basis, for selecting an appropriate ground water remedial action:

(1) The location of the contaminated site relative to ground water use;

(2) The potential human and environmental exposure to the ground water contamination;

(3) The present, projected, and potential ground water use at the site and in the area surrounding the site over the 25 years after the selection of the ground water remedy;

(4) The ambient ground water quality at the site and in the area surrounding the site resulting from both human activities and natural conditions;

(5) The physical and chemical characteristics of the contaminants of concern; and

(6) The criteria in N.J.A.C. 7:26E-6.3(d)1i, used to determine when natural remediation is appropriate as a remedial action for ground water contamination.

(b) The Department shall not approve an alternative ground water remediation standard that is based on a site-specific risk assessment.

SUBCHAPTER 3. MINIMUM SURFACE WATER REMEDIATION STANDARDS

7:26D-3.1 Purpose

This subchapter establishes the minimum remediation standards for surface water.

7:26D-3.2 Minimum surface water remediation standards

(a) The minimum remediation standards for surface water are:

1. The numeric New Jersey Surface Water Quality Standards, N.J.A.C. 7:9B-1.14(c) and (d); and

2. The following narrative surface water remediation standards:

i. The general surface water quality policies in N.J.A.C. 7:9B-1.5;

ii. The narrative surface water quality criteria in N.J.A.C. 7:9B-1.14;

iii. The remediation requirements in N.J.A.C. 7:26E-1 through 8 in order to both:

(1) Address the adverse impact of the contamination on the surface water itself; and

(2) Limit additional risks posed by the contamination to the public health and safety and to the environment;

iv. The free and residual product removal, treatment, or containment requirements of N.J.A.C. 7:26E-6.1(d); and

v. The following narrative criteria, as applicable on a site-specific basis, for selecting an appropriate surface water remedial action:

(1) The location of the contaminated site relative to surface water use;

(2) The potential human and environmental exposure to the surface water contamination;

(3) The present and projected surface water use at the site and in the area surrounding the site;

(4) The ambient ground water quality at the site and in the area surrounding the site resulting from both human activities and natural conditions; and

(5) The physical and chemical characteristics of the contaminants of concern.

(b) The Department shall not approve an alternative surface water remediation standard that is based on a site-specific risk assessment.

SUBCHAPTER 4 MINIMUM SOIL REMEDIATION STANDARDS

7:26D-4.1 Purpose

(a) This subchapter establishes minimum soil remediation standards, including:

1. Residential direct contact soil remediation standards;
2. Non-residential direct contact soil remediation standards; and
3. Impact to ground water soil remediation standards.

7:26D-4.2 Residential direct contact soil remediation standards

(a) The Department developed the residential direct contact human health-based criteria in chapter Appendix 1, Table 1A, incorporated herein by reference, as follows:

1. The residential human health-based criteria for the ingestion-dermal exposure pathway, based on the equations, data sources, and conventions provided in chapter Appendix 2 incorporated herein by reference; and

2. The residential human health-based criteria for the inhalation exposure pathway, based on the equations, data sources, and conventions provided in chapter Appendix 3, incorporated herein by reference.

(b) The residential direct contact soil remediation standard for each contaminant listed in Appendix Table 1A is the more stringent of either the ingestion-dermal human health-based criterion or the inhalation human health-based criterion, or the PQL if the PQL is less stringent than the corresponding human health-based criterion.

7:26D-4.3 Non-residential direct contact soil remediation standards

(a) The Department developed the non-residential direct contact human health-based criteria in Appendix 1, Table 1B, incorporated herein by reference, as follows:

1. The non-residential human health-based criteria for the ingestion-dermal exposure pathway, based on the equations, data sources, and conventions provided in Appendix 2; and

2. The non-residential human health-based criteria for the inhalation exposure pathway, based on the equations, data sources, and conventions provided in Appendix 3.

(b) The non-residential direct contact soil remediation standard for each contaminant listed in Table 1B is the more stringent of either the ingestion-dermal human health-based criterion or the inhalation human health-based criterion, or the PQL if the PQL is less stringent than the corresponding human health-based criterion.

7:26D-4.4 Impact to ground water soil remediation standards

(a) The Department developed the impact to ground water human health-based criteria for Class IIA ground water in chapter Appendix 1, Tables 2A, 2B and 2C, incorporated herein by reference, as follows:

1. The human health-based soil criteria for the impact to ground water pathway, based on the equations, data sources, and conventions provided in chapter Appendix 4, incorporated herein by reference; and

2. The human health-based leachate criteria for the impact to ground water pathway, based on the equations, data sources, and conventions provided in Appendix 4.

(b) The impact to ground water soil remediation standard for each contaminant listed in Appendix 1, Tables 2A, 2B or 2C, or the PQL if the PQL is less stringent than the corresponding human health-based criterion.

SUBCHAPTER 5 INTERIM SOIL REMEDIATION STANDARDS

7:26D-5.1 Purpose

This subchapter sets forth the procedures that the Department will use to establish interim soil remediation standards.

7:26D-5.2 Development of an interim soil remediation standard

(a) The Department may establish an interim remediation standard for soil when a contaminant is not listed in Appendix 1, Tables 1A, 1B, 2A, 2B, or 2C of this chapter.

(b) An interim remediation standard shall be developed for soil as follows:

1. For the ingestion-dermal pathway, using the procedures set forth in Appendix 2;

2. For the inhalation pathway, using the procedures set forth in Appendix 3; and

3. For the impact to ground water pathway, using the procedures set forth in Appendix 4.

(c) The person responsible for conducting a remediation may request that the Department develop an interim soil remediation standard under this section.

7:26D-5.3 Publication of interim soil remediation standards; promulgation

(a) The Department shall publish on its web site a listing of all interim soil remediation standards and the technical basis used in their derivation.

(b) Interim soil remediation standards shall be replaced with duly promulgated soil remediation standards as soon as reasonably possible.

SUBCHAPTER 6 UPDATING SOIL REMEDIATION STANDARDS

7:26D-6.1 Purpose

This subchapter sets forth the procedures that the Department will use to update remediation standards for soil.

7:26D-6.2 Notice of administrative change to update promulgated soil remediation standards

(a) The Department shall post on its web site and publish in the New Jersey Register a notice of administrative change to modify a soil remediation standard in Appendix 1, Tables 1A, 1B, 2A, 2B or 2C when:

1. The USEPA revises the carcinogenic slope factor or reference dose data contained in the Integrated Risk Information System (IRIS) database on which a remediation standard in Table 1A or 1B is based; or

2. The Department promulgates a new criterion in the Ground Water Quality Standards at N.J.A.C. 7:9C on which an impact to ground water soil remediation standard is based.

(b) The notice of administrative change shall identify the contaminant, the basis for the administrative change, and the revised criterion to be listed in Appendix 1, Table 1A, 1B, 2A, 2B or 2C.

SUBCHAPTER 7 ALTERNATIVE SOIL REMEDIATION STANDARDS

7:26D-7.1 Purpose

This subchapter sets forth the circumstances in which the Department may require the person responsible for conducting the remediation to develop an alternative soil remediation standard, the procedures that the person responsible for conducting the remediation shall use to apply for permission to use an alternative soil remediation standard, and the procedures the Department shall use to evaluate an application for the use of an alternative soil remediation standard that is proposed by the person responsible for conducting the remediation.

7:26D-7.2 Applicability

An alternative soil remediation standard may only be numeric and may only be used at the site for which it is approved and is not applicable at any other site.

7:26D-7.3 Basis for an alternative soil remediation standard

(a) The person responsible for conducting the remediation may propose, in accordance with N.J.A.C. 7:26D-7.4, an alternative soil remediation standard based on the following:

1. For the ingestion-dermal exposure pathway, the procedures set forth in chapter Appendix 5, incorporated herein by reference;

2. For the inhalation pathway, the procedures set forth in chapter Appendix 6, incorporated herein by reference; and

3. For the impact to ground water pathway, the procedures set forth in chapter Appendix 7, incorporated herein by reference.

(b) The basis for the request for an alternative remediation standard may include, but is not limited to, the following:

1. New chemical toxicity data;

2. New risk assessment methodology or models;

3. Alternative land use planned for the site; or

4. Site-specific conditions that support the modification of input parameters for models used to develop alternative soil remediation standards pursuant to Appendices 5 through 7.

(c) The Department may require the person responsible for conducting the remediation to develop an alternative soil remediation standard that is more stringent than the minimum standards established by this chapter where necessary to ensure adequate protection of human health, based upon a review of the following:

1. The number or magnitude of the discharge(s) being investigated;

2. The nature of the contaminants;

3. Distance to and sensitivity of people at risk of exposure; and

4. Any other site-specific conditions the Department identifies that necessitate the need for an alternative soil remediation standard in order to protect human health.

7:26D-7.4 Alternative soil remediation standards application and approval process

(a) The person responsible for conducting the remediation may seek Department approval for an alternative soil remediation standard based on the criteria in N.J.A.C. 7:26D-7.2(a) and (b) above by completing the application in chapter Appendix 8, incorporated herein by reference, and submitting the completed application in accordance with (c) below.

(b) The person responsible for conducting the remediation that elects to submit an application for an alternative soil remediation standard agrees to pay the Department's oversight costs pursuant to Industrial Site Recovery Act Rules, N.J.A.C. 7:26B , Underground Storage Tanks rules, N.J.A.C. 7:14B or the Department Oversight of the Remediation of Contaminated Sites rules, N.J.A.C. 7:26C.

(c) The Department will review the application to develop an alternative remediation standard and send the person responsible for conducting the remediation the following, as applicable:

1. If the Department determines that the application is complete and that the proposed alternative soil remediation standard is protective of human health and safety and the environment, the Department will provide the person responsible for conducting the remediation with a written approval of the alternative soil remediation standard for that site or area of concern;

2. If the Department determines that the application is deficient, the Department will provide written comments to the person responsible for conducting the remediation describing the deficiencies in the application, in which case the person may submit a revised application addressing the deficiencies to the Department; or

3. If the Department determines that the proposed alternative soil remediation is not protective of human health, the Department will provide the person responsible for conducting the remediation with written notification of the denial of the application. The person shall not apply the denied alternative remediation standard to the contaminated site or area of concern.

APPENDIX 1
SOIL REMEDIATION STANDARDS TABLES

Table 1A – Residential Direct Contact Health Based Criteria and Soil Remediation Standards (mg/kg)

Contaminant	CAS No.	Ingestion-Dermal Heath Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Acenaphthene	83-32-9	3,400	NA	0.2	3,400
Acenaphthylene	208-96-8	NA	NA	0.2	NA
Acetone (2-Propanone)	67-64-1	70,000	NA	0.01	70,000
Acetophenone	98-86-2	6,100	2	0.2	2
Acrolein	107-02-8	39	0.5	0.5	0.5
Acrylonitrile	107-13-1	1	0.9	0.5	0.9
Aldrin	309-00-2	0.04	5	0.002	0.04
Aluminum	7429-90-5	78,000	NA	20	78,000
Anthracene	120-12-7	17,000	380,000	0.2	17,000
Antimony	7440-36-0	31	36,000	6	31
Arsenic	7440-38-2	0.4	980	1	19*
Atrazine	1912-24-9	210	NA	0.2	210
Barium	7440-39-3	16,000	910,000	20	16,000
Benzaldehyde	100-52-7	6,100	NA	0.2	6100
Benzene	71-43-2	3	2	0.005	2
Benzidine	92-87-5	0.002	0.004	0.7	0.7
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.6	38,000	0.2	0.6
Benzo(a)pyrene	50-32-8	0.06	3,800	0.2	0.2
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.6	38,000	0.2	0.6
Benzo(ghi)perylene	191-24-2	NA	380,000	0.2	380,000
Benzo(k)fluoranthene	207-08-9	6	38,000	0.2	6
Beryllium	7440-41-7	16	1,800	0.5	16
1,1'-Biphenyl	92-52-4	3,100	NA	0.2	3,100
Bis(2-chloroethyl)ether	111-44-4	0.4	0.6	0.2	0.4
Bis(2-chloroisopropyl)ether	108-60-1	2,400	23	0.2	23
Bis(2-ethylhexyl) phthalate	117-81-7	35	NA	0.2	35
Bromodichloromethane (Dichlorobromomethane)	75-27-4	10	1	0.005	1
Bromoform	75-25-2	81	98	0.005	81
Bromomethane (Methyl bromide)	74-83-9	110	25	0.005	25
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	3,100	NA	0.01	3,100
Butyl benzyl phthalate	85-68-7	1,200	NA	0.2	1,200
Cadmium	7440-43-9	78	1,000	0.5	78

Contaminant	CAS No.	Ingestion-Dermal Heath Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Caprolactam	105-60-2	31,000	NA	0.2	31,000
Carbazole	86-74-8	24	740,000	0.2	24
Carbon disulfide	75-15-0	7,800	NA	0.5	7,800
Carbon tetrachloride	56-23-5	7	0.6	0.005	0.6
Chlordane (alpha and gamma)	57-74-9	0.2	42,000	0.002	0.2
4-Chloroaniline (p-Chloroaniline)	106-47-8	9	26	0.2	9
Chlorobenzene	108-90-7	510	NA	0.005	510
Chloroethane (Ethyl chloride)	75-00-3	220	NA	0.005	220
Chloroform	67-66-3	780	0.6	0.005	0.6
Chloromethane (Methyl chloride)	74-87-3	NA	4	0.005	4
2-Chlorophenol (o-Chlorophenol)	95-57-8	310	910	0.2	310
Chrysene	218-01-9	62	380,000	0.2	62
Cobalt	7440-48-4	1,600	9,100	5	1,600
Copper	7440-50-8	3,100	NA	3	3,100
Cyanide	57-12-5	1,600	NA	3	1,600
4,4'-DDD	72-54-8	3	61,000	0.003	3
4,4'-DDE	72-55-9	2	670	0.003	2
4,4'-DDT	50-29-3	2	44,000	0.003	2
Dibenz(a,h)anthracene	53-70-3	0.06	3,500	0.2	0.2
Dibromochloromethane (Chlorodibromomethane)	124-48-1	8	3	0.005	3
1,2-Dibromo-3-chloropropane	96-12-8	0.3	0.08	0.005	0.08
1,2-Dibromoethane	106-93-4	0.008	0.1	0.005	0.008
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	5,300	NA	0.005	5,300
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	5,300	NA	0.005	5,300
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	610	5	0.005	5
3,3'-Dichlorobenzidine	91-94-1	1	3	0.2	1
Dichlorodifluoromethane	75-71-8	16,000	490	0.005	490
1,1-Dichloroethane	75-34-3	510	8	0.005	8
1,2-Dichloroethane	107-06-2	5	0.9	0.005	0.9
1,1-Dichloroethene	75-35-4	11	61	0.005	11
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	780	230	0.005	230
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	1,300	300	0.005	300
2,4-Dichlorophenol	120-83-2	180	NA	0.2	180
1,2-Dichloropropane	78-87-5	9	2	0.005	2
1,3-Dichloropropene (cis and trans)	542-75-6	6	2	0.005	2
Dieldrin	60-57-1	0.04	1	0.003	0.04
Diethyl phthalate	84-66-2	49,000	NA	0.2	49,000
2,4-Dimethyl phenol	105-67-9	1,200	NA	0.2	1,200

Contaminant	CAS No.	Ingestion-Dermal Heath Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
Di-n-butyl phthalate	84-74-2	6,100	NA	0.2	6,100
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	6	730,000	0.3	6
2,4-Dinitrophenol	51-28-5	120	NA	0.3	120
2,4-Dinitrotoluene	121-14-2	0.7	6	0.2	0.7
2,6-Dinitrotoluene	606-20-2	0.7	2	0.2	0.7
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	0.7	NA	0.2	0.7
Di-n-octyl phthalate	117-84-0	2,400	NA	0.2	2,400
1,2-Diphenylhydrazine	122-66-7	0.6	5	0.7	0.7
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	470	NA	0.003	470
Endosulfan sulfate	1031-07-8	470	NA	0.003	470
Endrin	72-20-8	23	NA	0.003	23
Ethyl benzene	100-41-4	7,800	NA	0.005	7,800
Fluoranthene	206-44-0	2,300	NA	0.2	2,300
Fluorene	86-73-7	2,300	NA	0.2	2,300
alpha-HCH (alpha-BHC)	319-84-6	0.1	0.7	0.002	0.1
beta-HCH (beta-BHC)	319-85-7	0.4	8,000	0.002	0.4
Heptachlor	76-44-8	0.1	6	0.002	0.1
Heptachlor epoxide	1024-57-3	0.07	5	0.002	0.07
Hexachlorobenzene	118-74-1	0.3	1	0.2	0.3
Hexachloro-1,3-butadiene	87-68-3	6	12	0.2	6
Hexachlorocyclopentadiene	77-47-4	370	45	0.2	45
Hexachloroethane	67-72-1	35	83	0.2	35
Indeno(1,2,3-cd)pyrene	193-39-5	0.6	38,000	0.2	0.6
Isophorone	78-59-1	510	NA	0.2	510
Lead	7439-92-1	400	44,000	1	400
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	0.4	3	0.002	0.4
Manganese	7439-96-5	11,000	91,000	2	11,000
Mercury	7439-97-6	23	27	0.1	23
Methoxychlor	72-43-5	390	NA	0.02	390
Methyl acetate	79-20-9	78,000	NA	0.005	78,000
Methylene chloride (Dichloromethane)	75-09-2	46	34	0.005	34
2-Methylnaphthalene	91-57-6	230	NA	0.17	230
2-Methylphenol (o-Creosol)	95-48-7	310	NA	0.2	310
4-Methylphenol (p-Creosol)	106-44-5	31	NA	0.2	31
Methyl tert-butyl ether (MTBE)	1634-04-4	780	110	0.005	110
Naphthalene	91-20-3	2,400	6	0.2	6
Nickel (Soluble salts)	7440-02-0	1,600	360,000	4	1,600
2-Nitroaniline	88-74-4	NA	39	0.3	39
Nitrobenzene	98-95-3	31	160	0.2	31

