NOTE: THIS IS A COURTESY COPY OF THIS RULE ADOPTION. THE OFFICIAL VERSION WILL BE PUBLISHED IN THE MAY 17, 2021 NEW JERSEY REGISTER. SHOULD THERE BE ANY DISCREPANCIES BETWEEN THIS TEXT AND THE OFFICIAL VERSION OF THE ADOPTION, THE OFFICIAL VERSION WILL GOVERN.

ENVIRONMENTAL PROTECTION

SITE REMEDIATION AND WASTE MANAGEMENT

Remediation Standards

Adopted Repeals and New Rules: N.J.A.C. 7:26D-4.2 and 4.3; and 7:26D Appendices 1 through 6

Adopted Amendments: N.J.A.C. 7:26D-1.1, 1.2, 1.4, 1.5, 2.1, 2.2, 3.1, 3.2, 4.1, 5.1, 5.2, 5.3, 6.1, 6.2, 7.1, 7.2, and 7.4; and 7:26E-1.5

Adopted New Rules: N.J.A.C. 7:26D-4.4, 5.1, 5.2, 7.2, 8.1, 8.3, and 8.5, and 7:26D Appendices 7 through 12

Adopted Repeals: N.J.A.C. 7:26D-6.2, 7.1, 7.3, and 7.5

Proposed: April 6, 2020, at 52 N.J.R. 566(a) (see also 52 N.J.R. 1011(a) and 52 N.J.R. 1321(a)).

Adopted: March 31, 2021, by Shawn LaTourette, Acting Commissioner, Department of Environmental Protection.

Filed: March 31, 2021, as R.2021 d.041, **with non-substantial changes** not requiring additional public notice and comment (see N.J.A.C. 1:30-6.3).

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.

DEP Docket Number: 01-20-03.

Effective Date: May 17, 2021.

Expiration Dates: April 27, 2022; N.J.A.C. 7:26D;

March 13, 2026, N.J.A.C. 7:26E.

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The Department of Environmental Protection (Department) is adopting amendments, new rules, and repeals to its Remediation Standards, N.J.A.C. 7:26D, which are applied to contaminated sites throughout the State. The Brownfield and Contaminated Site Remediation Act (Brownfield Act), N.J.S.A. 58:10B-1 et seq., requires the Department to develop remediation standards for soil, ground water, and surface water quality necessary for the remediation of contaminated sites that are protective of public health, safety, and the environment.

Through this rulemaking, the Department is establishing separate residential and nonresidential soil remediation standards for the ingestion-dermal and the inhalation exposure pathways. It is also creating new soil remediation standards for the migration to ground water exposure pathway, which were previously established on a site-specific basis using Department guidance. The Department is also recodifying the ground water and surface water remediation standards that are based upon the Ground Water Quality Standards, N.J.A.C. 7:9C, and the Surface Water Quality Standards, N.J.A.C. 7:9B. In addition, the Department is adopting new remediation standards for soil leachate (for the migration to ground water exposure pathway) and indoor air (for the vapor intrusion exposure pathway).

The adopted remediation standards are based upon toxicity factors, exposure assumptions, chemical factors, and physical factors. Some of the remediation standards are more stringent than the former rules, and some are less stringent. Further, the Department is adopting remediation standards for several contaminants that were not included in the former rules and adopting remediation standards for several contaminants that were included in the former rules, for which the standards could no longer be scientifically justified.

The adopted remediation standards for some contaminants are more stringent than the former remediation standards by a factor of 10 or more, which may require additional remediation at both active and closed sites. As in the former rules, the adopted rules provide for interim remediation standards for contaminants for which there are no codified remediation standards. The Department is also expanding the availability of interim remediation standards to soil leachate, ground water, and indoor air.

The adopted remediation standards, like the former standards, allow the person responsible for conducting the remediation to request an alternative remediation standard (ARS) for a specific area of concern. In addition, the adopted remediation standards expand the use of alternate remediation standards to include the new soil leachate and indoor air remediation standards. Likewise, the adopted rules continue to allow the Department to update soil remediation standards by published notice when there is a change in either the U.S. Environment Protection Agency (USEPA) Integrated Risk Information System (IRIS) toxicity factor or the New Jersey Drinking Water Quality Institute (NJDWQI) toxicity factor on which a codified remediation standard is based. The adopted rules also add provisions allowing the Department to update soil leachate and indoor air remediation standards if there is a change to the USEPA IRIS toxicity factor or NJDWQI toxicity factor.

This notice of adoption may also be viewed or downloaded from the Department's website at http://www.nj.gov/dep/rules.

Summary of Hearing Officer's Recommendation and Agency's Response:

The Department held a public hearing on July 21, 2020. The hearing was conducted virtually through the Department's video conferencing software (Microsoft Teams), and a link to the virtual public hearing was provided on the Department's Site Remediation and Waste Management Program website (http://nj.gov/dep/srp/regs/rsrp.html). Dr. Barry Frasco, Assistant Director of the Hazardous Site Science Element within the Site Remediation and Waste Management Program, served as hearing officer. Two people provided oral comments during the public hearing. After reviewing the comments received during the public comment period, the hearing officer recommended that the rulemaking be adopted with the changes described below in the Summary of Public Comments and Agency Responses and the Summary of Agency-Initiated Changes. The Department accepts the hearing officer’s recommendations.

The record of the public hearing is available for inspection in accordance with applicable law by contacting:

Department of Environmental Protection
Office of Legal Affairs
ATTN: Docket No. 01-20-03
401 East State Street, 7th Floor
Mail Code 401-04L
PO Box 402
Trenton, New Jersey 08625-0402

Summary of Public Comments and Agency Responses:

The following people submitted written comments and/or gave oral testimony on the proposal:

1. Raymond Cantor, New Jersey Business and Industry Association
2. Geoff Clark, Equity Environmental Engineering, LLC
3. Eric DeGesero, Fuel Merchants Association of New Jersey
4. Scott R. Drew, New Jersey Licensed Site Remediation Professional Association
5. Paul C. Dritsas, Esq., United States Metals Refining Company
6. Michael A. Egenton, New Jersey State Chamber of Commerce
7. Rodger A. Ferguson, Jr., Penn Jersey Environmental Consulting
8. Dennis Hart, Chemistry Council of New Jersey and the Site Remediation Industry Network
9. Samantha Jones, Chemistry Council of New Jersey and the Site Remediation Industry Network
10. Grant Lucking, New Jersey Builders Association
11. Michael McGuinness, NAIOP NJ, the Commercial Real Estate Development Association
12. Michael Pattison, U.S. Department of Defense
13. Jean Public
14. Ritikrana Rana
15. David J. Russell, AECOM Technical Services, Inc.
16. Anthony Russo, Commerce and Industry Association of New Jersey
17. Eileen Snyder, Alpha Analytical, Inc.

18. Bill Wolfe

A summary of the timely submitted comments and the Department's responses follows. The number(s) in parentheses after each comment identify the commenter(s) listed above.

Rulemaking Procedure

Stakeholder Process

1. COMMENT: The stakeholder process concerning this rule proposal was insufficient and inconsistent with recent Department precedent as it largely occurred in highly abbreviated sessions in 2014 and 2015, with only one update in 2018. During the sessions that did occur, the level of stakeholder involvement allowed in the process at the time was minimal in comparison to other stakeholder initiatives that the Department had sponsored in the recent past. Interested parties would have welcomed the opportunity to review updates and additional information that the Department purports to rely on prior to the rulemaking, which also occurred with little warning and amid a State of Emergency. Based upon the COVID-19 crisis, the Governor extended deadlines for Department action on proposed regulations, expiring rules, and 90-day permit reviews. Although it was appropriate that the comment period was extended by 60 days, additional stakeholder sessions should have been convened, at least, to discuss the creation of new exposure pathways that were last reviewed by stakeholders in 2015. There appears to be little or no need from a public health or environmental perspective to introduce these pathways now. That is, environmental risks presented by ground water contamination and vapor intrusion are already being fully and

adequately evaluated and remediated in the site remediation process. Coupled with the difficulties in working conditions and communications presented by the COVID-19 crisis, the lack of compelling need for speedy adoption of new standards presents a process lacking in fairness to the public and, particularly, the regulated community. (10 and 11)

2. COMMENT: Given the inherent complexity of this rulemaking, there should have been greater opportunity for stakeholder input, particularly due to the fact that the proposal was published during the ongoing COVID-19 State of Emergency. Even with the 60-day extension of the comment period, the ability to confer with the professionals the association relies upon for their expertise has been severely limited, and no additional stakeholder sessions were offered. (11)

RESPONSE TO COMMENTS 1 AND 2: Thirteen stakeholder sessions took place between March 2014 and June 2015. Each session was at least two hours long. In addition, during that time, the Department provided stakeholders with information on the rule outline and specific rule text, how remediation standards were going to be calculated, the Department’s position on overarching policy issues (for example, toxicity information/hierarchy, significant figures, and Group C carcinogens), and proposed remediation standards for contaminants. Stakeholders were given the opportunity to review and comment on this information.

Due to Department delay in proposing the rules, an additional stakeholder meeting was held in December 2018, to advise stakeholders of the additional changes to the proposed remediation standards that had occurred since 2015. The purpose of this meeting was to inform the stakeholders that proposed remediation standards for some contaminants were changed due to updates in toxicity information, which were not substantive changes from the anticipated notice of proposal discussed with the stakeholders in 2015. Stakeholders were provided with a list of affected contaminants and the changes in proposed remediation standards. The Department made no significant changes to the draft rules (including no changes to specific contaminant remediation standards) between the December 2018 stakeholder meeting and publication of the notice of proposal in the New Jersey Register in April 2020. Consequently, the Department determined that there was no reason to convene an additional stakeholder meeting.

The Department recognizes that the COVID-19 emergency placed added burdens on the regulated community; however, the stakeholder community was aware of the content of the proposed rule since December 2018. The Department believes that the 60-day extension to the comment period provided ample additional time to comment on the proposed rules.

3. COMMENT: The Department published the notice of proposal touting an extensive stakeholder process, was undertaken over the past many years the rules have been in development. However, while the stakeholder process may have been extensive, stakeholder input was largely ignored. The Department has moved along on a course set well before the stakeholder process for this current iteration of the rules was initiated. The Department armed itself with arguments to support a predetermined position. The Department accepted input from stakeholders and, rather than give any level of consideration to that input, the Department only developed more arguments to support the predetermined position. In the

end, when no middle ground was reached, the Department terminated the stakeholder process. While the rule proposal apparently speaks to the science of remediation standards, the fact is the rules speak to the policy of remediation standards. The rules are written in a manner that weakens the licensed site remediation professional (LSRP) program and undermines the Site Remediation Reform Act (SRRA) by providing the Department with more tools to return a "command and control" case management bureaucracy. The rules are regressive and should not be adopted. (3)

4. COMMENT: This rulemaking is another in a long list of Department initiatives in the past few years to establish the Site Remediation Program as a “command and control” case management organization and history has demonstrated it to be a failed approach to remediation in New Jersey. Other commenters present a significant and well-developed basis for objections to the proposal on several levels. The Department must give serious consideration to the significant and well-developed basis for stakeholder objections to the rulemaking. (3)

RESPONSE TO COMMENTS 3 AND 4: The Department considered all input from the stakeholders and considers all comments that it receives on a notice of proposal. Nevertheless, the Department is not obligated to incorporate all stakeholder comments or concerns into the proposed or adopted rules. The adopted rules are based on the best available science, adherence to statutory requirements, and application of Department policy.

The Department interprets the statement that the Department's Site Remediation and Waste Management Program is a “command and control” organization as referring to the requirement to obtain Department preapproval of ARS. Such preapproval is a statutory requirement. For a discussion of ARS, see the Response to Comments 175 through 181. To the extent that the comment refers to proposed rulemakings other than this one, discussion of such initiatives is beyond the scope of this rulemaking.

5. COMMENT: The Department is neither willing to understand, nor respond to, the regulated community's concerns. Stakeholders have worked cooperatively with the Department for many years to establish protective and clearly defined chemical levels for all site conditions. However, to date, in the time leading up to the proposed amendments, the Department has neither demonstrated a willingness to understand, nor respond to, the detailed presentations and documents that commenters have made and submitted concerning real problems and implications with how the Department has intended to change the Site Remediation Program, standards, and analysis. The regulated community's priorities focus on maintaining the consistency of the hierarchy of toxicity information for the remediation standards calculations in order to ensure transparency in the science utilized, as well as maintaining an equal and level playing field with neighboring states. (6 and 8)

RESPONSE: As noted in the notice of proposal Summary at 52 N.J.R. 567, the Department met with stakeholders, including members of Department programs affected by the Remediation Standards, N.J.A.C. 7:26D. Participants included the New Jersey Department of Health, the Licensed Site Remediation Professional Association, the New Jersey Business and Industry Association, the Commerce and Industry Association of New Jersey, the Site Remediation

Industry Network, and representatives of environmental groups, environmental justice advocates, county planners, municipalities, and other associations. The Department held a total of 14 stakeholder meetings. The records of those meetings are available on the Site Remediation and Waste Management Program Stakeholder Process, Remediation Standards, page of the Department's website, https://www.nj.gov/dep/srp/srra/stakeholder/ . The Department considered the suggestions and recommendations of the stakeholders in preparing the proposed rules. In addition, the Department met with individual commenters several times subsequent to the stakeholder process to listen to their concerns and provided written responses.

As to concerns about the hierarchy of toxicity information, the Department provided the rationale for deviating from the hierarchy in the notice of proposal Summary at 52 N.J.R. 575. In addition, adopted Appendix 11 of the Remediation Standards, N.J.A.C. 7:26D, explains the specific reasoning for not following the hierarchy for the affected contaminants.

Administrative Procedure Act and Executive Order No. 63 (2019) Issues

6. COMMENT: Aside from the Department's failure to comply with both the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq., and the general principles of due process, the Department's omittance of certain information and references is also in direct conflict with section 4.d of Governor Murphy's Executive Order No. 63 (2019), which provides, in relevant part, that "State entities should work to make available data sets relevant to determining

distributed impacts, subject to the limitations associated with privacy laws." The Department should have made information utilized to support this rule proposal available to the public. (11)

7. COMMENT: The Department did not follow Executive Order No. 63 (2019). The rulemaking did not adhere to, nor is it consistent with, the Department's past practices or the directives and mandates established by the Governor of New Jersey for State agency rulemaking, rendering the public's opportunity to comment less than the reasonable opportunity, as required by the Administrative Procedure Act. Executive Order No. 63 (2019) requires that "Governmental decisions should be based on the best available data, including scientific data if applicable. Where scientific evidence is an important element in developing or evaluating a rule, State entities should seek out and make productive use of scientific expertise available to them." The Department did not seek out and make productive use of scientific expertise available to them in the regulated community, because key scientific data and assumptions relied upon were not included in the rulemaking record for scientific experts to provide public comment. (6 and 8)

8. COMMENT: The Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq., requires the Department to provide a reasonable opportunity for comment. These requirements were not met. The Department denied requests for an extension of the public comment period and a request to receive additional information, which would have provided sufficient time and opportunity to analyze those documents to provide the Department with more comprehensive comments. The Department claims that simple and clear explanations of the process it followed are not necessary because a sophisticated reader can glean the details from various sections

and appendices of the rulemaking document and then in effect reconstruct portions of the notice of proposal in order to comment upon it. This stands the concept of transparency on its head and deprives the public of a true opportunity to comment. The notice of proposal should be withdrawn and reproposed in full compliance with the Administrative Procedure Act. (11 and 16)

9. COMMENT: The length of the comment period was not sufficient. Based upon the COVID-19 crisis, the Governor extended deadlines for Department action on proposed regulations and expiring rules, not to mention 90-day permit reviews. If such action was appropriate then it is equally appropriate to extend the deadline for public review of new regulations that will have a wide-ranging impact on the transfer, development, and financing of real property throughout the State. Coupled with the difficulties in working conditions and communications presented by the COVID-19 crisis, the lack of compelling need for speedy adoption, paints a picture of regulation for regulation sake, and is a process lacking in fairness to the public and particularly the regulated community. (16)

10. COMMENT: Governor Murphy declared a Statewide public health emergency due to the COVID-19 pandemic. Further, the Administrative Procedure Act requires that a public hearing be held on a major regulatory policy notice of proposal. It is totally inappropriate and unlawful for the Department to propose a major regulatory change during such a declared emergency, which the Department itself admits makes it impossible for the public to participate, as required by the Administrative Procedure Act. (13 and 18)

11. COMMENT: The Department fails to even commit to holding a public hearing by noting in the notice of proposal that "if the DEP holds a public hearing," it will provide notice to the public. The public hearing for this notice of proposal should be guaranteed, because the public always needs to be heard. (13)

12. COMMENT: This notice of proposal was not subject to the calendar requirements of the Administrative Procedure Act. That compounds the need for a public hearing on the notice of proposal, as the public was blindsided. (18)

13. COMMENT: Given the declared emergency, the Administrative Procedure Act calendar issue, and the lack of a public hearing, the notice of proposal must be withdrawn immediately through a public notice published in the New Jersey Register until the COVID-19 emergency is over. Now is not the time to be proposing any policy or regulatory changes, obviously because it is not possible for the public to effectively participate in reviewing or opposing them. (13 and 18)

14. COMMENT: The subject matter of this notice of proposal is highly technical and scientific in nature, and this is by no means a simple notice of proposal, where the alleged justification for the regulatory changes might otherwise be self-evident, straightforward, and uncomplicated in nature to understand, or not capable of reasonable questioning or disagreement by the regulated community. This underscores the need for an extended comment period and a more robust stakeholder process to satisfy the Administrative Procedure Act requirement for reasonable and meaningful opportunity to comment. (11)

15. COMMENT: The Requirements for Agency Rulemaking, as codified in the Administrative Procedure Act, were not followed. The proposed amendments were published on April 6, 2020, during the peak of the COVID-19 pandemic in New Jersey and the Governor's "work from home" executive orders. The Department initially only allowed for an approximate two-month public comment period, until June 5, 2020, but the period was extended to August 4, 2020, only allowing for an approximate four-month public comment period.

Consequently, the Department's rulemaking did not adhere to the requirements of the Administrative Procedure Act and applicable executive orders, which hindered the public's opportunity to comment and their due process rights to participate in the rulemaking process, as required by the Administrative Procedure Act. The proposed amendments should be withdrawn and reproposed in full compliance with the statutory, regulatory, and legal requirements of the Administrative Procedure Act. (6 and 8)

16. COMMENT: The Department's notice of proposal does not comport with the requirements of the Administrative Procedure Act. Enforceable standards should only be promulgated through a robust stakeholder process, including a notice of proposal with the basis and background in the New Jersey Register and an adequate public comment period. Proposed N.J.A.C. 7:26D-7, updating remediation standards, should be deleted. (4)

17. COMMENT: The Department's impact analyses for housing affordability, jobs, agriculture, environment, social, economic, Federal standards, regulatory flexibility, and smart growth development are woefully inadequate. The Department's purported basis for the evaluation of the social impact of the increases in the estimated cost of remediation relies on

three identified sources: private party estimates from cases in the regulated underground storage tank program; the managers in the Site Management Group; and remediation cost estimates from private parties. Given the timing of the notice of proposal, there has been no opportunity to access and review the documents that were purportedly relied on to support the conclusions reached by the Department, let alone seek to speak with unidentified Site Management Group managers or obtain unspecified remediation cost estimates from unidentified private parties. The failure to provide the complete administrative record thoroughly limits the public’s ability to evaluate and, as appropriate, challenge the impact analyses upon which these proposed regulations are based. The notice of proposal should be withdrawn and reproposed with the aforementioned supporting documentation in accordance with the Administrative Procedure Act and Executive Order No. 63 (2019). (11 and 16)

RESPONSE TO COMMENTS 6 THROUGH 17: In Executive Order No. 63 (2019), effective June 1, 2019, Governor Murphy reiterated the importance of focused regulations that consider impacts, and directed that State entities strive to pursue the creation of a regulatory environment designed to support innovation, remove bottlenecks, and streamline interaction with the government, while supporting strong environmental, health, safety, and labor standards, by focusing on enumerated common sense goals. Among the specifically enumerated goals is that governmental decisions should be based on the best available data, including scientific data. Executive Order No. 63 (2019) additionally reinforces that due consideration be given to Environmental Justice, with State agencies to identify and address, as appropriate and practicable, disproportionately high and adverse human health or environmental effects of the program, policy, or activity on minority and low-income populations. Executive Order No. 63 (2019) specifically addresses the need for developing State-level regulatory frameworks to protect New Jersey's environment, as well as providing opportunities for groups and stakeholders to engage with the State in crafting those regulatory solutions, where practicable. Executive Order No. 63 (2019) additionally stresses the importance of the rulemaking process being user-friendly, directing that rulemaking summaries give a straight-forward explanation of what the State entity intends to do or is doing before the technical description of the regulatory changes.

The process followed by the Department throughout this rulemaking is consistent both with Executive Order No. 63 (2019) and the similar intent of the Administrative Procedure Act. As an example, several stakeholders requested additional information from the Department in order to better understand how the proposed remediation standards were derived. The Department responded in writing by stating that all of the information requested was currently available to the general public and provided instructions (such as web links) to enable the public to obtain the information. See the Response to Comments 212, 213, and 214 for a discussion of where the information for calculating the remediation standards can be found.

When a State agency does not publish a quarterly rulemaking calendar identifying anticipated rulemaking activities, it must provide a 60-day comment period. See N.J.S.A. 52:14B-3. Accordingly, the Department initially published the notice of proposal with a 60-day public comment period. Thereafter, on May 4, 2020, the Department published a public notice in the New Jersey Register extending the public comment period to August 4, 2020, in acknowledgement that some stakeholders, particularly in the early part of the public health emergency, may require additional time to provide comments on the notice of proposal. See 52 N.J.R. 1011(a). This notice was also posted on the Department's website. Accordingly, rather than approximately two months to provide comments, the public had more than four months.

With regard to the public hearing, the notice of proposal that the Department filed with the Office of Administrative Law, and that was published in the New Jersey Register in April 2020, announced that the Department would hold a public hearing at the Department's headquarters on May 11, 2020. See 52 N.J.R. 566(a). At the time the notice of proposal was filed with the Office of Administrative Law for publication in the New Jersey Register, a month before the actual publication, Governor Murphy had not yet declared a public health emergency or directed residents to stay home. See Executive Order No. 103 (2020), signed on March 9, 2020, declaring a public health emergency, and Executive Order 107, signed on March 21, 2020, directing New Jersey residents to stay home until further notice. On its website, the Department posted a courtesy copy of the notice of proposal, which differed from the version published in the New Jersey Register. The courtesy copy stated that the Department "anticipates holding a public hearing on the proposal," and the Department would post additional information on its website. The May 4, 2020, public notice extending the public comment period provided notice that the May 11 public hearing would not be held. Again, the Department advised that it anticipated holding a public hearing and would provide additional information at a later date. See 52 N.J.R. 1011(a). Under the circumstances of the declared public health emergency, the Department made arrangements for the public hearing to be held virtually on July 21, 2020, rather than in person. The Department published a notice on its website and in the New Jersey Register on July 6, 2020, advising of the date of the public hearing and providing instructions for access to that meeting. See 52 N.J.R. 1321(a).

The Department, by extending the public comment period and holding a virtual public hearing, struck a balance between the public's potential need for additional time to provide comments on the notice of proposal, and the Department's need to continue to function, including promulgation of rules. Through the stakeholder process, the opportunity for the public to provide comment both in written form and at a public hearing, and the extended public comment period, the Department acted in a manner consistent with both the Administrative Procedure Act and the principles articulated in Executive Order No. 63 (2019).

18. COMMENT: There should be a moratorium on all Department permitting and regulatory actions, including this rulemaking, until the COVID crisis is over. (13)

19. COMMENT: The world remains uncertain right now, with many people focusing on just trying to survive. This is a healthcare crisis, but it is also an economic crisis. Although the notice of proposal has been in the works for about six years, the Department should delay the adoption of this rulemaking, so people have a chance to better absorb it. (16)

20. COMMENT: There is still much in the notice of proposal that has to be digested and absorbed, especially if the Department is going to take what used to be screening levels and promulgate them into standards, which will have an impact. The Department should pause its

proposal of the remediation standards and give the regulated community an opportunity to better explain its positions once it has all of the technical information. (16)

21. COMMENT: The proposed amendments will have a significant impact on the regulated community in the State of New Jersey and add increased burden to the COVID-19 recovery efforts of businesses. The existing Remediation Standards chapter expires April 27, 2022; therefore, there is sufficient time to address all aspects of the proposed amendments. The proposed amendments should be withdrawn to appropriately evaluate the economic and social impacts on this rulemaking. (6 and 8)

22. COMMENT: The regulated community asked for additional time to offer comments because information necessary to fully evaluate the justification of various provisions in this proposal that was not provided by the Department. The Department denied the commenters' request for this missing information. (1 and 11)

23. COMMENT: The Department was correct in extending the comment period. However, the comment period should be further extended. The world changed back in March 2020, and the commenter's membership is struggling to stay in business and survive. The notice of proposal is complex, and once it is adopted, a lot of the closed cases would have to be reevaluated. (16)

RESPONSE TO COMMENTS 18 THROUGH 23: The Department is not withdrawing the rulemaking or postponing the adoption of the rules in response to comments. The Department recognizes that the COVID-19 emergency placed added burdens on the regulated community; however, the stakeholder community has been aware of the content of the rules since

December 2018. The adopted rules do not significantly change how remediation standards are applied in the remediation of contaminated sites. The adopted rules apply impact to ground water screening levels and indoor air screening levels as remediation standards. The inclusion of these levels as standards does not change how these values are applied in the remediation of contaminated sites. Under the former rules, these screening levels have already been applied as site-specific remediation standards. Accordingly, the practical impact of this change will be minimal in that application of this rule (with subsequent cost and time expenditures) to sites will be the same as when screening levels were applied as site-specific standards. For those sites that have a Department-approved site-specific number prior to the adopted rule, there may be some impact if a contaminant with an order of magnitude change in a standard is present on-site, necessitating reevaluation of the site, with possible additional remediation. However, promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost. In addition, promulgation of screening levels as remediation standards establishes a stronger basis for the Department to enforce compliance with the standards, the primary purpose of which is the protection of public health and safety and the environment. See the Response to Comments 51, 52, and 53 for further discussion of the purposes of the remediation standards.

The State of New Jersey has long been recognized as a leader in the protection of human health and the environment through its statutory and regulatory initiatives to protect the public, the State’s wildlife, and its environment from the effects of inappropriate development and discharges of pollutants into the environment. This leadership has been based up a history of monitoring scientific developments, reviewing the adequacy of existing protections in light of developments in scientific knowledge, and acting in an expeditious manner to institute regulatory controls based upon the best available science. It is not practical or desirable for the Department to place a moratorium on all permitting and regulatory actions for the duration of the public health emergency, since that would effectively suspend most of the Department's functions for an indefinite period, to the detriment of public health and welfare and the environment.

See the Response to Comments 6 through 17 for a discussion of the Department's response to stakeholder requests for additional information. See the Response to Comments 212, 213, and 214 for a discussion of where the information for calculating the remediation standards can be found.

24. COMMENT: The Department's proposed creation of new exposure pathways was last reviewed by stakeholders in 2015. There appears to be little or no need from a public health or environmental perspective to introduce them now. That is, environmental risks presented by ground water contamination and vapor intrusion are already being fully and adequately evaluated and remediated in the site remediation process. Coupled with the difficulties in working conditions and communications presented by the COVID-19 crisis, the lack of compelling need for speedy adoption of new standards presents a process lacking in fairness to the public and, particularly, the regulated community. (11)

RESPONSE: With the exception of updating some soil remediation standards in 2017, the Department has not fully reviewed and updated the Remediation Standards, N.J.A.C. 7:26D, since their initial adoption in 2008. Remediation standards should be based on the most up-to-date scientific information that is available; accordingly, delaying the amendments is not in the best interest of protecting human health and safety and the environment or the citizens of New Jersey.