Contaminant	CAS No.	Ingestion-Dermal Heath Based Criterion	Inhalation Health Based Criterion	Soil PQL	Residential Direct Contact Soil Remediation Standard
N-Nitrosodimethylamine	62-75-9	0.01	0.02	0.7	0.7
N-Nitrosodi-n-propylamine	621-64-7	0.07	0.2	0.2	0.2
N-Nitrosodiphenylamine	86-30-6	99	NA	0.2	99
Pentachlorophenol	87-86-5	3	590	0.3	3
Phenanthrene	85-01-8	NA	NA	0.2	NA
Phenol	108-95-2	18,000	NA	0.2	18,000
Polychlorinated biphenyls (PCBs)	1336-36-3	0.2	20	0.03	0.2
Pyrene	129-00-0	1,700	NA	0.2	1,700
Selenium	7782-49-2	390	NA	4	390
Silver	7440-22-4	390	NA	1	390
Styrene	100-42-5	16,000	90	0.005	90
Tertiary butyl alcohol (TBA)	75-65-0	1,400	4,800	0.1	1,400
1,1,2,2-Tetrachloroethane	79-34-5	10	1	0.005	1
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	8	2	0.005	2
Thallium	7440-28-0	5	360,000	3	5
Toluene	108-88-3	6,300	NA	0.005	6,300
Toxaphene	8001-35-2	0.6	70	0.2	0.6
1,2,4-Trichlorobenzene	120-82-1	73	NA	0.005	73
1,1,1-Trichloroethane	71-55-6	290	NA	0.005	290
1,1,2-Trichloroethane	79-00-5	31	2	0.005	2
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	21	7	0.005	7
Trichlorofluoromethane	75-69-4	23,000	NA	0.005	23,000
2,4,5-Trichlorophenol	95-95-4	6,100	NA	0.2	6,100
2,4,6-Trichlorophenol	88-06-2	19	340	0.2	19
Vanadium	7440-62-2	78	NA	5	78
Vinyl chloride	75-01-4	2	0.7	0.005	0.7
Xylenes	1330-20-7	12,000	NA	0.005	12,000
Zinc	7440-66-6	23,000	NA	6	23,000

NA = Standard not available

* The direct contact standard for arsenic is based on natural background

Table 1B – Non-Residential Direct Contact Health Based Criteria and Soil Remediation Standards (mg/kg)

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Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Acenaphthene	83-32-9	37,000	300,000	0.2	37,000
Acenaphthylene	208-96-8	NA	300,000	0.2	300,000
Acetone (2-Propanone)	67-64-1	NA	NA	0.01	NA
Acetophenone	98-86-2	68,000	4	0.2	4
Acrolein	107-02-8	570	1	0.5	1
Acrylonitrile	107-13-1	6	2	0.5	2
Aldrin	309-00-2	0.2	13	0.002	0.2
Aluminum	7429-90-5	NA	NA	20	NA
Anthracene	120-12-7	180,000	30,000	0.2	30,000
Antimony	7440-36-0	450	23,000	6	450
Arsenic	7440-38-2	2	76	1	19*
Atrazine	1912-24-9	2,400	NA	0.2	2,400
Barium	7440-39-3	230,000	59,000	20	59,000
Benzaldehyde	100-52-7	68,000	NA	0.2	68,000
Benzene	71-43-2	14	4	0.005	4
Benzidine	92-87-5	0.008	0.01	0.7	0.7
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	2	3,000	0.2	2
Benzo(a)pyrene	50-32-8	0.2	300	0.2	0.2
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	2	3,000	0.2	2
Benzo(ghi)perylene	191-24-2	NA	30,000	0.2	30,000
Benzo(k)fluoranthene	207-08-9	23	3,000	0.2	23
Beryllium	7440-41-7	230	140	0.5	140
1,1'-Biphenyl	92-52-4	34,000	NA	0.2	34,000
Bis(2-chloroethyl)ether	111-44-4	2	1	0.2	1
Bis(2-chloroisopropyl)ether	108-60-1	27,000	60	0.2	60
Bis(2-ethylhexyl) phthalate	117-81-7	140	140,000	0.2	140
Bromodichloromethane (Dichlorobromomethane)	75-27-4	51	3	0.005	3

Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Bromoform	75-25-2	400	250	0.005	250
Bromomethane (Methyl bromide)	74-83-9	1,600	53	0.005	53
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	44,000	NA	0.01	44,000
Butyl benzyl phthalate	85-68-7	14,000	NA	0.2	14,000
Cadmium	7440-43-9	1,100	78	0.5	78
Caprolactam	105-60-2	340,000	NA	0.2	340,000
Carbazole	86-74-8	96	58,000	0.2	96
Carbon disulfide	75-15-0	110,000	NA	0.5	110,000
Carbon tetrachloride	56-23-5	35	2	0.005	2
Chlordane (alpha and gamma)	57-74-9	1	3,300	0.002	1
4-Chloroaniline (p-Chloroaniline)	106-47-8	2,700	66	0.2	66
Chlorobenzene	108-90-7	7,400	NA	0.005	7,400
Chloroethane (Ethyl chloride)	75-00-3	1,100	NA	0.005	1,100
Chloroform	67-66-3	11,000	2	0.005	2
Chloromethane (Methyl chloride)	74-87-3	NA	11	0.005	11
2-Chlorophenol (o-Chlorophenol)	95-57-8	3,400	2,000	0.2	2,000
Chrysene	218-01-9	230	30,000	0.2	230
Cobalt	7440-48-4	23,000	590	5	590
Copper	7440-50-8	45,000	280,000	3	45,000
Cyanide	57-12-5	23,000	NA	3	23,000
4,4'-DDD	72-54-8	13	4,800	0.003	13
4,4'-DDE	72-55-9	9	3,400	0.003	9
4,4'-DDT	50-29-3	8	3,400	0.003	8
Dibenz(a,h)anthracene	53-70-3	0.2	270	0.2	0.2
Dibromochloromethane (Chlorodibromomethane)	124-48-1	38	7	0.005	7
1,2-Dibromo-3-chloropropane	96-12-8	1	0.2	0.005	0.2

Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
1,2-Dibromoethane	106-93-4	0.04	0.3	0.005	0.04
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	59,000	NA	0.005	59,000
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	59,000	NA	0.005	59,000
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	6,800	12	0.005	12
3,3'-Dichlorobenzidine	91-94-1	4	960	0.2	4
Dichlorodifluoromethane	75-71-8	230,000	NA	0.005	230,000
1,1-Dichloroethane	75-34-3	7,400	21	0.005	21
1,2-Dichloroethane	107-06-2	26	2	0.005	2
1,1-Dichloroethene	75-35-4	160	130	0.005	130
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	11,000	500	0.005	500
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	19,000	650	0.005	650
2,4-Dichlorophenol	120-83-2	2,100	NA	0.2	2,100
1,2-Dichloropropane	78-87-5	47	5	0.005	5
1,3-Dichloropropene (cis and trans)	542-75-6	32	6	0.005	6
Dieldrin	60-57-1	0.2	3	0.003	0.2
Diethyl phthalate	84-66-2	550,000	NA	0.2	550,000
2,4-Dimethyl phenol	105-67-9	14,000	NA	0.2	14,000
Di-n-butyl phthalate	84-74-2	68,000	NA	0.2	68,000
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	68	47,000	0.3	68
2,4-Dinitrophenol	51-28-5	1,400	820,000	0.3	1,400
2,4-Dinitrotoluene	121-14-2	3	15	0.2	3
2,6-Dinitrotoluene	606-20-2	3	6	0.2	3
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	3	NA	0.2	3
Di-n-octyl phthalate	117-84-0	27,000	NA	0.2	27,000
1,2-Diphenylhydrazine	122-66-7	2	12	0.7	2
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	6,800	NA	0.003	6,800

Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Endosulfan sulfate	1031-07-8	6,800	NA	0.003	6,800
Endrin	72-20-8	340	120,000	0.003	340
Ethyl benzene	100-41-4	110,000	NA	0.005	110,000
Fluoranthene	206-44-0	24,000	300,000	0.2	24,000
Fluorene	86-73-7	24,000	300,000	0.2	24,000
alpha-HCH (alpha-BHC)	319-84-6	0.5	2	0.002	0.5
beta-HCH (beta-BHC)	319-85-7	2	620	0.002	2
Heptachlor	76-44-8	0.7	16	0.002	0.7
Heptachlor epoxide	1024-57-3	0.3	12	0.002	0.3
Hexachlorobenzene	118-74-1	1	4	0.2	1
Hexachloro-1,3-butadiene	87-68-3	25	31	0.2	25
Hexachlorocyclopentadiene	77-47-4	4,100	97	0.2	97
Hexachloroethane	67-72-1	140	82,000	0.2	140
Indeno(1,2,3-cd)pyrene	193-39-5	2	3,000	0.2	2
Isophorone	78-59-1	2,000	NA	0.2	2,000
Lead	7439-92-1	800	12,000	1	800
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	2	9	0.002	2
Manganese	7439-96-5	160,000	5,900	2	5,900
Mercury	7439-97-6	340	65	0.1	65
Methoxychlor	72-43-5	5,700	NA	0.02	5,700
Methyl acetate	79-20-9	NA	NA	0.005	NA
Methylene chloride (Dichloromethane)	75-09-2	230	87	0.005	87
2-Methylnaphthalene	91-57-6	2400	250,000	0.17	2400
2-Methylphenol (o-Creosol)	95-48-7	3,400	NA	0.2	3,400
4-Methylphenol (p-Creosol)	106-44-5	340	NA	0.2	340
Methyl tert-butyl ether (MTBE)	1634-04-4	11,000	290	0.005	290
Naphthalene	91-20-3	25,000	16	0.2	16
Nickel (Soluble salts)	7440-02-0	23,000	23,000	4	23,000
2-Nitroaniline	88-74-4	NA	83	0.3	83

Contaminant	CAS No.	Ingestion-Dermal Health Based Criterion	Inhalation Health Based Criterion	Soil PQL	Non-Residential Direct Contact Soil Remediation Standard
Nitrobenzene	98-95-3	340	350	0.2	340
N-Nitrosodimethylamine	62-75-9	0.06	0.04	0.7	0.7
N-Nitrosodi-n-propylamine	621-64-7	0.3	130,000	0.2	0.3
N-Nitrosodiphenylamine	86-30-6	390	1,500	0.2	390
Pentachlorophenol	87-86-5	10	300,000	0.3	10
Phenanthrene	85-01-8	NA	300,000	0.2	300,000
Phenol	108-95-2	210,000	NA	0.2	210,000
Polychlorinated biphenyls (PCBs)	1336-36-3	1	52	0.03	1
Pyrene	129-00-0	18,000	300,000	0.2	18,000
Selenium	7782-49-2	5,700	NA	4	5,700
Silver	7440-22-4	5,700	NA	1	5,700
Styrene	100-42-5	230,000	230	0.005	230
Tertiary butyl alcohol (TBA)	75-65-0	20,000	10,000	0.1	10,000
1,1,2,2-Tetrachloroethane	79-34-5	150	3	0.005	3
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	39	5	0.005	5
Thallium	7440-28-0	79	23,000	3	79
Toluene	108-88-3	91,000	NA	0.005	91,000
Toxaphene	8001-35-2	3	180	0.2	3
1,2,4-Trichlorobenzene	120-82-1	820	NA	0.005	820
1,1,1-Trichloroethane	71-55-6	4,200	NA	0.005	4,200
1,1,2-Trichloroethane	79-00-5	440	5	0.005	5
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	100	18	0.005	18
Trichlorofluoromethane	75-69-4	340,000	NA	0.005	340,000
2,4,5-Trichlorophenol	95-95-4	68,000	NA	0.2	68,000
2,4,6-Trichlorophenol	88-06-2	74	870	0.2	74
Vanadium	7440-62-2	1,100	470,000	5	1,100
Vinyl chloride	75-01-4	8	2	0.005	2
Xylenes	1330-20-7	170,000	NA	0.005	170,000
Zinc	7440-66-6	340,000	110,000	6	110,000

NA = Standard not available
* The direct contact standard for arsenic is based on natural background

Table 2A – Impact to Ground Water (GW) Health Based Soil Criteria and Soil Remediation Standards for Mobile Organic Chemicals (mg/kg)

Contaminant	CAS Number	Impact to GW Health Based Soil Criterion	Soil PQL	Impact to GW Soil Remediation Standard
Acenaphthene	83-32-9	74	0.2	74
Acenaphthylene	208-96-8	NA	0.2	NA
Acetone (2-propanone)	67-64-1	12	0.01	12
Acetophenone	98-86-2	2	0.2	2
Acrolein	107-02-8	0.008	0.5	0.5
Acrylonitrile	107-13-1	0.0001	0.5	0.5
Atrazine	1912-24-9	0.03	0.2	0.2
Benzaldehyde	100-52-7	NA	0.2	NA
Benzene	71-43-2	0.0008	0.005	0.005
Benzidine	92-87-5	0.0000006	0.7	0.7
1,1'-Biphenyl	92-52-4	90	0.2	90
Bis(2-chloroethyl)ether	111-44-4	0.00007	0.2	0.2
Bis(2-chloroisopropyl)ether	108-60-1	3	0.2	3
Bromodichloromethane (Dichlorobromomethane)	75-27-4	0.002	0.005	0.005
Bromoform	75-25-2	0.02	0.005	0.02
Bromomethane (Methyl bromide)	74-83-9	0.03	0.005	0.03
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	0.6	0.01	0.6
Caprolactam	105-60-2	NA	0.2	NA
Carbazole	86-74-8	NA	0.2	NA
Carbon disulfide	75-15-0	4	0.5	4
Carbon tetrachloride	56-23-5	0.003	0.005	0.005
4-Chloroaniline (p-Chloroaniline)	106-47-8	0.1	0.2	0.2
Chlorobenzene	108-90-7	0.4	0.005	0.4
Chloroethane	75-00-3	NA	0.005	NA
Chloroform	67-66-3	0.2	0.005	0.2
Chloromethane (Methyl chloride)	74-87-3	NA	0.005	NA
2-Chlorophenol (o-Chlorophenol)	95-57-8	0.5	0.2	0.5
Dibromochloromethane (Chlorodibromomethane)	124-48-1	0.001	0.005	0.005
1,2-Dibromo-3-chloropropane	96-12-8	0.00008	0.005	0.005
1,2-Dibromoethane	106-93-4	0.000001	0.005	0.005
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	11	0.005	11
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	12	0.005	12
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	1	0.005	1
3,3'-Dichlorobenzidine	91-94-1	0.002	0.2	0.2
Dichlorodifluoromethane	75-71-8	25	0.005	25
1,1-Dichloroethane	75-34-3	0.2	0.005	0.2
1,2-Dichloroethane	107-06-2	0.0008	0.005	0.005
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	0.005	0.005	0.005
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	0.2	0.005	0.2
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	0.4	0.005	0.4
2,4-Dichlorophenol	120-83-2	0.1	0.2	0.2

Contaminant	CAS Number	Impact to GW Health Based Soil Criterion	Soil PQL	Impact to GW Soil Remediation Standard
1,2-Dichloropropane	78-87-5	0.002	0.005	0.005
1,3-Dichloropropene (cis and trans) (summed)	542-75-6	0.002	0.005	0.005
Diethyl phthalate	84-66-2	57	0.2	57
2,4-Dimethyl phenol	105-67-9	0.7	0.2	0.7
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	534-52-1	NA	0.3	NA
2,4-Dinitrophenol	51-28-5	0.02	0.3	0.3
2,4-Dinitrotoluene	121-14-2	NA	0.2	NA
2,6-Dinitrotoluene	606-20-2	NA	0.2	NA
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	0.0002	0.2	0.2
1,2-Diphenylhydrazine	122-66-7	0.0008	0.7	0.7
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	2	0.003	2
Endosulfan sulfate	1031-07-8	1	0.003	1
Endrin	72-20-8	0.6	0.003	0.6
Ethyl benzene	100-41-4	8	0.005	8
Fluorene	86-73-7	110	0.2	110
alpha-HCH (alpha-BHC)	319-84-6	0.0002	0.002	0.002
beta-HCH (beta-BHC)	319-85-7	0.0007	0.002	0.002
Hexachloroethane	67-72-1	0.1	0.2	0.2
Isophorone	78-59-1	0.1	0.2	0.2
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	0.0009	0.002	0.002
Methyl acetate	79-20-9	14	0.005	14
2-Methylnaphthalene	91-57-6	5	0.17	5
Methylene chloride (Dichloromethane)	75-09-2	0.007	0.005	0.007
2-Methylnaphthalene	91-57-6	5	0.17	5
2-Methylphenol (o-cresol)	95-48-7	NA	0.2	NA
4-Methylphenol (p-cresol)	106-44-5	NA	0.2	NA
Methyl tert-butyl ether (MTBE)	1634-04-4	0.2	0.005	0.2
Naphthalene	91-20-3	16	0.2	16
2-Nitroaniline	88-74-4	NA	0.3	NA
Nitrobenzene	98-95-3	0.01	0.2	0.2
N-Nitrosodimethylamine	62-75-9	0.000001	0.7	0.7
N-Nitrosodi-n-propylamine	621-64-7	0.00001	0.2	0.2
N-Nitrosodiphenylamine	86-30-6	0.2	0.2	0.2
Pentachlorophenol	87-86-5	0.04	0.3	0.3
Phenol	108-95-2	5	0.2	5
Styrene	100-42-5	2	0.005	2
Tertiary butyl alcohol (TBA)	75-65-0	0.2	0.1	0.2
1,1,2,2-Tetrachloroethane	79-34-5	0.004	0.005	0.005
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	0.003	0.005	0.005
Toluene	108-88-3	4	0.005	4
1,2,4-Trichlorobenzene	120-82-1	0.4	0.005	0.4
1,1,1-Trichloroethane	71-55-6	0.2	0.005	0.2
1,1,2-Trichloroethane	79-00-5	0.01	0.005	0.01
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	0.007	0.005	0.007

Contaminant	CAS Number	Impact to GW Health Based Soil Criterion	Soil PQL	Impact to GW Soil Remediation Standard
Trichlorofluoromethane	75-69-4	22	0.005	22
2,4,5-Trichlorophenol	95-95-4	44	0.2	44
2,4,6-Trichlorophenol	88-06-2	0.03	0.2	0.2
Vinyl chloride	75-01-4	0.0003	0.005	0.005
Xylenes (total)	1330-20-7	12	0.005	12

NA = Standard not available

Table 2B - Impact to Ground Water (GW) Health Based Leachate* Criteria and Leachate Standards for Low Mobility Organic Contaminants (ug/L)

Contaminant	CAS Number	Impact to GW Health Based Leachate Criterion	Aqueous PQL	Impact to GW Leachate Standard
Aldrin	309-00-2	0.03	0.04	0.04
Anthracene	120-12-7	26,000	5	26,000
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.6	0.1	0.6
Benzo(a)pyrene	50-32-8	0.06	0.1	0.1
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.6	0.2	0.6
Benzo(ghi)perylene	191-24-2	NA	0.2	NA
Benzo(k)fluoranthene	207-08-9	6	0.3	6
Bis(2-ethylhexyl)phthalate	117-81-7	26	3	26
Butyl benzyl phthalate	85-68-7	1300	1	1,300
Chlordane (alpha and gamma)	57-74-9	0.1	0.05	0.1
Chrysene	218-01-9	65	0.2	65
4,4'-DDD	72-54-8	1	0.02	1
4,4'-DDE	72-55-9	1	0.01	1
4,4'-DDT	50-29-3	1	0.1	1
Dibenz(a,h)anthracene	53-70-3	0.06	0.3	0.3
Dieldrin	60-57-1	0.03	0.02	0.03
Di-n-butyl phthalate	84-74-2	9,100	5	9,100
Di-n-octyl phthalate	117-84-0	1,300	5	20
Fluoranthene	206-44-0	3,900	5	3,900
Heptachlor	76-44-8	0.1	0.05	0.1
Heptachlor epoxide	1024-57-3	0.05	0.02	0.05
Hexachlorobenzene	118-74-1	0.3	0.02	0.3
Hexachloro-1,3-butadiene	87-68-3	5	1	5
Hexachlorocyclopentadiene	77-47-4	520	0.5	520
Indeno(1,2,3-cd)pyrene	193-39-5	0.6	0.2	0.6
Methoxychlor	72-43-5	520	0.1	520
Phenanthrene	85-01-	NA	0.4	NA
Polychlorinated biphenyls (PCBs)	81336-36-3	0.3	0.5	0.5
Pyrene	129-00-0	2,600	0.1	2,600
Toxaphene	8001-35-2	0.4	2.0	2.0

NA = Standard not available

* The leachate standard is based on analysis of leachate resulting from the synthetic leaching procedure conducted on contaminated soil.

Table 2C - Impact to Ground Water (GW)Health Based Leachate* Criteria and Leachate Standards for Inorganic Contaminants (ug/L)

Contaminant	CAS Number	Impact to GW Health Based Leachate Criteria	Aqueous PQL	Leachate Standard
Aluminum	7429-90-5	2,600	20	2,600
Antimony	7440-36-0	78	3	78
Arsenic	7440-38-2	0.3	0.5	0.5
Barium	7440-39-3	91,000	1	91,000
Beryllium	7440-41-7	13	0.3	13
Cadmium	7440-43-9	52	1	52
Cobalt	7440-48-4	NA	2	NA
Copper	7440-50-8	16,900	3	16,900
Cyanide	57-12-5	1,300	6	1,300
Lead	7439-92-1	65	5	65
Manganese	7439-96-5	650	0.4	650
Mercury	7439-97-6	26	0.2	26
Nickel (Soluble salts)	7440-02-0	1,300	4	1,300
Selenium	7782-49-2	520	4	520
Silver	7440-22-4	520	1	520
Thallium	7440-28-0	6	0.7	6
Vanadium	7440-62-2	NA	3	NA
Zinc	7440-66-6	26,000	2	26,000

* The leachate standard is based on analysis of leachate resulting from the synthetic leaching procedure conducted on contaminated soil.

APPENDIX 2
Methods for the Development of Ingestion-Dermal Soil Remediation Standards for Residential and Non-residential Exposure (Equations 1 through 4)

Equation 1

Combined Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil Residential Scenario

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard (mg/kg)} = \frac{TR * AT * 365 d/yr}{\left(EF * 10^{-6} kg/mg\right)\left[\left(SF_o * IF_{soil/adj}\right) + \left(SF_{ABS} * SFS * ABS_d * EV\right)\right]}$$

Parameter	Definition	Units	Default
TR	Target cancer risk	Unitless	10^{-6}
AT	Averaging time	Years	70
EF	Exposure frequency	Days/year	350
SF_{ABS}	Dermally adjusted cancer slope factor	$(mg/kg\text{-}d)^{-1}$	Chemical-specific
SFS	Age-adjusted dermal factor	mg-yr/kg-event	360
ABS_d	Dermal absorption fraction	Unitless	Chemical-specific
EV	Event frequency	Events/day	1
SF_o	Oral cancer slope factor	$(mg/kg\text{-}d)^{-1}$	Chemical-specific
$IF_{soil/adj}$	Age-adjusted soil ingestion factor	mg-yr/kg-d	114

Equation 2

Combined Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Contaminants in Soil Residential Sites

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard (mg/kg)} = \frac{THQ * BW * AT * 365 d/yr}{\left(EF * ED * 10^{-6} kg/mg\right)\left[\left(\frac{1}{RfD_o} * IR\right) + \left(\frac{1}{RfD_{ABS}} * AF * ABS_d * EV * SA\right)\right]}$$

Parameter	Definition	Units	Default
THQ	Target hazard quotient	Unitless	1
BW	Body weight	kg	15
AT	Averaging time	Years	6
EF	Exposure frequency	Days/year	350
ED	Exposure duration	Years	6
RfD_o	Oral reference dose	mg/kg-day	Chemical-specific
IR	Soil ingestion rate	mg/day	200
RfD_{ABS}	Dermally adjusted reference dose	mg/kg-day	Chemical-specific
AF	Skin-soil adherence factor	mg/cm^2-event	0.2
ABS_d	Dermal absorption factor	Unitless	Chemical-specific
EV	Event frequency	Events/day	1
SA	Skin surface area exposed-child	cm^2	2,800

Equation 3

Combined Ingestion and Dermal Absorption Exposure to Carcinogenic Contaminants in Soil Non-Residential Outdoor Worker Site

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard (mg/kg)} = \frac{TR * BW * AT * 365\,d/yr}{\left(EF * ED * 10^{-6}\,kg/mg\right)\left(\left(SF_o * IR\right) * \left(SF_{ABS} * AF * ABS_d * SA * EV\right)\right)}$$

Parameter	Definition	Units	Default
TR	Target cancer risk	Unitless	10^{-6}
BW	Body weight	kg	70
AT	Averaging time	Years	70
EF	Exposure frequency	Days/year	225
ED	Exposure duration	Years	25
SF_O	Oral cancer slope factor	$(mg/kg\text{-}d)^{-1}$	Chemical-specific
IR	Soil ingestion rate	mg/d	100
SF_{ABS}	Dermally adjusted cancer slope factor	$(mg/kg\text{-}d)^{-1}$	Chemical-specific
AF	Soil-skin adherence factor	mg/cm^2-event	0.2
ABS_d	Dermal absorption factor	Unitless	Chemical-specific
SA	Skin surface exposed	cm^2	3,300
EV	Event frequency	Events/day	1

Equation 4

Combined Ingestion and Dermal Absorption Exposure to Non-Carcinogenic Contaminants in Soil Non-Residential Outdoor Worker Site

Source: USEPA. 2002. Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Final.

$$\text{Remediation Standard (mg/kg)} = \frac{THQ * BW * AT * 365\,d/yr}{\left(EF * ED * 10^{-6}\,kg/mg\right)\left[\left(\frac{1}{RfD_o} * IR\right) + \left(\frac{1}{RfD_{ABS}} * AF * ABS_d * SA * EV\right)\right]}$$

Parameter	Definition	Units	Default
THQ	Target hazard quotient	Unitless	1
BW	Body weight	kg	70
AT	Averaging time	Years	25
EF	Exposure frequency	Days/years	225
ED	Exposure duration	Years	25
RfD_o	Oral reference dose	mg/kg-d	Chemical-specific
IR	Soil ingestion rate	mg/d	100
RfD_{ABS}	Dermally adjusted reference dose	mg/kg-d	Chemical-specific
AF	Skin-soil adherence factor	mg/cm^2-event	0.2
ABS_d	Dermal absorption fraction	Unitless	Chemical-specific
SA	Skin surface exposed	cm^2	3,300
EV	Event frequency	Events/day	1

APPENDIX 3
Methods for the Development of Inhalation Remediation Standards Residential and Non-residential Use (Equations 1 through 25)

I. Methods for the Development of Inhalation Standards for Volatile Contaminants (Equations 1 through 8)

Equation 1

Inhalation Soil Remediation Standards for Carcinogenic Volatile Organic Contaminants

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 4

$$Inh_v SRS_c = \frac{TR * AT * 365\,{}^{days}\!/_{year}}{URF * 1000\,{}^{\mu g}\!/_{mg} * EF * ED * \left(\frac{1}{VF}\right)}$$

Parameter	Definition	Units	Default
Inh_vSRS_c	Inhalation soil remediation standard for volatile carcinogens	mg/kg	Chemical-specific
TR	Target cancer risk	unitless	$1x10^{-6}$
AT	Averaging time	years	70
URF	Inhalation unit risk factor	$(\mu g/m^3)^{-1}$	Chemical-specific
EF	Exposure frequency	day/year	350 (Residential) 225 (Non-residential)
ED	Exposure duration	years	30 (Residential) 25 (Non-residential)
VF	Soil-to-air volatilization factor	m^3/kg	Chemical-specific

Equation 2

Inhalation Soil Remediation Standards for Non-carcinogenic Volatile Organic Contaminants

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 5

$$Inh_vSRS_n = \frac{THQ * AT * 365^{days/year}}{EF * ED * \left(\frac{1}{RfC}\right) * \left(\frac{1}{VF}\right)}$$

Parameter	Definition	Units	Default
Inh_vSRS_n	Inhalation soil remediation standard for volatile noncarcinogens	mg/kg	Chemical-specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	years	30 (Residential) 25 (Non-residential)
EF	Exposure frequency	day/year	350 (Residential) 225 (Non-residential)
ED	Exposure duration	years	30 (Residential) 25 (Non-residential)
RfC	Inhalation reference concentration	mg/m^3	Chemical-specific
VF	Soil-to-air volatilization factor	m^3/kg	Chemical-specific

Equation 3

Volatilization Factor (VF)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 6

$$VF = \left(Q / C_{vol} \right) * \frac{\left(3.14 * D_A * T\right)^{1/2}}{2 * \rho b * D_A} * 10^{-4} \; {}^{m^2}/_{cm^2}$$

Parameter	Definition	Units	Default
VF	Soil-to-air volatilization factor	m^3/kg	Chemical-specific
Q/C_{vol}	Inverse concentration at center of (specific to volume)	$(g/m^2\text{-}s)/(kg/m^{3)}$	90.4 (Residential) 138.7 (Non-residential)
D_A	Apparent diffusivity	cm^2/s	Chemical-specific
T	Exposure interval	seconds	$9.5x10^8$ (Residential) $7.9x10^8$ (Non-residential)
ρb	Dry soil bulk density	g/cm^3	1.5

Equation 4

Apparent Diffusivity (DA)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 57

$$D_A = \frac{\left[\left(\theta_a^{10/3} * D_i * H'\right) + \left(\theta_w^{10/3} * D_w\right)\right] / n^2}{\left(\rho b * K_d\right) + \theta_w + \left(\theta_a * H'\right)}$$

Parameter	Definition	Units	Default
D_A	Apparent diffusivity	cm^2/s	Chemical-specific
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
D_i	Diffusivity in air	cm^2/s	Chemical-specific
H'	Henry's Law Constant	unitless	Chemical-specific
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
D_w	Diffusivity in water	cm^2/s	Chemical-specific
n	Total soil porosity	L_{pore}/L_{soil}	0.41
ρb	Dry soil bulk density	g/cm^3	1.5
K_d	Soil-water partition coefficient	cm^3/g	Chemical-specific

Equation 5

Soil-Water Partition Coefficient (Kd)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 74

$$K_d = K_{oc} * f_{oc}$$

Parameter	Definition	Units	Default
K_d	Soil-water partition coefficient	cm^3/g	Chemical-specific
K_{oc}	Soil organic carbon-water partition coefficient	cm^3/g	Chemical-specific
f_{oc}	Organic carbon content of soil	g/g	0.002

Equation 6

Air-Filled Soil Porosity (θ_a)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 7

$$\theta_a = n - \theta_w$$

Parameter	Definition	Units	Default
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
n	Total soil porosity	L_{pore}/L_{soil}	0.41

Equation 7

Soil Moisture Content

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Attachment A - "Conceptual Site Model"

$$\theta_w = n(I / K_s)^{1/(2b+3)}$$

Parameter	Definition	Units	Default
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
n	Total soil porosity	L_{pore}/L_{soil}	0.41
I	Soil moisture infiltration rate	m/yr	0.28
K_s	Saturated hydraulic conductivity of the soil	m/yr	387
1/(2b+3)	Determined by soil type (Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Attachment A - "Conceptual Site Model," Table A-2)	Unitless	0.080

Equation 8

Soil Saturation Limit (C_{sat})

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 9

$$C_{sat} = \frac{S}{\rho_b}\left[\left(K_d * \rho_b\right) + \theta_w + \left(H' * \theta_a\right)\right]$$

Parameter	Definition	Units	Default
C_{sat}	Soil saturation concentration	mg/kg	Chemical-specific
S	Solubility in water	mg/L_{water}	Chemical-specific
ρ_b	Dry soil bulk density	g/cm^3	1.5
K_d	Soil-Water partition coefficient	cm^3/g	Chemical-specific
θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
H'	Henry's Law Constant	Unitless	Chemical-specific
θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18

II. Methods for the Development of Inhalation Standards for Particulate Contaminants for Exposure Scenarios for Residential Sites (Equations 9 through 13)

Equation 9

Inhalation Soil Remediation Standards for Carcinogenic Particulate Contamination for Residential Sites

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 4

$$Inh_pSRS_c = \frac{TR * AT \times 365\ days/year}{URF * 1{,}000\ \mu g/mg * EF * ED * \left(\frac{1}{PEF}\right)}$$

Parameter	Definition	Units	Default
Inh_pSRS_c	Inhalation Soil Remediation Standard for carcinogens	mg/kg	Chemical-specific
TR	Target cancer risk	unitless	$1x10^{-6}$
AT	Averaging time	years	70
URF	Inhalation unit risk factor	$(\mu g/m^3)^{-1}$	Chemical-specific
EF	Exposure frequency	days/year	350 (Residential)
ED	Exposure duration	years	30 (Residential)
PEF	Particulate emission factor	m^3/kg	1,739,586,603

Equation 10

Inhalation Soil Remediation Standards for Noncarcinogenic Particulate Contamination for Residential Sites

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 5

$$Inh_pSRS_n = \frac{THQ * AT * 365\ days/year}{EF * ED * \left(\frac{1}{RfC}\right) * 1{,}000\,\mu g/mg * \left(\frac{1}{PEF}\right)}$$