Screening levels for ground water contamination and vapor intrusion are already being applied to sites throughout the State; therefore, the practical impact of the adopted amendments to these standards will be minimal in that application of this rulemaking (with subsequent cost and time expenditures) to sites will be the same as when screening levels were applied as site-specific standards. For those sites that have a Department-approved site-specific number prior to adoption of this rulemaking, there may be some impact if a contaminant with an order of magnitude change in a standard is present on-site, necessitating reevaluation of the site, with possible additional remediation. However, promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost. In addition, promulgation of screening levels as remediation standards establishes a stronger basis for the Department to enforce the regulated community’s compliance with promulgated remediation standards, to the benefit of public health and welfare and the environment. See the Response to Comments 51, 52, and 53 for further discussion of the purposes of the remediation standards.

25. COMMENT: The Department was required to include a process for implementing the new standards as part of the rulemaking process. Failure to provide an implementation plan is contrary to the requirements of the Administrative Procedure Act. The Department's failure to share any plans for the safe and effective management of these new remediation standard pathways also is discourteous to the regulated community.

If the proposed amendments will be effective upon adoption, the legal implications of the Department's failure to include the implementation process with the proposed rulemaking also will have material impacts on the regulated community and a Licensed Site Remediation Professional's (LSRP's) ability to comply with regulatory requirements. For example, in the Administrative Requirements for the Remediation of Contaminated Sites (ARRCS) at N.J.A.C. 7:26C-6.4(a)2, the LSRP is mandated to rescind a response action outcome and a remedial action permit when "[t]he Department amends a remediation standard after the issuance of a final remediation document and the difference between the new remediation standard and the level or concentration of a contaminant at the property differs by an order of magnitude and the person responsible for conducting the remediation fails to complete further remediation ..."

For example, the Department recognizes "ethylbenzene is a gasoline component, as such, it is a common contaminant." Given the indoor air remediation standards are being introduced for the first time, the Department must clarify what is expected if the historic concentration of ethylbenzene at a property exceeds the proposed remediation standard. Is additional indoor air sampling required under this condition? Is rescinding the remedial action permit required under this condition? Is additional remediation required under this condition?

If new indoor air remediation standards are set, but only the soil remediation standards are reviewed, the same uncertainty in implementation is applicable. Within the proposed amendments, the Department notes that 2,458 sites "have ethylbenzene contamination in the soil in excess of the proposed residential soil standard" (52 N.J.R. at 578). The Department notes that 741 of these sites are "closed," but the document does not clarify if the "closed" sites are projects with remedial action permits issued to support a response action outcome. As defined in ARRCS, any evaluation of these several hundred sites may mandate rescinding remedial action permits and response action outcomes and completion of further remediation, without the Department providing any justification for the measurable benefits to public health, safety, or the environment. The accuracy and detail in the chemical concentrations for the referenced sites is based on the Department's internal evaluation. It is important to note, historic fuel oil and diesel underground storage tank removals, including contingency analysis for volatile organic compounds. It is possible these sites may have been closed with elevated ethylbenzene concentrations in soils, as well as many other potentially impacted historical sites.

The proposed amendments should be withdrawn until the Department issues documentation required by the Administrative Procedure Act as part of the notice of proposal, so that the regulated community can understand, evaluate, and comment on the social, financial, and legal implications of the proposed amendments; otherwise, the regulated community is being denied its due process rights, as required by the Administrative Procedure Act, in the rulemaking process. (6 and 8)

RESPONSE: The Department is not withdrawing the adoption in response to comment. Neither the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq., nor the Office of Administrative Law's Rules for Agency Rulemaking, N.J.A.C. 1:30, require an agency to include an implementation process as part of the rulemaking process. However, the adopted Remediation Standards at N.J.A.C. 7:26D-1.4(b) contains a phase-in timeframe for the implementation of the amended rules (see 52 N.J.R. at 568 and 582). This rule provision allows a responsible party to complete remediation at a site using the former remediation standards if an LSRP certifies and submits a remedial action workplan or response action outcome to the Department within six months of the adoption of Remediation Standards, N.J.A.C. 7:26D. The phase-in period does not apply, however, when the Department adopts a new remediation standard that is an order of magnitude or more stringent than the former remediation standard.

With regard to the indoor air standards for ethylbenzene, the Department has evaluated indoor air contamination as a result of vapor intrusion at contaminated sites since 2005 through the use of indoor air screening levels. Under the adopted rules, instead of a site evaluation based on an indoor air screening level, the evaluation will be based on an indoor air remediation standard. The basic process will not change.

The indoor air screening levels for ethylbenzene were two ug/m^3 (residential) and five ug/m^3 (nonresidential). The adopted indoor air remediation standards are 1.1 ug/m^3 (residential) and 4.9 ug/m^3 (nonresidential). As the difference between these screening levels and these remediation standards is less than an order of magnitude, no additional investigation is required when there is an approved remedial action workplan or remedial action report for the site or area of concern.

It is true that the effect of the order of magnitude change for ethylbenzene contamination in soil for the soil inhalation exposure pathway may result in the Department rescinding remedial action permits and response action outcomes and requiring further remediation at otherwise closed sites. However, as discussed in the notice of proposal Summary, 52 N.J.R. at 578, the order of magnitude evaluation is conducted to determine if the existing remedy at a site remains protective to the level that the newly promulgated soil remediation standard for ethylbenzene requires. If the existing remedy remains protective, then no further action at the site is required.

The Department developed the adopted soil remediation standard for ethylbenzene pursuant to the Brownfield Act, N.J.S.A. 58:10B-1et seq. If soil contaminated with ethylbenzene is in excess of the remediation standard (or an ARS developed for the site), and compliance with that standard cannot be demonstrated, then the conditions at the site are not protective of public health, safety, and the environment, and additional remediation would be required. For additional discussion on the ethylbenzene order of magnitude issue, see the Response to Comments 26, 27, and 28.

<u>Impact Statements</u>

26. COMMENT: The effect of ethylbenzene order of magnitude evaluation is obfuscated with benzene. (3)

27. COMMENT: The Department has significantly underestimated the economic impact of the lowering of the standards for ethylbenzene. While the Department emphasized the projected impact to be small, as remediation of benzene to the current standard typically achieves compliance to the proposed standard for ethylbenzene, this is not established to any degree of certainty. Therefore, a serious economic impact should be expected when former motor fuel facility pads become the subject of a real estate transfer. Numerous sites, particularly those that had had gasoline releases solely impacting soils, could be subject of reopener provisions and sites with releases of diesel fuel will generate many more. These redeveloped sites will need minimal investigation, and possibly remediation beneath structures. (3)

28. COMMENT: The effect of ethylbenzene order of magnitude evaluation is conflated with benzene. When evaluating the order of magnitude decrease in the ethylbenzene concentration for soil inhalation, the Department conflates the economic analysis of the lower ethylbenzene values by blending the investigation, monitoring, and remediation of ethylbenzene with benzene. The Department believes ethylbenzene and benzene are both common chemicals in refined fuels, such as gasoline, and the remediation standard for benzene is very low, such that the site investigation, remediation, and monitoring will not be affected by order of magnitude decrease in ethylbenzene. The Department's position is there are practically no costs to deal with ethylbenzene when benzene is detected, though the Department also concludes the

following: “Consequently, the actual economic impact will depend on the site-specific concentrations of each contaminant present.” The Department’s contradictory positions, that the order of magnitude decrease of ethylbenzene will have little economic effect and that the economic effect is site-specific, are unresponsive.

Within its notice of proposal, the Department highlights the proposed order of magnitude decrease for ethylbenzene and concludes that there will be “easing of cost impacts,” as ethylbenzene is commingled with benzene, which, in many cases, benzene will be the driver of remediation. The Department is not wrong; however, its assessment and conclusion are focused on only one phase (that is, the remedial action phase) of the site remediation process.

The Department has failed to consider that the order of magnitude decrease of the ethylbenzene standard will require additional delineation pursuant to the Technical Requirements for Site Remediation (Technical Requirements) at N.J.A.C. 7:26E-4.2. The adoption of the Site Remediation Reform Act, N.J.S.A. 58:10C-1 et seq. (SRRA), in September 2012, and the Department’s subsequent determination that many active cases had not completed the remedial investigation phase while under the Department's oversight, forced persons responsible for conducting the remediation to spend a significant amount of time and resources completing delineation by the arbitrarily mandated statutory deadlines of May 2014 and May 2016. Ethylbenzene, using the existing remediation standard, was not included in many of these additional delineation efforts required pursuant to N.J.A.C. 7:26E-4.2. The Department must complete an assessment of the delays and costs associated with further soil delineation and site access negotiations prior to adopting the proposed ethylbenzene remediation standard.

Furthermore, the order of magnitude decrease of ethylbenzene will require the evaluation of the remedies associated with the many limited restricted and restricted response action outcomes and the appropriateness of unrestricted response action outcomes. The Department has failed to assess the impacts to this change in a meaningful way, especially for a compound that they have identified as a “common contaminant.” The Department has the data readily available to evaluate the potential quantity of sites that may be affected by the proposed remediation standards but failed to present this data in the rulemaking. Potentially hundreds of sites may be affected by the ethylbenzene order of magnitude standard reduction with an economic impact of millions of dollars. A recent geographic Information system mapping of active classification exception areas in New Jersey shows active classification exception areas, the land area affected, and some of the chemicals that exceed the ground water quality standard. Benzene exceedances are easily identified within a classification exception area, given that benzene is listed as one of the unique chemicals of concern. Economic Table 1 presents 5,136 active classification exception areas in New Jersey through 2019; 18.7 percent of the classification exception areas included ethylbenzene; and 52.9 percent of the classification exception areas included benzene. This simple analysis demonstrates that hundreds to thousands of sites will be affected by the ethylbenzene reduction:

Economic Table 1

Potential Sites Affected by the Ethylbenzene Order of Magnitude Reduction Based on Classification Exception Area Records

Parameter / Condition	Quantity of Sites	Unit of Measure / Reference
CEAs - Active in April 2020	5,136	Sites Listed in the CEA GIS Mapping Files - April 2012
CEAs with Ethylbenzene Listed as a Chemical of Concern	959 18.7% of all CEAs	Sites which Currently include Ethylbenzene as a Compound Exceeding GWQS
CEAs with Benzene Listed as a Chemical of Concern	2,716 52.9% of all CEAs 68,445 Acres of Ground Water	Sites which Currently include Benzene as a Compound Exceeding GWQS
Potential Sites with Ethylbenzene Requiring Additional RI/RA/RAP Modifications	1,757	Sites with Benzene but **NOT** Ethylbenzene
	2,716	All Benzene Sites Will Require Additional Work for Ethylbenzene

Economic Table 1 presents a reasonable number of sites that may fail an order of magnitude evaluation, as required pursuant to ARRCS, N.J.A.C. 7:26C. If only 50 percent of the potentially affected sites require an LSRP to rescind a response action outcome because of an historic ethylbenzene exceedance, the economic impact could be well over $50,000,000, as presented in Economic Table 2:

Economic Table 2

Potential Economic Impact of Sites with Ethylbenzene Requiring New Remedial Action

Permits & Response Action Outcomes

Parameter / Condition	Quantity of Sites	Unit of Measure / Reference
Potential Sites with Ethylbenzene Requiring Additional RI/RA/RAP Modifications	1,757	Sites with Benzene but NOT Ethylbenzene
	2,716	All Benzene Sites Will Require Additional Work for Ethylbenzene
Reasonable Number of Sites that Will be Affected	879	50% of the 1,715 Sites with Benzene but not Ethylbenzene
Cost to Evaluate Ethylbenzene Order of Magnitude Condition	$1,500	Per Site
Cost to Terminate an Existing Remedial Action Permit	$5,000	Per Site
NJDEP Administrative Consent Order Settlement Costs for Direct oversight (NJDEP Fees Only)	$25,000	Per Site
Soil Investigation Costs and Remedial Investigation Addendum	$10,000	Per Site
Amend Existing Institutional Controls	$5,000	Per Site
Application, Fee, and Establishment of New Remedial Action Permit	$6,000	Per Site
Issue New Remedial Action Outcome (RAO) Document	$5,000	Per Site
Sub-total Potential Per Site Fees	**$57,500**	**Per Site**
Economic Impact	**>$50,000,000**	**Assumes only 879 Sites will be Affected by Ethylbenzene Order of Magnitude**

This analysis clearly challenges the Department's statements that there will be "easing of cost impacts" as ethylbenzene is commingled with benzene, which, in many cases, benzene will be the driver of remediation. Given the litigious nature of many property owners, the Department's clear desire to increase enforcement actions, the regulatory deadlines established through regulation, and the Department's unilateral control on the issuance of remedial action permits, the proposed economic impact is likely an underestimate of the final cost to the regulated community. (6 and 8)

RESPONSE TO COMMENTS 26, 27, AND 28: The Department, in discussing the economic impact of the order of magnitude change in the soil remediation standard for the inhalation exposure pathway for ethylbenzene, states "there is a potential for significant economic impact resulting from the need to reopen cases and implement additional remedial action." See 52 N.J.R. at 578. The Department also states "[t]he factor easing any cost impact for such cases is that ethylbenzene is typically commingled with benzene, another gasoline component. Historically, benzene has driven the remediation (been the determinant of the extent of contamination to be remediated) when a gasoline discharge has occurred. The contaminants are usually comingled, and remediation of benzene will also remediate the ethylbenzene. Thus, even with the proposed change in the ethylbenzene standard, benzene may still determine the extent of the remediation required. Consequently, the actual economic impact will depend on the site-specific concentrations of each contaminant present." See 52 N.J.R. at 578.

Ethylbenzene is a common ground water contaminant. At sites with ethylbenzene contamination, an evaluation of the impact to ground water exposure pathway should be conducted. Since 2008, the Department's soil screening level for ethylbenzene has been 13 mg/kg (soil-water partition equation). This value is similar to the proposed soil inhalation remediation standard of 10 mg/kg (residential) and 48 mg/kg (nonresidential). The delineation and remediation of ethylbenzene contamination in soil at a site based on the impact to ground water exposure pathway could concurrently address the delineation and remediation of ethylbenzene contamination in soil based on the soil inhalation exposure pathway. Consequently, the added cost to delineate and remediate a site to the ethylbenzene soil inhalation remediation standard would be minimal if ethylbenzene contamination in soil at a site is also being remediated for migration to ground water.

The notice of proposal, at 52 N.J.R. 578, states that “there is a potential for significant economic impact resulting from the need to reopen cases and implement additional remedial action.” This would include the potential need to conduct additional delineation of ethylbenzene contamination in soil. However, if benzene contamination is present in soil, delineation of benzene in soil would have been conducted by performing sample analysis for volatile organic compounds. Such an analysis would have included an analysis for ethylbenzene. Since ethylbenzene is typically commingled with benzene, if soil is delineated for benzene, then ethylbenzene would have been reported in the volatile organic compound analysis. Therefore, additional delineation sampling for ethylbenzene would be minimal since the prior sampling reports will likely already include the ethylbenzene results.

The Department disagrees that contaminated sites with releases of diesel fuel could generate many order of magnitude evaluations for ethylbenzene. Pursuant to the Technical

Requirements, at N.J.A.C. 7:26E-2.1(d) Table 2-1, the Department does not require analysis of soil samples for volatile organic compounds, including ethylbenzene, as part of a diesel fuel discharge. Consequently, an order of magnitude evaluation for ethylbenzene is not likely.

The Department disagrees that it failed to evaluate the potential number of sites that may be affected by the proposed remediation standards. As part of the Economic Impact statement, the Department identified the number of sites that would be impacted by the order of magnitude change in the ethylbenzene soil remediation standards (see 52 N.J.R. at 578).

Economic Table 1 attempts to demonstrate the number of potentially affected sites by evaluating the number of sites that have ground water classification exception areas. Such analysis is inappropriate, as ground water classification exception areas are based on a ground water remediation standard for ethylbenzene. The order of magnitude provision is for a change in a soil remediation standard based on inhalation of ethylbenzene vapors from soil. The existing ground water remediation standard for ethylbenzene has not changed. Therefore, the data in Economic Table 1 above do not accurately reflect the number of potentially impacted sites.

Economic Table 2 above presents the potential economic impact of sites with ethylbenzene requiring new remedial action permits and response action outcomes. The table provides a total cost impact for the change in the ethylbenzene soil remediation standard. The Department, however, believes that the monetary impact is more meaningful if presented on a cost-per-site basis, as opposed to a total cost impact because property owners are impacted by the cost associated with the remediation of their property and not the total costs of all sites.

Economic Table 2 fails to differentiate between impacted active cases and impacted closed cases in determining the economic impact of the order of magnitude change in the ethylbenzene soil remediation standard. Active cases do not have a final remediation document (that is, a response action outcome or a no further action letter). Therefore, there would be no need to issue a “new” response action outcome as a result of an order of magnitude change to an existing soil standard ($5,000 – Economic Table 2). Also, active cases would not have a remedial action permit in place. Therefore, there would be no permit to terminate ($5,000 – Economic Table 2) and no “new” permit to obtain as a result of an order of magnitude change in a soil remediation standard ($6,000 – Economic Table 2). In addition, there would not be any existing institutional controls in place that would have to be amended ($5,000 – Economic Table 2).

There is a concern that promulgation of remediation standards that are more stringent by an order of magnitude or more could result in the need for additional remediation at a site, which could impact compliance with mandatory remediation timeframes. This is a concern that responsible parties will have to enter into direct oversight by the Department through a costly administrative consent order. The concern is not well-founded. Additional time to comply with a newly promulgated remediation standard that is more stringent by an order of magnitude or more could be the basis for an extension request of a mandatory timeframe pursuant to ARRCS, N.J.A.C. 7:26C, provided that an adequate justification can be given on a site-specific basis. Extension requests for mandatory timeframes are subject to Department review and approval. The Department believes that timeframe extension requests will be much more common, as compared to sites entering into direct oversight ($25,000 – Economic Table 2). Using the commenters’ cost estimates, and deducting the costs in Economic Table 2 that are not applicable, or expected, for active cases, the per site cost to comply with the new ethylbenzene soil remediation standard for the inhalation exposure pathway for active sites is reduced from the commenters’ $57,500 estimate to a more modest $11,500 per site.

The per site cost to evaluate an order of magnitude change in a remediation standard is higher for a closed case than it is for an active case. A closed case has a final remediation document issued for the site. In addition, a closed case could have institutional controls in place along with a remedial action permit. For a closed case, costs would include those associated with active cases ($11,500) plus potential costs to amend existing institutional controls or establish new institutional controls ($5,000 – Economic Table 2) and issue a new response action outcome document ($5,000 – Economic Table 2).

An existing permit would only need to be modified, not terminated and reissued as a new permit. The Department believes the cost to terminate an existing permit and reissue a new permit ($11,000 – Economic Table 2) is excessive. A more likely cost to modify an existing permit is $2,000. As described in more detail above, timeframe extensions will be much more common than sites entering into direct oversight. Taking this into consideration, the per site cost to comply with the new ethylbenzene soil remediation standard for the inhalation exposure pathway for closed sites is reduced from the commenters’ $57,500 estimate to a more modest $23,500.

Economic Table 2 above presents an estimated total added cost to comply with new ethylbenzene soil remediation standards for the inhalation exposure pathway of $50 million. Using the number of additional active cases (1,717) and closed cases (741) impacted by the new ethylbenzene soil remediation standards for the inhalation exposure pathway as derived from the Department COMPASS database and using the Department's per site cost estimate to comply with the new ethylbenzene soil inhalation remediation standards of $11,500 for active sites and $23,500 for closed sites, the Department estimates the total added cost to comply with the new ethylbenzene soil remediation standard for the inhalation exposure pathway to be $37.1 million. While $37.1 million appears to be a significant cost, the added remedial costs must be balanced against the protection of human health and safety and the environment.

29. COMMENT: As presented in Economic Table 3.1 below, there are 4,574 active sites where benzene concentrations exceed the proposed residential inhalation soil standard. As documented by the Department, Haley and Aldrich, and many other authors, almost every home, school, or office will have an indoor air exceedance. Therefore, Economic Table 3.1 assumes a conservative 25 percent of the sites will undergo an expanded vapor intrusion investigation, and approximately 90 percent or more sites of the investigation sites will require a forensic evaluation of the chemical source:

Economic Table 3.1

Conceptual Costs Associated with Unnecessary Indoor Air Analysis for Benzene

Condition	Quantity	Reference

Number of Active Sites that Exceed the Proposed Soil Inhalation Exposure Remediation Standard	4,574	COMPASS Database - NJDEP
Estimated Percentage of Sites which will Undergo Vapor Intrusion Investigations	25%	Professional Estimate
Estimated Number of Sites which will Undergo Vapor Intrusion Investigations	1,143	Sites
Estimated Percentage of Sites with Potential Indoor Air Exceedances Due to Background Indoor Chemicals	90%	NJDEP Research
Estimated Number of Sites Requiring a Background Indoor Air Investigation	1,028	Sites
Estimated Cost per Background and Forensic Indoor Air Investigation	$20,000	Minimum Per Site
Unnecessary Expenditures for Background Air Investigation	**$20,574,000**	
Additional Costs	Toxicologic Discussions	
Additional Costs	Threatened Litigation	
Additional Costs	Project Delays	
Additional Costs	Multiple Sampling Events	

The Department identified 1,717 active sites where ethylbenzene concentrations exceed the proposed residential inhalation soil standard. See 52 N.J.R. at 578. As documented by the Department, Haley and Aldrich, and many other authors, almost every home, school, or office will have an indoor air exceedance. Therefore, Economic Table 3.2 assumes a conservative 25 percent of the sites will undergo an expanded vapor intrusion investigation, and approximately 90 percent or more sites of the investigation sites will require a forensic evaluation of the chemical source:

Economic Table 3.2

Conceptual Costs Associated with Unnecessary Indoor Air Analysis for Ethylbenzene

Condition	Quantity	Reference
Number of Active Sites that Exceed the Proposed Soil Inhalation Exposure Remediation Standard	1,717	NJDEP
Estimated Percentage of Sites which will Undergo Vapor Intrusion Investigations	25%	Professional Estimate
Estimated Number of Sites which will Undergo Vapor Intrusion Investigations	429	Sites
Estimated Percentage of Sites with Potential Indoor Air Exceedances Due to Background Indoor Chemicals	90%	NJDEP Research
Estimated Number of Sites Requiring a Background Indoor Air Investigation	386	Sites
Estimated Cost per Background and Forensic Indoor Air Investigation	$20,000	Minimum Per Site
Unnecessary Expenditures for Background Air Investigation	**$7,720,000**	

Additional Costs	Toxicologic Discussions
Additional Costs	Threatened Litigation
Additional Costs	Project Delays
Additional Costs	Multiple Sampling Events

Economic Tables 3.1 and 3.2 present a reasonable evaluation of the potential costs associated with unnecessary additional indoor air analysis associated with “false positive” detections of only benzene and ethylbenzene. Although various parameters are estimated, the tables provide two conclusions. First, the economic impact of the very low indoor air remediation standards can be estimated. For estimating purposes, the project costs for benzene sites and the project costs for ethylbenzene sites were summed together. Second, the proposed $28.29 million costs will not decrease the human health risk for any New Jersey resident. As documented in the record, the Department appears to be solely motivated by increasing enforcement, litigation, and cost recovery, and not protection of human health and the environment when proposing the indoor air remediation standards. The last four lines of Economic Tables 3.1 and 3.2 briefly describe additional costs that may be associated with an indoor air remediation standard exceedance. Upon notification of a resident and the local Health Department, it is reasonable to expect the LSRP’s involvement with the project will increase. A client representative (potentially the LSRP, or a public involvement specialist, or toxicologist) will begin evaluating the toxicologic aspects of the site. It is reasonable to believe a property owner will threaten and potentially take litigation steps. It is reasonable to believe site access may be delayed or challenged. Lastly, it is also reasonable to believe either the property owner or the Department may require multiple sampling events to document the indoor air is only affected by background conditions.

Economic Tables 3.1 and 3.2 focus solely on the number of active Department cases with benzene and ethylbenzene exceedances of the proposed soil inhalation remediation standards. The same calculation can be completed for several other chemicals including carbon tetrachloride, naphthalene, trichloroethylene, 1,4-dioxane, and other compounds based on the Department study alone. Research by scientists with Haley and Aldrich has been shared with the Department and provides an independent reference, further documenting the frequency and concentration of volatile organic compounds in indoor air spaces.

The detection of a chemical of concern within the indoor air space will cause a psychological concern to the average resident. It is reasonable that every resident will have questions, and most will probably follow one of four potential pathways as noted in Economic Tables 3.1 and 3.2 and described in further detail below. First, the resident may request reasonable toxicologic and health information. These conversations will require the expertise of an experienced, trained individual knowledgeable in chemistry and toxicology. Second, the resident may seek litigation for perceived damages. An experienced environmental attorney who is familiar with chemistry and toxicology will be required. Third, the resident may cease all further access to the property, thereby delaying the project. It may be necessary to sue for site access, which most probably will make continued sampling more expensive and more contentious. Fourth, the resident may deny the quality of the data and require additional samples. The additional sampling may be multiple samples extended over a period of time, or multiple split samples collected over each sampling event, or additional sample locations, such as requesting four samples in the basement when one or two meet the data quality objectives for the project or any mathematical combination that collects more data.

Compliance with the indoor air remediation standards will be an onerous process at many sites. Many persons responsible for conducting the remediation do not have these resources immediately available, which may increase the quantity of recalcitrant sites and ultimately increase the risk to human health and the environment across the State. (6 and 8)

RESPONSE: The basis for estimating the number of impacted sites is flawed. The application of proposed soil remediation standards for the inhalation exposure pathway is not associated with the evaluation of the vapor intrusion exposure pathway. The soil remediation standards for the inhalation exposure pathway are a measure of contamination in soil such that inhalation of soil particles and contaminant vapor emitted from soil at or less than the remediation standard is protective of human health. The direct measure of vapor contamination in indoor air is the basis of evaluating the vapor intrusion exposure pathway. The proper approach to evaluate the economic impact of indoor air analysis for benzene and ethylbenzene is to use indoor air data. Ground water screening levels and soil gas screening levels, not the soil remediation standards for the inhalation exposure pathway, are the triggers to conduct an indoor air evaluation. In accordance with the Department’s Vapor Intrusion Technical Guidance, the need for indoor air sampling is triggered if the soil gas screening level for a given contaminant is exceeded. The exceedance of a soil gas screening level is a strong indication that vapor intrusion into a building is occurring. Under such conditions, indoor air sampling is prudent and should not be categorized as unnecessary. In addition, the LSRP should follow the Department's Vapor Intrusion Technical Guidance and remove potential background sources of volatile organic compounds from the building prior to indoor air sampling, as well as collect and analyze outdoor ambient air samples.

Data from the Department COMPASS database indicates there are 276 sites where benzene exceeds the prior residential indoor air screening level of two ug/m3. There are an additional 389 sites where benzene exceeds the adopted residential indoor air remediation standard of 0.64 ug/m3. When the 389 sites were evaluated for indoor air contamination based on the prior screening level for benzene, the sites did not require any further investigation or remediation by the LSRPs. However, applying the adopted indoor air remediation standard of 0.64 ug/m3, these same 389 sites now represent an additional number of sites triggering an indoor air evaluation for benzene. The economic impact analysis should be conducted based on the added cost of conducting an indoor air evaluation as a result of the decrease in the benzene indoor air standard. If indoor air sampling is conducted only if there is exceedance of soil gas screening levels, then only sites with a strong likelihood of vapor intrusion will be investigated. If potential indoor sources of volatile organic compounds are removed from the building prior to sampling, the influence of background contamination is minimized. If outdoor ambient air samples are collected and analyzed, potential ambient air impacts are identified. For these reasons, the Department disagrees that 90 percent of the sites with potential background influence will need to undergo additional background investigation.

Based on the Department’s experience, nearly all background determinations for benzene (about 95 percent) are resolved based on evaluation of initial analytical results of soil gas, indoor air, and outdoor ambient air samples and, the application of multiple lines of evidence conducted by the LSRP. Of the 389 sites discussed above, the Department estimates that only five percent (approximately 20 additional sites) will need to undergo additional background investigation. Assuming that an additional background investigation will cost $20,000 per site and using the Department’s number of 20 additional sites (not the commenter’s 1,028 sites), the added total cost would be $400,000 (not $20.6 million).

Data from the Department COMPASS database indicates there are 333 sites where a vapor intrusion evaluation has been conducted, and ethylbenzene exceeds the prior residential indoor air screening level of 2.0 ug/m3. There are an additional 102 sites where ethylbenzene now exceeds the adopted residential indoor air remediation standard of 1.1 ug/m3. These 102 sites represent the additional number of sites that would trigger an indoor air evaluation for ethylbenzene based on the residential indoor air remediation standard of 1.1 ug/m3. When the 102 sites were evaluated for indoor air contamination based on the prior screening level for ethylbenzene, the sites did not require any further investigation or remediation by the LSRPs. As discussed above, the economic impact analysis should be conducted on the added cost of conducting an indoor air evaluation as a result of the decrease in the ethylbenzene indoor air standard. Since indoor air sampling is conducted only if there is exceedance of soil gas screening levels, then only sites with a strong likelihood of vapor intrusion will be investigated. If potential indoor sources of volatile organic compounds are removed from the building prior to sampling, the influence of background contamination is minimized. If outdoor ambient air samples are collected and analyzed, potential ambient air impacts are identified. As stated above with regard to benzene, the Department disagrees that 90 percent of the sites with potential background influence will need to undergo additional background investigation for ethylbenzene.

Based on the Department's experience, nearly all background determinations for ethylbenzene (about 95 percent) are resolved based on evaluation of initial analytical results of soil gas, indoor air, and outdoor ambient air samples and the application of multiple lines of evidence conducted by the LSRP. Assuming that an additional background investigation will cost $20,000 per site and using the Department's number of five additional sites out of these 102 sites (not the commenter's 386 sites), the added cost would be $100,000 (not the commenter's $7.7 million).

The commenter states that the economic analysis conducted for benzene and ethylbenzene in Economic Tables 3.1 and 3.2 could be performed for other volatile organic compounds to determine additional costs needed to conduct background investigations. The Department does not think such economic analyses are necessary. The proposed indoor air remediation standards for other volatile organic compounds are either at concentrations in the upper range of indoor air background concentrations or higher based on information in Haley and Aldrich (2015). Background impact for those volatile organic compounds would be minimal, at best.

The last four lines of Economic Tables 3.1 and 3.2 briefly describe additional costs that may be associated with an indoor air remediation standard exceedance, including possible psychological concerns. The Department believes that the psychological concerns, if any, will be the same if the exceedance is of a screening level or a remediation standard. The Department's adoption of a remediation standard, rather than the screening level prior to these adopted rules, will have no added psychological effect on the average resident.

Economic Tables 3.1 and 3.2 suggest that as a result of the adopted standards, most residents will request reasonable toxicologic and health information; seek litigation for perceived damages; cease all further access to the property, thereby delaying the project; and deny the quality of the data and require additional samples. These four categories of potential costs are not unique to the adopted rules, but are equally applicable to the prior rules. Therefore, the costs associated with the four categories, if any, are not attributable to the adopted new and amended remediation standards.

The adopted remediation standards are no more onerous to comply with than were the prior rules. Remediation of sites has included the evaluation of indoor air contamination as a result of vapor intrusion since 2005. Therefore, sites have been remediated for impacts to the vapor intrusion exposure pathway using the Technical Requirements, N.J.A.C. 7:26E, ARRCS, N.J.A.C. 7:26C, and Department-issued Technical Guidance documents that contained screening levels for contaminants. Promulgating screening levels as remediation standards does not change how sites are evaluated and remediated for the vapor intrusion exposure pathway. The cost, time, and difficulty to remediate a site will not change. For those sites that have a

Department-approved site-specific number prior to the operative date of this rulemaking, there may be some impact if a contaminant with an order of magnitude change in a standard is present on-site, necessitating reevaluation of the site, with possible additional remediation. However, promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost.

30. COMMENT: The proposed amendments do not evaluate housing impacts. Housing projects within urban redevelopment zones may experience the greatest economic effects of the proposed amendments. The New Jersey Department of Community Affairs, Fair Share Housing Authority, and other agencies identify housing projects within urban zones as strongly encouraged across New Jersey. The Department states “a change in average costs (in residential housing) is extremely unlikely.” As identified above, indoor air sampling will most detect exceedances of the proposed indoor air samples at most, if not all, sites. This condition will lead to “false positive” detections of chemicals that are not associated with subsurface conditions, but caused by residential chemical use. It is reasonable and prudent to believe residential home builders will increase the frequency of installing engineering controls, such as vapor barriers, in their construction techniques to eliminate any vapor concerns.

The Department’s assertion of no change in average housing costs is misleading and wrong. A cursory review of housing in New Jersey quickly identifies that the proposed standards will cost New Jersey home purchasers millions of dollars.

In 2018, the New Jersey Department of Community Affairs identified 25,743 new housing permits in New Jersey. Approximately 80 percent of the new housing permits were located within the New Jersey Office of Planning Advocacy Planning Area 1, which are generally considered metropolitan or suburban areas in New Jersey (New Jersey Department of Community Affairs, State Development and Redevelopment Plan). When Planning Area 16 is overlain with the Department Known Contaminated Sites list, 84.2 percent of the contaminated sites exist within Planning Area 1. In other words, New Jersey housing permits are routinely issued near known contaminated sites.

Economic Table 4

Potential Vapor Barrier Costs on 2021 Housing Starts in New Jersey

Parameter / Condition	Quantity / Cost	Unit of Measure
Potential Housing Units in New Jersey - 2021	26,000	Units Based on NJDCA 2018 Housing Starts - 25,473 Units
Conservative Percentage of Housing Units that May be On or Near a Known Contaminated Site	20%	Professional Judgment - 84.2% of Contaminated Sites Exist Within NJDCA Planning Area 1
Potential Housing Units with Concern for Possible Indoor Air Issues	5,200	Affected Housing Units in 2021 Building Year Only. Additional Units in Additional Years Not Included
Estimated Installation Costs for Sub-slab Vapor Barrier System	$3,000	Per Affected Housing Unit in 2021 - Professional Judgment, Interstate Technology & Regulatory Council (ITRC), USEPA, and Other references

Estimated Operational Costs per 15-year period	4,000	Per Housing Unit Electrical Costs, Blower Replacement, Biennial Inspection
Subtotal 15 Year Cost Per Housing Unit	**$7,000**	Per Affected Housing Unit in 2021
One Year Potential Economic Impact on Housing Units	**36,400,000 For Housing Built in 2021**	15-year Costs for Housing Units Built in Calendar Year 2021 Only. Additional Costs Required for Additional Years.

If only 20 percent of the residential building permits include vapor barriers as a protection against future vapor concerns, the proposed standards could increase residential housing costs by greater than $36 million for housing starts in 2021, and additionally each year, into the near future.

Economic Table 5

Potential Vapor Barrier Costs on Housing Units 2021 through 2026

Parameter / Condition	Quantity / Cost	Unit of Measure
2021 Housing Costs	$36,400,000	Installation and 15-Year Costs for Housing Units
2022 Housing Costs	$36,400,000	
2023 Housing Costs	$36,400,000	
2024 Housing Costs	$36,400,000	
2025 Housing Costs	$36,400,000	
5-Year Housing Cost Economic Impact	**$182,000,000**	Installation and 15-Year Costs for Housing Units

Economic Table 5 presents the 2021 costs expanded over a five-year home construction period. The economic impact to the New Jersey home building industry of imposing indoor air remediation standards may be greater than $180 million. (6 and 8)

RESPONSE: Economic Table 4 presents the total cost of installation and 15-year operation of a vapor barrier system for all housing constructed in 2021. It is more meaningful to evaluate these costs on a per house basis, as property owners are impacted by the cost associated with remediation of their properties and not total costs of all sites. Economic Table 4 states that a per house estimate of installation and 15-year operational cost of a vapor barrier system is $7,000. Assuming a median home value in New Jersey of $371,000 (see https://www.neighborhoodscout.com/nj/real-estate), the cost of the vapor barrier system relative to the median cost of a home is 1.9 percent. This includes a 15-year operational cost. If the $7,000 installation/operation cost is spread over 15 years, the cost as a percentage of the value of the house is 0.12 percent. On this basis, the Department believes that this is not a significant impact on housing in New Jersey.

In addition, the analysis contained in the comment is based on the need to install a vapor barrier system regardless of the specific contaminants that might affect indoor air. The analysis was not evaluating the added impact as a result of significant decrease of an indoor air standard for a specific contaminant. There are 33 contaminants that have existing indoor air screening levels and proposed indoor air remediation standards. Of the 33 contaminants, the indoor air remediation standards will decrease for 12 contaminants, will increase for seven contaminants, and will remain the same for 14 contaminants when compared to the screening levels. It is highly likely that the costs presented in the comment would be the same costs if the indoor air remediation standards were not promulgated. In other words, the promulgation of indoor air remediation standards will have no added economic impact. Even considering that there may be a slight increase in housing costs in overburdened communities, such an increase is offset by the gains in ensuring that residents are not unfairly burdened by increased health risks.

31. COMMENT: The Department fails to evaluate the time delays for training, policy development, and technical comfort within the Department. The Department fails to recognize the economic impact of a time delay associated with evaluating newly regulated exposure pathways. SRRA has established mandatory and regulatory timeframes for environmental projects including penalties and loss of direct project management for the person responsible for conducting the remediation. The establishment of newly regulated exposure pathways will increase the technical complexity and the time required to complete environmental projects and increase project costs.

The technical complexity and probable time delays are exemplified by delays when developing technical guidance documents. The Department does not evaluate the time delays inherent within the learning period for LSRPs, persons responsible for conducting the remediation, and the Department. The Department allows a six-month “phase-in” period for a new guidance document. Given the complexity of the establishment of three new remediation standards, it is reasonable to believe that the average Department staff member or remedial action permit reviewer will require 10 to 12 months to become generally knowledgeable of the proposed remediation standards. During this time, new remedial action permits and technical consultations will be delayed.

Cobalt is an example of a compound that will increase the project time and complexity. The Department COMPASS database presents 28,633 cobalt samples taken from multiple sites with only seven sites impacted above the current residential soil standard of 1,600 mg/kg. With a proposed ingestion standard of 23 mg/kg, 335 sites will immediately exceed the residential cobalt standards. Many of these sites will require additional soil samples, potential remedial action modifications, and several other project expenditures. The Department does not evaluate these project costs, but Economic Table 6 below provides an assessment of probable project costs:

Economic Table 6

Economic Impact of Decreased Cobalt Concentrations

Parameter / Condition	Quantity / Cost	Unit of Measure
Number of Sites Affected	335	As determined by the NJDEP COMPASS Database
Estimated Costs for Expanded Vertical and Horizontal Soil Investigations and Reporting	$12,000	Per Site Costs

Estimated Costs for Remedial Action Permit and Response Action Outcome Modifications	$10,000	Per Site Costs
Estimated Costs to Expand an Engineering Control for Cobalt	$5,000	Per Site Costs
Potential Economic Impact of Decreased Cobalt Concentrations	**$9,045,000**	Total Costs to Address Order of Magnitude Decrease in Cobalt Concentrations

(6 and 8)

RESPONSE: Remediation of sites has included the evaluation of soil impact to ground water (called migration to ground water in the adopted rules) since 1993, and the evaluation of indoor air contamination as a result of vapor intrusion since 2005. Sites have been remediated for impacts to these two exposure pathways using Department-issued Technical Guidance documents that contained screening levels for contaminants. Promulgating screening levels as remediation standards does not change how sites are evaluated and remediated for the migration to ground water and vapor intrusion exposure pathways. The cost, time, and difficulty to remediate a site will not change in that application of the adopted rules (with subsequent cost and time expenditures) to sites will be the same as when screening levels were applied as site-specific standards. For those sites that have a Department-approved site-specific number prior to the operative date of this rulemaking, there may be some impact if a contaminant with an order of magnitude change in a standard is present on-site, necessitating reevaluation of the site, with possible additional remediation. However, promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost. The Department anticipates that staff training on the adopted rules will not take an inordinate amount of time, even during the pandemic period, and any delays in reviews will be minimal. The Department does not have a backlog in addressing current ARS referrals at the time of this adoption, and none is anticipated in the future.

The commenter presents cobalt as an example of a contaminant that will increase the project time and complexity due to the significant change in the soil ingestion-dermal remediation standard. Dividing the total costs attributable to all sites by the number of sites, the total per-site cost in Economic Table 6 is $27,000. However, the estimate does not distinguish between the cost attributable to active cases and the cost attributable to closed cases.

In Comment 28 there is a similar, but not identical, assessment for costs to remediate ethylbenzene in soil (see Economic Table 2). The Department reviewed both Economic Tables 2 and 6 and determined that the analysis provided in Economic Table 2 in Comment 28 is more comprehensive, in that it provides cost estimates for the various components of a reopened remediation for an individual site, rather than all of the sites in the State that may be impacted by the amended cobalt standard. Property owners are affected by the cost associated with remediation of their property and not total costs of all sites in the State that may be impacted; consequently, an estimate of monetary impact is more meaningful if it is presented on a cost-per-site basis, as opposed to the cost attributable to all affected sites in the State.

Although Economic Table 2 in Comment 28 discusses ethylbenzene, the categories of costs and the estimates are not contaminant specific. The per-site estimate includes the following costs categories: evaluate the order of magnitude condition; terminate an existing remedial action permit; Department fee for an administrative consent order for settlement costs of direct oversight; soil investigation costs and a remedial investigation addendum; amendment to existing institutional controls; application, fee, and establishment of a new remedial action permit; and issuance of a new remedial action outcome document. Using the cost estimates in Economic Table 2 in Comment 28, the commenter’s per site estimated cost to comply with a new soil remediation standard is $57,500. This dollar amount does not differentiate between active and closed cases.

In contrast, the Department estimates the per site cost to comply with the new cobalt soil remediation standard for the ingestion-dermal exposure pathway at active sites to be a more modest $11,500. The Department estimates the per site cost to comply with the new cobalt soil remediation standard for the ingestion-dermal exposure pathway at closed sites to be $23,500. The basis for these estimates is provided in the Response to Comments 26, 27, and 28 above. Although the discussion in the Response to Comments 26, 27, and 28 is for the cost of complying with the new ethylbenzene soil remediation standard, the same categories of costs and approximate expenditures apply to cobalt.

Applying the Department’s estimates to the 238 active cases and 90 closed cases (figures derived from the Department’s COMPASS database) results in a total added cost to comply with the new cobalt soil remediation standard to be $4.86 million.

32. COMMENT: The reasonable economic impact of the proposed amendment is hundreds of millions of dollars. The proposed new remediation standards (migration to ground water, soil leachate, and indoor air) have been proposed to support Department enforcement and cost recovery actions. Economic Table 7 demonstrates the overall costs for the proposed remediation standards can be nearly one-quarter of a billion dollars.

The Department offers no description of the enforcement and cost recovery actions to define the estimated economic benefit of the proposed amendments. Similarly, the Department offers no reduction in human health risk or human toxicology that will be gained by the proposed amendments.

Economic Table 7

Conceptual Economic Impact of the Proposed Remediation Standards

Condition	Estimated Cost	Total Affected Sites
Additional Costs to Address New Remedial Action Permits and Response Action Outcomes for Ethylbenzene	$50,000,000	Estimated 869 Sites
Additional Costs Associated with Background Indoor Air Investigations	$7,720,000	Estimated 386 Sites

Additional Costs to Address Protective Vapor Barriers Beneath Housing Units	$182,000,000	Estimated 20% of the New Housing Built Between 2021 and 2025
Additional Costs to Address Cobalt Order of Magnitude and Remedial Investigation / Remedial Action Permit / Response Action Outcome Activities	$9,045,000	Per Site Costs
Rapid Assessment / Economic Analysis to Establish New Remediation Standards and New Remediation Pathways	**$248,765,000**	Economic Impact

(3, 6, and 8)

RESPONSE: The Department believes the costs presented in Economic Table 7 are overstated. Economic Table 7 presents an estimated total added cost to comply with new ethylbenzene soil remediation standards for the inhalation exposure pathway. This cost estimate is discussed in detail in the Response to Comments 26, 27, and 28 above. Economic Table 7 lists an estimate to added cost to comply with new ethylbenzene soil remediation standards of $50 million dollars. The Department estimates the total added cost to comply with the new ethylbenzene soil remediation standard to be $37.1 million.

Economic Table 7 above presents an estimated total added cost to comply with the new cobalt soil remediation standard for the ingestion - dermal exposure pathway. This cost estimate is discussed in detail in the Response to Comment 31 above. Economic Table 7 lists an estimated added cost of $9.04 million to comply with the new ethylbenzene soil remediation standard. The Department estimates the total added cost to comply with the new cobalt soil remediation standard to be $4.86 million.

Economic Table 7 presents an estimated total added cost to conduct background indoor air investigations for ethylbenzene. This cost estimate is discussed in detail in the Response to Comment 29. Economic Table 7 lists an estimated to added cost to conduct background indoor air investigations for ethylbenzene of $7.72 million dollars. The Department estimates the total added cost to conduct background indoor air investigations for ethylbenzene to be $100,000.

Economic Table 7 presents an estimated total added cost to address protective vapor barriers beneath housing units. This cost estimate is discussed in detail in the Response to Comment 30. Economic Table 7 lists an estimated to added cost to address protective vapor barriers beneath housing units of $182 million dollars. The Department estimates the total added cost to address protective vapor barriers beneath housing units to be $17.2 million.

The Department’s estimated added cost for the four conditions listed in Economic Table 7 is $59.3 million compared to the $248.8 million contained in the table. While $59.3 million appears to be a significant cost, the cost per site is minor (see the Responses to Comments 26 through 31 for detailed discussion). In addition, the added remedial costs must be balanced against the protection of human health and safety and the environment.

33. COMMENT: The Department did not conduct the necessary economic analysis as required by the Administrative Procedure Act. The Administrative Procedure Act requires the Department to include an "Economic Impact" statement, which describes the expected costs, revenues, and other economic impact upon governmental bodies of the State, and particularly any segments of the public proposed to be regulated. See N.J.A.C. 1:30-5.1(c)3. Although the proposed amendments include an Economic Impact statement, what is clear is that the Department's analysis violates the Administrative Procedure Act, as it failed to perform the minimum, reasonable evaluation of the actual economic impacts of the proposed amendments on the regulated public, and also is arbitrary and capricious. The Department states that they are unable to estimate the magnitude of increased costs, but then makes blanket statements that the "additional economic impact is minimal."

The Department's economic analysis fails to meet the minimum requirements of the Administrative Procedure Act and is arbitrary and capricious. The economic impact on the regulated community will be substantial, yet the Department fails to include any discussion on how this substantial economic impact is justifiable, particularly considering the paucity of information in the record about development and implementation of the remediation standards. (6 and 8)

34. COMMENT: The Economic Impact analysis is insufficient. (3)

35. COMMENT: The Department failed to perform the minimum reasonable evaluation of the economic requirements associated with the proposed amendments. The Department's

failure appears purposeful with the desire to minimize or conceal the economic impact on the public. The Department avoids this analysis with multiple approaches.

First, the Department states it is unable to estimate the magnitude of the increase in costs because each site is different. However, the Administrative Procedure Act requirement is not that the Department estimate the cost at every site in the State, but an estimate of the overall, general impact of the proposed regulation. The Department is, in effect, saying that since the statutory requirement is too difficult or may contain uncertainty, it can be ignored. This position is unreasonable, and arbitrary and capricious. (6 and 8)

RESPONSE TO COMMENTS 33, 34, AND 35: The impact statements in the notice of proposal, including the Economic Impact statement, fully comply with the requirements of the Administrative Procedure Act at N.J.S.A. 52:14B-4(a)(2) and the Office of Administrative Law's Rules for Agency Rulemaking at N.J.A.C. 1:30-5.1(c)3. The Economic Impact statement describes the expected range of costs and other economic impacts that the Department anticipates for this portion of the rulemaking. The Department is required to provide "adequate notice" of its "views regarding the rules' expected economic impacts" to enable interested parties "opportunity to submit comments on the issue." It is not required to quantify these costs with particularity where the actual costs may vary significantly on a case-by-case basis. *In re Adoption of N.J.A.C. 5:96 and 5:97*, 416 *N.J. Super.* 462, 473-74 (App. Div. 2010); see also *In re Protest of Coastal Permit Program Rules*, 354 *N.J. Super.* 293, 365 (App. Div. 2002) (holding that the Department's socio-economic impact statement is sufficient when it "set[s] forth the impact that [the Department] 'anticipate[s]' or expect[s] from the proposed regulations").

In the Economic Impact statement, the Department maintains that the proposed remediation standards would primarily impact the person responsible for conducting the remediation. The Department also acknowledges that it is difficult to assign a specific dollar value for the cost of a typical remediation, due to the variety and complexity of contaminated sites throughout the State. See 52 N.J.R. at 577. The Department understands that its rules and policies, particularly those that relate to remediation and redevelopment of the State's brownfields, affect the State and its citizens as a whole. However, in order for the citizens to truly benefit from brownfield redevelopment, the remediation of contaminated sites must be protective of human health and safety and the environment.

36. COMMENT: The proposed amendments do not evaluate job impacts (even absent a pandemic). The Department's assessment on job impacts is very limited in breadth and needs to consider factors beyond the remediation phase of the site remediation process. The Department fails to recognize the financial pressure the adoption of overly conservative remediation standards has on businesses and industries operating in the State. In addition to the financial impacts, the Department needs to assess the psychological and business risk impacts of the establishment of overly conservative standards. Many environmental business managers understand the adoption of standards for exposure pathways that are managed with screening levels by the USEPA and other states increases the business risk in New Jersey. In addition, the Department's stated goal of establishing "a stronger basis for the Department to enforce the regulated community's compliance" suppresses business growth. While many

factors contribute to the business/industry landscape in the State, acknowledgment that overly conservative environmental regulations will not assist New Jersey in retaining its businesses and industries nor incentivize them to reinvest or expand in-state operations. (6 and 8)

RESPONSE: The Department does not anticipate that the adopted remediation standards will cause jobs to be lost or deter development. The Department is confident that its Brownfield Program will continue to grow and foster the redevelopment in many of its urban and industrial areas. As discussed in the Jobs Impact statement in the notice of proposal at 52 N.J.R. 581, although the adopted rules do change the remediation standards for some contaminants, and provide standards based on exposure pathways that are not in the prior rules, although they are in the guidance documents, the adopted rules do not change the underlying obligation of persons responsible for conducting the remediation to remediate site contamination in a timely manner. In fact, promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost.

The commenters have not provided information to support the assertion that the Department needs to assess the psychological and business risk impacts of the establishment of alleged overly conservative remediation standards. The Department believes that any psychological concerns are the same, whether a screening level or remediation standard is exceeded. Promulgating a screening level as a remediation standard, as the Department has done in this rulemaking, will have no added psychological effect on the average resident.

37. COMMENT: The proposed amendments do not evaluate agricultural industry impacts. The Department's assessment of impact to agricultural industry is limited in breadth, focuses on one phase of the site remediation processes, and does not fully assess the effects of adopting overly conservative remediation standards. New Jersey has an abundance of recalcitrant properties prime for redevelopment (that is brownfields). While many of these properties remain undeveloped, New Jersey continues to lose its agricultural lands. While the rate of agricultural land loss has slowed recently, New Jersey lost 25 percent of its agricultural lands from 1986 to 2012 (Lathrop and Bognar, 2016). Clearly, factors beyond the proposed remediation standards can be attributed to land use changes in New Jersey. However, the Department has failed to acknowledge any impact from the proposed rules, which is clearly wrong. (6 and 8)

RESPONSE: The agricultural impact analysis that the Department provided in the notice of proposal Summary focused on discharges at farms that would require remediation. As noted in the Agricultural Industry Impact statement in the notice of proposal at 52 N.J.R. 581, the impact would be the same as the impact to any other entity with a similar discharge. The adopted rules provide the State's standards for the remediation of all sites without regard to the origin of the discharge or the use of the site. The Remediation Standards, N.J.A.C. 7:26D, are necessary to protect human health and the environment. Agricultural land is affected by remediation standards primarily when the owner of the land chooses to discontinue farm activities and use the site for other uses, such as residential development or the building of new schools. When the Department reviews such evaluations, it is entirely appropriate and necessary to use standards that are protective of residential use and to ensure that ground water quality has not been impacted by many years of farming, which usually includes the extended use of pesticides and fertilizers.

38. COMMENT: It is the wrong time to weaken public health protections. The Department fails to mention any health risks associated with sites at which the weaker standards were used. The Department merely mentions a fiscal impact statement. (13)

RESPONSE: The Department interprets this comment as referring to any newly adopted remediation standard for a given contaminant that is less stringent than the former remediation standard for that contaminant. The adopted remediation standards are based on updates to toxicity factors and other parameters. As such, the Department does not consider the adopted remediation standards to be "weaker"; rather, the standards are more accurate because they are based on the best available science. The Department deems all of the remediation standards, which are based on requirements in the Brownfield Act, N.J.S.A. 58:10B-1 et seq., to have acceptable risk. Site-specific standards are protective of human health and the environment because they take into account soil, chemical, and land use characteristics**.**

39. COMMENT: The Department fails to evaluate the social and economic impact of establishing new indoor air standards. (3)

40. COMMENT: The Department fails to evaluate the social, psychological, and economic impact of establishing new indoor air standards. New Jersey’s Administrative Procedure Act, at

N.J.S.A. 52:14B-4(a)(1), requires an evaluation of the social and economic impact of a new regulatory requirement. The Department fails to assess the impact of establishing new indoor air standards on the regulated community, as well as the public. The proposed amendments discuss increases, decreases, and modifications of existing remediation standards, but the Department does not discuss the impact of the new indoor air standards media.

The Department's existing Vapor Intrusion Technical Guidance follows the USEPA policy to establish indoor air monitoring criteria. An LSRP can utilize lines of evidence evaluations and site-specific information to evaluate indoor air quality. Formalizing indoor air standards will limit the professional judgment of LSRPs and persons responsible for conducting a remediation. With 1,717 active sites exceeding the proposed residential inhalation soil standard just for ethylbenzene (defined by the Department), dozens, to hundreds, of sites may undergo additional indoor air testing.

It is reasonable and predictable that residential air sampling will yield multiple “false positives” at many homes. A “false positive” may be defined as the detection of a volatile organic compound above the proposed indoor air standard, where the source of the volatile organic compound is not from chemicals released to the soil or ground water.

The Department does not provide any consideration of the social and psychological effect of notifying a resident that volatile organic compounds exceed the Department’s indoor air remediation standards. The unnecessary psychological invasion of someone’s home is very troubling to the vast majority of the public.

Any indoor air exceedance will require additional technical, legal, and persons responsible for conducting remediations interactions with the residents. Additional confirmatory and forensic sampling at a home increases the psychological trauma, project costs, and project times. Establishing indoor air standards creates undue social and economic burdens on the residents of New Jersey.

The proposed amendments should be withdrawn considering the excessive cost and impact associated with implementation of an unnecessary rulemaking, and the fact that the Department does not have the statutory authority. (6 and 8)

RESPONSE TO COMMENTS 39 AND 40: The Department described the social, psychological, and economic impact of establishing new indoor air standards consistent with the requirements of the Administrative Procedure Act and the Rules for Agency Rulemaking, N.J.A.C. 1:30. See 52 N.J.R. at 577-580.

Formalizing indoor air remediation standards will not limit the professional judgment of LSRPs. The Department proposed to codify existing indoor air screening levels as remediation standards, which does not change the ability of LSRPs to use their independent professional judgment in conducting a vapor intrusion evaluation. This includes establishing a sampling and analysis program, evaluating background conditions, as well as determining if the development of an ARS is a viable option for the remediation of a site.

The commenter includes the proposed soil inhalation remediation standard for ethylbenzene as an example of how dozens to hundreds of sites may undergo additional indoor air testing. The use of soil inhalation remediation standards as a trigger to conduct indoor air evaluations is inappropriate. As discussed in more detail in the Response to Comment 29, the adopted soil inhalation remediation standards are independent of the vapor intrusion exposure pathway. The proper approach to evaluate the economic impact of indoor air analysis for ethylbenzene is to use indoor air data. Ground water screening levels and soil gas screening levels, not the soil remediation standards for the inhalation exposure pathway, are the triggers to conduct an indoor air evaluation. See the Response to Comment 29 for additional discussion of this issue. The Department estimates that the adopted indoor air remediation standard for ethylbenzene would trigger indoor air evaluations at an additional 102 sites (see the Response to Comment 29). This number is lower than the estimated additional 429 sites calculated by stakeholders. See Comment 29 for a more detailed discussion on the derivation of 429 additional sites. As detailed in the Response to Comment 29, the cost to conduct additional background investigations would be $100,000, not the $7.7 million estimated in Comment 29.