Parameter	Definition	Units	Default
Inh_pSRS_n	Inhalation Soil Standard for noncarcinogens	mg/kg	Chemical-specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	years	30 (Residential)
EF	Exposure frequency	days/year	350 (Residential)
ED	Exposure duration	years	30 (Residential)
RfC	Inhalation reference concentration	$\mu g/m^3$	Chemical-specific
PEF	Particulate emission factor	m^3/kg	1,739,586,603

Equation 11

Particulate Emission Factor (PEF)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 10

$$PEF = Q/C * \left[\frac{3{,}600 \text{ sec}/ hr}{0.036 * (1 - V) * \left(\frac{U_m}{U_t} \right)^3 * F(x)} \right]$$

Parameter	Definition	Units	Default
PEF	Particulate emission factor	m^3/kg	1,739,586,603 (Residential)
Q/C	Inverse concentration at center of source	$(g/m^2\text{-}s)/(kg/m^3)$	90.4 (Residential)
V	Fraction of vegetative cover	unitless	0.5
U_m	Mean annual wind speed	m/s	4.56
U_t	Equivalent threshold value of wind speed at seven miles per hr	m/s	11.32
F(x)	Function dependent on U_m/U_t derived using Cowherd et al. (1985)	unitless	0.159

Equation 12

Inverse Concentration Factor for Dispersion (Q/C)

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 59

$$Q/C = \frac{J_{s^{ave}}}{C_{air} * 10^{-9}\, kg/\mu g}$$

Parameter	Definition	Units	Default
Q/C	Inverse concentration at center of source	$(g/m^2\text{-}s)/(kg/m^3)$	90.4 (Residential)
J_s^{ave}	Average rate of contaminant flux	$g/m^2\text{-}s$	0.000494315 (Residential)
C_{air}	Maximum contaminant concentration	$\mu g/m^3$	5,468 (Residential)

Equation 13

Average Rate Of Contaminant Flux (J_s^{ave})

Source: Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996); Equation 59

$$J_{s^{ave}} = \frac{ER}{A}$$

Parameter	Definition	Units	Default
J_s^{ave}	Average rate of contaminant flux	g/m^2-s	0.000494315 (Residential)
ER	Emission rate (normalized)	g/s	1
A	Area	m^2	1/2 acre = 2,023 m^2 (Residential)

III. Methods for the Development of Inhalation Standards for Particulate Contaminants for Exposure Scenarios for Non-Residential Sites (Equations 14 through 21)

Equation 14

Inhalation Soil Remediation Standards for Non-Residential Sites for Carcinogenic Particulate Contaminants

ource: Derived from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4-24 (March 2001), Equation 4-3

$$Inh_{p}SRS_{c} = \frac{TR}{CSF * DOSE} * \frac{10^{6} mg}{kg}$$

Parameter	Definition	Units	Default
Inh_pSRS_c	Health-based soil cleanup level for carcinogens	mg/kg	Chemical-specific
TR	Target cancer risk	unitless	$1x10^{-6}$
CSF	Cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical-specific
DOSE	Exposure dose calculation	mg/kg-day	0.00105

Equation 15

Inhalation Soil Remediation Standards for Non-Residential Sites for Non-Carcinogenic Particulate Contaminants

Source: Derived from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4-24 (March 2001), Equation 4-4

$$Inh_pSRS_n = \frac{1}{DOSE \,/\, RfD} * \frac{10^6\, mg}{kg}$$

Parameter	Definition	Units	Default
Inh_pSRS_n	Health-based soil cleanup level for noncarcinogens	mg/kg	Chemical-specific
DOSE	Exposure dose calculation	mg/kg-day	0.00294
RfD	Reference dose	mg/kg-day	Chemical-specific

Equation 16

Converting Unit Risk Factor to Cancer Slope Factor

Source: Derived from footnote equation Table A-1, NJDEP Technical Manual 1003 - Guidance on Preparing a Risk Assessment for Air Contaminant Emissions, December 1994

$$CSF = \frac{URF * BW}{DIR} * \frac{10^3 \mu g}{mg}$$

Parameter	Definition	Units	Default
CSF	Cancer Slope Factor	$(mg/kg\text{-}day)^{-1}$	Chemical-specific
URF	Unit Risk Factor	$(\mu g/m^3)^{-1}$	Chemical-specific
BW	Body weight	kg	70
DIR	Daily inhalation rate	m^3/day	20

Equation 17

Converting Reference Concentration to Reference Dose

Source: Users Guide and Background Technical Document for USEPA Region IX Preliminary Remediation Goals Table, USEPA (2004)

$$RfD = RfC * DIR * \left(1/BW\right) * \left(mg/10^3\,\mu g\right)$$

Parameter	Definition	Units	Default
RfD	Reference dose	(mg/kg-day)	Chemical-specific
RfC	Reference concentration	($\mu g/m^3$)	Chemical-specific
DIR	Daily inhalation rate	m^3/day	20
BW	Body weight	kg	70

Equation 18

Exposure Dose

Source: Derived from Guidelines for Exposure Assessment, EPA/600/2-92/001 (May 1992); Equation 2-5

$$DOSE = \frac{PEF_s * IR * EF * ED}{BW * AT}$$

Parameter	Definition	Units	Default
DOSE	Exposure dose calculation	mg/kg-day	0.00105 (Carcinogenic) 0.00294 (Non-carcinogenic)
PEF_s	Particulate emission factor from site activity; differs from "PEF" noted in Equations 10 and 11	mg/m^3	0.0167
IR	Inhalation rate	m^3/day	20
EF	Exposure frequency	days at site per year	225
ED	Exposure duration	Years	25
BW	Body weight	kg	70
AT	Averaging time	days	25,550 (Carcinogenic) 9,125 (Non-carcinogenic)

Equation 19

Particulate Emission Factor From Site Activity (PEF_s)

Source: Derived from Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Peer Review Draft, OSWER 9355.4-24 (March 2001), Equation 5-9

$$PEF_s = CF * \left[(D_{isc} * ER_{wind}) + (D_{isc} * ER_{traffic}) * \left(\frac{A_{traf}}{A_s} \right) \right]$$

Parameter	Definition	Units	Default
PEF_s	Particulate emission factor from site activity	mg/m^3	0.0167
CF	Conversion factor	mg/μg	10^{-3}
D_{isc}	Air dispersion factor for unit emission rate of one g/s	(μg-sec)/(m^3-g)	170
ER_{wind}	Wind generated particulate emission rate per year	g/s	0.0528
$ER_{traffic}$	Particulate emission rate for site traffic	g/s	0.0453
A_{traf}	Area of traffic	m^2	8,093.65
A_s	Site area	m^2	8,093.65

Equation 20

Particulate Emission Rate ($ER_{traffic}$)

Source: Derived from Equation 21, below - conversion of units in Equation 21 from g/VKT to g/s

$$ER_{traffic} = \frac{E_{10} * TC * D * TF}{(28{,}800 \text{ seconds/8-hr day}) * EF}$$

Parameter	Definition	Units	Default
$ER_{traffic}$	Particulate emission rate for site traffic	g/s	0.0453
E_{10}	Particulate emission factor	g/VKT	579.3
TC	Daily traffic count for the unpaved area	vehicles/day	33
D	Average distance a vehicle travels through the unpaved area	km	0.09
TF	Traffic frequency	days with traffic/year	225
EF	Exposure frequency	days at site/year	225

Equation 21

Particulate Emission Factor from vehicles per kilometer traveled (from USEPA 2003c)

Source: AP-42, Chapter 13.2.2.2; Equations 1a and 2

$$E_{10} = (281.9\ g/VKT) * \left[k(s/12)^{0.9} * (W/3)^{0.45}\right] * \left[\frac{(365 - p)}{365\ days}\right]$$

Parameter	Definition	Units	Default
E_{10}	Particulate emission factor per kilometer traveled	g/VKT (grams per vehicle-kilometer-traveled)	579.3
k	Particle size multiplier	unitless	1.5 for PM10
s	Silt content of unpaved surface	%	11
W	Mean vehicle weight	tons	3.1
p	days with at least 0.254 mm (0.01 in) precipitation per year	days	121.3

IV. Equations for Industrial Wind Erosion listed in Section 13.2.5 of U.S. EPA's AP-42, Compilation of Air Pollutant Emission Factors, Volume I: Stationary, Point, and Area Source (listed with several New Jersey-specific values for convenience; Equations 22 through 25)

Equation 22

Particulate Emission Rate from Wind Erosion (ER_{wind})

Source: Derived from AP-42, Chapter 13.2.5.3; Equation 2

$$ER_{wind} = \frac{k*N*P*SA}{31{,}536{,}000\ \text{sec}/\ year}$$

Parameter	Definition	Units	Default
ER_{wind}	Wind generated particulate emission rate per year	g/s	0.0528
k	Particle size multiplier	unitless	0.5 for PM10
N	Number of disturbances per year	$(year)^{-1}$	225
P	Erosion Potential	g/m^2	1.83
SA	Surface area of the site	m^2	8,093.65

Equation 23

Erosion Potential for a Dry Exposed Surface

Source: Derived from AP-42, Chapter 13.2.5.3; Equation 3

$$P = 58*(u* - u^t)^2 + 25*(u* - u^t)$$

Parameter	Definition	Units	Default
P	Erosion potential	g/m^2	1.83
u*	Friction velocity	m/s	1.39376
u^t	Threshold Friction Velocity	m/s	1.33

A threshold friction velocity of 1.33 m/s for roadbed material is assumed. This value is taken from Table 13.2.5-2 of AP-42 (USEPA 1998a).

Equation 24

Friction Velocity (u*)

Source: Derived from AP-42, Chapter 13.2.5.3; Equation 4

$$u* = 0.053*u_{10}^{+}$$

Parameter	Definition	Units	Default
u*	Friction velocity	m/s	1.39376
u^{+}_{10}	Fastest Mile Wind at 10 meters	m/s	26.297

Equation 25

Correct the Fastest Wind Mile ($u^{6.1}$) to a Reference Height of 10 meters

Source: Derived from AP-42, Chapter 13.2.5.3; Equation 5

$$u_{10}^{+} = u^{6.1} * \frac{\ln(10m / 0.005)}{\ln(z / 0.005)}$$

Parameter	Definition	Units	Default
u^{+}_{10}	Fastest Mile Wind at 10 meters	m/s	26.297
$u^{6.1}$	Fastest Mile Wind at standard anemometer height	m/s	24.587
z	Anemometer height	m	6.1

Fastest Mile Wind Speed of 55 miles per hour (24.58 m/s) found in "Local Climatological Data Annual Summary for Newark, New Jersey" (NOAA 2002b). Value is fastest mile wind speed among climatological records for stations at Allentown and Philadelphia, Pennsylvania, Wilmington, Delaware, Atlantic City, New Jersey, and Central Park, New York.

APPENDIX 4
Methods for the Development
Impact to Ground Water Soil Remediation Standards for Class II A Ground Water

Equation 1

Soil-Water Partition Equation
Generic Impact to Ground Water Soil Remediation Standards for Mobile Organic Chemicals

Source: USEPA. Soil Screening Guidance: Technical Background Document, May 1996. U.S. Environmental Protection Agency, Office of Emergency Response: Washington, D.C., EPA/540/R-95/128 PB96-963502

$$\text{Impact to Ground Water Soil Remediation Standard } (IGWSRS) = GWQC\left\{(K_{oc} f_{oc}) + \frac{\theta_w + \theta_a H'}{\rho_b}\right\} DAF$$

Parameter	Definition	Units	Default
$GWQC$	Health Based Ground Water Quality Criterion (N.J.A.C. 7:9C-1.6 *et seq.*)	mg/L	Chemical-specific
K_{oc}	Soil organic carbon-water partition coefficient	L/kg	Chemical-specific
f_{oc}	Fraction organic carbon	dimensionless	0.002
θ_w	Water filled soil porosity	dimensionless	0.23
θ_a	Air filled soil porosity	dimensionless	0.18
H'	Henry's Law Constant	dimensionless	Chemical specific
ρ_b	Dry soil bulk density	kg/L	1.5
DAF	Dilution attenuation factor	dimensionless	13 (see eq. 2)

Equation 2
Dilution-Attenuation Factor (DAF):

Source: USEPA. Soil Screening Guidance: Technical Background Document, May 1996. U.S. Environmental Protection Agency, Office of Emergency Response: Washington, D.C., EPA/540/R-95/128 PB96-963502

$$\text{Dilution Attenuation Factor}\,(DAF) = 1 + \frac{Kid}{IL}$$

Parameter	Definition	Units	Default
Ki product	Aquifer Hydraulic Conductivity (m/yr)* hydraulic gradient (dimensionless)	m/yr	30
d	Mixing zone depth	m	3.5 (See eq. 3)
I	Infiltration rate	m/yr	0.28
L	Length of area of concern parallel to ground water flow direction	m	30.5

Equation 3
Aquifer mixing zone depth, *d*

Source: USEPA. Soil Screening Guidance: Technical Background Document, May 1996. U.S. Environmental Protection Agency, Office of Emergency Response: Washington, D.C., EPA/540/R-95/128 PB96-963502

$$\text{Mixing zone depth}\left(d\right) = (0.0112L^2)^{0.5} + d_a\left\{1 - \exp\left[(-LI)/(Kid_a)\right]\right\}$$

Parameter	Definition	Units	Default
L	Length of area of concern parallel to ground water flow direction	m	30.5
d_a	Aquifer thickness	m	3.5
I	Infiltration rate	m/yr	0.28
Ki Product	Aquifer hydraulic conductivity (m/yr) multiplied by the hydraulic gradient (dimensionless)	m/yr	30

Equation 4
Leachate Standards

Source: NJDEP Derived equation

$$\text{Leachate Standard}\left(LS\right) = GWQC * DAF$$

Parameter	Definition	Units	Default
GWQC	Health Based Ground Water Quality Criterion (N.J.A.C. 7:9C-1.4)	µg/l	Chemical Specific
DAF	Dilution Attenuation Factor (see equation 2)	dimensionless	13 (see eq. 2)

APPENDIX 5
Methods for the Development of
Alternative Ingestion-Dermal Soil Remediation Standards

Pursuant to N.J.A.C. 7:26D-7, the person responsible for conducting the remediation may propose, for the Department's approval, an alternative soil remediation standard (ARS) for the Ingestion-Dermal exposure pathway for a site or an area of concern based on one of the options provided in this Appendix.

A. General Requirements

The ingestion-dermal exposure pathway has limited ARS options. Soil remediation standards developed for this exposure pathway are based on established risk assessment methods that do not employ site-specific factors. In addition, the default input parameters for these factors are generally accepted and used by EPA and other state agencies. The Department does not believe it is practicable to develop site-specific ARS through the modifications of these standard default input parameters. Therefore, ARS options for the ingestion-dermal pathway are limited to the two options listed below.

Alternative remediation standards calculated pursuant to this Appendix are applicable to ingestion-dermal remediation standards only. The person responsible for conducting the remediation is required to evaluate an ingestion-dermal ARS to determine if such an ARS impacts 1) human health via the inhalation exposure pathway, 2) ground water quality and 3) ecological receptors.

B. Alternative Remediation Standard Options

Option I– Site Specific Default Values (Lead Site Contamination)

The ingestion-dermal pathway uses EPA recommended default exposure parameters for residential and non-residential scenarios for all standards, except lead. These default parameters are generic and reflect a reasonable maximum exposure (RME) that may not be adjusted.

For lead, other risk assessment tools have been developed that use models to predict appropriate blood lead levels. The Department may accept an application for an ARS for residential exposure based on input parameters identified by the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) (USEPA, 1994)[1] using site-specific data for soil and dust lead concentrations. Site data may be used to refine estimates for other exposure-related model parameters such as bioavailability. However, except for lead, the Department will not accept

[1] U.S. Environmental Protection Agency (USEPA). 1994. Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children. Office of Solid Waste and Emergency Response, Washington, DC. OSWER 9285.7-15-1.

applications for alternative remediation standards based on changes to bioavailability assumptions.

The Department may accept an application for alternative remediation standard for lead for non-residential site use based on input parameters identified in the document Recommendations of the Technical Review Workgroup (TRW) for Lead for an Interim Approach to Assessing Risk Associated with Adult Exposures to Lead in Soil (USEPA, 1996)[2].

The Department may accept an application for an alternative remediation standard for a recreational land use at a lead site based on the assessment of non-continuous exposure for all ages identified in the EPA guidance, Assessing Intermittent or Variable Exposures at Lead Sites (USEPA, 2003)[3].

More information on the development of an alternative remediation standard for lead is provided in the ingestion dermal basis and background document which is available on the Department's web site at www.state.nj.us/dep/srp.

The Department does not require the remediation of a discharge to levels that are lower than natural background levels. See N.J.S.A. 58:10B-12(g)(4). The person responsible for conducting the remediation may conduct a site investigation to determine background levels in soil, pursuant to N.J.A.C. 7:26E-3.10 on a site specific basis.

Option II- Recreational Land Use Scenario

An alternative remediation standard may be based on use of the site for recreational purposes. Recreational purposes are site-specific uses that do not reflect either a residential or non-residential land use scenario. Alternative standards may be based on site-specific land use scenarios that effect the amount time that people are likely to spend at a site that is designated for recreational use. There are two basic types of recreational land use, active and passive, that may be considered. Examples of active recreational land use are sports playing fields and playgrounds. Examples of passive recreational land use are walking or bike trails. The approval of an alternative remediation standard for recreational land use will be contingent on the use of proper institutional controls to ensure the continued use of the site for the proposed recreational purpose.

[2] U.S. Environmental Protection Agency (USEPA). 1996b. Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil, USEPA Technical Workgroup for Lead. December, 1996.

[3] U.S. Environmental Protection Agency (USEPA). 2003b. Assessing Intermittent or Variable Exposures at Lead Sites, Office of Solid Waste and Emergency Response, OSWER 9285.7-76.

APPENDIX 6
Methods for the Development of Alternative Inhalation Soil Remediation Standards

Pursuant to N.J.A.C. 7:26D-7.2, the person responsible for conducting the remediation may propose, for the Department's approval, an alternative soil remediation standard (ARS) for the inhalation exposure pathway for a site or an area of concern based on one of the options provided in this Appendix.

A. General Requirements

The inhalation exposure pathway has several ARS options. The soil remediation standards developed for this exposure pathway are based on established risk assessment methods that employ some factors that are not site-specific. In addition, the default input parameters for these factors are generally accepted and used by EPA and other state agencies. The Department does not believe it is practicable to develop a site-specific ARS through the modification of these standard default input parameters. Therefore, ARS options for the inhalation pathway are limited to the options listed below.

If the concentration of any alternative remediation standard derived pursuant to this Appendix exceeds the contaminant's C_{sat} value (Table 1), the contaminant is not regulated as a volatile phase contaminant by the inhalation exposure pathway. However, the contaminant may be regulated as a particulate if appropriate.

Alternative remediation standards calculated pursuant to this Appendix are applicable to inhalation remediation standards only. The person responsible for conducting the remediation is required to evaluate an inhalation ARS to determine if such an ARS impacts 1) human health via the ingestion-dermal exposure pathway, 2) ground water quality and/or 3) ecological receptors.

Multiple site-specific conditions may be used to calculate an ARS for a given contaminant. If an ARS is developed using a given site-specific physical and/or operational condition(s), that (those) condition(s) must be applied consistently.

B. Alternative Remediation Standard Options

Option I. Volatile Phase Contaminants

1. For volatile phase contaminants, three parameters can be varied to develop an ARS. These parameters are depth range of contamination, organic carbon content of the soil, and site size. These parameters are applicable to residential and non-residential scenarios as well as carcinogenic and noncarcinogenic health endpoints.

   i. Depth Range of Contamination

      (1) Determine the actual depth range of contamination by conducting sampling pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-4.

(2) Use the actual depth range of contamination in the Jury Model that is included in the EMSOFT software package to derive a site-specific volatilization factor (VF) following the methodology in Appendix I of the Inhalation Pathway Basis and Background.

(3) Substitute the derived site-specific volatilization factor into Equations 1 and 2 N.J.A.C. 7:26D, Appendix 2, to calculate an alternative inhalation remediation standard. Using a finite depth range reduces the mass of contaminant in the soil, which will reduce the average volatilization flux.

(4) The Department will not require the use of an institutional control pursuant to N.J.A.C. 7:26E-8 for an ARS based on depth range of contamination.

ii. Soil organic carbon content (f_{oc}):

(1) Collect a minimum of three samples from different locations at the site that are representative of each area of concern including soil type(s) and sample depth equivalent to the location of contamination. Samples may not be collected from areas with high levels of organic contamination (greater than 1,000 ppm).

(2) Analyze samples for soil organic carbon content using the Lloyd Kahn Method[4].

(3) Use the average soil organic carbon content as f_{oc} in the Soil-Water Partition Coefficient Equation (Appendix 2, Equation 5) to develop a site-specific Kd value. If f_{oc} values at a given area of concern vary by more than an order of magnitude, they may not be averaged to calculate a site-specific Kd value. In this case, the lowest f_{oc} value must be used to determine the K_d value for the soil in the area of concern.

(4) Use the site-specific Kd value in Equation 4, Appendix 2 to calculate a site-specific value for apparent diffusivity, DA.

(5) Use the site-specific value for apparent diffusivity, DA, in Equation 3, Appendix 2, to calculate a site-specific volatilization factor, VF.

(6) Substitute the site-specific volatilization factor into Equations 1 and 2, Appendix 2, to calculate an alternative inhalation remediation standard.

(7) The Department will not require the use of an institutional control pursuant to N.J.A.C. 7:26E-8 for an ARS based on soil organic carbon content.

[4] Determination of Total Organic Carbon in Sediment (Lloyd Khan Method). U.S. Environmental Protection Agency, Region II, Edison, New Jersey, 1988. (http://www.epa.gov/region02/qa/documents.htm)

Option II. Particulate Phase Contaminants

1. For Residential Exposure

i. Vegetative Cover:

(1) Measure the actual amount of vegetative cover to determine the fraction of vegetative cover (V) on the site. An example of an acceptable vegetative cover would be areas of continuous grass where there is no bare ground.

(2) Use the measured fraction of vegetative cover (V) in Equation 11, Appendix 2 to calculate the particulate emission factor (PEF).

(3) Use the calculated particulate emission factor (PEF) in Equation 9 or 10 of Appendix 2 to calculate the volatile contaminant carcinogenic (Inh_vSRS_c) or noncarcinogenic (Inh_vSRS_n) soil remediation standard for the inhalation pathway, respectively.

(4) The Department will require the use of an institutional control pursuant to N.J.A.C. 7:26E-8 for an ARS based on an actual amount of vegetative cover to ensure that the basis for the ARS is maintained.

2. For Non-residential Scenario

i. Vehicle Trips Per Day ARS for nonresidential sites of two or more acres

(1) Determine the daily traffic count for an unpaved area (TC) (For future use, the entire site is assumed to be unpaved). The number of vehicle trips per day will be calculated by dividing the weekly total by the number of days of site operation for that week.

(2) Use the measured daily traffic count for an unpaved area (TC) in Equation 20, Appendix 2 to calculate the particulate emission rate for site traffic ($ER_{traffic}$).

(3) Use the calculated particulate soil remediation standards ($ER_{traffic}$) in Equation 19 to calculate the particulate emission factor from site activity (PEF_s).

(4) Use the calculated particulate emission factor from site activity (PEF_s) in Equation 18, Appendix 2 to calculate the exposure dose calculation (DOSE).

(5) Use the calculated exposure dose calculation (DOSE) in Equation 14 or 15 of Appendix 2 to calculate the particulate contaminant carcinogenic (Inh_pSRS_c) or the particulate contaminant noncarcinogenic (Inh_pSRS_n) soil remediation standard for the inhalation pathway, respectively.

(6) The Department will require the use of an institutional control pursuant to N.J.A.C. 7:26E-8 for an ARS based on actual vehicle activity to ensure that the basis for the ARS is maintained.

Option III. Recreational Land Use Scenario

An alternative remediation standard may be based on use of the site for recreational purposes. Recreational purposes are site-specific uses that do not reflect either a residential or non-residential land use scenario. Alternative standards may be based on site-specific land use scenarios that effect the amount time that people are likely to spend at a site that is designated for recreational use. There are two basic types of recreational land use, active and passive, that may be considered. Examples of active recreational land use are sports playing fields and playgrounds. Examples of passive recreational land use are walking or bike trails. The approval of an alternative remediation standard for recreational land use will be contingent on the use of proper institutional controls to ensure the continued use of the site for the proposed recreational purpose.

APPENDIX 7
Methods for the Development of
Alternative Impact to Ground Water Soil Remediation Standards

Pursuant to N.J.A.C. 7:26D-7, the person responsible for conducting the remediation may propose, for the Department's approval, an alternative soil remediation standard (ARS) for the impact to ground water exposure pathway for a site or an area of concern based on one of the options provided in this Appendix.

A. General Requirements

The impact to ground water exposure pathway has several ARS options. Soil remediation standards developed for this pathway are based on established risk assessment methods that employ some factors that are not site-specific. In addition, the default input parameters for these factors are generally accepted and used by EPA and other state agencies. The Department does not believe it is practicable to develop a site-specific ARS through the modification of these standard default input parameters. Therefore, ARS options for the impact to ground water pathway are limited to the options listed below.

The concentration of any alternative remediation standard derived pursuant to this Appendix shall not exceed the contaminant's C_{sat} value (Table 1).

A generic dilution-attenuation factor of 13 may be used for mobile chemicals in the ARS options or a site specific dilution-attenuation factor (*DAF*) may be determined pursuant to Option I below.

A site specific leachate standard may be developed for low mobility and inorganic chemicals using a site specific *DAF*. The criterion is determined by multiplying the Class IIA health based Ground Water Quality Criterion by the site specific *DAF* determined pursuant to Option I below.

Alternative remediation standards calculated pursuant to this Appendix are applicable to impact to ground water remediation standards only. The person responsible for conducting the remediation is required to evaluate an impact to ground water ARS to determine if the ARS would impact 1) human health via the ingestion-dermal and inhalation exposure pathways or 2) ecological receptors.

B. Alternative Remediation Standard Options

Option I. Site Specific Modification of Soil-Water Partition Equation Input Parameters for Mobile Chemicals

1. An ARS may be developed for mobile chemicals by site-specifically modifying one or more of the input parameters used in the Soil-Water Partition Equation (SPE), Appendix 3, Equation 1. The options available are listed below. Adjust the SPE input parameters for site specific conditions as follows:

   i. Soil organic carbon content (f_{oc}):

(1) Collect a minimum of 3 samples from locations at the site that are representative of the area of concern including soil type and contaminant depth. Samples may not be collected from areas with high levels of organic contamination (greater than 1,000 ppm).

(2) Analyze samples for soil organic carbon content using the Lloyd Kahn Method[5].

(3) Use the average soil organic carbon content as f_{oc} in the Soil-Water Partition Equation (Appendix 3, Equation 1) to develop an alternative remediation standard. If f_{oc} values vary by more than an order of magnitude, they may not be averaged to calculate an ARS. In this case, the lowest f_{oc} value must be used to develop the alternative remediation standard.

ii. Soil pH (for ionizable phenols):

(1) Collect a minimum of 3 samples from locations at the site that are representative of the area of concern including soil type and contaminant depth.

(2) Measure the pH in each sample using standard methods.

(3) Use the pH value for each sample to select a soil organic carbon-water partition coefficient (K_{oc}) from Table 2 below reproduced from USEPA "Soil Screening Guidance: User's Guide"[6]. If the measured pH is less than 4.9, use the pH 4.9 K_{oc}. If the measured pH is higher than 8.0, use the K_{oc} value for pH 8.0.

(4) Use the resulting K_{oc} value in the Soil-Water Partition Equation (Appendix 3 Equation 1) to develop an alternative remediation standard for each sample. If the calculated ARS values vary by less than an order of magnitude, they may be averaged to determine the site specific ARS. If they vary by more than an order of magnitude, the lowest calculated ARS value must be used.

iii. Dilution Attenuation Factor (*DAF*) - The Dilution Attenuation Factor may be adjusted to reflect site-specific conditions. The following parameters in the *DAF* equations (Appendix 3, Equations 2 and 3) may be adjusted and substituted into equations for the mixing zone depth and the attenuation factor:

(1) Area of concern length (*L*):

(A) Measure the length of the area of concern parallel to ground water flow.

[5] Determination of Total Organic Carbon in Sediment (Lloyd Khan Method). U.S. Environmental Protection Agency, Region II, Edison, New Jersey,1988. (http://www.epa.gov/region02/qa/documents.htm)
[6] Soil Screening Guidance: User's Guide, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC, 1996, Table C-2

(B) Use the length to develop a site-specific aquifer mixing zone depth using Equation 3. If the calculated aquifer mixing zone depth is greater than the aquifer thickness, set the mixing zone depth equal to the aquifer thickness.

(C) Substitute the site-specific values for the mixing zone depth and *L* into the equation for the dilution-attenuation factor (*DAF*) Appendix 3, Equation 2; and

(D) Use the resulting *DAF* value in the Soil-Water Partition Equation (Appendix 3 equation 1) to develop an alternative remediation standard.

(2) Ground water velocity parameters, (hydraulic conductivity, *K* and gradient, *i*):

(A) Determine *K* and *i* from field measurements pursuant to the Technical Requirements for Site Remediation N.J.A.C. 7:26E-3.7(e)3iv, 7:26E-4.4(h)3ii and 7:26E-4.4(h)3iii.

(B) Measure the length (*L*) of the area of concern parallel to ground water flow.

(C) Substitute the above values into the mixing zone equation (Appendix 3, Equation 3) to determine a site-specific aquifer mixing zone depth. If the calculated aquifer mixing zone depth is greater than the aquifer thickness, set the mixing zone depth equal to the aquifer thickness.

(D) Substitute the site-specific values for *K, i, L* and the mixing zone depth into the equation for the dilution-attenuation factor (*DAF*) (Appendix 3, Equation 2) to calculate a site specific *DAF*.

(E) Substitute the *DAF* value into the Soil-Water Partition Equation (Appendix 3 Equation 1) to develop an alternative remediation standard.

(3) Aquifer thickness (d_a):

(A) Aquifer thickness shall be measured in the field by logging continuous core in accordance with the Department's Field Sampling Procedures Manual or shall be determined using available data from the New Jersey Geological Survey or the United States Geological Survey where available.

(B) Measure the length (*L*) of the area of concern parallel to ground water flow.

(C) Use the site-specific aquifer thickness and the actual length of the area of concern in the mixing zone equation (Appendix 3, Equation 3) to calculate a site-specific mixing zone depth. If the calculated aquifer mixing zone depth is greater than the aquifer thickness, set the mixing zone depth equal to the aquifer thickness.

(D) Use the calculated site specific mixing zone depth, and the site specific value for L in the *DAF* equation to calculate a site specific *DAF* (Appendix 3, Equation 2).

(E) Substitute the site specific *DAF* into the Soil-Water Partition Equation (Appendix 3 Equation 1) to develop an alternative remediation standard.

Option II. Synthetic Precipitation Leaching Procedure

1. This option is not appropriate for volatile organic chemical contamination. After completing sections 2i through v below, one or more of the options described in sections 2vi through viii below may be used to calculate an ARS using the Synthetic Precipitation Leaching Procedure.

2. Develop an alternative soil remediation standard using SPLP as follows:

i. Collect soil samples for the site or each area of concern. The number of samples collected shall be determined by the size of the area initially being investigated pursuant to the Department's Technical Requirements for Site Remediation, N.J.A.C. 7:26E. A minimum of three samples must be collected, and should include the highest suspected concentrations of the contaminants on site. Additional samples that represent a range of contaminant concentrations will be useful in using options 2vi through viii below if some or all of the SPLP results exhibit unacceptable leachate concentrations. The samples should be representative of the variation in soil conditions over the area of concern, including variation with soil depth.

ii. Split each sample and analyze as follows:

(1) Analyze one sub-sample for total contaminant concentrations pursuant to the Technical Rules.

(2) Submit the other sub-sample for testing using the SPLP procedure described in USEPA SW-846, Analytical Method 1312, and analyze the leachate using appropriate analytical methods.

(3) Measure the pH of the resulting leachate sample at the end of the extraction.

iii. Report the following information for each sample collected for SPLP analysis:

(1) The total contaminant concentration in the soil, C_T.

(2) The leachate concentration C_L; and the adjusted leachate concentration C_{adj}, if necessary (see section iv below).

(3) The final pH of the leachate.

(4) The volume of the leachate, V_L.

(5) The dry weight of the soil sub-sample used in the SPLP test, M_S.

iv. The Department may require an alternative remediation standard to be developed using adjusted leachate concentrations when site conditions indicate that contaminants may be weakly adsorbed to soil. Leachate concentrations measured in the SPLP test may need to be adjusted to reflect the soil-to-water ratios that exist under field conditions.

(1) The leachate concentration must be adjusted when greater than 25% of the contaminant mass is in the leachate solution at the conclusion of the SPLP test.

(2) Determine the percent concentration of the contaminant in SPLP leachate using Equation 1 below:

$(C_L \text{ x } V_L)/(C_T \text{ x } M_S) \text{ x } 100$ = percent concentration of contaminant in leachate

Equation 1

Where:

V_L = volume of leachate in liters (2 L)
M_S = mass of the soil sample in kilograms (0.1 kg)
C_L = leachate concentration (mg/L)
C_T = total soil concentration (mg/kg)

(3) If the percent contaminant in the leachate is 25 or greater, calculate a K_d value for the contaminant in each sample using Equation 2 below:

$$Kd = \left[\frac{\left(C_T M_S - C_L V_L\right)/ M_S}{C_L} \right]$$

Equation 2

Where:

K_d = is the soil water partition coefficient (L/kg)

C_T = the total concentration of the contaminant in the SPLP soil sample (mg/kg)

M_S = the total weight of the soil sample submitted for SPLP analysis (kg)

C_L = the concentration of contaminant in the SPLP leachate (mg/L)

V_L = the volume of the SPLP leachate (L)

(4) For each sample, substitute the K_d value in the following equation to calculate an adjusted leachate concentration:

Equation 3

$$C_{adj} = C_T[\rho_b/(K_d \text{ x } \rho_b + \theta_w)]$$

Where:

ρ_b = bulk density of the soil (1.5 kg/L)
θ_w = soil moisture (0.23)
C_{adj} = adjusted leachate concentration (mg/L)

(5) Use C_{adj} as C_L in sections vi. and vii below.

v. If option vi or viii below are to be used to calculate an alternate remediation standard, determine a "Leachate standard (LS)" for a contaminant of concern by using a generic LS (see Appendix 3, Table 2B or Table 2C for low mobility chemicals and inorganics respectively) or calculate it as follows:

(1) Determine the health-based Ground Water Quality Criterion, N.J.A.C. 7:9-6, Table 1, for each contaminant.