The Department does not anticipate that residential air sampling will yield multiple "false positives" at many homes. The "false positive" issue will primarily affect only indoor air levels of benzene and ethylbenzene because the indoor air remediation standards for benzene and ethylbenzene are within the range of background conditions. This is not a new issue and, therefore, the adopted standards will not have major additional impacts. The Department's existing Vapor Intrusion Technical Guidance document recommends that an outdoor ambient air sample be collected and analyzed. In addition, the Vapor Intrusion Technical Guidance document also recommends the removal of all potential in-building sources of volatile organic compounds in order to reduce background indoor air contamination that can result in false positives. Further, the Vapor Intrusion Technical Guidance document recommends if background sources of indoor air contamination are identified and removed from a building, it would be prudent to ventilate the rooms affected in advance of the sampling event. If these recommendations are followed, the number of false positives will be kept to a minimum.

The Department does not anticipate that the adopted indoor air remediation standards will create undue social and economic burdens on the residents of New Jersey. Remediation of sites has included the evaluation of indoor air contamination as a result of vapor intrusion since 2005. Therefore, sites have been remediated for vapor intrusion impacts using the Technical Requirements, N.J.A.C. 7:26E, ARRCS, N.J.A.C. 7:26C, and Department-issued Technical Guidance documents that contained screening levels for contaminants. Promulgating screening levels as remediation standards does not change how sites are evaluated and remediated for the vapor intrusion exposure pathway. The cost, time, and difficulty to a remediate a site will not change in that application of the adopted rules (with subsequent cost and time expenditures) to sites will be the same as when screening levels were applied as site-specific standards. For those sites that have a Department-approved site-specific number prior to the effective date of the adopted rules, there may be some impact if a contaminant with an order of magnitude change in a standard is present on-site, necessitating reevaluation of the site, with possible additional remediation. However, promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost.

The Department expects that interactions among residents and technical, legal, and remediation professionals will not change as a result of the adopted rules. To the extent that these interactions have taken place during the application of screening levels prior to this rulemaking, the interactions will remain at the same level with remediation standards.

The Department believes that the social and psychological concerns, if any, will be the same if the exceedance is of a screening level or a remediation standard. The Department's adoption of a remediation standard, rather than continuing to use the screening level, will have no added social and psychological effect on the average resident.

Federal Standards Analysis

41. COMMENT: A Federal standards analysis is required, but not completed. (3)

42. COMMENT: The Department's Federal standards analysis is not in compliance with the Administrative Procedure Act. The proposed remediation standards result in more requirements than those under Federal rules or requirements, and, thus, a Federal standards analysis is required. See N.J.A.C. 1:30-5.1(c)(4). "Federal standards" is defined as "Executive Order 27 (1994) [which] means the 27th Executive Order issued by Governor Whitman in 1994. Commonly referred to as the "Federal standards" provision, the Executive Order requires a statement or analysis as to whether a rule exceeds standards or requirements imposed by Federal law. Federal law includes statutes, rules, regulations, orders, directives, or guidelines. (N.J.A.C. 1:30-1.2). Although the Department confirms that the USEPA has not promulgated any soil remediation standards for the ingestion-dermal exposure pathway, the USEPA has

developed regional screening levels, which are guidelines and, therefore, are "Federal standards" for purposes of the Administrative Procedure Act. The Department's Federal standard analysis is, therefore, based on a comparison of the proposed remediation standards to the USEPA's regional screening levels. And, based on this comparison, it is evident that the Department's proposed remediation standards are lower and more conservative than the USEPA requirements, but the Department provides no reasonable justification as to why the lower, more conservative standards are protective of public health, safety, and the environment. (6 and 8)

RESPONSE TO COMMENTS 41 AND 42: The Federal standards analysis in the notice of proposal meets the intent of the statutory and regulatory requirements. The Administrative Procedure Act, N.J.S.A. 52:14B, and N.J.A.C. 1:30 require a State agency, on proposal of an amendment to an existing rule or a new rule, to compare State rules with applicable, analogous Federal rules. Even though the Federal government does not have remediation rules, it is appropriate to compare its remediation guidance with the Department's remediation standards. One of the purposes of the Federal standards analysis is to inform the public and remediating parties about the relationship between the proposed remediation standards and the existing Federal regulatory scheme. As indicated in the Federal standards analysis, USEPA and the Department use different approaches to evaluate and remediate contaminated sites.

As discussed in the Federal standards analysis at 52 N.J.R. 580, the Department conducted an analysis for each of the remediation standards by environmental medium (soil, soil leachate, indoor air, ground water, and surface water) and exposure pathway (ingestion-dermal, inhalation, migration to ground water, and vapor intrusion). As explained in the notice of proposal Summary, the Department is changing the way it approaches the soil remediation standards to ensure that their development is protective of public health and safety, and the environment, pursuant to the Brownfield Act at N.J.S.A. 58:10B-12.

The Department acknowledges that is very difficult to provide a detailed evaluation of the costs associated with its standards, which is why the cost analysis in the notice of proposal is relatively general. However, because there are such large differences in the way that the State and Federal governments administer their remediation programs, it is not possible to evaluate the specific costs or benefits when the Department's standards exceed Federal standards. The Department believes that the adoption of remediation standards benefits the citizens of the State, as they are based on sound science and accurately reflect the health-based goals that are set by the Legislature as public policy for the State.

43. COMMENT: The Department has proposed standards for exposure pathways where Federal or other State standards do not exist (that is, indoor air remediation standards, migration to ground water exposure pathway, and soil leachate remediation standards). In these cases, the Department is left to compare its proposed standards with screening levels, which is not appropriate and overly conservative. The Department deceptively compares the proposed soil migration to ground water standards with a dilution attenuation factor of 20 to the USEPA regional screening levels and concludes that proposed standards are only more stringent for eight compounds; this is misleading and in support of more stringent criteria

unnecessarily. The Department fails to normalize this comparison, as the USEPA regional screening levels are calculated with a dilution attenuation factor of one. When USEPA regional screening levels are calculated with a dilution attenuation factor equal to 20, almost 50 percent of the compounds (46 out of 106) are more stringent. It is not possible for the Department to have properly evaluated the economic impact of the proposed soil migration to ground water standard. Focusing on the same exposure pathway (potential impact to ground water), the Department provides no economic impact assessment of the proposed soil leachate standard because it contends that the USEPA has no comparable regional screening levels. (6 and 8)

44. COMMENT: The Department has proposed standards for exposure pathways for which Federal or other State standards do not exist. For those instances, a comparison to screening levels is the only option. In one instance, the Department compares the proposed migration of ground water spoil standards with a dilution attenuation factor of 20 to the USEPA regional screening levels and concludes that proposed standards are only more stringent for eight compounds. The Department fails to normalize this comparison as USEPA regional screening levels are calculated with a dilution attenuation factor of one. A calculation of USEPA regional screening levels that replaces USEPA's dilution attenuation factor of one with the Department's dilution attenuation factor of 20 to appropriately compare the two factors indicates that almost 50 percent of the compounds, that is 46 out of 106, have values that are more stringent. (9)

45. COMMENT: The Department has identified eight contaminants with proposed site remediation standards more stringent than the USEPA regional screening levels based on soil-water partitioning. The Department compared the proposed soil migration to ground water

standards, which are based on a dilution attenuation factor of 20, to the USEPA regional screening level values, which are based on a dilution attenuation factor of one. However, stakeholders have identified remediation standards for 10 contaminants that are more stringent than the USEPA regional screening levels values when using the Department dilution attenuation factor of 20 compared to the USEPA dilution attenuation factor of 1. In addition, the Department included dibromochloromethane as one of the eight it identified as more stringent, but it should not have been included because the standard is actually the practical quantitation limit (PQL), which is greater than the regional screening level value. The three contaminants the Department did not include as being more stringent are 1,1-dichloroethene, mercury, and 1,1,1-trichloroethane.

A comparison of the proposed soil migration to ground water standards to the regional screening level applying the same dilution attenuation factor of 20 indicates that 46 of the 106 proposed standards are more stringent than the USEPA regional screening level values:

Comparison of NJDEP Soil and Soil Leachate Proposed Standards to USEPA SSLs	
Number of Contaminants with Soil and Soil Leachate Proposed Standards (Table 5)	106
NJDEP identified more stringent (NJDEP DAF 20 to USEPA DAF 1)	8*
CCNJ/SRIN identified more stringent (NJDEP DAF 20 to USEPA DAF 1)	10
CCNJ/SRIN identified more stringent (NJDEP DAF 20 to USEPA DAF 20)	46

SSL - USEPA Protection of Ground Water Soil Screening Level
DAF - Dilution Attenuation Factor
* NJDEP erroneously identified dibromochloromethane - a PQL based standard

The following table presents several examples of the comparison of the Department and USEPA soil leachate values when normalized for an appropriate comparison that demonstrates the unwarranted additional stringency (mg/kg = milligrams per kilogram):

Contaminant	**USEPA SSL DAF 20 (mg/kg)**	**NJDEP Soil Leachate DAF 20 (mg/km)**
Acetone	58	19
Cadmium	14	1.9
Nickel	510	48
Tetrachloroethene	0.1	0.0086
Toluene	15	7.8

SSL - USEPA Protection of Ground Water Soil Screening Level
DAF - Dilution Attenuation Factor

The Department offers no comparison of the proposed soil leachate remediation standard, stating that the USEPA does not have an equivalent regional screening level. Based on publicly available support documentation for this rulemaking, the veracity of this statement cannot be confirmed: physical properties, mathematical equations, and assumptions used should all be available, just as they are for the USEPA soil screening levels calculated to protect ground water against leaching. (6 and 8)

RESPONSE TO COMMENTS 43, 44, AND 45: The Department has compared the USEPA regional screening levels with the proposed standards, as a Federal standards analysis requires. The adopted standards are based on equations and models with parameter values appropriate for New Jersey. Similarly, USEPA regional screening levels are based on equations and models with values that are appropriate for the entire United States. Several parameter values for New

Jersey differ from USEPA values (a dilution attenuation factor of 20 versus a dilution attenuation factor of 1 is not the only parameter value that differs between New Jersey and USEPA). The commenter proposes to arbitrarily adjust one of these USEPA parameter values and recalculate the USEPA screening levels and then compare the New Jersey standards to the recalculated USEPA screening levels. What the commenter considers "normalizing" is in fact an arbitrary recalculation of the USEPA values, which is not the intent of the Federal standards analysis.

The Department cannot compare the Department leachate standards to USEPA leachate criteria because the USEPA has not determined such criteria, nor has it provided a procedure for determining such criteria.

Regarding the economic impact of the soil leachate standards, these standards are used in the same manner as the soil leachate criteria were used under the prior rules at N.J.A.C. 7:26D-1.1(b); accordingly, changing their status from criteria to standards has no economic impact on the regulated community.

General Concerns

46. COMMENT: The Department has taken a thoughtful approach to these rules and is to be commended for engaging in stakeholder meetings. (1)

47. COMMENT: Thanks for sharing this Remediation Standards notice of proposal. This is useful information for the public. (14)

48. COMMENT: The Department was right to allow ongoing site remediation cases to be completed before these new standards go into effect. As provided in the proposed rules, as long as the remedial action workplan or remedial action report (approved by the Department or certified by the LSRP) for the site is submitted within six months after the effective date of the rules establishing these new site remediation standards, those sites may continue to use the old standards. However, if the remedial action does not comply with the regulatory timeframes, then the new standards will apply. Of course, consistent with the Brownfield Act, if there is an order of magnitude change in the standard, the new standard applies in any event. (1)

RESPONSE TO COMMENTS 46, 47, AND 48: The Department acknowledges the commenters' support for the adopted rules.

49. COMMENT: The notice of proposal ignores the need to promulgate enforceable standards for the ecological impacts, for natural resource damages, for the remedial priority system; the trigger to the Department taking control over high-risk sites. Does anyone remember this promise on the remedial priority system? (13)

RESPONSE: The Department addresses ecological concerns on a site-specific basis by applying numeric ecological screening criteria to various media in environmentally sensitive natural resources or even subsets of a single environmentally sensitive natural resource. Ecological risk-based remediation goals are numeric criteria that are calculated based on site conditions and ecological receptors observed or expected to be present at the site. Remediation to either a risk-based remediation goal or risk management decision goal will require Department review and concurrence. See the Brownfield Act at N.J.S.A. 58:10B-12 and the Technical Rules at N.J.A.C. 7:26E-4.8(c)3. Upon Department approval, they are enforceable alternate remediation standards.

Natural resources damages are handled by the Department's Office of Natural Resource Restoration and are beyond the scope of this rulemaking. Comments on the remedial priority system are also beyond the scope of this rulemaking.

50. COMMENT: Following a longtime pattern of neglect, this notice of proposal ignores energy and climate impacts associated with the discharge of toxic chemicals and the cleanup of toxic sites. Climate impacts include toxic sites that are inundated by flood waters, storm surge, and rising sea levels. Climate impacts include sites that are related to alternative energy (wind and solar). Climate impacts include energy consumption and greenhouse gas emissions caused by cleanup operations. Polluters must be held responsible for these impacts. (13)

RESPONSE: Climate impacts are not within the scope of the Remediation Standards, N.J.A.C. 7:26D. The Department addresses climate impacts within the Technical Rules at N.J.A.C. 7:26E-1.9, which notes that the Department encourages the use of green and sustainable practices during the remediation of contaminated sites.

51. COMMENT: The Department is focused on cost recovery and not the protection of human health and the environment. The Department made this clear in response to a request

for an explanation of how the promulgation of three new remediation standards will increase the protectiveness of human health and the environment. In correspondence dated August 15, 2019, the Department demonstrates that cost recovery and Department enforcement are the primary reasons for the new remediation standards. The following paragraph is an excerpt of the letter.

“A central component of the proposed rule amendments is the promulgation of indoor air screening levels (for vapor intrusion) and impact to ground water screening levels as remediation standards. This promulgation is necessary for [the Department] to legally enforce these screening level values through enforcement actions against recalcitrant responsible parties, as well as through cost recovery actions. In many cases, [the Department] has found that the existing indoor air and impact to ground water screening levels have been used as de facto remediation standards; as such, [the Department] does not agree that the promulgation of these screening levels as remediation standards will make the remediation process more difficult, slower, or more costly.”

The Department clearly states the proposed remediation standards will support increased enforcement and legal actions. However, neither the proposed amendments nor any available guidance documents describe how a person responsible for conducting the remediation can comply with the proposed remediation standards without increased difficulty, time, or cost, especially within the context the Department is seeking additional powers to increase enforcement actions.

As an example, an exceedance of an indoor air remediation standard is extremely probable, given the very low proposed remediation standards and the elevated background concentrations for several common chemicals. Chemical fingerprinting techniques, chemical forensics, pneumatic testing, fate and transport modeling, and other techniques will be required to clearly document the source of a chemical detection within an indoor air space. Each of these investigation tools is complicated, time-consuming, and costly. However, each of these tools will be necessary to protect the regulated community from increased enforcement action, as well as potential third-party litigation actions.

Additionally, Department staff has not received any guidance on how to evaluate these investigative tools, which increases the complexity of the Department’s review, the time required to complete the review, and the overall project costs.

When considering the proposed indoor air remediation standard, the Department’s focus on enforcement and cost recovery is contrary to the protection of human health and the environment. The proposed amendments should be withdrawn. (3, 6, and 8)

52. COMMENT: The Department's rationale for setting standards for migration of ground water and vapor intrusion is cause for concern. The promulgation of screening levels as remediation standards is based on enforcement and cost recovery and not utilization of sound science, which should be used in order to be protective of the environment and public health. Screening levels are derived using conservative safety factors so that scientists, risk assessors, and LSRPs may use professional judgment and expertise to apply the actual standards that must be met. If these inherently conservative screening levels were to become remediation

standards, then the Department has designed the endpoint and the regulated community must comply with standards that incorporate additional safety factors. This removes the premise upon which the LSRP program was adopted, which is the use of the LSRP's professional judgment. (9)

53. COMMENT: The central point of this rulemaking (adoption of standards already in use as guidance) is not critical to the public health or the environment. All the environmental risks presented by contamination and vapor intrusion have long been part of the clean-up process and are already evaluated and remediated in the site remediation process. Thus, there is no compelling reason to rush the rulemaking. (16)

RESPONSE TO COMMENTS 51, 52, AND 53: The primary reason for promulgating remediation standards is to ensure that the potential for harm to public health and safety and to the environment is minimized to acceptable levels pursuant to the Brownfield Act, at N.J.S.A. 58:10B-12.a. See 52 N.J.R. at 566. The Department is adopting science-based remediation standards to ensure that remediation is conducted to a degree that public health and safety and the environment are protected. Enforcement is one of the tools the Department uses to ensure that protection, making enforcement a necessary, but not primary, purpose of the adopted rules.

As noted in the notice of proposal Summary, replacement of the development of site-specific soil remediation standards for the impact to ground water exposure pathway with codified soil and soil leachate remediation standards for the migration to ground water exposure pathway, and promulgation of indoor air screening levels for the vapor intrusion exposure pathway as indoor air remediation standards establish a stronger basis for the Department to ensure compliance with promulgated remediation standards. Without compliance, the public health and safety and the environment suffer.

Under the prior rules, when screening levels were applied as site-specific standards, recalcitrant responsible parties questioned the Department's authority to base remediation on the uncodified screening levels. Had the site-specific standards not been applied, the public health and safety and the environment would suffer. Further, challenges to the use of screening levels in a Department-initiated cleanup of a contaminated site using public moneys could affect the Department's ability to pursue the cost of remediation from responsible parties. The Spill Compensation and Control Act, N.J.S.A. 58:10-23.11 et seq., authorizes the Department to seek recovery of public monies used to remediate a contaminated site. Codifying the screening levels as remediation standards ensures that the Department is able to enforce the standards, as well as pursue responsible parties to recover the public funds it spends on remediating to meet the standards.

The promulgation of screening levels as remediation standards should not result in increased difficulty, time, or cost to comply with remediation standards, for either the Department or the responsible party. The Department has evaluated indoor air investigations since 2005, and the soil impact to ground water (now called migration to ground water) since 1993. Sites have been remediated for impacts to these two exposure pathways using Department-issued technical guidance documents that contained screening levels for contaminants. The codification of screening levels as remediation standards will not affect either the Department's review or how sites are evaluated and remediated for the migration to ground water and vapor intrusion exposure pathways. From the Department's standpoint, the time and complexity of the review remain the same, as will the overall project cost. From the responsible party's standpoint, the cost, time, and difficulty to a remediate a site will not change. It should also be noted that promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost.

The commenters identify a series of investigative techniques used in evaluating potential indoor air impacts as a result of vapor intrusion and imply that promulgation of indoor air screening levels as remediation standards will result in increased usage of those techniques. To the extent that these techniques are used with screening levels, the use of these techniques will remain at the same level with remediation standards.

The impact to ground water soil screening levels, impact to ground water leachate criteria, and indoor air screening levels contained in Department guidance documents were based on the requirements for the development of remediation standards, as contained in the Brownfield Act at N.J.S.A. 58:10B-12. The promulgation of screening levels as remediation standards does not affect the protectiveness of human health and the environment. The adopted remediation standards meet the requirements of the Brownfield Act and are not overly conservative.

The promulgation of screening levels as remediation standards will not decrease the ability of an LSRP to use his or her professional judgment. The LSRP has the latitude to use professional judgment to evaluate if using an ARS in lieu of a default remediation standard is appropriate for use at a site. In addition, the LSRP is able to use his or her professional judgment in demonstrating compliance with remediation standards at a site.

54. COMMENT: The Department relies upon the historical actions and protective decisions of the regulated community to justify no additional economic impact, based on language in a Department letter that states, "In many cases, the [Department] has found that the existing indoor air and impact to ground water screening levels have been used as de facto remediation standards; as such, the [Department] does not agree that the promulgation of these screening levels as remediation standards will make the remediation process more difficult, slower, or more costly."

The Department is taking a position that the regulated community is currently exceeding the regulatory requirements; therefore, the Department can mandate future expenditures without any economic impact. This position is punitive and unreasonable, and that inherent within the Department's statement (quoted above) is the recognition that the regulated community routinely maintains a conservative and protective level of remediation, and that environmental screening levels are effective and protective for the vast majority of sites.

The Department is proposing an economic impact costing hundreds of millions of dollars to help enforce a limited number of sites and conditions. There are alternatives available, such as advanced investigation techniques to assist in the enforcement of the current screening levels without establishing new, complicated remediation pathway standards.

The Department should withdraw the proposed amendments and reinitiate the soil remediation standards stakeholder process, exploring other options to strengthen the Department's ability to recover costs for publicly funded cleanup and removal costs. That stakeholder group could explore statutory, regulatory, and/or policy options as was recently completed with the SRRA 2.0 stakeholder process. (6 and 8)

RESPONSE: The Department does not assert that the regulated community is currently exceeding the regulatory requirements. The impact to ground water soil screening levels, impact to ground water leachate criteria, and indoor air screening levels contained in Department technical guidance documents are based on the requirements for the development of remediation standards as contained in the Brownfield Act, at N.J.S.A. 58:10B-12. Accordingly, the Department believes these screening levels and leachate criteria are protective of human health and the environment, but do not exceed the regulatory requirements. The Department's promulgation of these screening levels and criteria as standards meets the requirements of the Brownfield Act. The screening levels and criteria were protective of human health and the environment, and the promulgated remediation standards are protective of human health and the environment pursuant to the requirements in the Brownfield Act.

For example, under the prior rules, using the impact to ground water soil screening levels as impact to ground water soil remediation standards meant that the person responsible for conducting the remediation chose to use standards whose parameter values protect the majority of sites in New Jersey. The person responsible for conducting the remediation had, and continues to have, the option of using an ARS at the site that is based on site-specific data. The screening levels are remediation standards under the adopted rules. They are protective of the environment and do not exceed Brownfield Act requirements.

The adopted rules will not result in hundreds of millions of dollars in costs to enforce compliance at only a limited number of sites. Remediation of sites has included the evaluation of soil impact to ground water (now called migration to ground water) exposure pathway since 1993, and the evaluation of indoor air contamination as a result of the vapor intrusion exposure pathway since 2005. Sites have been remediated for impacts to these two exposure pathways using Department-issued technical guidance documents that contained screening levels for contaminants. Promulgating screening levels as remediation standards does not change how sites are evaluated and remediated for the migration to ground water and vapor intrusion exposure pathways. The cost, time, and difficulty to remediate a site will not change. For those sites that have a Department-approved site-specific number prior to the effective date of this rulemaking, there may be some impact when an order of magnitude change in a standard necessitates reevaluation of the site, with possible additional remediation. However, promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost.

Additional stakeholder meetings were not necessary for this rulemaking. The Department did not make any significant changes to the proposed rules (including no changes to specific contaminant remediation standards) between the December 2018 stakeholder meeting (final stakeholder meeting) and the publication of the notice of proposal in April 2020. Although the Department will take under consideration the commenters' offer to convene a stakeholder group to explore options to strengthen the Department's ability to recover costs for publicly funded cleanup and removal costs, the withdrawal of the Remediation Standards notice of proposal is not necessary. See the Response to Comments 18 through 23 for a discussion of why withdrawal of the notice of proposal is not appropriate.

55. COMMENT: The Department's ingestion-dermal and inhalation exposure pathway basis and background documents are not available for review and comment. It is critical for stakeholders to understand how the Department is utilizing the input parameters to calculate the ingestion-dermal and inhalation standards for residential and non-residential exposure scenarios in order to provide meaningful feedback. By understanding the input parameters, the LSRP and person responsible for conducting the remediation can develop ARSs for their sites. Without the guidelines used by the Department, such ARSs are not likely to reach concurrence. The Department must release these documents, so that they may be reviewed and commented on appropriately. (6 and 8)

RESPONSE: The Department's basis and background documents for the ingestion-dermal exposure pathway and inhalation exposure pathway provide information that is already contained in the Remediation Standards, N.J.A.C. 7:26D. This includes the information necessary to derive ingestion-dermal and inhalation soil remediation standards, such as equations, default exposure assumptions, toxicity values, and skin absorption fractions. The basis and background documents are available as of the effective date of this rulemaking. In addition, the Department's "Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil" has been released for external stakeholder comment. The document provides guidance for the development of ARS.

Order of Magnitude

56. COMMENT: Throughout the notice of proposal, the Department utilizes the terms "standard" or "criterion." At N.J.A.C. 7:26D-1.5, Definitions, these terms do not apply to indoor air screening levels. Therefore, it is not clear that the rule requires a reevaluation of sites where the new indoor air remediation standards are an order a magnitude less than the previous indoor air screening level. The Department should clarify this. This situation should not be a reopener for closed cases where a standard was not previously promulgated as regulation. (4)

RESPONSE: The Brownfield Act at N.J.S.A. 58:10B-12.a states, "[u]ntil the minimum remediation standards for the protection of public health and safety as described herein are adopted, the department shall apply public health and safety remediation standards for contamination at a site on a case-by-case basis based upon the considerations and criteria enumerated in this section." The Department has taken the position that such site-specific standards are remediation standards. The Department has also taken the position that, as long as default remediation standards do not exist, there are no remediation standards against which site-specific remediation standards can be compared. As such, the order of magnitude evaluation is not applicable. However, with the adoption of default indoor air remediation standards, there are remediation standards that may be compared against site-specific remediation standards. Accordingly, the order of magnitude evaluation is applicable. For example, using the existing indoor air screening levels as a benchmark, the proposed indoor air remediation standard for 1,1-dichloroethene is an order of magnitude lower in concentration than the existing screening level. As discussed above, an order of magnitude decrease in a promulgated indoor air remediation standard is a reopener for closed cases where a site-specific standard exists for a site.

57. COMMENT: Given the expected time for adoption of these remediation standards, the ability to use previously approved remediation standards, only if they are not an order of magnitude above the new standards, has the potential to create serious timeframe compliance issues. These remediation standards will be coming into effect at the same time as the mandatory timeframes to complete remediation will be expiring, potentially resulting in the remediating party having completed a non-compliant remedy, and without the ability to conduct additional remediation due to the expiration of the mandatory timeframe. This same comment applies to both N.J.A.C. 7:26D-1.4(b)2i and 3i. Remedial actions completed in the last 18 months prior to the rule adoption, using the existing standards, must be allowed to stand, until there is a new triggering event at the site (such as a new Industrial Site recovery Act (ISRA) filing) that will require reevaluation of the site. (16)

RESPONSE: The Department cannot waive the order of magnitude provision in the rules for remedial actions completed at sites in the last 18 months prior to rule adoption as the order of magnitude provision is a statutory requirement. See N.J.S.A. 58:10B-12.j. ARRCS, at N.J.A.C. 7:26C-3.5, provides for extensions of mandatory timeframes. Additional time to comply with a newly promulgated remediation standard could be the basis for submission of an extension request of a mandatory timeframe to the Department, provided an adequate justification can be provided on a site-specific basis. Extension requests for mandatory timeframes are subject to Department review and approval.

58. COMMENT: The Department claims to lower, that is make more stringent, some existing cleanup standards by more than an order of magnitude (10X, or 10 times). Under current toxic site cleanup law, this kind of order of magnitude change triggers reconsideration of the currently approved cleanup plans that were based on the prior, less stringent standard. Those cleanup plans are presumptively no longer protective of human health and the environment because current science means that they were based on a standard at least 10 times too lax. But the Department summary in the notice of proposal does not list the number, name, and/or location of sites where the current cleanup plans must be reopened due to the order of magnitude changes. So, impacted communities will have no way of knowing or holding the Department and polluters accountable for a protective cleanup. (13)

RESPONSE: The Department intends to keep its existing policy concerning when an order of magnitude evaluation is conducted. For active cases (cases that do not have a final remediation document), the person responsible for conducting the remediation, in conjunction with the LSRP, must revise the site remedial action workplan to use the more stringent remediation standard(s). For closed cases (cases that have a final remediation document), the timing differs depending on whether the site has a restricted, limited restricted, or unrestricted use remedy. For sites that have implemented a restricted or limited restrictive use remedy (cases that have an institutional control or an institutional and engineering control), the order of magnitude evaluation would be part of the required biennial remedial action protectiveness certification. For sites that have implemented an unrestricted use remedy, the order of magnitude evaluation would be required at the time when a site “re-enters” the Department's Site Remediation and Waste Management Program (for example, when a site is subject to an ISRA trigger, when a childcare facility license is up for renewal, and if a property sale requires update of site conditions for loan approval). The order of magnitude evaluation would be conducted pursuant to the Technical Rules at N.J.A.C. 7:26E-3.2(a).