(2) Multiply the Ground Water Quality Criterion by the generic dilution attenuation factor of 13 or by a site specific *DAF* as described in Option I above to determine the LS.

(3) If the Practical Quantitation Limit (PQL) for the contaminant is higher than the Leachate standard, use the PQL.

vi. Compare the SPLP leachate (or adjusted leachate) concentration for each sample, to the Leachate standard (LS) to determine if existing contaminant levels in soil can be used as a site specific alternative remediation standard as follows:

(1) If all SPLP leachate (or adjusted leachate) concentrations are at or below the LS, the highest soil concentration tested can be used as a site-specific ARS. If this ARS represents the highest concentration of contaminant on site, no further investigation is required for the impact to ground water pathway.

(2) If one or more of the SPLP leachate (or adjusted leachate) concentrations are above the LS, identify the highest soil concentration for which this and all lower soil concentrations give leachate (or adjusted leachate) concentrations at or below the LS. This concentration can be used as a site specific alternative remediation standard.

vii. A site specific alternative remediation standard may also be calculated as follows:

(1) Use the total contaminant concentration in a soil sample (C_T), and the corresponding SPLP leachate concentration (C_L) in Equation 2 above to calculate a sample-specific soil-water partition coefficient (K_d).

(2) If the K_d values of all the samples vary by less than an order of magnitude, calculate the average K_d. If the K_d values of all the samples vary by more than an order of magnitude, select the lowest calculated K_d.

(3) Substitute the site-specific partition coefficient (K_d) determined in (2) above into Equation 4 to calculate a site-specific alternative remediation standard:

$$ARS = C_{gw}\left\{\left[K_d\right] + \frac{\theta_w + \theta_a H'}{\rho_b}\right\} DAF \qquad \text{Equation 4}$$

Where:

ARS = alternative remediation standard (mg/kg)

K_d = is the average, or lowest, calculated sample specific soil-water partition coefficient (L/kg)

θ_w = the water-filled soil porosity (0.23)

θ_a = the air-filled soil porosity (0.18)

H' = the dimensionless Henry's law constant for the contaminant of interest

ρ_b = dry soil bulk density (1.5 kg/L)

DAF = the dilution-attenuation factor (default *DAF* of 13, or site specific *DAF*)

C_{gw} = the ground water criteria for the contaminant (mg/L)

viii. A linear regression technique may be used to determine an alternative soil remediation standard if an adequate linear correlation exists between leachate (or adjusted leachate) concentrations and the corresponding total soil contaminant concentrations. Determine an adequate linear correlation as follows:

(1) For all samples where both the total soil concentration and the leachate (or adjusted leachate) concentration are above the PQL, plot all the leachate (or adjusted leachate) concentration data (in units of µg/L) on the y-axis as the dependent variable versus the total soil concentration for all samples (in units of mg/kg) on the x-axis as the independent variable.

(2) For the data to qualify for the linear regression technique:

(A) At least half of the total soil concentrations data points must lie at or above the midpoint of the range.

(B) The calculated Leachate standard (*LS*) must lie within the range of measured leachate (or adjusted leachate) concentrations.

(C) Conduct a linear least-squares regression analysis of the plotted points. If the R-square value is 0.7 or higher, the calculated linear regression line may be used to determine the acceptable total soil concentration.

(3) Calculate the acceptable total soil concentration using Equation 5 below:

$$ARS = \frac{LS - b}{m} \qquad \text{Equation 5}$$

Where:

ARS = the impact to ground water alternative remediation standard (mg/kg)
m = the slope of the best fit line obtained via linear regression analysis ((µg/L)/(mg/kg))
b = the intercept of the best fit line obtained via linear regression analysis (µg/L)
LS = the Leachate standard (µg/L)

Option III. Vadose Zone Transport Modeling using the SESOIL Model

1. An alternative remediation standard may be developed using the Seasonal Soil Compartment Model (SESOIL), version 6.2 or later, when clean soil exists between the soil contamination and the seasonal high water table. The SESOIL model shall be run per the following instructions:

i. Run the model in the monthly mode.

ii. Use climate data from the weather station nearest to the site. Use the climate databases that are included with model software.

iii. Use chemical properties as required for the model.

(1) Use default values for water solubility, Henry's law constant, and diffusion coefficients from Table 1 below.

(2) For mobile organic chemicals, use K_{oc} values from Table 1.

(3) For low mobility organic chemicals, use K_{oc} values from Table 1, or develop a site specific K_d value using the SPLP test (Option II above).

(4) For ionizable phenols, a pH-dependant site specific K_{oc} value may be developed as described in Option I above.

(5) For inorganic chemicals, use K_d values from Table 1, or develop a site specific K_d value using the SPLP test (Option II above).

(6) Degradation of contaminants may not be included except for benzene, toluene, ethylbenzene and xylene (BTEX). For BTEX contaminants use a one month half life

biodegradation rate (biodegradation rate constant of 0.023 $days^{-1}$) in both the liquid and solid phases if aerobic conditions (>4 percent oxygen) can be demonstrated in the vadose zone.

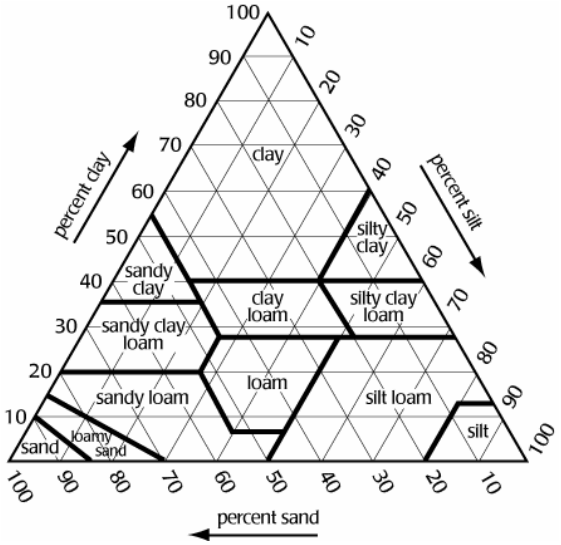
(7) Hydrolysis rate constants may not be used.

iv. Use default soil properties for bulk density, intrinsic permeability, soil pore disconnectedness index, and effective porosity as contained in the model documentation. The cation exchange capacity shall be set to zero. The Freundlich exponent shall be set to one. The default soil texture shall be sand. The default soil organic carbon content shall be set to 0.2 percent. The same soil properties must be used for all existing soil layers. Site-specific values for soil texture and soil organic carbon content may be developed.

(1) To establish soil texture, collect soil cores using a Shelby Tube, direct push sampler, or split-spoon. The soil cores collected should be representative of the variation that occurs within the area of concern. The soil cores/samples shall be collected continuously (every two or four feet depending on the length of the sampling device) from the soil surface to the surface of the static water level. A soil texture analysis is then completed on the cores/samples. Samples should be analyzed every two feet or for each distinct soil layer. To determine soil texture, the Department will consider any of the following techniques acceptable: sieve analysis for the sand and gravel portions of a given sample with pipette or hydrometer measurements of the silt and clay fractions, rapid sediment analyzers, or electro-resistance multichannel particle size analyzers.

The percentages of sand, silt and clay for each sample are compared to the USDA Soil Texture Triangle to determine the soil texture classification (Figure 1 below). Using the USDA Soil Texture Triangle below, sands are considered particles between 0.05 mm and 2 mm, silts are between 0.05 mm and 0.002 mm and clays are less than 0.002 mm in size.

Figure 1



To allow the use of a soil texture in the SESOIL model other than sand, at least 75 percent of the soil vertical profile must be as fine as the selected soil texture. Otherwise, the coarsest soil texture measured must be used for modeling.

The Department's GIS Soil Survey Geographic Database (SSURGO) data layer should be examined in conjunction with the soil boring logs for a particular site of interest as a cross check to confirm that the correct soil texture is being used. This data may also provide a basis for requiring multiple soil boring locations if it indicates horizontal changes in soil texture are likely across the building footprint.

(2) Set the organic carbon content at the generic value of 0.2 percent, or use a site-specific value determined under Option I above. The Freundlich exponent must be set to "1" and soil properties must the same in all layers.

v. The sediment washload option shall not be used.

vi. One foot soil sublayers must be used with the model, and should cover the entire soil column from the soil surface to the water table.

vii. The "Load area" or "Application Area" in the model shall be set equal to the size of the Area of Concern., the appropriate latitude of the site shall be entered, and "instantaneous release" of contaminant at Time 0 of the simulation shall be selected.

viii. Contaminant concentrations (either existing concentrations or proposed remediation standards) must be entered as initial concentrations in the appropriate soil layers.

ix. All ratios of soil properties between soil layers shall be set to "1".

x. The contaminant load parameters POLIN, TRANS, LIG, ISRM and ASL must be set to zero. The VOLF parameter must be set to "1".

xi. Set the model run time at 100 years for low mobility contaminants. For all other contaminants, the model run time must be long enough to achieve peak concentrations in ground water.

xii. Compare the time-dependant concentration of the contaminant in the soil moisture in the deepest soil layer to the Leachate standard (LS) to determine compliance with ground water criteria. To determine the Leachate standard, multiply the GWQC by the generic or site specific DAF. If this product is lower than the PQL, the PQL is used as the LS.

If the model predicts that the concentration will not exceed the LS, then the soil contaminant concentration distribution as used in the model (either existing concentrations or proposed remediation standards) is an acceptable ARS.

xiii. If the model predicts that the ground water concentration will exceed the LS, then soil remediation is necessary.

xiv. The SESOIL model may be rerun varying the concentration distribution in soil in order to identify a distribution that will not result in an exceedance. This identified soil concentration distribution is an acceptable alternative soil remediation standard.

xv. Report the following information for the SESOIL runs submitted for NJDEP consideration:

(1) The value of all input parameters, and their source.

(2) Output of the soil moisture concentration for the bottom soil sublayer as a function of time. Graphical output is preferred.

(3) Other output summaries as provided by the software.

Option IV. Development of an alternative soil remediation goal using Vadose Zone /Ground Water Modeling (SESOIL/AT123D)

1. An alternative remediation standard for the impact to ground water pathway may be developed with the linked SESOIL/AT123D vadose zone/ground water contaminant transport model when:

i. Ground water quality is already degraded by contamination emanating from soil at the area of concern.

ii. The vertical and horizontal extent of ground water contamination emanating from the area of concern has been fully delineated pursuant to N.J.A.C. 7:26E-4.4(h)3i.

iii. A natural ground water remediation or active ground water remediation is approved by the Department.

iv. The Department has established a ground water classification exception area pursuant to N.J.A.C. 7:26E 8.3 as part of the remedy.

v. Ground water contaminated above the applicable ground water remediation standard will not reach the nearest downgradient receptor, as estimated by an appropriate ground water flow/contaminant transport model selected pursuant to N.J.A.C. 7:26E-4.4(h)3iv.

vi. The fate of the contaminant plume has been documented pursuant to N.J.A.C. 7:26E-8.3(b)2.

vii. Contaminant levels in ground water do not present a vapor risk to any receptors in in accordance with the Department's vapor intrusion guidance. This determination shall be made on a case-by-case basis.

viii. Predicted impacts to potential receptors are consistent with the current and potential ground water uses based on a 25-year planning horizon as projected by local and county land use documents. This shall include, without limitation, information pertaining to the existence of water lines, proposed future installation of water lines, local and/or county ordinances restricting installation of potable wells.

2. The SESOIL vadose zone transport model (Version 6.2 or later) shall be used to generate the contaminant source input data for the AT123D ground water transport model as described in Option III.

3. The concentration of soil contamination shall be varied in the SESOIL model until the compliance objectives outlined in 4i and ii, below are met.

i. If the AT123D model predicts that the compliance objectives detailed in 4i and 4ii below will be met, then the soil contaminant concentration distribution as used in the SESOIL model (either existing concentrations or proposed remediation standards) is an acceptable ARS.

ii. If the model predicts that the compliance objectives detailed 4i and 4ii below will not be met, then soil remediation is necessary.

iii. The SESOIL model may be rerun varying the concentration distribution in soil in order to identify a distribution that will meet the compliance objectives detailed in 4i and 4ii below. This identified soil concentration distribution is an acceptable alternative soil remediation standard.

4. Compliance with the Ground Water Quality Standards must be demonstrated by AT123D at two locations. the source area, and the downgradient compliance point.

i. The AT123D predicted concentrations of contaminants at the source area must meet the ground water quality standards within five years or less.

ii. The location of the downgradient compliance point shall be the downgradient edge of the delineated ground water contaminant plume. The peak ground water concentration predicted by AT123D at the downgradient compliance point shall never exceed the health based Ground Water Quality Criterion.

5. Run the AT123D model as follows:

i. The following input parameters shall be measured at the site:

(1) Hydraulic conductivity, pursuant to N.J.A.C. 7:26E-4.4(h)3iii.

(2) Hydraulic gradient, pursuant to N.J.A.C. 7:26E-4.4(h)3iii.

(3) Organic carbon content using the Lloyd Kahn Method[7]. A default value of 0.2 percent (0.002) may also be used.

(4) Longitudinal dispersivity shall be estimated based on the measured plume length using the following equation:

$$\alpha_L = 0.83(\log_{10} L)^{2.414} \qquad \text{Equation 6}$$

where:

α_L = longitudinal dispersivity

L = length of contaminant plume

(5) Transverse dispersivity shall be calculated as $1/10^{th}$ the longitudinal dispersivity.

(6) Vertical dispersivity shall be calculated as $1/100^{th}$ the longitudinal dispersivity.

(7) Aquifer thickness shall be measured in the field by logging continuous core in accordance with the Department's Field Sampling Procedures Manual or shall be determined using available data from the New Jersey Geological Survey or the United States Geological Survey where available.

ii. The following input parameter from a peer reviewed reference:

[7] (Determination of Total Organic Carbon in Sediment (Lloyd Khan Method). U.S. Environmental Protection Agency, Region II, Edison, New Jersey,1988). (http://www.epa.gov/region02/qa/documents.htm).

(1) Effective porosity.

iii. The following input parameters fixed as follows:

(1) Soil bulk density.

(2) Aquifer width shall be set to "infinite".

(3) Eigen values shall be set between 500 and 1,000.

(4) Error tolerance shall be set to 0.001.

(5) First-Order decay coefficient shall be set to zero.

(6) AT123D release coordinates shall be identical to SESOIL source configuration.

(7) AT123D load parameters shall be set in the SESOIL model.

iv. The following input parameters shall be copied from Table 1:

(1) K_{oc} values.

(2) K_d values.

(3) Water diffusion coefficient.

6. A Department approved ground water monitoring program designed to monitor the predictions of the AT123D model shall be implemented.

7. Additional remediation is required when ground monitoring does not agree with AT123D predictions.

Table 1. Chemical Properties for Calculation of Generic and Alternative Impact to Ground Water Soil Remediation Standards

Chemical	*CAS Number*	*Henry's law constant (atm-m^3/mol)*	*Henry's law constant (dimensionless)*	*Water solubility (mg/L)*	*Diffusion coefficient in air (cm^2/sec)*	*Diffusion coefficient in water (cm^2/sec)*	*K_{oc} or K_d (L/kg)[a]*	*Soil Saturation Limit (mg/kg)*
Acenaphthene	83-32-9	1.55E-04	6.36E-03	4.24E+00	4.21E-02	7.69E-06	7.08E+03	-
Acenaphthylene	208-96-8	1.11E-04	4.51E-03	1.60E+01	4.40E-02	7.50E-06	2.76E+03	-
Acetone (2-propanone)	67-64-1	3.88E-05	1.59E-03	1.00E+06	1.24E-01	1.14E-05	5.75E-01	1.55E+05
Acetophenone	98-86-2	1.10E-05	4.51E-04	6.10E+03	6.00E-02	8.70E-06	3.70E+01	1.39E+03
Acrolein	107-02-8	1.20E-04	4.92E-03	2.10E+05	1.05E-01	1.20E-05	1.00E+00	3.27E+04
Acrylonitrile	107-13-1	1.00E-04	4.10E-03	7.40E+04	1.22E-01	1.30E-05	2.00E+00	1.17E+04
Aldrin	309-00-2	1.70E-04	6.97E-03	1.80E-01	1.32E-02	4.86E-06	2.45E+06	-
Aluminum (total)	7429-90-5	-	-	-	-	-	*1.50E+03*	-
Anthracene	120-12-7	6.50E-05	2.67E-03	4.34E-02	3.24E-02	7.74E-06	2.95E+04	-
Antimony (total)	7440-36-0	-	-	-	-	-	*4.50E+01*	-
Arsenic (total)	7440-38-2	-	-	-	-	-	*2.60E+01*	-
Atrazine	1912-24-9	2.96E-09	1.21E-07	7.00E+01	2.60E-02	6.70E-06	3.60E+02	-
Barium (total)	7440-39-3	-	-	-	-	-	*1.70E+01*	-
Benzaldehyde	100-52-7	2.67E-05	1.09E-03	3.00E+03	7.30E-02	9.10E-06	2.90E+01	6.34E+02
Benzene	71-43-2	5.55E-03	2.28E-01	1.75E+03	8.80E-02	9.80E-06	5.89E+01	5.22E+02
Benzidine	92-87-5	3.90E-11	1.60E-09	5.00E+02	3.40E-02	1.50E-05	4.70E+01	-
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	3.35E-06	1.37E-04	9.40E-03	5.10E-02	9.00E-06	3.98E+05	-
Benzo(a)pyrene	50-32-8	1.13E-06	4.63E-05	1.62E-03	4.30E-02	9.00E-06	1.02E+06	-
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	1.11E-04	4.55E-03	1.50E-03	2.26E-02	5.56E-06	1.23E+06	-
Benzo(ghi)perylene	191-24-2	1.40E-07	5.74E-06	2.60E-04	2.01E-02	5.30E-06	3.86E+06	-
Benzo(k)fluoranthene	207-08-9	8.29E-07	3.40E-05	8.00E-04	2.26E-02	5.56E-06	1.23E+06	-
Beryllium	7440-41-7	-	-	-	-	-	*3.50E+01*	-
1,1'-Biphenyl	92-52-4	3.00E-04	1.23E-02	6.00E+00	4.04E-02	8.20E-06	8.56E+03	-
Bis(2-chloroethyl)ether	111-44-4	1.80E-05	7.38E-04	1.72E+04	6.92E-02	7.53E-06	1.55E+01	3.17E+03
Bis(2-chloroisopropyl)ether (2,2'-oxybis(1-chloropropane))	108-60-1	7.40E-05	3.03E-03	1.30E+03	6.02E-02	6.40E-06	3.60E+02	1.14E+03
Bis(2-ethylhexyl)phthalate	117-81-7	1.02E-07	4.18E-06	3.40E-01	3.51E-02	3.66E-06	1.51E+07	1.03E+04
Bromodichloromethane (Dichlorobromomethane)	75-27-4	1.60E-03	6.56E-02	6.74E+03	2.98E-02	1.06E-05	5.50E+01	1.83E+03
Bromoform	75-25-2	5.35E-04	2.19E-02	3.10E+03	1.49E-02	1.03E-05	8.71E+01	1.02E+03
Bromomethane (Methyl bromide)	74-83-9	6.24E-03	2.56E-01	1.52E+04	7.28E-02	1.21E-05	1.05E+01	3.12E+03
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	5.60E-05	2.30E-03	2.20E+05	8.08E-02	9.80E-06	1.00E+00	3.42E+04
Butylbenzyl phthalate	85-68-7	1.26E-06	5.17E-05	2.69E+00	1.74E-02	4.83E-06	5.75E+04	3.10E+02
Cadmium	7440-43-9	-	-	-	-	-	*2.30E+01*	-
Caprolactam	105-60-2	3.66E-09	1.50E-07	3.01E+05	6.50E-02	9.00E-06	6.00E+00	-
Carbazole	86-74-8	1.53E-08	6.27E-07	7.48E+00	3.90E-02	7.03E-06	3.39E+03	-
Carbon disulfide	75-15-0	3.03E-02	1.24E+00	1.19E+03	1.04E-01	1.00E-05	4.57E+01	4.68E+02
Carbon tetrachloride	56-23-5	3.04E+02	1.25E+00	7.93E+02	7.80E-02	8.80E-06	1.74E+02	5.17E+02
Chlordane (alpha and gamma forms summed)	57-74-9	4.86E-05	1.99E-03	5.60E-02	1.18E-02	4.37E-06	1.20E+05	-
4-Chloroaniline (p-Chloroaniline)	106-47-8	3.31E-07	1.36E-05	5.30E+03	4.83E-02	1.01E-05	6.61E+01	-
Chlorobenzene	108-90-7	3.70E-03	1.52E-01	4.72E+02	7.30E-02	8.70E-06	2.19E+02	2.88E+02
Chloroethane	75-00-3	8.80E-03	3.61E-01	5.70E+03	2.71E-01	1.10E-05	1.50E+01	-
Chloroform	67-66-3	3.67E-03	1.50E-01	7.92E+03	1.04E-01	1.00E-05	3.98E+01	1.99E+03
Chloromethane (Methyl chloride)	74-87-3	8.80E-03	3.61E-01	5.30E+03	1.26E-01	6.50E-06	6.00E+00	-
4-Chloro-3-methyl phenol (p-Chloro-m-cresol)	59-50-7	4.00E-07	1.64E-05	3.80E+03	4.20E-02	9.50E-06	1.12E+03	-
2-Chlorophenol (o-Chlorophenol)	95-57-8	3.91E-04	1.60E-02	2.20E+04	5.01E-02	9.46E-06	3.98E+02	2.09E+04
Chromium (III) (Trivalent chromium)	16065-83-1	-	-	-	-	-	*8.10E+03*	-
Chromium (VI) (Hexavalent chromium)	18540-29-9	-	-	-	-	-	*2.80E+01*	-
Chromium (total)	7440-47-3	-	-	-	-	-	*2.80E+01*	-
Chrysene	218-01-9	9.46E-05	3.88E-03	1.60E-03	2.48E-02	6.21E-06	3.98E+05	-
Cobalt (total)	7440-48-4	-	-	-	-	-	*4.50E+01*	-
Copper (total)	7440-50-8	-	-	-	-	-	*4.30E+02*	-
Cyanide	57-12-5	-	-	-	-	-	*9.90E+00*	-
4,4'-DDD (p,p'-TDE)	72-54-8	4.00E-06	1.64E-04	9.00E-02	1.69E-02	4.76E-06	1.00E+06	-
4,4'-DDE (p,p'-DDX)	72-55-9	2.10E-05	8.61E-04	1.20E-01	1.44E-02	5.87E-06	4.47E+06	-
4,4'-DDT	50-29-3	8.10E-06	3.32E-04	2.50E-02	1.37E-02	4.95E-06	2.63E+06	-
Dibenz(a,h)anthracene	53-70-3	1.47E-08	6.03E-07	2.49E-03	2.02E-02	5.18E-06	3.80E+06	-
Dibenzofuran	132-64-9	1.30E-05	5.33E-04	1.00E+01	2.67E-02	6.00E-06	1.35E+04	2.71E+02
Dibromochloromethane (Chlorodibromomethane)	124-48-1	7.83E-04	3.21E-02	2.60E+03	1.96E-02	1.05E-05	6.31E+01	7.37E+02

Chemical	*CAS Number*	*Henry's law constant (atm-m^3/mol)*	*Henry's law constant (dimensionless)*	*Water solubility (mg/L)*	*Diffusion coefficient in air (cm^2/sec)*	*Diffusion coefficient in water (cm^2/sec)*	*K_{oc} or K_d (L/kg)[a]*	*Soil Saturation Limit (mg/kg)*
1,2-Dibromo-3-chloropropane	96-12-8	1.50E-04	6.15E-03	1.20E+03	2.12E-02	7.00E-06	7.90E+01	3.74E+02
1,2-Dibromoethane	106-93-4	7.40E-04	3.03E-02	4.20E+03	2.87E-02	8.10E-06	4.60E+01	1.05E+03
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	1.90E-03	7.79E-02	1.56E+02	6.90E-02	7.90E-06	6.17E+02	2.18E+02
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	3.10E-03	1.27E-01	1.30E+02	6.92E-02	7.90E-06	7.08E+02	2.06E+02
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	2.43E-03	9.96E-02	7.38E+01	6.90E-02	7.90E-06	6.17E+02	-
3,3'-Dichlorobenzidine	91-94-1	4.00E-09	1.64E-07	3.11E+00	1.94E-02	6.74E-06	7.24E+02	-
Dichlorodifluoromethane	75-71-8	3.40E-01	1.39E+01	2.80E+02	5.20E-02	1.00E-05	6.60E+01	-
1,1-Dichloroethane	75-34-3	5.62E-03	2.30E-01	5.06E+03	7.42E-02	1.05E-05	3.16E+01	1.24E+03
1,2-Dichloroethane	107-06-2	9.79E-04	4.01E-02	8.52E+03	1.04E-01	9.90E-06	1.74E+01	1.64E+03
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	2.61E-02	1.07E+00	2.25E+03	9.00E-02	1.04E-05	5.89E+01	8.99E+02
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	4.08E-03	1.67E-01	3.50E+03	7.36E-02	1.13E-05	3.55E+01	8.55E+02
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	9.38E-03	3.85E-01	6.30E+03	7.07E-02	1.19E-05	5.25E+01	1.92E+03
2,4-Dichlorophenol	120-83-2	3.16E-06	1.30E-04	4.50E+03	3.46E-02	8.77E-06	1.59E+02	-
1,2-Dichloropropane	78-87-5	2.80E-03	1.15E-01	2.80E+03	7.80E-02	8.73E-06	4.37E+01	7.13E+02
1,3-Dichloropropene (cis and trans) (summed)	542-75-6	1.77E-02	7.26E-01	2.80E+03	6.26E-02	1.00E-05	4.57E+01	9.29E+02
Dieldrin	60-57-1	1.51E-05	6.19E-04	1.95E-01	1.25E-02	4.74E-06	2.14E+04	-
Diethylphthalate	84-66-2	4.50E-07	1.85E-05	1.08E+03	2.56E-02	6.35E-06	2.88E+02	7.88E+02
2,4-Dimethylphenol	105-67-9	2.00E-06	8.20E-05	7.87E+03	5.84E-02	8.69E-06	2.09E+02	-
Dimethylphthalate	131-11-3	1.10E-07	4.51E-06	4.00E+03	5.68E-02	6.30E-06	3.70E+01	9.09E+02
Di-n-butyl phthalate	84-74-2	9.38E-10	3.85E-08	1.12E+01	4.38E-02	7.86E-06	3.39E+04	7.61E+02
4,6-Dinitro-2-methylphenol	534-52-1	4.30E-07	1.76E-05	2.00E+02	2.93E-02	6.90E-06	1.16E+02	-
2,4-Dinitrophenol	51-28-5	4.43E-07	1.82E-05	2.79E+03	2.73E-02	9.06E-06	1.78E-02	-
2,4-Dinitrotoluene	121-14-2	9.26E-08	3.80E-06	2.70E+02	2.03E-01	7.06E-06	9.55E+01	-
2,6-Dinitrotoluene	606-20-2	7.47E-07	3.06E-05	1.82E+02	3.27E-02	7.26E-06	6.92E+01	-
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	4.20E-07	1.72E-05	2.26E+02	1.18E-01	7.16E-06	8.24E+01	-
Di-n-octyl phthalate	117-84-0	6.68E-05	2.74E-03	2.00E-02	1.51E-02	3.58E-06	8.32E+07	3.33E+03
Dioxin (TCDD) (2,3,7,8-Tetrachlorodibenzo-p-dioxin)	1746-01-6	7.90E-05	3.24E-03	7.90E-06	1.04E-01	5.60E-06	2.45E+06	-
1,2-Diphenylhydrazine	122-66-7	1.50E-06	6.15E-05	6.80E+01	3.17E-02	7.40E-06	7.10E+02	-
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	1.12E-05	4.59E-04	5.10E-01	1.15E-02	4.55E-06	2.14E+03	-
Endosulfan sulfate	1031-07-8	2.10E-03	8.61E-02	6.40E+00	1.10E-02	4.40E-06	1.02E+03	-
Endrin	72-20-8	7.52E-06	3.08E-04	2.50E-01	1.25E-02	4.74E-06	1.23E+04	-
Ethylbenzene	100-41-4	7.88E-03	3.23E-01	1.69E+02	7.50E-02	7.80E-06	3.63E+02	1.55E+02
Fluoranthene	206-44-0	1.61E-05	6.60E-04	2.06E-01	3.02E-02	6.35E-06	1.07E+05	-
Fluorene	86-73-7	6.36E-05	2.61E-03	1.98E+00	3.63E-02	7.88E-06	1.38E+04	-
alpha-HCH (alpha-BHC)	319-84-6	1.06E-05	4.35E-04	2.00E+00	1.42E-02	7.34E-06	1.23E+03	-
beta-HCH (beta-BHC)	319-85-7	7.43E-07	3.05E-05	2.40E-01	1.42E-02	7.34E-06	1.26E+03	-
Heptachlor	76-44-8	1.09E-03	4.47E-02	1.80E-01	1.12E-02	5.69E-06	1.41E+06	-
Heptachlor epoxide	1024-57-3	9.50E-06	3.90E-04	2.00E-01	1.32E-02	4.23E-06	8.32E+04	-
Hexachlorobenzene	118-74-1	1.32E-03	5.41E-02	6.20E+00	5.42E-02	5.91E-06	5.50E+04	-
Hexachloro-1,3-butadiene	87-68-3	8.15E-03	3.34E-01	3.23E+00	5.61E-02	6.16E-06	5.37E+04	3.48E+02
Hexachlorocyclopentadiene	77-47-4	2.70E-02	1.11E+00	1.80E+00	1.61E-02	7.21E-06	2.00E+05	7.21E+02
Hexachloroethane	67-72-1	3.89E-03	1.59E-01	5.00E+01	2.50E-03	6.80E-06	1.78E+03	-
2-Hexanone	591-78-6	9.30E-05	3.80E-03	1.80E+04			2.40E+01	3.63E+03
Indeno(1,2,3-cd)pyrene	193-39-5	1.60E-06	6.56E-05	2.20E-05	1.90E-02	5.66E-06	3.47E+06	-
Isophorone	78-59-1	6.64E-06	2.72E-04	1.20E+04	6.23E-02	6.76E-06	4.68E+01	2.96E+03
Lead (total)	7439-92-1	-	-	-	-	-	*9.00E+02*	-
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	1.40E-05	5.74E-04	6.80E+00	1.42E-02	7.34E-06	1.07E+03	-
Manganese (total)	7439-96-5	-	-	-	-	-	*6.50E+01*	-
Mercury (total)	7439-97-6	-	-	-	-	-	*2.00E-01*	-
Methoxychlor	72-43-5	1.58E-05	6.48E-04	4.50E-02	1.56E-02	4.46E-06	9.77E+04	-
Methyl acetate	79-20-9	1.15E-04	4.72E-03	2.40E+05	1.04E-01	1.00E-05	2.00E+00	3.79E+04
Methylcyclohexane	108-87-2	4.30E-01	1.76E+01	1.40E+01	9.86E-02	8.50E-06	8.65E+02	5.59E+01
Methylene chloride (Dichloromethane)	75-09-2	2.19E-03	8.98E-02	1.30E+04	1.01E-01	1.17E-05	1.17E+01	2.44E+03
2-Methylnaphthalene	91-57-6	5.2E-04	2.13E-02	2.5E+01	5.22E-02	7.75E-06	6.82E+03	-
4-Methyl-2-pentanone (MIBK)	108-10-1	1.40E-04	5.74E-03	1.90E+04	7.50E-02	7.80E-06	1.50E+01	3.50E+03
2-Methylphenol (o-cresol)	95-48-7	1.20E-06	4.92E-05	2.60E+04	7.40E-02	8.30E-06	9.12E+01	-
4-Methylphenol (p-cresol)	106-44-5	7.90E-07	3.24E-05	2.20E+04	7.40E-02	1.00E-05	7.40E+01	-
MTBE (tert-butyl methyl ether)	1634-04-4	5.87E-04	2.40E-02	4.80E+04	1.02E-01	1.00E-05	8.00E+00	8.27E+03
Naphthalene	91-20-3	4.83E-04	1.98E-02	3.10E+01	5.90E-02	7.50E-06	2.00E+03	-
Nickel (total)	7440-02-0	-	-	-	-	-	*2.40E+01*	-
2-Nitroaniline	88-74-4	1.81E-08	7.42E-07	2.90E+02	7.30E-02	8.00E-06	7.40E+01	-