59. COMMENT: Soil remediation standards for the migration to ground water exposure pathway should not be subject to an order of magnitude. The Brownfield Act, at N.J.S.A. 58:10B-12.j, states that the Department cannot compel the use of a newly promulgated remediation standard at a site that has an approved remedial action workplan unless the new remediation standard is more stringent than the remediation approved in the remedial action workplan or other plan by an order of magnitude or more. The existing soil remediation standards for the migration to ground water exposure pathway are not subject to an order of

magnitude according to the Department order of magnitude policy dated August 10, 2009. Please confirm that soil remediation standards for the migration to ground water exposure pathway are not subject to an order of magnitude. (6 and 8)

60. COMMENT: The order of magnitude provisions in the Brownfield Act do not apply to the impact to ground water soil screening criteria and indoor air screening levels because these were not previously standards. (4)

61. COMMENT: The numerous proposed order of magnitude changes impact thousands of projects, as referenced in the notice of proposal's Economic Impact statement. It is unclear how this notice of proposal seeks to justify creating order of magnitude changes with new standards for what had previously been only screening levels. The proposed standards should be classified as new standards, not changes, in the context of standards for hazardous substances where no current standard exists, and for proposed remediation standards for indoor air remediation for the vapor intrusion pathway and the proposed remediation standards for soil and soil leachate for the migration to ground water exposure pathway, which are currently addressed in the remediation process through screening levels and Department guidance. The Brownfield Act, at N.J.S.A. 58:10B-12.j and 13.e, provides that additional remediation for a site that has an approved remedial action work plan or that has secured a final remediation document is only required upon adoption of a regulation that amends or changes a remediation standard; and for sites that have an approved remedial action work plan the amended or changed standard is more stringent than the standard approved remedial action work plan by an order of magnitude; and for sites that have an approved final remediation document the difference

between the amended or changed standard and the levels of the contaminant detected at the site differ by an order of magnitude. The order of magnitude change concept does not apply with respect to the proposed new standards (soil and soil leachate remediation standards for migration to ground water and the proposed remediation standards for indoor air remediation for the vapor intrusion pathway) as no standards currently exist; rather, an order of magnitude change (and the required order of magnitude analysis of potential liability for additional remediation) is only a consideration upon adoption of a regulation that amends or changes an existing remediation standard. Reopening approved remedial action work plans or completed remediation cases that have secured a final remediation document to require additional remediation based the creation of the new remediation standards for substances for which no remediation standard previously exists would be inconsistent with the Brownfield Act. Clarify that order of magnitude change evaluations and potential reopening of sites that have approved remedial action work plans or final remediation documents will not be required with respect to the proposed new remediation standards. (10 and 11)

62. COMMENT: The notice of proposal identifies 1,1-dichloroethene as having a standard that changes by more than an order of magnitude for indoor air. There are others. However, currently, there are no standards for indoor air, only screening levels. The Brownfield Act provides that changes in standards, not screening levels, trigger reviewing the protectiveness of remedies. So, it is inappropriate to suggest that the adoption of standards for the first time somehow acts as a reopener for sites with unrestricted-use no further actions or response action outcomes. (1)

63. COMMENT: In the notice of proposal, at 52 N.J.R. 568, the Department identifies those compounds that are impacted by the order of magnitude provision. There are two compounds identified under the categories of soil-migration to ground water (hexachlorocyclopentadiene) and residential and nonresidential indoor air for vapor intrusion (1,1-dichloroethylene) that are currently screening levels and not standards. The previous default impact to ground water screening levels and indoor air screening levels were not codified standards, so the order of magnitude evaluation is not applicable, as the order of magnitude evaluation applies only to existing standards that are amended and reduced by an order of magnitude as clearly stated in the Brownfield Act, at N.J.S.A. 58:10B-13.e. Therefore, these compounds are not applicable to the order of magnitude evaluation for migration to ground water and indoor air and this should be corrected when the rule is promulgated. (15)

RESPONSE TO COMMENTS 59 THROUGH 63: The Brownfield Act, at N.J.S.A. 58:10B-12.a, states "[u]ntil the minimum remediation standards for the protection of public health and safety as described herein are adopted, the department shall apply public health and safety remediation standards for contamination at a site on a case-by-case basis based upon the considerations and criteria enumerated in this section." The Department has taken the position that such site-specific standards are remediation standards. The Department has also taken the position that, as long as default remediation standards do not exist, there are no remediation standards against which site-specific remediation standards can be compared. As such, the order of magnitude evaluation is not applicable.

However, upon the adoption of default soil remediation standards (soil-water partition) for the migration to ground water exposure pathway and indoor air remediation standards for the vapor intrusion exposure pathway, there will be remediation standards that can be compared against site-specific remediation standards. Accordingly, the order of magnitude evaluation is applicable.

In the case of the migration to ground water exposure pathway and the vapor intrusion exposure pathway, the order of magnitude evaluation is conducted by comparing the site-specific soil-water partition remediation standard for a given contaminant and the site-specific indoor air remediation standard for a given contaminant against the current default soil-water partition remediation standard for the applicable contaminant and the default indoor air remediation standard for the applicable contaminant.

64. COMMENT: While the Department has evaluated the economic impact of order of magnitude changes, it has not reviewed the impact of N.J.A.C. 7:26C-6.4(a)3, which deems a remedial action to be not protective of the public health, safety, and the environment when "[a] contaminant exposure pathway from a discharge that predates the final remediation document is identified after the issuance of the final remediation document and was not addressed in the remediation to which the final remediation document pertains." The application of this rule to the new standards being proposed raises the potential of requiring a reevaluation of every site ever issued a final remediation document, even going back in time to before SRRA was enacted in 2009 and including all prior no further action closures issued by the

Department itself in the past. Based on the Department's analysis of potential economic impacts in the notice of proposal Summary's Impact on Newly Regulated Exposure Pathways section, which states that "any additional economic impact on promulgating standards for contaminates for these two exposure pathways is minimal," it appears that the Department did not intend the new exposure pathways to act as a basis for reopening completed remediation cases pursuant to N.J.A.C. 7:26C-6.4(a)3.

The final rulemaking should include an express statement that LSRPs, and current property owners holding a valid no further action or response action outcome determination, are not required to reopen a case with a final remediation document based on new pathways. If the Department's position is that LSRPs, and current property owners holding a valid no further action or response action outcome determination, are required to reopen a case with a final remediation document based on new pathways, then the economic impact analysis and notice of proposal is clearly flawed, fails to adequately consider economic impacts, and should be withdrawn and republished following reevaluation of the scope and impact of economic impacts. (10 and 11)

65. COMMENT: The Department states in its notice of proposal that it is proposing standards for new pathways that are not in the existing regulations, namely standards for the vapor intrusion exposure pathway. (See "Impact of Newly Regulated Exposure Pathways," 52 N.J.R. at 579). While the Department claims the economic impact of these changes will be minimal, it has completely ignored the impact of N.J.A.C. 7:26C-6.4(a)3. The application of this rule to the new standards being proposed raises the potential of requiring a reevaluation of

every site ever issued a final remediation document. It is incumbent on the Department to reevaluate this potential for the possible catastrophic impact on the economy or alternatively to state clearly in the adoption document, if it proceeds with this rulemaking that the "new pathways" being proposed will not require a such a reevaluation. (16)

RESPONSE TO COMMENTS 64 AND 65: It is not the Department's intent to reopen every site that has a final remediation document to evaluate every contaminant for the migration to ground water exposure pathway and indoor air vapor intrusion exposure pathway. However, the Department requires the person responsible for conducting the remediation to evaluate those contaminants found at closed sites that are subject to the order of magnitude provision.

The impact to ground water (now migration to ground water) exposure pathway has been evaluated at sites since 1993 and the vapor intrusion exposure pathway has been evaluated at sites since 2005. Sampling results for these two exposure pathways are contained in the Department's COMPASS database and were used to determine the impact of contaminants subject to the order of magnitude provisions on closed cases (cases with a final remediation document).

For the vapor intrusion exposure pathway, there is only one contaminant, 1,1-dichloroethene, that is subject to the order of magnitude provision. Data from the COMPASS database indicates that there are only three closed cases that would trigger an order of magnitude evaluation.

For the migration to ground water exposure pathway, there are five contaminants that are subject to the order of magnitude provision. The contaminants are hexachlorocyclopentadiene, bis(2-ethylhexyl)phthalate, DDE, DDT, and copper. Data from the COMPASS database indicates that there is only one closed case that would trigger an order of magnitude evaluation for hexachlorocyclopentadiene and there are 105 cases for bis(2-ethylhexyl)phthalate; 68 cases for DDE; 65 cases for DDT; and 131 cases for copper. The number of affected cases is minimal considering the total number of closed cases (94,194 as of August 2020).

The Department intends to keep its existing policy concerning when an order of magnitude evaluation would be conducted. See the Response to Comment 58 for a discussion of the timing of the evaluation.

66. COMMENT: The Department seems to provide conflicting information on whether an order of magnitude evaluation is appropriate relative to the indoor air screening levels. An order of magnitude change for indoor air remediation standards is discussed in the notice of proposal Summary at 52 N.J.R. 568. At 52 N.J.R. 574, under the heading "Comparison of Existing Soil Remediation Standards and Proposed Soil Remediation Standards," it is indicated that "As there are no existing … indoor air remediation standards for the vapor intrusion exposure pathway, no comparison to the proposed remediation standards for these exposure pathways can be made." The inclusion of the statement pertaining to indoor air remediation standards is confusing since this section appears to pertain to soil remediation standards.

At 52 N.J.R. 578, there is a discussion of the impact of the order of magnitude change for 1,1-DCE. This discussion is provided under the heading "Proposed Soil Remediation Standards that Decrease by an Order of Magnitude or More." (4)

RESPONSE: The heading at 52 N.J.R. at 574 incorrectly contains the word "soil." The heading should state, "Comparison of Existing Remediation Standards and Proposed Remediation Standards."

The Department's intent of the discussion cited at 52 N.J.R. 574 was to compare existing default soil remediation standards with proposed default soil remediation standards. As stated at 52 N.J.R. 574, no such comparison was made for indoor air remediation standards as there are no existing default indoor air remediation standards.

The heading at 52 N.J.R. 578 also incorrectly contains the word "soil." The heading should state, "Proposed Remediation Standards that Decrease by an Order of Magnitude or More."

As discussed in the Response to Comments 59 through 63, the order of magnitude provision applies to indoor air remediation standards for the vapor intrusion exposure pathway. Using the existing indoor air screening levels as a benchmark, the proposed indoor air remediation standard for 1,1-Dichloroethene is an order of magnitude lower in concentration than the existing screening level.

67. COMMENT: The Department did not identify all contaminants impacted by the order of magnitude provision. As provided by the Brownfield Act, N.J.S.A. 58:10B-1 et seq., the

Department cannot compel the use of a newly promulgated remediation standard unless the new standard is more stringent by an order of magnitude or more. The Department identified the contaminants impacted by the Brownfield Act's order of magnitude provision in the notice of proposal at 52 N.J.R. 568.

An evaluation of the existing and proposed remediation standards by the commenters has indicated that the Department did not identify all the contaminants impacted by this provision. The Department included caprolactam and ethylbenzene as contaminants with proposed soil inhalation remediation standards as meeting the provision of an order of magnitude change as a result of proposing a standard where none existed previously. The following tables present the contaminants impacted by the order of magnitude provision.

Residential Scenario			Table 1			Former
Medium	**Exposure Pathway**	**Contaminant**	**Contaminant**	**CAS No.**	**Soil Remediation Standard Ingestion-Dermal Nonresidential (mg/kg)**	**NJDEP 2017 Soil Remediation Standard Ingestion + Dermal Nonresidential (mg/kg)**
Soil	Ingestion-Dermal	Benzaldehyde	Benzaldehyde	100-52-7	170	6,100
		Cobalt	Cobalt	7440-48-4	23	1,600

Nonresidential Scenario			Table 2			Former
Medium	**Exposure Pathway**	**Contaminant**	**Contaminant**	**CAS No.**	**Soil Remediation Standard Ingestion-Dermal Nonresidential (mg/kg)**	**NJDEP 2017 Soil Remediation Standard Ingestion + Dermal Nonresidential (mg/kg)**
Soil	Ingestion-Dermal	Benzaldehyde	Benzaldehyde	100-52-7	910	68,000
		Butylbenzylphthalate	Butylbenzylphthalate	85-68-7	1,300	14,000
			Cobalt	7440-48-4	390	23,000
			1,1-Dichloroethane	75-34-3	640	7,400

Residential Scenario			Table 4			Former
Medium	**Exposure Pathway**	**Contaminant**	**Contaminant**	**CAS No.**	**Soil Remediation Standard Inhalation Nonresidential (mg/kg)**	**NJDEP 2017 Soil Remediation Standard Inhalation only**
Soil	Inhalation	Caprolactam	Caprolactam	105-60-2	1,300	NA
		Ethylbenzene	Ethylbenzene	100-41-4	48	NA

Scenario Not Applicable			**Table 5**			**Former**
Medium	**Exposure Pathway**	**Contaminant**	**Contaminant**	**CAS No.**	**Migration to Ground Water Soil Remediation Standard (mg/kg)**	**NJDEP 2013 Impact to Ground Water Soil Screening Level(mg/kg)**
Soil	Migration to ground water	Hexachlorocyclo pentadiene	Hexachlorocyclo pentadiene	77-47-4	2.5	320
			Bis(2-ethylhexyl)phthalate	117-81-7	14	1,200
			Copper (total)	7440-50-8	910	11,000
			4,4'-DDE (p,p'-DDX	72-55-9	0.47	18
			4,4'-DDT	50-29-3	0.67	11

Residential Scenario			**Table 7**			**Former**
Medium	**Exposure Pathway**	**Contaminant**	**Contaminant**	**CAS No.**	**Indoor Air Remediation Standard Residential (ug/m3)**	**NJDEP Indoor Air Screening Level (IASL) Residential (ug/m3)**
Indoor Air	Vapor Intrusion	1,1-Dichloroethene	1,1-Dichloroethene	75-35-4	21	210

Nonresidential Scenario			**Table 8**			**Former**
Medium	**Exposure Pathway**	**Contaminant**	**Contaminant**	**CAS No.**	**Indoor Air Remediation Standard Nonresidential (ug/m3)**	**NJDEP Indoor Air Screening Level (IASL) Nonresidential (ug/m3)**
Indoor Air	Vapor Intrusion	1,1-Dichloroethene	1,1-Dichloroethene	75-35-4	88	880

The additional contaminants identified must be addressed in the Social and Economic Impact statements of the proposed amendments because of the impacts on the Site Remediation and Waste Management Program. Note that in the Economic Impact discussion at 52 N.J.R. 579, the Department states that only the non-residential soil remediation standard for cobalt is impacted by the order of magnitude provision. The Department has reversed this designation at 52 N.J.R. 568, noting only that the residential scenario is impacted. However, a comparison of the existing and proposed cobalt remediation standards for ingestion-dermal indicates that both the residential and non-residential exposure scenarios are impacted by the provision. Therefore, the economic impact of the proposed cobalt soil remediation standard is significantly underestimated since the number of sites discussed is based on the proposed non-residential standard rather than residential standard. (6 and 8)

RESPONSE: Prior to the adopted rules, the nonresidential soil remediation standard for 1,1-dichloroethane was 24 mg/kg (inhalation exposure pathway). The previous nonresidential health-based soil criterion for 1,1-dichloroethane was 7,400 mg/kg for the ingestion-dermal exposure pathway. See 52 N.J.R. 569 for a discussion of standard and criterion. The adopted nonresidential health-based soil standard for 1,1-dichloroethane is 640 mg/kg for the ingestion-dermal exposure scenario. Although the standard decreased by more than an order of magnitude compared to the prior criterion (640 mg/kg versus 7,400 mg/kg), the standard concentration is higher than the previous standard for 1,1-dichloroethane (24 mg/kg). The adopted rules deleted the prior nonresidential soil remediation standard for 1,1-dichloroethane (24 mg/kg - inhalation exposure pathway) as USEPA withdrew the inhalation toxicity factor used to derive the standard. However, as the prior standard was 24 mg/kg and the adopted new standard is 640 mg/kg, there is no order of magnitude impact.

The prior nonresidential soil remediation standard for cobalt was 590 mg/kg (inhalation exposure pathway). The prior health-based nonresidential soil criterion for cobalt was 23,000 mg/kg for the ingestion-dermal exposure pathway. The adopted health-based nonresidential soil remediation standard for cobalt is 390 mg/kg for the ingestion-dermal exposure scenario. Although the adopted standard decreased by more than an order of magnitude compared to the prior criterion (390 mg/kg versus 23,000 mg/kg), the adopted remediation standard value of 390 mg/kg (ingestion-dermal exposure pathway) is within an order of magnitude of the prior nonresidential standard for cobalt of 590 mg/kg (inhalation exposure pathway). Therefore, there is no order of magnitude impact for cobalt for the nonresidential exposure scenario.

The order of magnitude discussion for cobalt, at 52 N.J.R. 568, identifies only the residential exposure scenario, whereas the order of magnitude discussion in the Economic Impact statement (52 N.J.R. at 579) addresses only the nonresidential exposure scenario. This was a Department oversight. The discussion of cobalt in the Economic Impact statement is for the residential exposure scenario. References to “nonresidential” should have been “residential.” As discussed above, there is no order of magnitude impact for cobalt for the nonresidential exposure scenario.

With regard to caprolactam and ethylbenzene, while the prior rules did not contain residential and nonresidential soil remediation criteria for these compounds for the inhalation exposure scenario, the prior rules did include residential and nonresidential soil remediation standards for caprolactam and ethylbenzene for the ingestion-dermal exposure pathway. The prior soil remediation standards for caprolactam and ethylbenzene were 31,000 mg/kg residential and 340,000 mg/kg nonresidential and 7,800 mg/kg residential and 110,000 mg/kg nonresidential, respectively. The adopted soil remediation standards for ethylbenzene (inhalation exposure pathway) of 10 mg/kg residential and 48 mg/kg nonresidential are more than an order of magnitude lower than the prior soil remediation standards. The adopted soil remediation standards for caprolactam (inhalation exposure pathway) of 290 mg/kg residential and 1,300 mg/kg nonresidential are more than an order of magnitude lower than the prior soil remediation standards.

The Department did not identify bis(2-ethylhexyl)phthalate, copper, 4-4'-DDE, and 4,4'-DDT as compounds subject to the order of magnitude evaluation. This was an oversight. The Department has conducted an impact analysis for these contaminants, as discussed below.

The adopted soil remediation standards for bis(2-ethylhexyl)phthalate, copper, 4-4'-DDE, and 4,4'-DDT (migration to ground water exposure pathway, soil-water partition) are greater than an order of magnitude more stringent than the prior impact to ground water soil screening level (soil-water partition). The Department reviewed analytical data for these contaminants in the Department's COMPASS database to determine the potential economic impact of the adopted remediation standard on the remediation of contaminated sites.

As a result of that review, the Department found that there are 27 active sites and six closed sites that had bis(2-ethylhexyl)phthalate contamination in soil in excess of the prior impact to ground water screening level. There are 192 additional active sites and 99 additional closed sites that have bis(2-ethylhexyl)phthalate contamination in soil in excess of the adopted soil remediation standard for the migration to ground water exposure pathway. There are 2,836 active cases and 2,918 closed cases that have detectable levels of bis(2-ethylhexyl)phthalate. The 192 additional active cases and 99 closed cases represent a 6.8 percent increase (active sites) and a 3.4 percent increase (closed sites) in the number of sites that have any level of bis(2-ethylhexyl)phthalate contamination in soil that would be subject to an order of magnitude evaluation.

The Department has found that there are 10 active sites and six closed sites that had 4,4'-DDE contamination in soil in excess of the prior impact to ground water screening level.

There are 69 additional active sites and 62 additional closed site that have 4,4'-DDE contamination in soil in excess of the adopted migration to ground water soil remediation standard. There are 1,525 active cases and 1,447 closed cases that have detectable levels of 4,4'-DDE. The 69 additional active cases and 62 additional closed cases represent a 4.5 percent increase (active sites) and a 4.3 percent increase (closed sites) in the number of sites that have any level of 4,4'-DDE contamination in soil that would be subject to an order of magnitude evaluation.

The Department has found that there are 33 active sites and 15 closed sites that had 4,4'-DDT contamination in soil in excess of the previous impact to ground water screening level. There are 30 additional active sites and 50 additional closed site that have 4,4'-DDT contamination in soil in excess of the adopted migration to ground water soil remediation standard. There are 1,524 active cases and 1,449 closed cases that have detectable levels of 4,4'-DDT. The 30 additional active cases and 50 additional closed cases represent a 2.0 percent increase (active sites) and a 3.5 percent increase (closed sites) in the number of sites that have any level of 4,4'-DDT contamination in soil that would be subject to an order of magnitude evaluation.

The Department has found that there are 104 active sites and 25 closed sites that had copper contamination in soil in excess of the previous impact to ground water screening level. There are 251 additional active sites and 106 additional closed sites that have copper contamination in soil in excess of the adopted migration to ground water soil remediation standard. There are 2,754 active cases and 2,695 closed cases that have detectable levels of

4,4’-DDT. The 251 additional active cases and 106 additional closed cases represent a 9.2 percent increase (active sites) and a 3.9 percent increase (closed sites) in the number of impacted sites that have any level of copper contamination in soil that would be subject to an order of magnitude evaluation.

The percentage of sites impacted by the order of magnitude difference in the remediation standards of bis(2-ethylhexyl)phthalate, copper, 4-4’-DDE, and 4,4’-DDT (migration to water exposure pathway) would be much lower if one were to consider all of the Department’s active sites (12,853 as of August 2020) and closed sites (94,194 as of August 2020).

Based on the above information, the Department anticipates only a minor economic impact on remediation, if it proves to be necessary at sites with one or more of these four contaminants.

As the order of magnitude evaluation for these four contaminants is based on the migration to ground water exposure pathway, additional options can be used to demonstrate compliance with this exposure pathway without the need for additional remedial actions. For example, if compliance for the migration to ground water exposure pathway for these four contaminants can be demonstrated using soil leachate remediation standards, no additional remedial action is required. Also, all four of the contaminants discussed above are considered immobile contaminants. As such, if a two-foot clean zone is present above the water table, compliance with the migration to ground water exposure pathway is achieved. Taking this information into account, the Department considers the additional economic impact to remediation due to an order of magnitude decrease for these four contaminants to be minimal.

Considerations for the Development of Remediation Standards

<u>Extractable Petroleum Hydrocarbons (EPH)</u>

68. COMMENT: EPH should not be used as a definitive indication of non-aqueous phase liquids. The Department fails to acknowledge EPH is a relatively simple and generally non-specific laboratory analysis that has a very large economic and practical impact on site remediations in New Jersey. EPH is the primary analysis for all heating oil investigations, including residential home heating oil tank projects, as well as large oil storage terminals, oil pipelines, and refineries. The proposed amendments propose conservative EPH standards from Category 1 fuels (#2 fuel oil and diesel fuel) and site-specific calculations for Category 2 fuels. The proposed standards fail to recognize that the Department also uses EPH concentrations as an indicator of the presence of non-aqueous phase liquid in the soil. (6 and 8)

RESPONSE: The Department acknowledges that EPH contamination may have a large economic and practical impact on site remediations in New Jersey. While that may be inherent, the remediation of contaminated sites to the degree in which they are protective of public health and the environment is paramount. The adopted EPH soil remediation standards were developed in accordance with the requirements contained in the Brownfield Act at N.J.S.A. 58:10B-12 and are protective of human health, safety, and the environment and are not conservative.

The Department notes that the soil remediation standards for Category 2 EPH are sample-specific and not site-specific.

The adopted standards cite N.J.A.C. 7:26E-5.1(e) and the requirement to remove, treat, or contain free and residual product.

Outside of the scope of the adopted rules, the Department has set default product limits based on parent petroleum product within the Evaluation of Extractable Petroleum Hydrocarbons in Soil Technical Guidance. Additionally, the Department affords the investigator the option to develop an area of concern specific EPH alternative product limit (see https://www.nj.gov/dep/srp/guidance/srra/evaluation_eph_soil_guidance.pdf?version_1_0).

69. COMMENT: The Department's maximum allowable EPH concentration is not a promulgated remediation standard. The 2019 EPH guidance document provided a methodology to evaluate site-specific conditions to calculate an EPH concentration that represents a residual non-aqueous phase liquid concentration. There is a benefit of an EPH product determination screening level to drive small-scale remediation projects (home heating oil cleanups); however, this same approach is overly conservative for larger scale operations where site-specific constituents are the primary remediation driver.

The Department has established a policy that 30,000 ppm is the maximum EPH concentration that may be evaluated for the presence of non-aqueous phase liquid. All soil samples above 30,000 ppm are automatically considered non-aqueous phase liquid and, therefore, must be remediated. This policy limit is built into the architecture of the EPH Product

Indicator calculator, as well as the guidance document. Through policy alone, the Department has established a remediation standard that was not published, or technically justified or published for comment. (6 and 8)

RESPONSE: The bulk of the comment focuses on the establishment of an EPH concentration that represents a residual non-aqueous phase liquid concentration. This is beyond the scope of the rulemaking. The 30,000 mg/kg EPH product ceiling concentration is not a health-based remediation standard. This ceiling concentration, however, works in conjunction with the Technical Requirements, which states at N.J.A.C. 7:26E-5.1(e), “The person responsible for conducting the remediation shall treat or remove free product and residual product to the extent practicable or contain free product and residual product when treatment or removal is not practicable. Monitored natural attenuation of free product and residual product is prohibited.”

The Remediation Standards at N.J.A.C. 7:26D-1.2(b)1 provides, “(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.”

The 30,000 mg/kg EPH product ceiling concentration is not a mobility-based limit, but it is a maximum EPH concentration by which the EPH technical guidance committee considers the soil to be too contaminated to behave as a natural soil. Therefore, it is necessary to develop a maximum allowed concentration for total petroleum hydrocarbons in soil to protect against other undesired effects of these contaminants when present at high levels. For additional guidance, please refer to the 2019 EPH in Soil Technical Guidance found at

https://www.nj.gov/dep/srp/guidance/srra/evaluation_eph_soil_guidance.pdf?version_1_0.

70. COMMENT: Multiple researchers provide effective use of EPH sample results. The Department should embrace the Interstate Technology and Regulatory Council approach for managing light non-aqueous phase liquids for its basis in sound and state-of-the-art science and would have the ability to promote this as Green Remediation. The approach has been adopted, or is in the process of being adopted, by other states including Massachusetts, on which the Department has attempted to model its LSRP program.

Technical Impracticability of product recovery for large or complex sites should include light non-aqueous phase liquid transmissivity assessment in addition to limitations on access due to infrastructure. The Technical Impracticability section of the 2019 guidance acknowledges large or complex non-residential identical sites that may contain physical obstacles and no accessibility to the product to meet regulatory requirements.

However, whether the light non-aqueous phase liquid accumulated in place is physically recoverable or not was not discussed. Light non-aqueous phase liquids transmissivity metrics are reliable indicators of recoverability. At light non-aqueous phase liquid transmissivity values of 0.1 to 0.8 ft2/d recovery is not practicable and light non-aqueous phase liquid in the saturation zone remains largely residual with a high potential to naturally attenuate *in situ* (ITRC, 2018). Ground water quality measurements should be used to provide a site-specific human health risk and exposure pathway evaluation, in support of the light non-aqueous phase liquid transmissivity evaluation. This technique is scientifically based and provides an increased level of chemical scrutiny by targeting specific chemicals within ground water, and not generalizing the light non-aqueous phase liquids characteristics.

There is little to no information in the EPH Guidance which differentiates between unsaturated zone petroleum liquid mobility and light non-aqueous phase liquid mobility and migration in water-saturated soils and ground water. The residual saturation levels reported by Brost and Devaull (2000) apply for unsaturated zone soils.

There is ample and relatively new guidance on evaluating petroleum liquid mobility in water-saturated soils and ground water. The commenters recommend its incorporation by reference (ITRC, 2018). This assessment includes evaluation using multiple lines of evidence, including (i) a stable footprint (stable and decreasing thickness), (ii) a shrinking dissolved phase plume, (iii) light non-aqueous phase liquid velocity using Darcy velocity and bail down tests, (iv) measured light non-aqueous phase liquid thickness critical thickness to invade water-wet pores, (v) declining recovery rates that would generally indicate reduced potential for light non-aqueous phase liquid mobility, and (vi) age of the release (abated release, timing of release, and weathering indicators).

Although the non-residential standard for EPH will be set at 75,000 parts per million (ppm), which represents a conservatively low risk level, the Department should provide a guidance document on how the existence of a light non-aqueous phase liquid may be more accurately evaluated. The alternative EPH product limit calculator can produce inaccurate values for specific soil types. Field approaches are more practical and efficient in assessing residual saturation and mobility.

The proposed amendments should be withdrawn, and the Department should reevaluate establishment of a multi-chemical analytical method, such as EPH as the primary indicator of the presence of light non-aqueous phase liquids. (6 and 8)

RESPONSE: This comment primarily focuses on evaluation of EPH as light non-aqueous phase liquid, which is beyond the scope of this rulemaking. The Department developed the adopted EPH soil remediation standards in accordance with the requirements of the Brownfield Act at N.J.S.A. 58:10B-12.

Toxicity and the Best Available Science

71. COMMENT: The Department is focused on promulgating the proposed Remediation Standards, N.J.A.C. 7:26D, without a thorough review of the science. On June 26, 2020, the commenters requested a stay of the proposed amendments or an additional 60 days to provide a comprehensive review and detailed comments. The request was supported with eight points identifying information that was referenced but has not been provided to the public. On July 14, 2020, the Department denied the commenters' request to stay the rule or extend the comment period. The Department provided detailed comments that demonstrate that the Department is recalcitrant to a cooperative discussion of the details. For example, the Department noted that, the ARS calculators “provide a more user-friendly tool for the development of site-specific ARS,” however, this user-friendly tool will not be provided.

The commenters' request for copies of the Department's basis and background documents resulted in two contradictory responses from the Department in the same paragraph. In brief, all of the information is in the proposed rule, but the document that justifies the selection of the variables, the referenced source of the details, and any subsequent calculations that would be provided in the basis and background document remain "in development" and "cannot be provided at this time."

These two observations continue to highlight the Department's goal of establishing remediation standards for enforcement, litigation, and cost recovery purposes. The commenters request that the proposed amendments be withdrawn until all relevant technical documents have been prepared and publicly reviewed including, but not limited to, the ARS calculators, the basis and background documents, the ARS Technical Guidance document for soil leachate, and the Department's policy plans for the management of remedial action permits associated with the proposed remediation standards. (3, 6, and 8)

RESPONSE: The Department is not withdrawing the Remediation Standards rule notice of proposal. See the Response to Comments 18 through 23 for a discussion of why withdrawal of the rulemaking is not appropriate.

The calculators provide a tool to derive an ARS; however, the calculators are not needed to evaluate the Remediation Standards rulemaking because the rules already contain the information necessary to derive all remediation standards, such as equations, default exposure assumptions, and default parameter values. In June 2020, the Department had not fully developed the ARS calculators. The fully developed calculators are now available at https://www.nj.gov/dep/srp/guidance/rs/index.html. A GovDelivery Communications Cloud notice will be sent indicating that the Department will accept comments concerning the calculators. A timeframe for receipt of comments will be included in the notice.

Likewise, the Department's basis and background documents are also now available. The basis and background documents for the ingestion-dermal exposure pathway and inhalation exposure pathway provide information that is already contained in the Remediation Standards, N.J.A.C. 7:26D. The equations, default exposure assumptions, toxicity values, and skin absorption fractions are already contained at N.J.A.C. 7:26D.

The Department's technical guidance document for developing ARS for the soil ingestion-dermal and soil inhalation exposure pathways was distributed to stakeholders for review and comment prior to the closure of the extended public comment period for this rulemaking. This technical guidance document is now available to the general public at https://www.nj.gov/dep/srp/guidance/. The Department's technical guidance document for developing ARS for the migration to ground water exposure pathway was distributed to stakeholders for review and comment subsequent to the closure of the extended comment period for this rulemaking. This new technical guidance document, which is a compilation of the Department's existing Impact to Ground Water guidance documents that have been in use for years, is now available at https://www.nj.gov/dep/srp/guidance/rs.

Please see the Response to Comments 51, 52, and 53 regarding concern about the Department’s goal of establishing remediation standards for enforcement, litigation, and cost recovery purposes.

The request for the Department's policy plans for the management of remedial action permits is beyond the scope of this rulemaking.

72. COMMENT: The Department is not using the best available science for setting toxicity source data. The Department has established a hierarchy of toxicity source data based on "maintaining consistency with the other state standards" rather than on the basis of the best available scientific information. The Department gives first priority among the many sources of toxicity values available, to the New Jersey Drinking Water Quality Institute (NJDWQI), rather than to the USEPA Integrated Risk Information System (IRIS) database. The IRIS assessments are the preferred sources of toxicity information used by the USEPA and are an important source of toxicity information used by state and local health agencies, other Federal agencies, and international health organizations. The process for developing an IRIS human health assessment may be found at: https://www.epa.gov/iris/basic-information-about-integrated-risk-information-system).

Under the USEPA's process, there are numerous opportunities for public comment, as well as interagency science consultations and external peer review. The toxicity values generated through this process are representative of the most recent toxicological and epidemiological studies available and up-to-date methodologies for dose-response assessment, including the 2005 USEPA Guidelines for Carcinogen Risk Assessment.

As an example of the importance of utilizing the most current toxicity assessments, all six of the NJDWQI-derived oral slope factors represent higher toxicities than those established by IRIS. With the exception of chlordane (for which a toxicity reference source cannot be located), all the IRIS oral slope factors were generated more recently than the NJDWQI values. The following table provides a comparison of the NJDWQI slope factors and the IRIS slope factors, as well as the ratio of the two slope factors; the NJDWQI slope factors range from 1.3 to seven times higher than the IRIS values:

Contaminant	CAS No.	SFO (mg/kg - day)-1	Source Noted in Appendix 11	Source Identified	SFO (mg/kg - day)-1	Source	Ratio NJDWQI:IRIS
Benzene	71-43-2	2.30E-01	NJDWQI SF (1994)	NJDWQI SF (1987)	5.50E-02	IRIS 2000	4.2
Carbon tetrachloride	56-23-5	9.10E-02	NJDWQI SF (1994)	NJDWQI SF (1987)	7.00E-02	IRIS 2010	1.3
Chlordane (alpha and gamma forms summed)	57-74-9	2.30E+00	NJDWQI SF (2001)	Not Located	3.50E-01	IRIS 1998	6.6
1,2-Dichoroethane	107-06-2	1.20E-01	NJDWQI SF (1994)	NJDWQI SF (1987)	9.10E-02	IRIS 2005	1.3
Methylene chloride (Dichloromethane)	75-09-2	1.40E-02	NJDWQI SF (1994)	NJDWQI SF (1987)	2.00E-03	IRIS 2011	7.0

The Department must withdraw the proposed amendments and reevaluate the data hierarchy to prioritize the current, most widely accepted, scientifically defensible toxicity values in accordance with the Brownfield Act at N.J.S.A. 58:10B-12(b), and also to ensure that the proposed soil remediation standards are not more stringent than Federal criteria as a result of utilizing outdated toxicity information.

The Department should also establish an independent Risk Assessment and Risk Management Science Advisory Board (Board) to incorporate up-to-date risk assessment principles and practices in the development of soil remediation standards. In addition, the Board could assist the Department and the Governor in establishing policies for the consistent application of scientifically defensible risk assessment methodologies across State programs and create a peer review process to ensure the best scientific practices continue to be utilized in the future.

The notice of proposal, at 52 N.J.R. 575, states that, in some instances, the Department developed toxicity factors from the primary scientific literature if toxicity information was not available from any of the toxicity hierarchy sources or if a toxicity factor was warranted by new scientific information. Proposed N.J.A.C. 7:26D Appendix 11 did not identify any toxicity values utilizing primary scientific literature. A clarification is necessary regarding this statement to confirm the toxicity data sources. The Department also stated that, “for some contaminants, toxicity information from a lower tier source was used in lieu of toxicity information from a higher source if it was determined that the lower tier toxicity information was derived using better scientific information.” The contaminants using these alternative toxicity values should be identified and the supporting documentation for the toxicity value selection provided for public review. Department decisions such as these, regarding the selection of appropriate toxicity values inconsistent with the hierarchy, should be made by the proposed Board and peer reviewed before they are used for rulemaking.

An additional issue related to toxicity values is the assessment of mutagenicity for contaminants identified as having mutagenic potential. Mutagenicity is not addressed in the proposed amendments but is mentioned in the “Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil.” Within this document, on page 30, a Table 2 footnote states: “By policy, the [Department's Site Remediation and Waste Management Program] does not consider mutagenic mode of action when calculating carcinogenic soil remediation standards." This is inconsistent with the current USEPA scientifically robust risk assessment methodology. Note that during the March 11, 2014 remediation standards stakeholder meeting, the Department stated that mutagenicity was to be included in the derivation of standards to be consistent with the USEPA policy. The Department must provide the policy detailing the rationale for not considering a potential toxicological response in the establishment of health-based criteria utilizing the best scientific information available. (6 and 8)

73. COMMENT: Adherence to a toxicity value hierarchy may result in the preferential selection of older or less robust toxicity values established in a higher tier, rather than criteria that are based on the best available science. The Department states that, for some contaminants, toxicity information from a lower tier source was used in lieu of toxicity information from higher tier sources if it was determined that the lower tier was derived using better information. An evaluation of the quality of toxicity information should be extended to all analytes and the use of the hierarchy approach should be eliminated. (16)

RESPONSE TO COMMENTS 72 AND 73: The Department's development of a toxicity hierarchy ensures a uniform approach to selecting toxicity values that is consistent and transparent. However, there are several factors contributing to this hierarchy. It is a misconception of the regulated community that when new toxicity information becomes available, all institutions will react at the same time. In practice, one institution may adopt a new toxicity factor based on new chemical toxicity studies earlier than another institution. An institution's funding and staff resources, among other issues, will all affect the timing of evaluation. Other variables influence the Department's selection of toxicity factors.

In the notice of proposal Summary, at 52 N.J.R. 575, the Department notes that the first source of toxicity information the Department relied on was the toxicity information for contaminants identified in the New Jersey Safe Drinking Water Act, at N.J.S.A. 58:12A-13. The Safe Drinking Water Act mandates that the Department establish Maximum Contaminant Levels (MCLs) for a list of specific contaminants and provide for the establishment of MCLs for additional contaminants based on occurrence and potential for human health effects. The Legislature established this list through amendments to the Safe Drinking Water Act (P.L. 1983, c. 443). The amendments are commonly referred to as “A-280” or “A-280 amendments.” Thereafter, the Department adopted MCLs as drinking water quality standards, which are used as the basis for the existing New Jersey’s Ground Water Quality Standards, N.J.A.C. 7:9C, and existing Surface Water Quality Standards, N.J.A.C. 7:9B. To maintain consistency with other State standards, the Department has used the A-280 contaminant toxicity information as the first source of toxicity information (first tier) for the development of soil ingestion-dermal absorption standards. Supporting documentation for A-280 toxicity information can be found in the NJDWQI “Maximum Contaminant Level Recommendations for Hazardous Contaminants in Drinking Water, Appendix A, Health-Based Maximum Contaminant Level Support Documents and Addenda (NJDWQI 1987 and 1994).” Similar to the USEPA’s IRIS toxicity information, the toxicity information developed by the NJDWQI for A-280 contaminants is externally peer reviewed, public comment is invited, and the process is transparent. The process used by

NJDWQI can be found on the NJDWQI website at https://www.state.nj.us/dep/watersupply/pdf/dwqi-flowchart.pdf.

Following the use of toxicity information recommended by the NJDWQI, the Department uses a hierarchy approach similar to the USEPA's, with the USEPA's IRIS toxicity information used as the second tier and a variety of other sources as the third tier, including, but not limited to, the USEPA's Provisional Peer Reviewed Toxicity Values (PPRTV), the USEPA's Health Effects Assessment Summary Tables (HEAST), the California Environmental Protection Agency (CalEPA), and the Agency for Toxic Substances and Disease Registry (ATSDR). See the notice of proposal Summary, at 52 N.J.R. 575. However, for the inhalation exposure pathway, which requires inhalation toxicity factors, the Department does not use A-280 toxicity factors to derive remediation standards because they are oral toxicity factors.

Department staff knowledgeable in human health risk assessment and toxicology spent extensive time reviewing the toxicity information for each chemical to select the appropriate source. In most cases, the Department followed the toxicity hierarchy, but as pointed out in the comment and as stated in the notice of proposal Summary, at 52 N.J.R. 575, "toxicity information from a lower tier source was used in lieu of toxicity information from a higher tier source if it was determined that the lower tier toxicity information was derived using better scientific information." In all instances where the Department selected a lower tier toxicity information source over that of a higher tier, that selection was based on scientific information that is most defensible, as noted in the footnotes to adopted N.J.A.C. 7:26D Appendix 11.

The commenters state that they were unable to identify any toxicity values developed by the Department for a contaminant using scientific literature if toxicity values were not available from any of the toxicity hierarchy sources. An oral reference dose (RfD) for tertiary butyl alcohol was developed internally by the Department using the best available science, since toxicity information was not available from any of the toxicity hierarchy sources. See 52 N.J.R. 651 and the footnotes to N.J.A.C. 7:26D Appendix 11, which provide the reference for the development of the oral toxicity value for tertiary butyl alcohol.

The commenters also state that the Department does not address contaminants with mutagenic mode of action in the proposed amendments, and this practice is inconsistent with the risk assessment methodology of the USEPA. While the Department's Site Remediation and Waste Management Program supports the protection against cancer risks from early-life exposure in the context of the baseline risk assessment and its associated screening levels, as existing policy, the Department's Site Remediation and Waste Management Program does not include the mutagenic mode of action in the development of its soil remediation standards. By regulation, the Department’s standards are based on a conservative 10^{-6} risk level for carcinogenic compounds, which is protective of any additional risks incurred from early life exposure. The Department's Site Remediation and Waste Management Program will continue to review this issue as more information becomes available and will consider it for future amendments to the Remediation Standards, N.J.A.C. 7:26D, if deemed appropriate or necessary.

74. COMMENT: The Defense Environmental Restoration Program, 10 U.S.C. §§ 2701-2711, provides authorities for the Department of Defense (DOD) to perform and fund the remediation at DOD facilities, and requires they be carried out in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA provides a consistent, risk-based approach for cleanup, which includes robust State agency review and public participation. The DOD uses the best available science and a tiered approach to select toxicity values for risk assessment in accordance with USEPA guidance (OSWER Directive 9285.7-53), Environmental Council of States recommendations, DOD Manual 4715.20, and DOD Instruction 4715.18. These documents state that, unless compelling scientific reasons suggest otherwise (for example, recently published peer-reviewed scientific research), the hierarchy of tiered toxicity values should be used for assessing risks to human health. This allows for consideration of the best science and the commenter suggests the Department consider utilizing this toxicity hierarchy when setting its remediation standards.

The USEPA (and Environmental Council of States /DOD) hierarchy Tier 1 values are the USEPA IRIS values and Tier 2 values are USEPA’s PPRTV. Tier 3 values are “Other Toxicity Values” and include both USEPA and non-USEPA sources of toxicity information, provided the information is informed by the current best scientific information and practices, externally and independently peer reviewed, public comment was invited, and the process is transparent.

Specifically, there is concern with the Department notice of proposal to replace N.J.A.C. 7:26D-6.2, which references changes to USEPA IRIS values as the basis to update the Department's Remediation Standards with a new section at N.J.A.C. 7:26D-7.2. Under proposed N.J.A.C. 7:26D-7.2, while changes to IRIS values remain a basis for updating New Jersey soil and indoor air remediation standards, new toxicity data developed by the NJDWQI are placed on equal footing with revisions to USEPA IRIS values. This change is inconsistent with the USEPA and Environmental Council of States guidance referenced above and may not ensure utilization of the best available science. USEPA IRIS values are Tier 1 toxicological values because they undergo extensive scientific rigor. The Department should utilize the USEPA toxicity hierarchy when setting its remediation standards. (12)

RESPONSE: See the Response to Comments 72 and 73 for a discussion of the Department’s use and sources of toxicity information.

As stated in the notice of proposal Summary, at 52 N.J.R. 585, the Department updates the rules pursuant to N.J.A.C. 7:26D-7.2(a) using toxicity information from IRIS or using toxicity information developed by NJDWQI when promulgating a new or revised MCL for drinking water or for a ground water quality standard. Both IRIS and NJDWQI sources of toxicity information are externally peer reviewed, invite public comment, and the processes are transparent. Toxicity information from third tier sources, including, but not limited to, USEPA PPRTV, HEAST, CalEPA, and ATSDR, do not undergo the same rigorous review and comment process that IRIS and NJDWQI toxicity information undergo and, therefore, cannot be used to update a remediation standard through a notice of administrative change. Updating a remediation standard using a third-tier toxicity information source would require a formal rulemaking in accordance with the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq.

CERCLA requires that on-site remedial actions comply with the more stringent State environmental Applicable or Relevant and Appropriate Requirements (ARARs) upon completion of the remedial action. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) also requires compliance with ARARs during removal and remedial actions to the extent practicable. This ensures that the Department's soil remediation standards, including those derived using a NJDWQI toxicity value, will be taken into consideration where determining what remedial actions are indicated at a site covered under CERCLA.

75. COMMENT: The Department will update soil and soil leachate remediation standards for migration to ground water based solely on when a ground water quality criterion is updated. This eliminates the requirement for a change in a USEPA IRIS value, and again does not ensure utilization of the best available science for risk-based cleanups. The commenter recommends that the Department utilize the USEPA toxicity hierarchy when setting its remediation standards. (12)

RESPONSE: Toxicity factors are not input directly into the equations that are used to calculate the soil remediation standards for the migration to ground water exposure pathway. When the Department adopts a new or revised Ground Water Quality Standard (GWQS), the corresponding remediation standard for the migration to ground water exposure pathway for that contaminant is also revised because the GWQS is the target endpoint for the calculation of the migration to ground water soil remediation standard.

76. COMMENT: Two contaminants do not have inhalation toxicity values, but are listed in Tables 3 and 4 of the proposed amendments. (6 and 8)

RESPONSE: The Department reviewed proposed N.J.A.C. 7:26D Appendix 1, Tables 3 and 4, and compared them with proposed N.J.A.C. 7:26D Appendix 11, Table 2 toxicity factors. The Department did not find any discrepancies.

Soil Background: Natural and Anthropogenic

77. COMMENT: In the Department's "Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil," Table 2 (see https://www.nj.gov/dep/srp/guidance/), why is arsenic (established at "natural background") the same across all land use scenarios? Based on the exposure assumptions, was the resulting potential ARS below 19 mg/kg and that results in reverting to background? If so, the Department should state that. If not, why is background concentration the ARS? (6 and 8)

78. COMMENT: The Department should add a provision at N.J.A.C. 7:26D-1, General information, specifying that cleanup will not be required to a remediation standard that is less than either natural regional background or anthropogenic background. The rationale for this request is that several revisions to General Information, N.J.A.C. 7:26D-1, have been made to clarify how the new remediation standards are to be applied under various conditions or scenarios. This section should be revised to clarify that the new soil remediation standards would not be applied when such standards are more stringent than demonstrated regional natural background and/or anthropogenic background conditions. (5)

79. COMMENT: The Department’s definition of "regional natural background level" at N.J.A.C. 7:26D-1.5, Definitions, ignores the widespread anthropogenic impacts on the environmental media of New Jersey that cannot be traced to specific point-sources, release events, and/or area of concern specific activities. This is of particular concern for chemicals, such as metals, polycyclic aromatic hydrocarbons (PAHs), dioxins, perfluoro alkylated substances, and historically applied pesticides. The commenter recommends that the Department amend the rule language to address this condition, so that remediation to levels stricter than regional impacts due to anthropogenic activity is considered. (4)

80. COMMENT: The Department’s definition of "regional natural background level" at N.J.A.C. 7:26D-1.5, Definitions, ignores the widespread man-made impacts on the environmental media of New Jersey, that cannot be traced to specific point-sources, release events, and area of concern-specific activities. The definition must be expanded (or supplemented by an additional definition) and the rule must be amended to address this condition. Clean up must not be required to be stricter than levels of regional contamination due to non-specific human activities. (16)

81. COMMENT: A definition of “anthropogenic background,” similar to “regional natural background,” should be added at N.J.A.C. 7:26D-1.5, Definitions, with a methodology for establishing anthropogenic background conditions similar to the methodology for establishing “regional background conditions.” Anthropogenic background concentrations of constituents of concern in urban areas can be equally as important as natural background in evaluating whether a release has occurred that requires remedial action. For example, the Department

has established an arsenic soil remediation standard at regional anthropogenic concentrations. Proposed N.J.A.C. 7:26D-7.2(a)4 states that the standard for lead may be revised if the USEPA updates its Integrated Exposure Uptake Biokinetic (IEUBK) or Adult Lead Methodology (ALM) model. Such an update could result in the establishment of a new soil remediation standard for lead that falls below the lead concentrations associated with regional anthropogenic background conditions for certain urban areas. The application of a reduced lead standard in such areas would be unreasonable and, given the regional nature of the anthropogenic conditions, would not be more protective of human health, safety, or the environment. (5)

RESPONSE TO COMMENTS 77, 78, 79, 80, AND 81: The comments address two types of background conditions: natural regional background and background with contaminant levels above natural background, due to widespread anthropogenic impacts on the environmental media of New Jersey that cannot be traced to specific point-sources, release events, and/or area of concern-specific activities. The second type of background is designated as "anthropogenic background."

The Brownfield Act, at N.J.S.A. 58:10B-12.g(4), requires the Department to address only "regional natural background." The Brownfield Act, at N.J.S.A. 58:10B-12.g(4), and the Remediation Standards, at N.J.A.C. 7:26D-1.5, define "regional natural background." Both definitions include the phrase "not been influenced by localized human activities." Accordingly, regional natural background could include an anthropogenic component, namely contamination from non-localized human activities. The Brownfield Act further states that "[r]emediation shall not be required beyond the regional natural background levels for any particular contaminant." See the notice of proposal Summary at 52 N.J.R. 576. The Department does not consider contamination as a result of localized human activities to be part of regional natural background.

The notice of proposal Summary, at 52 N.J.R. 576, discusses the derivation of the 19 mg/kg natural background concentration of arsenic in soil. The arsenic data used to establish the soil remediation standard for arsenic were from samples collected in areas in New Jersey where there were no discernable localized human (anthropogenic) activities. The selected background value for arsenic meets the definition of "regional natural background." The part of Comment 77 related to Department guidance and arsenic is beyond the scope of this rulemaking. See the Department's responses to external stakeholder comments on the "Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil," which is available at https://www.nj.gov/dep/srp/guidance/.

The comments present a hypothetical situation concerning a decrease in the soil remediation standard for lead, such that the remediation standard is below regional natural background. In such an instance, the person responsible for conducting the remediation may conduct a background investigation pursuant to the Technical Rules at N.J.A.C. 7:26E-3.8.

The Brownfield Act does not allow an exemption for "anthropogenic contamination," therefore, both defining this term and adding a provision stating that cleanup is not required for anthropogenic contamination is not appropriate. However, anthropogenic contamination could be addressed in the remediation of a site as "off-site" contamination, in accordance with the Technical Rules at N.J.A.C. 7:26E-3.9.

Department guidance documents that address contamination that cannot be attributed to specific point-sources, release events, and/or area of concern-specific activities include: the Department's "Diffuse Anthropogenic Pollution (DAP) Administrative Guidance," April 30, 2013, https://nj.gov/dep/srp/guidance/srra/dap_guidance.pdf; ARRCS, N.J.A.C. 7:26C, Appendix D, which provides the model response action outcome language to utilize for regional natural background levels of materials in soil and for soil contamination from an off-site source not remediated--diffuse anthropogenic pollution. See https://www.nj.gov/dep/rules/rules/njac7_26c.pdf; the Department's Historic Fill Technical Guidance document at https://www.nj.gov/dep/srp/guidance/srra/historic_fill_guidance.pdf; and the Department's Historically Applied Pesticides Technical Guidance document at https://www.nj.gov/dep/srp/guidance/srra/hap_guidance.pdf.

82. COMMENT: The Department states in its notice of proposal, at 52 N.J.R. 576, that the arsenic natural background level is 19 mg/kg. This is approximately 40 times higher than the health-based standard of 0.5 mg/kg. The natural background provision of cleanup law contradicts the health-based standard in cleanup law. The Department should not have interpreted the law as they did. The Department should have gone back to the Legislature and requested an amendment to fix the conflict. (13)

RESPONSE: The Brownfield Act, at N.J.S.A. 58:10B-12.g(4), addresses "regional natural background." The Brownfield Act states that "[r]emediation shall not be required beyond the regional natural background levels for any particular contaminant." See the notice of proposal

Summary at 52 N.J.R. 576. The Brownfield Act, at N.J.S.A.r 58:10B-12.g(4), and the Remediation Standards, at N.J.A.C. 7:26D-1.5, Definitions, define “regional natural background.” Both definitions include the phrase “not been influenced by localized human activities.” Therefore, regional natural background could include an anthropogenic component, namely contamination from non-localized human activities. Therefore, the Department is not changing the wording at N.J.A.C. 7:26D-1.2(e).

Technical Impracticability

83. COMMENT: The proposed remediation standards should recognize that technical impracticability may be encountered. The establishment of three new remediation pathways will increase the complexity of remedial investigations and potential remedial actions. The Department should include a definition and clarification that technical impracticability may be encountered in soil, ground water, vapor, and surface water samples. The implementation of a technical impracticability review would be managed under the Technical Rules, N.J.A.C. 7:26E; however, the inclusion of the concept in the Remediation Standards, N.J.A.C. 7:26D, will support the best available science. (3, 6, and 8)

RESPONSE: The adopted rules establish remediation standards for soil, soil leachate, ground water, surface water, and indoor air. In addition, the chapter provides a process for developing interim remediation standards, updating remediation standards, and developing ARS. Adding tangential information into the chapter is not necessary or appropriate. For example, the adopted rules do not address how a person responsible for conducting the remediation can demonstrate compliance with remediation standards because that is addressed in technical guidance. As noted in the notice of proposal, at 52 N.J.R. 569, former N.J.A.C. 7:26D-2.2(a)4vii and 3.2(a)2v provide criteria for remedy selection for contaminated ground water and surface water, respectively. This information does not need to be included in subchapters that describe ground water and surface water remediation standards. Information concerning criteria for selecting a remedy for ground water and surface water contamination can be found in the Technical Requirements, N.J.A.C. 7:26E, ARRCS, N.J.A.C. 7:26C, and various Department technical guidance documents. The adopted rules do not include N.J.A.C. 7:26D-2.2(a)4vii and 3.2(a)2v.

By the same logic, adding information about technical impracticability to the Remediation Standards, N.J.A.C. 7:26D, is not necessary. As the commenters note, technical impracticability is regulated pursuant to the Technical Rules, N.J.A.C. 7:26E, and associated Department technical guidance documents.