Chemical	*CAS Number*	*Henry's law constant (atm-m^3/mol)*	*Henry's law constant (dimensionless)*	*Water solubility (mg/L)*	*Diffusion coefficient in air (cm^2/sec)*	*Diffusion coefficient in water (cm^2/sec)*	*K_{oc} or K_d (L/kg)[a]*	*Soil Saturation Limit (mg/kg)*
Nitrobenzene	98-95-3	2.40E-05	9.84E-04	2.09E+03	7.60E-02	8.60E-06	6.46E+01	5.91E+02
4-Nitrophenol	100-02-7	4.20E-10	1.72E-08	1.20E+04	4.30E-02	9.60E-06	7.40E+01	-
N-Nitrosodimethylamine	62-75-9	1.20E-06	4.92E-05	1.00E+06	1.13E-01	1.20E-05	3.00E-01	1.54E+05
N-Nitrosodi-n-propylamine	621-64-7	2.25E-06	9.23E-05	9.89E+03	5.45E-02	8.17E-06	2.40E+01	-
N-Nitrosodiphenylamine	86-30-6	5.00E-06	2.05E-04	3.51E+01	3.12E-02	6.35E-06	1.29E+03	-
PCBs (Polychlorinated biphenyls) (summed)	1336-36-3	2.60E-03	1.07E-01	7.00E-01	1.75E-02	8.00E-06	3.09E+05	4.33E+02
Pentachlorophenol	87-86-5	2.44E-08	1.00E-06	1.95E+03	5.60E-02	6.10E-06	5.10E+03	-
Phenanthrene	85-01-8	2.30E-05	9.43E-04	1.10E+00	3.33E-02	7.50E-06	2.65E+04	-
Phenol	108-95-2	3.97E-07	1.63E-05	8.28E+04	8.20E-02	9.10E-06	2.88E+01	-
Pyrene	129-00-0	1.10E-05	4.51E-04	1.35E-01	2.72E-02	7.24E-06	1.05E+05	-
Selenium (total)	7782-49-2	-	-	-	-	-	*1.40E+01*	-
Silver (total)	7440-22-4	-	-	-	-	-	*2.60E-01*	-
Styrene	100-42-5	2.75E-05	1.13E-01	3.10E+02	7.10E-02	8.00E-06	7.76E+02	5.33E+02
Tertiary butyl alcohol (TBA)	75-65-0	9.05E-06	3.71E-04	1.00E+06	9.85E-02	1.14E-05	2.00E+00	-
1,1,2,2-Tetrachloroethane	79-34-5	3.45E-04	1.41E-02	2.97E+03	7.10E-02	7.90E-06	9.33E+01	1.01E+03
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1.84E-02	7.54E-01	2.00E+02	7.20E-02	8.20E-06	1.55E+02	1.11E+02
Thallium (total)	7440-28-0	-	-	-	-	-	*4.80E+01*	-
Toluene	108-88-3	6.64E-03	2.72E-01	5.26E+02	8.70E-02	8.60E-06	1.82E+02	2.89E+02
Toxaphene	8001-35-2	6.00E-06	2.46E-04	7.40E-01	1.16E-02	4.34E-06	2.57E+05	-
1,2,4-Trichlorobenzene	120-82-1	1.42E-03	5.82E-02	3.00E+02	3.00E-02	8.23E-06	1.78E+03	1.12E+03
1,1,1-Trichloroethane	71-55-6	1.72E-02	7.05E-01	1.33E+03	7.80E-02	8.80E-06	1.10E+02	6.09E+02
1,1,2-Trichloroethane	79-00-5	9.13E-04	3.74E-02	4.42E+03	7.80E-02	8.80E-06	5.01E+01	1.14E+03
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1.03E-02	4.22E-01	1.10E+03	7.90E-02	9.10E-06	1.66E+02	5.90E+02
Trichlorofluoromethane	75-69-4	9.70E-02	3.98E+00	1.10E+03	4.26E-02	1.00E-05	1.14E+02	9.44E+02
2,4,5-Trichlorophenol	95-95-4	4.33E-06	1.78E-04	1.20E+03	2.91E-02	7.03E-06	2.34E+03	-
2,4,6-Trichlorophenol	88-06-2	7.79E-06	3.19E-04	8.00E+02	3.18E-02	6.25E-06	9.99E+02	-
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	4.80E-01	1.97E+01	1.70E+02	7.80E-02	8.20E-06	4.10E+02	5.67E+02
Vanadium (total)	7440-62-2	-	-	-	-	-	*1.00E+03*	-
Vinyl chloride	75-01-4	2.70E-02	1.11E+00	2.76E+03	1.06E-01	1.23E-06	1.86E+01	-
Xylenes (total)	1330-20-7	6.73E-03	2.76E-01	1.75E+02	7.69E-02	8.44E-06	3.86E+02	1.68E+02
Zinc (total)	7440-66-6	-	-	-	-	-	*2.30E+01*	-

a Values in italics are Kd values

Table 2. K_{oc} Values (L/kg) for Ionizing Organics as a Function of pH

pH	Benzoic Acid	2-Chloro-phenol	2,4-Dichloro-phenol	2,4- Dinitro-phenol	Pentachloro-phenol	2,3,4,5-Tetrachloro-phenol	2,3,4,6-Tetrachloro-phenol	2,4,5-Trichloro-phenol	2,4,6 Trichloro-phenol
4.9	5.54E+00	3.98E+02	1.59E+02	2.94E-02	9.05E+03	1.73E+04	4.45E+03	2.37E+03	1.04E+03
5.0	4.64E+00	3.98E+02	1.59E+02	2.55E-02	7.96E+03	1.72E+04	4.15E+03	2.36E+03	1.03E+03
5.1	3.88E+00	3.98E+02	1.59E+02	2.23E-02	6.93E+03	1.70E+04	3.83E+03	2.36E+03	1.02E+03
5.2	3.25E+00	3.98E+02	1.59E+02	1.98E-02	5.97E+03	1.67E+04	3.49E+03	2.35E+03	1.01 E+03
5.3	2.72E+00	3.98E+02	1.59E+02	1.78E-02	5.10E+03	1.65E+04	3.14E+03	2.34E+03	9.99E+02
5.4	2.29E+00	3.98E+02	1.58E+02	1.62E-02	4.32E+03	1.61 E+04	2.79E+03	2.33E+03	9.82E+02
5.5	1.94E+00	3.97E+02	1.58E+02	1.50E-02	3.65E+03	1.57E+04	2.45E+03	2.32E+03	9.62E+02
5.6	1.65E+00	3.97E+02	1.58E+02	1.40E-02	3.07E+03	1.52E+04	2.13E+03	2.31E+03	9.38E+02
5.7	1.42E+00	3.97E+02	1.58E+02	1.32E-02	2.58E+03	1.47E+04	1.83E+03	2.29E+03	9.10E+02
5.8	1.24E+00	3.97E+02	1.58E+02	1.25E-02	2.18E+03	1.40E+04	1.56E+03	2.27E+03	8.77E+02
5.9	1.09E+00	3.97E+02	1.57E+02	1.20E-02	1.84E+03	1.32E+04	1.32E+03	2.24E+03	8.39E+02
6.0	9.69E-01	3.96E+02	1.57E+02	1.16E-02	1.56E+03	1.24E+04	1.11 E+03	2.21 E+03	7.96E+02
6.1	8.75E-01	3.96E+02	1.57E+02	1.13E-02	1.33E+03	1.15E+04	9.27E+02	2.17E+03	7.48E+02
6.2	7.99E-01	3.96E+02	1.56E+02	1.10E-02	1.15E+03	1.05E+04	7.75E+02	2.12E+03	6.97E+02
6.3	7.36E-01	3.95E+02	1.55E+02	1.08E-02	9.98E+02	9.51 E+03	6.47E+02	2.06E+03	6.44E+02
6.4	6.89E-01	3.94E+02	1,54E+02	1.06E-02	8.77E+02	8.48E+03	5.42E+02	1.99E+03	5.89E+02
6.5	6.51 E-01	3.93E+02	1.53E+02	1.05E-02	7.81 E+02	7.47E+03	4.55E+02	1.91 E+03	5.33E+02
6.6	6.20E-01	3.92E+02	1.52E+02	1.04E-02	7.03E+02	6.49E+03	3.84E+02	1.82E+03	4.80E+02
6.7	5.95E-01	3.90E+02	1.50E+02	1.03E-02	6.40E+02	5.58E+03	3.27E+02	1.71E+03	4.29E+02
6.8	5.76E-01	3.88E+02	1.47E+02	1.02E-02	5.92E+02	4.74E+03	2.80E+02	1.60E+03	3.81 E+02
6.9	5.60E-01	3.86E+02	1.45E+02	1.02E-02	5.52E+02	3.99E+03	2.42E+02	1.47E+03	3.38E+02
7.0	5.47E-01	3.83E+02	1.41 E+02	1.02E-02	5.21 E+02	3.33E+03	2.13E+02	1.34E+03	3.00E+02
7.1	5.38E-01	3.79E+02	1.38E+02	1.02E-02	4.96E+02	2.76E+03	1.88E+02	1.21E+03	2.67E+02
7.2	5.32E-01	3.75E+02	1.33E+02	1.01 E-02	4.76E+02	2.28E+03	1.69E+02	1.07E+03	2.39E+02
7.3	5.25E-01	3.69E+02	1.28E+02	1.01E-02	4.61 E+02	1.87E+03	1.53E+02	9.43E+02	2.15E+02
7.4	5.19E-01	3.62E+02	1.21 E+02	1.01 E-02	4.47E+02	1.53E+03	1.41 E+02	8.19E+02	1.95E+02
7.5	5.16E-01	3.54E+02	1.14E+02	1.01 E-02	4.37E+02	1.25E+03	1.31 E+02	7.03E+02	1.78E+02
7.6	5.13E-01	3.44E+02	1.07E+02	1.01 E-02	4.29E+02	1.02E+03	1.23E+02	5.99E+02	1.64E+02
7.7	5.09E-01	3.33E+02	9.84E+01	1.00E-02	4.23E+02	8.31 E+02	1.17E+02	5.07E+02	1.53E+02
7.8	5.06E-01	3.19E+02	8.97E+01	1.00E-02	4.18E+02	6.79E+02	1.13E+02	4.26E+02	1.44E+02
7.9	5.06E-01	3.04E+02	8.07E+01	1.00E-02	4.14E+02	5.56E+02	1.08E+02	3.57E+02	1.37E+02
8.0	5.06E-01	2.86E+02	7.17E+01	1.00E-02	4.10E+02	4.58E+02	1.05E+02	2.98E+02	1.31 E+02

APPENDIX 8

Alternative Soil Remediation Standard Application

A. SITE INFORMATION

1. Program Interest Name:_____

2. Program Interest Number (Preferred ID): _____

3. EPA site ID number, if applicable: _____

4. Street address: _____

5. City: _____

6. County: _____

7. Block and Lots of the site (duplicate if the site is located in more than one municipality):

   a. Name of the municipality in which the site is located: _____

   b. Block and Lots: _____

   c. Year of tax map: _____

8. The location of the site in a GIS-compatible format (State Plane Coordinates): _____

B. APPLICANT INFORMATION:

   a. Name of applicant: _____

   b. Company name: _____

   c. Mailing address: _____

   d. Phone number: (__ __ __) __ __ __ - __ __ __ __

C. PROPOSED ALTERNATIVE SOIL REMEDIATION STANDARD INFORMATION (Add additional pages as necessary)

1. Name and chemical abstract number of contaminant for which ARS is being sought:

2. A summary of contaminant concentrations at the site for which the ARS is being sought.

3. Description of the exposure pathway for which the ARS is being sought:

4. Proposed numeric ARS:

5. Documentation to support proposed ARS, including but not limited to the following:

a. New chemical toxicity.

b. New risk assessment methodology or models.

c. Alternative land use planned for the site.

d. Site specific conditions that support modification of input parameters for models used to develop ARS pursuant to Appendices 4 through 6.

D. Oversight Document Information

1. Is the site for which the ARS is being sought being remediated pursuant to Department oversight: Yes____ No_____

2. If yes, the type of Department oversight pursuant to which the Department is reviewing the application:

Memorandum of Agreement

a. Effective date of Memorandum of Agreement _____

b. Name of Department contact person _____

Administrative Consent Order

a. Effective date of Administrative Consent Order _____

b. Name of Department contact person _____

Industrial Site Recovery Act Program

a. Name of Department contact person _____

Underground Storage Tank Program

a. Name of Department contact person _____

3. If no, the applicant shall enter into a Memorandum of Agreement with the Department pursuant to N.J.A.C. 7:26C-3 prior to the Department reviewing the application. Upon the applicant entering into the Memorandum of Agreement, the applicant shall contact the Department with the following information.

a. Effective date of Memorandum of Agreement _____

b. Name of Department contact person _____

Chapter 26E

TECHNICAL REQUIREMENTS FOR SITE REMEDIATION

SUBCHAPTER 1 GENERAL INFORMATION

7:26E-1.3 Applicability

(a) - (c) (No change.)

(d) The person responsible for conducting the remediation of a site shall remediate soil:

1. To meet the remediation standards at N.J.A.C. 7:26D; or

2. To meet the standards or criteria developed by the Department under N.J.S.A. 58:10B-12a for that site prior to (effective date of N.J.A.C. 7:26D) provided:

i. A remedial action workplan or a remedial action report containing standards or criteria developed for the site under N.J.S.A. 58:10B-12a is submitted to the Department before (effective date of N.J.A.C. 7:26D plus 6 months);

ii. The remedial action workplan or a remedial action report meets the requirements of N.J.A.C. 7:26E-6; and

iii. The standards or criteria developed by the Department under N.J.S.A. 58:10B-12a for the site are not greater by an order of magnitude or more, than the soil remediation standards otherwise applicable under N.J.A.C. 7:26D.

[(d)] (e) (No change in text.)

[7:26E-1.13 Minimum Ground Water and Surface Water Remediation Standards

(a) This section sets forth the minimum remediation standards that apply to ground water and surface water for purposes of the remediation of a contaminated site pursuant to this chapter.

(b) The minimum ground water remediation standards are:

1. The following numeric ground water remediation standards:

i. The Ground Water Quality Standards, N.J.A.C. 7:9-6, Appendix, Tables 1 and 2;

ii. The standards resulting from application of the procedures in N.J.A.C. 7:9-6.7(c)2 through 6, for the derivation of a new criterion where a specific contaminant is not listed in N.J.A.C. 7:9-6, Appendix, Table 1; and

iii. The standards resulting from application of the procedures in N.J.A.C. 7:9-6.7(c)3, for the derivation of a new criterion when the Department determines that current scientific information indicates that a specifically listed numeric criterion is no longer appropriate. The Department will post standards developed pursuant to (b)1ii and iii above on the Department's web site at http://www.state.nj.us/dep/wmm/bfbm /is_text.html; and

2. The following narrative ground water remediation standards:

i. The general ground water quality policies in N.J.A.C. 7:9-6.2;

ii. The narrative ground water quality criteria in N.J.A.C. 7:9-6.7;

iii. The ground water quality antidegradation policy in N.J.A.C. 7:9-6.8;

iv. The remediation requirements in N.J.A.C. 7:26E- 1 through 8 in order to both:

(1) Address the adverse impact of the contamination on the ground water itself; and

(2) Limit additional risks posed by the contamination to the public health and safety and to the environment;

v. Removal, treatment, or containment of free and residual product pursuant to N.J.A.C. 7:26E-6.1(d);

vi. Ensure no release of contaminants to the ground surface, structures or air in concentrations that pose a threat to human health; and

vii. The following factors, as applicable on a site-specific basis, for selecting an appropriate ground water remedial action:

(1) The location of the contaminated site relative to ground water use;

(2) The potential human and environmental exposure to the ground water contamination;

(3) The present, projected, and potential ground water use at the site and in the area surrounding the site over the 25 years after the selection of the ground water remedy;

(4) Ambient ground water quality at the site and in the area surrounding the site resulting from both natural and human activities;

(5) The physical and chemical characteristics of the contaminants of concern; and

(6) The criteria in N.J.A.C. 7:26E-6.3(d)1i, to determine when natural remediation is appropriate as a remedial action for ground water contamination.

(c) The person responsible for conducting the remediation is not required to remediate ground water to a level or concentration that is lower than the level or concentration of the regional natural background level or concentration for any particular hazardous substance or pollutant.

(d) The Department will not accept alternate numeric ground water remediation standards developed based on a site-specific risk assessment.

(e) The minimum surface water remediation standards are:

1. The more stringent of either the numeric New Jersey Surface Water Quality Standards pursuant to N.J.A.C. 7:9B-1.14(c) and (d) or the numeric Federal Surface Water Criteria, 40 CFR Part 131; and

2. The following narrative surface water remediation standards:

i. The general surface water quality policies included in N.J.A.C. 7:9B-1.5;

ii. The narrative surface water quality criteria included in N.J.A.C. 7:9B-1.14;

iii. The remediation requirements in N.J.A.C. 7:26E- 1 through 8 in order to both:

(1) Address the adverse impact of the contamination on the surface water itself; and

(2) Limit additional risks posed by the contamination to the public health and safety and to the environment;

iv. Removal, treatment, or containment of free and residual product pursuant to N.J.A.C. 7:26E-6.1(d); and

v. The following narrative criteria, as applicable on a site-specific basis, for selecting an appropriate surface water remedial action:

(1) The location of the contaminated site relative to surface water use;

(2) The potential human and environmental exposure to the surface water contamination;

(3) The present and projected surface water use at the site and in the area surrounding the site;

(4) Ambient surface water quality at the site and in the area surrounding the site resulting from both natural and human activities; and

(5) The physical and chemical characteristics of the contaminants of concern.

(f) The Department will not accept alternate numeric surface water remediation standards developed based on a site-specific risk assessment.]