Direct Contact

84. COMMENT: The Technical Requirements, N.J.A.C. 7:26E, use the term “direct contact” 18 times throughout the chapter. An exceedance of the direct contact criteria will affect decisions and actions on the media outlined below. There is no direct connection between direct contact standards and the two new remediation pathways, therefore, the Technical Requirements cannot be followed directly. The term direct contact is used in the following sections of the Technical Requirements Surface Water Investigations (N.J.A.C. 7:26E-3.6),

Sediment Investigations (N.J.A.C. 7:26E-3.6), Historic Fill Investigations (N.J.A.C. 7:26E-3.12), Soil Remedial Investigation (N.J.A.C. 7:26E-4.2), Offsite Surface Water and Sediment Investigation (N.J.A.C. 7:26E-3.11), Offsite Soil RI (N.J.A.C. 7:26E-4.2), Deed Notices (N.J.A.C. 7:26E-5.2), and Immediate Environmental Concern (IEC) Conditions (N.J.A.C. 7:26E-1.11). (6 and 8)

85. COMMENT: The proposed rules create uncertainty in the remediation process when comparing the existing standards/screening levels versus the proposed remediation standards. Please clarify the uncertainty. (6 and 8)

RESPONSE TO COMMENTS 84 AND 85: Since 1993, the impact to ground water exposure pathway (now called migration to ground water) has been evaluated at remediation sites using screening levels. Likewise, since 2005, the vapor intrusion exposure pathway has been evaluated at remediation sites using screening levels. The Department's promulgation of these screening levels as remediation standards will not change the evaluation process and should not create uncertainly.

The Department has been conducting the evaluation of direct contact soil exposure since 1993. In the prior Remediation Standards, N.J.A.C. 7:26D, the Department developed health-based soil remediation criteria for each contaminant for the soil ingestion-dermal and soil inhalation exposure pathways. The soil remediation standard applied was the more stringent of either the soil ingestion-dermal exposure pathway or the soil inhalation exposure pathway cleanup criteria. In the adopted rules, the Department established soil remediation standards for the soil ingestion-dermal and the soil inhalation exposure pathways because both exposure pathways need to be evaluated in the remediation of a site. See 52 N.J.R. 569 for additional discussion of this topic. From a practical perspective, the more stringent soil remediation standard of the two exposure pathways would be used to demonstrate compliance with both exposure pathways. The Department does not believe that this approach adds a level of uncertainty to the remedial process.

The Department recognizes that the term "direct contact" as used in the Technical Requirements, N.J.A.C. 7:26E, needs clarification. Through a future rulemaking, the Department intends to clarify that the term "direct contact" means both the soil ingestion-dermal and soil inhalation exposure pathways. The Department believes that making this change to the Technical Requirements will eliminate any uncertainty regarding the use of the term "direct contact." Prior to the future rulemaking, the Department will issue a clarification memo concerning this issue.

Significant Figures

86. COMMENT: The Department is proposing to express all soil standards (and soil leachate standards) as two significant digits. This is a departure from existing Department rules and guidance, and there is no technical basis for this revision. It does nothing to improve or enhance public health, safety, or the environment, and actually serves to propagate a false level of accuracy and precision relative to risk-based regulatory criteria. The Department notes that this revision has been performed to maintain consistency with the way the USEPA regional screening levels are presented. There is a fundamental difference in intent and in application between screening levels and cleanup standards. In fact, the USEPA specifically states, "It

should be emphasized that screening levels are not cleanup standards." See "Introduction to the Regional Screening Levels (RSLs) Users Guide; May 2020."

In general, the USEPA's regional screening levels are intended to be used for the evaluation of cumulative risk from all chemicals of concern at a site, and then prioritized for performance of a baseline risk assessment. Regional screening levels are often used to define preliminary remediation goals, early on the remedial process, but following performance of the baseline risk assessment, site-specific risks can be used to derive preliminary remediation goals, and regional screening levels are less likely to apply. The evaluation of cumulative risk involves multiple calculations involving many chemicals. As a result, the USEPA notes in its "Regional Screening Levels Frequently Asked Questions (May 2020)," "The Supplemental Guidance for Developing Soil Screening Levels (SSLs) for Superfund Sites in Appendix A presents SSLs above 10 rounded to 2 digits, and below 10 rounded to 1 digit. The regional screening levels tables round to 2 digits for results above and below 10, and the calculator results display 3 digits. The rationale for providing 'extra' digits is to assist users in checking the math. When individual exposure route results are rounded, many times it is impossible to reproduce the total across multiple routes. Enough digits are provided in regional screening levels tables and calculator results for the user to apply their own rounding protocol."

In other words, the USEPA provides "extra" digits in the presentation of regional screening levels to avoid rounding errors while calculations are being performed. In terms of a value that can be used for site-specific decision-making (in the case above, the Appendix A Soil Screening Levels for Superfund Sites, but also MCLs), the USEPA policy is to round to two significant digits above 10, and to one significant digit below 10. As noted further elsewhere, there is no technically sound reason for the Department to deviate from this policy, which, in most cases, is currently reflected in remediation standards and criteria. (4)

87. COMMENT: In the derivation of the remediation standards proposed by the Department, a series of calculations are performed that involve a range of input parameters (the equations associated with these calculations are contained in the Remediation Standards, N.J.A.C. 7:26D, at Appendix 2 for ingestion-dermal pathway, Appendix 3 for inhalation pathway, and Appendix 4 for the Migration to Ground Water pathway). Many of the input parameters associated with each equation are expressed in terms of one significant digit, due either to a lack of accuracy and precision in the supporting data, or recognition that risk-based assessments are at best approximate and accommodate orders of magnitude of uncertainty. For example, for the ingestion/dermal pathway, these inputs include, but are not limited to, the designation of the target cancer and noncancer risks (that is, 1E-6 and 1, respectively), body weight (for example, 80 kg), and soil ingestion rate (for example, 200 mg/day). In the case of the migration to ground water, the controlling variable in the calculation is the ground water quality standard, which is uniformly expressed in terms of one significant digit. Similarly, the soil leachate standard simply represents multiplication of the ground water quality standard by the dilution attenuation factor of 20; both of which are expressed to one significant digit. (4)

88. COMMENT: At the most rudimentary level, the expression of results of a scientific calculation follows a number of basic rules. The first such rule states, “round off the results of any calculation in which several numbers are multiplied and divided to as few significant figures

as are present in the factor with the fewest significant figures." (Standard Methods, 2017 (23rd Ed.), 1050-B: Significant Figures; ASTM, 1993, E29-93, Standard Practice for Using Significant Digits for Test Data to Determine Conformance with Specifications.) The Department's notice of proposal to uniformly convert soil remediation standards to two significant digits does not conform to this scientific principle and the commenter recommends that this not be implemented. (4)

89. COMMENT: The Department has proposed numerical soil remediation standards to two significant digits. This approach creates a false precision in the calculation of the migration to ground water pathway, where the controlling variable is the ground water quality standard, which is almost uniformly expressed to one significant digit. In fact, a number of the underlying exposure assumptions are expressed to one significant digit. Significant digits express the precision of a measuring tool, and when calculating measured values, the final result can only contain as many significant figures as the least precise value. The numerical standards should be modified accordingly. (16)

RESPONSE TO COMMENTS 86 THROUGH 89: The reporting of remediation standards using two significant figures is based on a Department policy decision that all drinking water MCLs, ground water quality standards, surface water quality standards, and remediation standards will be expressed using two significant figures. As standards are added or amended, they will be rounded to two significant figures.

In addition, the Department's decision to use two significant figures for soil remediation standards is consistent with the USEPA Regional Screening Levels for Chemical Contaminants at

Superfund Sites. See 52 N.J.R. 577. See the Response to Comment 129 for a general discussion of the use of regional screening levels as remediation standards.

Amendments to the Remediation Standards

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

General

90. COMMENT: The Department's notice of proposal to amend N.J.A.C. 7:26D-1.1(a) to remove references to "minimum" standards conflicts with the Brownfield Act, N.J.S.A. 58:10B-12.a, which requires the Department to adopt "minimum remediation standards." The Department should clarify that the introduced concept of default standards is intended to be the equivalent of minimum remediation standards required under the Brownfield Act. (10 and 11)

RESPONSE: As stated in the proposal notice of Summary at 52 N.J.R. 567, "[t]he remediation standards in the chapter are not necessarily minimum requirements, as an ARS established pursuant to proposed amended N.J.A.C. 7:26D-8 may allow a contaminant concentration that is less stringent than the 'minimum' remediation standard. The remediation standards contained at N.J.A.C. 7:26D Appendix 1 of the proposed rules are better described as 'default' standards, since they are the standards that remediating parties must meet if an alternative remediation standard is not developed."

91. COMMENT: The notice of proposal Summary, at 52 N.J.R. 567 states, “[t]he existing rules do not provide a codified impact to ground water soil remediation standard on a site-by-site basis. Because the proposed amended rules establish a remediation standard for the migration to ground water exposure pathway, existing N.J.A.C. 7:26D-1.1(b) is no longer applicable and is proposed to be deleted.” Please clarify that the deletion of referenced site-specific impact to ground water soil remediation standards does not negate existing site-specific impact to ground water soil remediation standards developed for sites under the existing rules. Please confirm that upon promulgation of this rulemaking, these site-specific impact to ground water soil remediation standards will be referenced as approved alternative soil remediation standards, as defined in the proposed rule. (15)

RESPONSE: The Department’s adoption of the new and amended remediation standards does not negate site-specific impact to ground water soil remediation standards that are acceptable to the Department and that have been developed under the former rules.

92. COMMENT: There is a discrepancy between the language at proposed N.J.A.C. 7:26D and 7:26E-1.5(c)2. The same discrepancy also exists at N.J.A.C. 7:26D-1.4. Specifically, site-specific standards are generated for a site at N.J.A.C. 7:26E-1.5(c)2 and all subsections at N.J.A.C. 7:26D-1.4, except for N.J.A.C. 7:26D-1.4(b). That section references an area of concern. It would be burdensome to generate a soil standard for each area of concern at a complex ISRA Case, for example, where there are numerous areas of concern, many of which are in close

proximity to one-another. As such, N.J.A.C. 7:26D-1.4(b) should replace "an area of concern" with "a site." (2)

RESPONSE: There is a discrepancy in the proposed language at N.J.A.C. 7:26D-1.4(b). The use of “area of concern” in one sentence at N.J.A.C. 7:26D-1.4(b) differs from the rest of N.J.A.C. 7:26D-1.4(b), which uses “site.” In most instances, the remediation standard for a given contaminant and given exposure pathway is applied to the entire site. However, an ARS may be developed for an individual area of concern. To address this potential situation and provide clarity, the Department is modifying N.J.A.C. 7:26D-1.4(b) on adoption to replace “area of concern” and “site” with the phrase “site or an area of concern.” This will not impact the Technical Requirements, N.J.A.C. 7:26E. Unlike former N.J.A.C. 7:26D-1.4(b), adopted N.J.A.C. 7:26D-1.4(b) does not refer to N.J.A.C. 7:26E-1.5(c)2.

93. COMMENT: The use of standards currently in place for ongoing remediation is a critical element to the redevelopment of brownfield sites and remediation in general. In the past, the Department has recognized that such continued use of standards in place for ongoing remediation (grandfathering) is a critical element to the successful redevelopment of brownfield sites and the remediation of sites generally. The Department's proposed grandfathering provisions include a restriction that voids the ability to continue to use the standards in place when the remediation was developed if the remediating party fails to meet any regulatory remediation timeframe. This is inconsistent with prior remediation standard rule changes. Critically, such voiding of grandfathering will adversely impact remediation in progress

and further exacerbate delays in those remediation projects. In many, if not all, instances, remediation in progress will need to be reassessed and substantially altered. This will further delay remediation of those sites, particularly projects that have been ongoing for many years, thus implicating timeframes. Tying grandfathering to remediation timeframes, particularly the regulatory remediation timeframes, should be removed from the rulemaking. (10 and 11)

94. COMMENT: N.J.A.C. 7:26E-1.5(c)2 directly addresses the same matter as proposed N.J.A.C. 7:26D-1.4(b)1iv, and the language at N.J.A.C. 7:26E does not include a requirement that remediation be completed by the regulatory timeframe. As such, these sections are contradictory. Further, there are already penalties provided at ARRCS, N.J.A.C. 7:26C, for missing a regulatory or mandatory time frame, which are unrelated to remediation standards. Finally, it would be burdensome for a person conducting the remediation if one set of standards were applied through the remediation, but the response action outcome could not be issued within a timeframe and a different set of soil remediation standards became effective. (2)

95. COMMENT: N.J.A.C. 7:26D-1.4, Applicability, identifies when the person responsible for conducting a remediation shall comply with the Remediation Standards identified in the chapter. Given the expected time for adoption of these standards, timeframe compliance issues may be experienced by sites that cannot meet the order of magnitude metric. The proposed standards will likely take effect concurrently with the remedial action mandatory timeframe submission date associated with the pre-1999 Site Remediation Program cases. This will potentially result in the remediating party having completed what would now be a non-

compliant remedy, without the ability to conduct additional remediation or evaluation prior to their mandatory timeframe date. (4)

RESPONSE TO COMMENTS 93, 94, AND 95: Linking the grandfathering provisions with remediation timeframes has a statutory basis. The Brownfield Act, at N.J.S.A. 58:10B-12.j, states "[u]pon the approval by the department or by an LSRP of a remedial action workplan, or similar plan that describes the extent of contamination at a site and the remedial action to be implemented to address that contamination, the department may not subsequently require a change to that workplan or similar plan in order to compel a different remediation standard due to the fact that the established remediation standards have changed … The limitation to the department's authority to change a workplan or similar plan pursuant to this subsection shall only apply if the workplan or similar plan is being implemented in a reasonable timeframe, as may be indicated in the approved remedial action workplan or similar plan."

Prior grandfathering provisions in the Technical Requirements, at N.J.A.C. 7:26E-1.5(c)2ii, link grandfathering with remediation timeframes. N.J.A.C. 7:26E-1.5(c)2ii states, "(c) The person responsible for conducting the remediation of a site shall remediate: … 2. To comply with the standards or criteria developed by the Department under N.J.S.A. 58:10B-12a for that site prior to June 2, 2008, provided: … ii. The remedial action workplan or a remedial action report meets the requirements of N.J.A.C. 7:26E-5.5 or N.J.A.C. 7:26E-5.7, respectively, and is approved as written by a licensed site remediation professional." Further, N.J.A.C. 7:26E-5.5(b) states, "(b) The person responsible for conducting the remediation shall include the following in each remedial action workplan for each area of concern: … 11. The proposed completion date of the remedial action and a schedule of the remedial action for the initiation and completion of each remedial action task, pursuant to the required regulatory timeframe at N.J.A.C. 7:26E-5.8."

The adopted rules relocate grandfathering provisions from the Technical Requirements, N.J.A.C. 7:26E, to the Remediation Standards, N.J.A.C. 7:26D, and expand them. The Department is not removing compliance with remediation timeframes as part of grandfathering provisions.

There is a concern that promulgation of remediation standards that are an order of magnitude or more stringent could result in additional remediation at a site that could have an impact in complying with mandatory remediation timeframes. However, there are provisions in ARRCS, at N.J.A.C. 7:26C-3.5, for extensions of mandatory timeframes. Additional time to comply with a newly promulgated remediation standard could be the basis for submission of an extension request for a mandatory timeframe to the Department, provided an adequate justification can be provided on a site-specific basis. Extension requests for mandatory timeframes are subject to Department review and approval.

96. COMMENT: If a remedial action workplan has been submitted to the Department that will comply with the previous Remediation Standards, N.J.A.C. 7:26D, either prior to promulgation or within the phase-in period, can the remedial action be implemented applying less stringent Remediation Standards promulgated under the new rules, or must the remedial action comply with the standards identified in the remedial action workplan? (15)

RESPONSE: The person responsible for conducting the remediation may opt to use newly promulgated remediation standards that are less stringent than existing remediation standards for a given contaminant. The person responsible for conducting the remediation should submit a modified remedial action workplan, certified by the LSRP, which identifies what remediation standards are being applied at the site.

97. COMMENT: The prior remediation standards should be the standard at sites. The continued protectiveness of these remedies would then be reevaluated at the time a future remediation-triggering event occurs when an unrestricted use response action outcome is issued or during the biennial certification process if a restricted use or limited restricted use response action outcome is issued. (4)

RESPONSE: The person responsible for conducting the remediation may use prior remediation standards if the requirements at N.J.A.C. 7:26D-1.4(b)1, 2, or 3, as applicable, are met. The person responsible for conducting the remediation must use a newly promulgated remediation standard(s) for a contaminant(s) in the remediation of a site if that remediation standard(s) has decreased by an order of magnitude or more.

If a site has an approved remedial action workplan or an approved remedial action report, and an applicable numeric remediation standard decreases by an order of magnitude or more prior to the issuance of a final remediation document for the site being remediated, the person responsible for conducting remediation must conduct all additional remedial action necessary to comply with the newly adopted remediation standard. See N.J.A.C. 7:26E-5.1(d)4.

If a final remediation document has been issued for a site and an applicable numeric remediation standard decreases by an order of magnitude or more, the person responsible for conducting remediation shall conduct an evaluation of the existing remedy to determine if the existing remedy is protective of human health and the environment (commonly known as an order of magnitude evaluation).

As discussed in the Response to Comments 64 and 65, the Department intends to keep its existing policy concerning when an order of magnitude evaluation must be conducted.

Definitions

98. COMMENT: The proposed definition of "residential" creates ambiguity for projects concerning mixed-use development. The proposed rules should be clarified to confirm that LSRPs may utilize options to create ARSs to accurately reflect site-specific conditions where settings are not 100 percent residential or 100 percent commercial. In fact, the clear trend in brownfields redevelopment throughout the State, and what has made locations like the "Gold Coast" along the Hudson River a virtual poster child for the success of private redevelopers to convert previously contaminated former industrial sites into productive and highly desirable and, above all else, successfully remediated properties, is the ability to create mixed use projects that combine both residential and commercial elements. At such sites, rigid adherence to immutable and prescribed remediation standards that do not allow an LSRP to take into account the mixed-use purpose of a project unnecessarily tie the LSRP's hands, create confusion, and drive away some redevelopers even from considering involvement in

Brownfields projects in this State. Nor is there any citable policy rationale for restating what have previously been only screening levels and guidance numbers as remediation standards. For instance, the Department has developed criteria for parks that allow for risk-based assessments. The Department should allow LSRPs to establish site-specific values that take into account the potential for institutional controls that are protective of public health and safety for projects that include both nonresidential and residential use, like ground floor commercial projects or parking decks that include residential occupancy, not in a basement or first floor, but several stories above ground/grade level. The Department has similarly developed criteria for parks that allow for risk-based assessments. (10 and 11)

99. COMMENT: The definition of "nonresidential" needs to include the concept of mixed-use properties. A property is only nonresidential if no part of the property is residential. (2)

100. COMMENT: The designation of only two property types is impractical with current and future land use and is overly restrictive. The regulated community understands the Department’s general procedures are to encourage the maximum remedial action at all sites. The definition of only two property types represents this observation. The proposed amendments should include a definition of a mixed-land use beyond residential and non-residential. A mixed-land use site could include ground floor commercial operations with upper floor residents, industrial lofts, and condominiums.

These mixtures of residential and non-residential could be easily evaluated through an ARS process and documented within an institutional control document. Residential land uses should be considered under a “restricted residential scenario” that limits exposure through homeowner's associations, deed restrictions, or other mechanisms that prevent disturbance to subsurface soils and limits grounds maintenance to workers. In many cases, these mixed properties are the most closely monitored of all property uses, helping to insure human health protectiveness without unnecessary financial burdens. (6 and 8)

101. COMMENT: The Department should expand the definition of "land use" beyond residential and non-residential. It is very common to have mixed land use with retail shops on the first floor and residential use on the upper floors. Mixed use (ground floor commercial/upper floor residential), industrial lofts, and condominiums are residential land uses that should be considered under a "restricted residential scenario" that limits exposure through homeowners associations, deed restrictions, or other mechanisms that prevent disturbance to subsurface soils and limits grounds maintenance to workers. In addition, the majority of planned developments import surface soil for landscaping purposes which would further limit the potential exposure to soils under the restricted residential scenario. (6 and 8)

RESPONSE TO COMMENTS 98, 99, 100, AND 101: In accordance with the Brownfield Act, at N.J.S.A. 58:10B-12.c(1), the Department is required to address only residential and nonresidential scenarios in the Remediation Standards, N.J.A.C. 7:26D. The Department is handling all other scenarios through the ARS process. In the former rules, the Department defined residential direct contact soil remediation standards at N.J.A.C. 7:26D-1.5 as applying to "residential use sites, schools (pre-K-12) and childcare centers." The adopted rules do not reflect a change in policy; the rules still reflect the Department's desire to be protective of the most sensitive receptors (that is, children). Although there is no change in Department policy, there is a change in application, as adopted N.J.A.C. 7:26D establishes separate residential and nonresidential soil remediation standards for the ingestion-dermal exposure pathway, and residential and nonresidential soil remediation standards for the inhalation exposure pathway. In the prior Remediation Standards, N.J.A.C. 7:26D, the Department developed health-based soil remediation criteria for each contaminant for the soil ingestion-dermal and soil inhalation exposure pathways. The soil remediation standard applied was the more stringent of either the soil ingestion-dermal exposure pathway or the soil inhalation exposure pathway cleanup criteria. The Department called this standard a direct contact soil remediation standard. See 52 N.J.R. 569 for additional discussion of this topic.

An ARS may be proposed for a mixed-use setting. However, in a mixed-use setting, either the most sensitive receptor would be accounted for over the entire project, or the project could be broken down into separate units, applying different standards to different units depending on proposed property use. The Department allows for the use of engineering and institutional controls for compliance with the appropriate standards predicated on the planned use of the property.

102. COMMENT: The Department's definition of "residential," at proposed N.J.A.C. 7:26D-1.5, Definitions, includes schools and day care centers. While this can be construed as being protective of sensitive child populations, the derivation of health-based criteria typically accounts for sensitive subpopulations, including children. The rule language should be amended to provide options for deriving an ARS for child day care and school settings to reflect

the variation of the duration and intensity of exposure in such settings versus the assumptions for residential exposure at a home. Doing so would provide flexibility for LSRPs and the Department to apply good science, as required by the Brownfield Act, without any impact on an LSRP or the Department's ability to ensure protective cleanup decisions. (4)

103. COMMENT: While the definition of "residential" to include schools and day care centers can be construed as being protective of sensitive populations, the definition is technically improper. The duration and intensity of exposure at a home and at a school setting are greatly different. (16)

104. COMMENT: "Nonresidential" should mean "used for any purpose other than exclusively residential." The rationale is that defining residential and nonresidential by listing potential uses will not be comprehensive (there will be other uses not included in either definition). For example, agricultural use should be nonresidential, but is not included in the definition at proposed N.J.A.C. 7:26D. (2)

105. COMMENT: An ARS for nonresidential land use based on current commercial or industrial exposure is warranted, with the same requirements to control and/or monitor (for example, institutional control, remedial action permit). (4)

106. COMMENT: The Department is considering a more risk-based approach to developing standards, which is appropriate. Also, it is appropriate not to allow use of different exposure scenarios for residential use scenarios. However, there may be highly different exposure scenarios for different commercial and industrial uses. Therefore, the use of the property is not germane to the determination of exposure duration and exposure frequency, and the actual

site-specific information should be used to calculate an ARS even for a nonresidential property. (2)

RESPONSE TO COMMENTS 102, 103, 104, 105, AND 106: See the Response to Comments 98, 99, 100, and 101 for a discussion of the requirements of the Brownfield Act with regard to residential and nonresidential, and the Department's continuing policy to protect the most sensitive receptors.

If the site or area of concern is for nonresidential use as defined at adopted N.J.A.C. 7:26D-1.5, Definitions, the nonresidential soil remediation standards apply. Pursuant to N.J.A.C. 7:26D-8, an ARS for nonresidential use could be developed. If the use of the site or area of concern does not meet the nonresidential use definition, then an ARS could potentially be applied, based on an alternative land use exposure scenario. The Department may require institutional or engineering controls and a soil remedial action permit for use of these types of ARSs.

107. COMMENT: The Department should count a vacant, wooded, or undeveloped property as residential, in order to be conservative, because its final use has not been established at the time of the investigation. (2)

RESPONSE: The default land use for a vacant wooded property would be site-specific depending on zoning, proximity to nonresidential properties, nature of contaminant discharge, and other factors; however, the property could also be used as a recreational area and, thus an ARS consistent with that use would be appropriate. The Department would require an institutional control if remediation was determined using a nonresidential standard or a recreational use ARS. The property owner may also choose to remediate the vacant property to residential standards in order to receive an unrestricted response action outcome.

108. COMMENT: The Department should refine the definition of “Extractable Petroleum Hydrocarbons (EPH) Category 1 and Category 2” to be consistent with the Department’s EPH Guidance Sections 2.0 and 4.0. (4)

RESPONSE: The adopted definition, as explained in the notice of proposal Summary at 52 N.J.R. 568, describes the Department’s definition of EPH generally and does not explicitly list each potential compound and its respective category. More simply, the adopted definition describes what EPH is, and what EPH is not, as determined by the Department’s Extractable Petroleum Hydrocarbons Methodology (Version 3.0). See https://www.nj.gov/dep/srp/guidance/srra/eph_method.pdf.

109. COMMENT: The Department's removal of references to ground water classifications in the Remediation Standards, N.J.A.C. 7:26D, indicates the Department’s refusal to accept accurate characterization of ground water conditions. (3)

110. COMMENT: The proposed definition of “ground water” at N.J.A.C. 7:26D-1.5, Definitions, removes a reference to ground water classifications, Class I, Class II, and Class III. This is the only reference to the three ground water classifications authorized at N.J.A.C. 7:9C. The proposed amendments should be expanded to include a definition of the three

classifications, as defined and discussed in the Ground Water Quality Standards, N.J.A.C. 7:9C. The additional definition may include a cross-reference to N.J.A.C. 7:9C-1.5, Ground water classification system and designated uses. A minimum discussion of ground water classifications and their use for ARS in the proposed amendments, the basis and background documents, the ARS Technical Guidance document(s), and policy documents are necessary to accurately characterize site conditions. Historically, the Department has refused to accept accurate mapping of the ground water classifications beneath New Jersey. Removal of the Class I, Class II, and Class III references from the definition eliminates any reference to the classification system.

The Department's decision to codify the migration to ground water exposure pathway will mandate ARS values at dozens of sites. The proposed ARS Technical Guidance for Soil Leachate and Soil Migration to Ground Water, which, to date, has not been released for public review and comment, should include guidance on determining alternative standards based on classifications other than the default Class IIA standard. The ARS Technical Guidance should describe the methods and documentation to establish when the ground water classification at a site may be established through documentation of water use, vertical delineation, and characteristics of the receiving water discharge zone from the investigation site. (6, 8)

RESPONSE TO COMMENTS 109 AND 110: As noted in the notice of proposal Summary, at 52 N.J.R. 568, the proposed definition of "ground water" corrects the citation to the definition of "ground water" in the Ground Water Quality Standards at N.J.A.C. 7:9C-1.4, Definitions. In order to prevent multiple definitions for a single term, the Department is defining a term in a single rule and refers to that definition in other rules. “Ground water” is defined in the Remediation Standards rule as the definition contained in the Ground Water Quality Standards, N.J.A.C. 7:9C-1.4. The phrase, “which includes Class I, Class II, and Class III ground water,” is not in the definition of “ground water” in the Ground Water Quality Standards. For consistency, the Department proposed to delete the references to the classes of ground water. The adopted rule refers only to the definition in the Ground Water Quality Standards.

The development and mapping of ground water classifications are governed by the Ground Water Quality Standards, N.J.A.C. 7:9C, not the Remediation Standards, N.J.A.C. 7:26D. Comments concerning the establishment and mapping of ground water classifications are beyond the scope of this rulemaking.

The Department's “Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway” document has undergone stakeholder review and is available at https://www.nj.gov/dep/srp/guidance/. The “Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway” is a compilation of the previous Impact to Ground Water guidance documents and, with the exception of a few updates, the information is substantially the same. The new guidance document allows for an ARS for soil and soil leachate, based on ground water remediation standards derived from the ground water quality standards for Class I and Class III ground water.

Ground water remediation standards, N.J.A.C. 7:26D-2

111. COMMENT: The Department proposes to delete the following language from N.J.A.C. 7:26D-2.2(a)4vii: “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; and (5) The physical and chemical characteristics of the contaminants of concern.”

This language is appropriate and consistent with the language in the Brownfield Act, and accordingly, should be maintained in the rule. (4 and 7)

RESPONSE: As noted in the notice of proposal Summary at 52 N.J.R. 569, former N.J.A.C. 7:26D-2.2(a)4vii provided a list of factors to be considered when selecting an appropriate ground water remedial action. Adopted N.J.A.C. 7:26D-2 contains ground water remediation standards and should not contain criteria for selecting a remedy to clean up ground water. Information concerning criteria for selecting a remedy for ground water contamination may be found in the Technical Requirements, N.J.A.C. 7:26E; ARRCS, N.J.A.C. 7:26C; and various Department technical guidance documents. Therefore, the deletion is appropriate.

Surface water remediation standards, N.J.A.C. 7:26D-3

112. COMMENT: The Department proposes to delete the following language from N.J.A.C. 7:26D-3.2(a)2v: "[t]he 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." This language is appropriate and consistent with the language in the Brownfield Act and, accordingly, should be maintained in the rule. Deletion of this language precludes the use of an ecological risk-derived Surface Water Quality Criterion value that would be considered an ARS, contradicting the changes noted in the ruling. Clarification should be provided to continue to allow use of a risk derived surface water quality standard. (4 and 7)

RESPONSE: As noted in the notice of proposal Summary, at 52 N.J.R. 569, former N.J.A.C. 7:26D-3.2(a)2v provided a list of factors to be considered when selecting an appropriate surface water remedial action. Adopted N.J.A.C. 7:26D-3 contains surface water remediation standards and should not contain criteria for selecting a remedy to clean up surface water. Information concerning criteria for selecting a remedy for surface water contamination can be found in the Technical Requirements, N.J.A.C. 7:26E; ARRCS, N.J.A.C. 7:26C; and various Department technical guidance documents. The adopted rules do not include N.J.A.C. 7:26D-3.2(a)2v.

The Remediation Standards, N.J.A.C. 7:26D, do not address ecological-based remediation standards. The deletion of N.J.A.C. 7:26D-3.2(a)2v should have no impact on the development of ecological-based remediation goals.

Soil and Soil Leachate Remediation Standards, N.J.A.C. 7:26D-4

113. COMMENT: The Department's notice of proposal Summary failed to list, name, or quantify the number of chemicals for which standards are rolled back and compare then to the chemicals for which the Department proposed stricter standards. The net effect is negative. This will take a detailed review of the notice of proposal. (13)

RESPONSE: The comparison of existing soil remediation standards and proposed soil remediation standards was discussed in the notice of proposal Summary, at 52 N.J.R. 572, 573, and 574.

114. COMMENT: The adopted rule should include language defining the specific target blood lead concentration (goal) and input assumptions used by the Department in deriving the residential and nonresidential soil remediation standards for lead, through the IEUBK and ALM model. (4)

RESPONSE: The Department did not propose to amend the soil remediation standards for the ingestion-dermal exposure pathway for lead, or the input assumptions used to develop those standards. They remain the same as in the rules prior to this rulemaking. The soil remediation standards for the ingestion-dermal exposure pathway for lead are also identical to those found in the USEPA Regional Screening Level Tables and Regional Removal Management Levels for lead. Details on the target blood lead level and input assumptions used by the Department to derive the soil remediation standards for the ingestion-dermal exposure pathway for lead may be located in both the Department's Ingestion-Dermal Exposure Pathway Remediation Standards: Basis and Background Document (https://www.nj.gov/dep/srp/guidance/rs/) and in the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil (https://www.nj.gov/dep/srp/guidance/).

115. COMMENT: The nonresidential soil remediation standard for lead for the ingestion-dermal exposure pathway of 800 mg/kg does not reflect the USEPA's (2017) Transmittal of Update of the Adult Lead Methodology’s Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters, which at a blood lead goal of 10 ug/dL would result in a nonresidential soil remediation standard of 2,500 mg/kg. The Department’s soil remediation standard for lead reflects a baseline blood lead ($PbB_{baseline}$) and geometric standard deviation (GSD) from 1996, both of which USEPA has updated several times since 2009. The Department should update the default nonresidential soil remediation standard for lead to reflect USEPA’s current recommended $PbB_{baseline}$ and geometric standard deviation assumptions for the ALM model. (4)

RESPONSE: The Department did consider using the USEPA's May 2017 Transmittal of Update to the Adult Lead Methodology’s Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters. The Department also considered use of the five micrograms of lead per deciliter of blood (µg/dL) target blood lead level recommended by the Centers for Disease Control and Prevention and currently used by USEPA Region 2 in response to the Office of Land and Emergency Management Directive 9200.2-167, which states that several studies have observed "clear evidence of cognitive function decrements (as measured by Full Scale IQ, academic performance, and executive function) in young children (four to 11 years old) with mean or group blood lead levels between two and eight µg/dL (measured at various life stages and time periods)." The use of the five µg/dL target blood lead level and updated inputs for the baseline blood lead concentration and geometric standard deviation parameters would result in a nonresidential soil remediation standard for lead of 780 mg/kg, which is almost identical to the current nonresidential soil remediation standard for the ingestion-dermal exposure pathway for lead of 800 mg/kg and much lower (more stringent) than the 2,500 mg/kg suggested in the comment.

Although some USEPA Regions have revised their policies for addressing lead contamination in site soils, USEPA has still not revised its lead policy at the national level. In addition, both the USEPA's Regional Screening Level Tables and Regional Removal Management Levels continue to use 400 mg/kg (residential) and 800 mg/kg (industrial) for lead, which are based on a 10 µg/dL target blood lead level and the combined phases of the National Health and Nutrition Examination Survey (NHANES III) data. Due to these inconsistencies, the Department decided to not change the soil remediation standards for the ingestion-dermal exposure pathway for lead at this time and to keep the standards consistent with USEPA national screening and removal management levels. The Department will continue to evaluate the science and USEPA policies involving lead to determine if future updates to the lead soil remediation standards for the ingestion-dermal exposure pathway are necessary.

116. COMMENT: The Department identified proposed soil remediation standards for the ingestion-dermal exposure pathway for 24 contaminants that are more stringent than the USEPA soil ingestion-dermal regional screening levels. The Department did not specify the exposure pathway (residential or non-residential) associated with this analysis. As with the assessment of the proposed remediation standards to the existing standards, an analysis conducted by the commenters differs from that of the Department. There are 27 contaminants for the residential ingestion-dermal soil remediation standard and 25 for the non-residential ingestion-dermal soil remediation standard that are more stringent than the nationally used USEPA risk-based screening levels (excluding extractable petroleum hydrocarbons). (6 and 8)

RESPONSE: The commenters are correct that the notice of proposal Summary, at 52 N.J.R. 580, incorrectly states that there are 24 contaminants more stringent than the ingestion-dermal USEPA regional screening levels. The notice of proposal summary should have stated that there were 27 contaminants more stringent than the residential soil ingestion-dermal USEPA regional screening levels. The three additional contaminants are 1,3-dichlorobenzene, n-hexane, and 4-methyl-2-pentanone (methyl isobutyl ketone). 1,3-dichlorobenzene is not currently listed on the USEPA regional screening level tables, but it has been a regulated contaminant in New Jersey in various media for some time. In addition to the proposed soil remediation standards for the ingestion-dermal and migration to ground water exposure pathways for 1,3-

dichlorobenzene, New Jersey also regulates 1,3-dichlorobenzene in drinking water, ground water, and surface water. All media-specific standards were developed using an oral RfD developed by the NJDWQI.

The soil remediation standards for the ingestion-dermal exposure pathway for n-hexane and 4-methyl-2-pentanone were developed using oral toxicity values from the USEPA HEAST. After the Department proposed amendments to N.J.A.C. 7:26D, the Department discovered that the USEPA withdrew the HEAST RfD values for n-hexane and for 4-methyl-2-pentanone due to subsequent USEPA IRIS assessments citing inadequate data to derive a chronic oral RfD. The retired HEAST RfD values were also removed from the USEPA's regional screening level tables in 2015. Without the HEAST RfD, there is no other reliable toxicity information to develop a soil remediation standard for the ingestion-dermal exposure pathway for 4-methyl-2-pentanone. An RfD for n-hexane developed by NJDWQI (1994) is available; however, that toxicity factor is based on a route-to-route conversion of an inhalation study. The Department's Site Remediation and Waste Management Program does not allow, except where physiologically based pharmacokinetic (PBPK) modeling is employed, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This Department policy conforms with the USEPA policy concerning route-to-route conversion of toxicity factors in accordance with "Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment)."

Considering that there is no other adequate toxicity information to develop soil remediation standards for the ingestion-dermal exposure pathway for n-hexane and 4-methyl-

2-pentanone, the Department is not adopting soil remediation standards for the ingestion-dermal exposure pathway for those contaminants. This change, plus the modifications to the dermal absorption fractions for 12 contaminants, discussed in the Response to Comments 122 through 125, will result in only 14 contaminants for which the standard is more stringent than the residential soil ingestion-dermal USEPA regional screening levels.

With regard to nonresidential standards, the commenters did not identify the 25 contaminants with proposed nonresidential soil remediation standards for the ingestion-dermal exposure pathway more stringent than the USEPA's composite (nonresidential) worker soil ingestion-dermal regional screening levels. However, following the updates to the ingestion-dermal soil remediation standards discussed above, the Department identified 13 such contaminants, which are the same as those for the residential soil remediation standards for the ingestion-dermal exposure pathway, minus 1,2-dichlorobenzene.

117. COMMENT: The proposed rules do not address the application of standards for mixed-use developments, either at N.J.A.C. 7:26D-4, Soil and soil leachate remediation standards, or at N.J.A.C. 7:26D-8, Alternative Remediation Standards. For mixed use properties, the LSRP should be able to apply the most applicable standards. (4)

RESPONSE: In accordance with the Brownfield Act, at N.J.S.A. 58:10B-12.c(1), the Department is required to address only residential and nonresidential scenarios in the Remediation Standards, N.J.A.C. 7:26D. The Department is handling all other scenarios through the ARS process.

An ARS may be proposed for a mixed-use setting. However, in a mixed-use setting, either the most sensitive receptor would be accounted for over the entire project, or the project could be broken down into separate units, applying different standards to different units depending on proposed property use. The Department allows for the use of engineering and institutional controls for compliance with the appropriate standards predicated on the planned use of the property.

118. COMMENT: The Department provides no description on the intended use of the ingestion-dermal and inhalation standards. (3)

119. COMMENT: The rationale for segregation of ingestion-dermal and inhalation criteria in the notice of proposal is not explicitly described by the Department. The proposed rules require reference to multiple tables to determine the most-stringent standard for a specific chemical and land use. It is unclear how this framework is more useful or transparent than the existing rule format, which provides all pertinent information for both the ingestion-dermal and inhalation pathways in a single table for each land use. The inclusion of carcinogenic and non-carcinogenic human health-based criteria in the proposed N.J.A.C. 7:26D Appendix 1 Tables 1 through 4 of the remediation standards (with comparison to select the most stringent) is pedantic, as comparison of these criteria for the same constituent vary by one or more orders of magnitude in nearly all cases. These data could be incorporated into a basis and background document, with the most stringent of the two incorporated into the proposed remediation standard tables (the selected values could be annotated to identify which human health criteria were selected). In this manner, ingestion-dermal and inhalation criteria could remain consolidated into a single tabular presentation for each land use. Note that extensive reference

to the term “direct contact” is contained in the Technical Rules, N.J.A.C. 7:26E; multiple revisions to these rules will be necessary if the Department proceeds with its rulemaking to eliminate reference to this term. (4)

120. COMMENT: Neither the proposed amendments nor the Department's Alternative Remediation Standard Draft Technical Guidance document provides any description of how the regulated community will utilize the two separate soil remediation standards, ingestion-dermal and inhalation. The two standards replace the previous single direct contact standard; however, the documentation and remedial decision options for each standard are not described.

The guidance and proposed amendments should state the ingestion-dermal pathway is most relevant to the direct contact standards and the associated investigation activities as described in the Technical Rules, N.J.A.C. 7:26E. In addition, migration to ground water is not a direct contact pathway and, therefore, institutional and engineering controls are not applicable in accordance with the Brownfield Act, at N.J.S.A. 58:10B-13. The inhalation remediation standard would apply for delineation and site characterization in the Remedial Investigation phase, but should not be a basis to determine attainment of site remedial goals. (6 and 8)

121. COMMENT: No justification is provided for the decision to eliminate the direct contact standard (the more stringent of the ingestion-dermal and inhalation criteria) and replace it with two independent standards (ingestion-dermal and inhalation). The implementation of the standards has not been specified, but if the intent is to require remediation to the most stringent standard, the segregation of the ingestion-dermal and inhalation into separate standards is unnecessary. The terminology “direct contact” is the most frequently used

terminology in the establishment of soil screening levels and/or remediation standards. The Department should provide the rationale for the new standards regime and expressly identify how the proposed amendments will result in increased protection of human health and the environment. (6 and 8)

RESPONSE TO COMMENTS 118, 119, 120, AND 121: As stated in the notice of proposal Summary of N.J.A.C. 7:26D-4, Soil and soil leachate remediation standards, 52 N.J.R. at 569-570, "[t]he Department is proposing these separate residential and nonresidential soil remediation standards for the ingestion-dermal exposure pathway and the inhalation exposure pathway to emphasize that both the ingestion-dermal exposure pathway and the inhalation exposure pathway must be evaluated when remediating a contaminated site." In principle, and in practice, the process will not change for the inhalation exposure pathway and the ingestion-dermal exposure pathway from the former way of comparing soil analytical results to the soil remediation standards. Prior to this rulemaking, the Department identified the more stringent of the two exposure pathways and defined this value as the direct contact soil remediation standard.

Also, prior to this rulemaking, an ARS for one exposure pathway must have taken the other exposure pathway into account if the value was lower than the ARS value for the given exposure pathway. For example, the residential direct contact soil remediation standard for benzene was 2.0 mg/kg based on the inhalation exposure pathway. The health-based soil criterion for benzene for the ingestion-dermal exposure pathway was 3.0 mg/kg. If an ARS for benzene was developed and resulted in a soil concentration of 6.0 mg/kg, there would be the question of whether 6.0 mg/kg or 3.0 mg/kg was the appropriate soil remediation for benzene. The Department believes that the establishment of soil remediation standards for both the ingestion-dermal and inhalation exposure pathways in this rulemaking clarifies this issue by requiring remediation to the more stringent of the soil remediation standard for the ingestion-dermal and inhalation exposure pathways. In doing so, protection of human health and the environment is maintained. Under the adopted rules, the LSRP will identify the lower remediation standard of the two exposure pathways and then compare that remediation standard to the soil analytical results. That lower remediation standard is the applicable remediation standard for the contaminant for all phases of remediation at the site or area of concern.

The Department's inclusion of carcinogenic and non-carcinogenic human health-based criteria in the proposed N.J.A.C. 7:26D Appendix 1 Tables 1 through 4 provides a high level of transparency for the regulated community. This information is also included in the Ingestion - Dermal Exposure Pathway Remediation Standards: Basis and Background and Inhalation Exposure Pathway Remediation Standards: Basis and Background, which are available at https://www.nj.gov/dep/srp/guidance/rs/index.html. If the regulated community find the Tables in the adopted Remediation Standards rule too cumbersome, they may prepare remediation standard spreadsheets to suit their needs.

Impact to ground water exposure pathway values also had to be considered prior to this rulemaking. This consideration will not change with the promulgation of the soil remediation standards for the migration to ground water exposure pathway, at N.J.A.C. 7:26D-4.3.

The Department has reviewed N.J.S.A. 58:10B-13 and cannot find support for the assertion that migration to ground water is not a direct contact pathway and, therefore, institutional and engineering controls are not applicable in accordance with the Brownfield Act, at N.J.S.A. 58:10B-13. The Brownfield Act, at N.J.S.A. 58:10B-13, makes no reference to "direct contact" or "direct contact pathway." N.J.S.A. 58:10B-13 does refer to "the use of engineering controls for the remediation of soil, ground water, or surface water, to protect public health, safety or the environment." As the migration to ground water exposure pathway deals with soil, institutional and engineering controls can be used in the remediation of this exposure pathway.

For a discussion of "direct contact," see the Response to Comments 84 and 85.

122. COMMENT: The Department identified contaminants for the ingestion-dermal pathway that are more stringent as a result of the use of toxicity values that differ from those utilized by the USEPA in the derivation of the regional screening level values, the consideration of contaminants as semi-volatile compounds rather than volatile compounds resulting in the application of dermal absorption factors, the Group C carcinogen policy, and one compound with no regional screening level value.

Of the few scientific, data-based parameters in health risk assessment, the physical/chemical properties of a specific substance should be the least contentious and easiest to reach concurrence among scientists. Differences in the physical definition of chemicals verges on arbitrary and capricious. The Department specifically stated that more stringent criteria were developed for several contaminants as a result of consideration as semi-volatile organic compounds rather than volatile organic compounds with inclusion of the dermal absorption exposure pathway. See 52 N.J.R. at 577.

The notice of proposal Summary, at 52 N.J.R. 580 states, "The USEPA Regional Screening Levels do not apply a skin absorption factor to these compounds as they are considered volatile organic compounds by the USEPA. However, the USEPA does not consider lindane to be a volatile compound and provides a dermal absorption value … The USEPA has not developed default dermal absorption values for volatile organic compounds because they tend to volatilize from the soil adhered to skin, and exposure should be accounted for via the inhalation exposure pathway."

Though this statement is true for the majority of contaminants, the USEPA has established dermal absorption values for polychlorinated biphenyls (PCBs), PAHs, tetrachlorodibenzoparadioxin (TCDD), technical chlordane, and total petroleum hydrocarbons (TPH) as stated by the Department. The lack of dermal absorption factors for the USEPA-designated volatile compounds that the Department has identified as semi-volatile organic compounds required the selection of a dermal absorption value for each contaminant. Unfortunately, this determination does not align with most scientific risk-based assessments of these chemicals in other jurisdictions and is not based on chemical specific science. The semi-volatile organic compound default dermal absorption factor of 0.1 was selected for each of the contaminants identified by the Department as semi-volatile organic compounds.

USEPA Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment) EPA/540/R/99/005 July 2004 states, “This guidance provides a default dermal absorption fraction for semi-volatile organic compounds of 10 [percent] as a screening method for the majority of semi-volatile organic compounds without dermal absorption fractions. This fraction is suggested because the experimental values in Exhibit 3-4 are considered representative of the chemical class for screening evaluations. If these are used quantitatively, they represent another uncertainty that should be presented and discussed in the risk assessment. There are no default dermal absorption values presented for volatile organic compounds nor inorganic classes of compounds. The rationale for this is that in the considered soil exposure scenarios, volatile organic compounds would tend to be volatilized from the soil on skin and should be accounted for via inhalation routes in the combined exposure pathway analysis. For inorganics, the speciation of the compound is critical to the dermal absorption and there are too little data to extrapolate a reasonable default value.”

The Department has not considered the uncertainty of using this default dermal absorption factor for the chemicals identified by the Department as semi-volatile organic compounds.

It appears the Department considered five contaminants to have exposure through dermal absorption as a semi-volatile organic compound and through inhalation as a volatile organic compound. A comparison of the USEPA dermal absorption and volatile inhalation classification with the Department classification is shown below:

Contaminants NJDEP considers both dermal and volatile inhalation pathways	USEPA considers a VOC	USEPA considers dermal pathway
Caprolactam	No	Yes
Hexachlorocyclopentadiene	Yes	No
Naphthalene	Yes	Yes
Phenol	No	Yes
1,2,4-Trichlorobenzene	Yes	No

Hexachlorocyclopentadiene is considered to be a volatile organic compound by the USEPA, but the Department has determined that it will be treated as a semi-volatile organic compound and, thus, a dermal absorption factor was selected by the Department for calculation of the soil ingestion-dermal pathway. However, the calculated soil inhalation values for hexachlorocyclopentadiene at proposed N.J.A.C. 7:26D Appendix 1 Tables 3 and 4 could only be replicated by considering hexachlorocyclopentadiene a volatile organic compound. It appears that the Department has considered this compound to behave as a semi-volatile organic compound for purposes of dermal absorption and as a volatile organic compound for the inhalation exposure pathway.

Naphthalene is the only one of the five contaminants that is considered by the USEPA to be a volatile organic compound and have a USEPA dermal absorption factor, which comports with the scientific data.

Phenol is not considered to be a volatile organic compound by the USEPA, but the Department has made the determination that it should be evaluated as a volatile organic compound for the inhalation pathway, as well as having exposure through the dermal pathway.

The CalEPA's derived noncarcinogenic Reference Concentration (RfC) is used for the calculation on the soil remediation standard, as the USEPA has not developed an inhalation RfC for phenol.

The USEPA considers 1,2,4-trichlorobenzene a volatile organic compound and has not established a dermal absorption factor. The Department selected the default semi-volatile organic compound dermal absorption factor for consideration of the dermal exposure pathway, as well as utilizing the inhalation RfC for the inhalation exposure pathway.

Therefore, the Department is more restrictive than the USEPA in the consideration of both dermal absorption and inhalation pathways for these contaminants with the exception of naphthalene. The USEPA does consider both exposure pathways for naphthalene and provides a volatilization factor and a dermal absorption factor.

Please explain why the rules contain what appears to be an inconsistent application of the semi-volatile/volatile dermal absorption/inhalation distinction (6 and 8)

123. COMMENT: The Department has not clearly identified contaminants that it considers to be volatile compounds. To conduct calculations to verify the proposed numerical standards at N.J.A.C. 7:26D Appendix 1 Tables 3 and 4 (residential soil inhalation and nonresidential soil inhalation), it was necessary to identify the list of contaminants that the Department identified as volatile compounds. The volatilization factor was not included (or was removed) from the soil remediation standard equation if the contaminant was not identified as a volatile compound. As the Department did identify some contaminants as volatiles that the USEPA does not, and vice versa, and given that the input parameters into the volatilization factor are available for most contaminants whether they are volatile or not, a list of Department volatiles

required identification for calculation verification. The inclusion of the volatile designation and the volatilization factor at N.J.A.C. 7:26D Appendix 10, Chemical and Physical Properties of Contaminants, would provide clarity for calculation verification and for the development of an ARS. (6 and 8)

124. COMMENT: To recalculate the inhalation only soil remediation standards at N.J.A.C. 7:26D Appendix 1 Tables 3 and 4, it was necessary to identify the list of contaminants considered to be volatile compounds by the Department. The inclusion of the volatile designation and the volatilization factor at N.J.A.C. 7:26D Appendix 10, Chemical and Physical Properties of Contaminants would provide clarity. The determination of the volatile compounds required a rather convoluted process of modifying the calculations to match the proposed soil remediation standards. Following the removal of contaminants, the Department had identified as semi-volatile compounds and adding the two contaminants that the Department deemed to be volatiles, three contaminants required inclusion with both dermal absorption and inhalation exposure pathways included. Note that inhalation only soil remediation standards for two inorganic contaminants that the USEPA considers to be volatile (that is mercury and cyanide) are based on exposure to particulate matter only and not volatilization.

The Department did not provide a table of the calculated volatilization factors used in the calculation of the remediation standards; thus, it was necessary to calculate the volatilization factor from the underlying chemical and physical properties at N.J.A.C. 7:26D Appendix 10. Except for chlordane (alpha and gamma forms summed and identified by the USEPA as “chlordane (technical mixture)”), all calculated volatilization factors associated with the proposed remediation standards are greater than the USEPA default volatilization factors (less stringent than USEPA).

Hexachlorocyclopentadiene could only be matched to the proposed inhalation soil remediation standard if it is considered a volatile compound. (6 and 8)

125. COMMENT: The Department has included the chemical and physical parameters in the proposed rule at N.J.A.C. 7:26D, Appendix 10 for transparency, so that the regulated community is aware of the data used to develop the proposed remediation standards. See 52 N.J.R. at 626, 627, 628, 629, and 630. This information is necessary for the verification of the remediation standards calculations, as well as to ensure consistency of these parameters in development of alternative standards. For the same reasons that the physical and chemical parameters have been provided, the identification of contaminants the Department considers volatile compounds should be provided at N.J.A.C. 7:26D Appendix 10. No criteria for the selection of a chemical as a volatile compound based on physical parameters, such as Henry's Law Constant or vapor pressure, have been identified by the Department. These physical and chemical parameters utilized in the calculation of the volatilization factor are available for most contaminants regardless of whether they are classified as volatile compounds. The identification of contaminants the Department considers volatile compounds is necessary for clarity and to provide the information required to verify the remediation standards and develop alternative standards.

In addition, the Department should include the volatilization factor calculated by the Department for the derivation of the soil remediation standard for each identified volatile compound be included at N.J.A.C. 7:26D Appendix 10. For reference, the USEPA includes the volatilization factor in its residential and industrial soil regional screening levels tables. Providing the volatilization factor at N.J.A.C. 7:26D Appendix 1 Tables 3 and 4 would also clarify which of the contaminants have volatilization considered in the calculation of the soil remediation inhalation standard.

Proposed N.J.A.C. 7:26D Appendix 3 notes that "[i]f a calculated soil criterion for a contaminant for the inhalation exposure pathway is greater than its soil saturation limit for the volatile portion of the equation, the volatile component of the equation is not applicable in the development of the soil criterion for the inhalation exposure pathway." However, the equation that is provided for the calculation of the soil inhalation standard combines the volatile and particulate components rather than having the calculations performed separately. In comparison, Appendix 3 of the rule prior to this rulemaking provides separate equations for the calculation of volatile and particulate inhalation criteria, thus making the recognition that the calculated volatile criteria are greater than the soil saturation limit a one step process. The text at proposed Appendix 3 (noted above) should be revised to clarify the procedure given the equation provided. This is crucial to the understanding of the footnotes for the "NA" designations at proposed N.J.A.C. 7:26D Appendix 1 Tables 3 and 4. The footnotes are based on evaluating the organic volatile and particulate components separately. If the calculated volatile component exceeds the soil saturation limit, Footnote 3 applies. Footnote 2 (calculated health-based criterion exceeds one million mg/kg) applies almost exclusively to the particulate component of the inhalation calculation. However, the contribution of the particulate component is not known until the volatile component is removed, consistent with the proposed Appendix 3 statement (noted above), if Footnote 3 conditions (calculated concentration is greater than soil saturation) apply. In the absence of the supporting documentation for the 2014 proposed rule, where the tables provide the volatile and particulate calculated criteria separately and combined, the use of Footnote 2 for the "NA" designation (in conjunction with Footnote 3 in many cases) is not readily apparent.

The proposed amendments should be modified to address this issue by providing the equations to calculate the volatile and particulate components separately to align with the text at proposed N.J.A.C. 7:26D Appendix 3 or provide a detailed explanation of the process for identifying the conditions addressed in Footnotes 2 and 3 at Appendix 1 Tables 3 and 4 of the proposed amendments.

The proposed amendments must be withdrawn until errors can be corrected and data omissions addressed, so that impacts can be properly assessed. (6 and 8)

RESPONSE TO COMMENTS 122, 123, 124, AND 125: The Department does not maintain a list of volatile and non-volatile contaminants for the inhalation exposure pathway. The classification of a chemical as "volatile" or "semi-volatile" is based on professional judgment, since all chemicals (unless they are ionized) manifest at least a small amount of volatility, which increases with increasing temperature. While values for physicochemical properties of a contaminant are generally not contentious, the determination of volatility for a chemical in the environment is considerably more complicated. The most basic indicator of a chemical's volatility is its vapor pressure, but this parameter does not take into account the relatively large effects on volatility that may occur when a chemical is dissolved in water (for example soil moisture), adsorbed to soil, or the effects of air movement at the soil surface.

For the inhalation exposure pathway, the Department has avoided classifying chemicals as volatile or nonvolatile, for the reasons discussed above. The volatile transport equations for the inhalation pathway make a more refined estimate of volatility than simply using the vapor pressure and Henry's law criteria. The equations take into account a chemical's adsorption to soil, volatilization from soil moisture, soil properties such as organic carbon and soil moisture, and air movement at the soil surface. Particulate calculations were done on all contaminants with available inhalation toxicity factors. In addition, volatile calculations were conducted on all organic contaminants (and elemental mercury) with available inhalation toxicity factors. For the inhalation exposure pathway, the transport of a given contaminant from the soil surface was either dominated by the volatile or particulate transport pathway, as indicated by the results of the calculations. The equation for the volatilization factor is at Equation 3 of Appendix 3 in the adopted rule. Parameters that are input into the equation are listed at Equation 3 of Appendix 3 or at Appendix 10. The volatilization factor is not listed at Appendix 10, because it is a derived equation transport parameter, not a fundamental property.

The soil remediation standards for the inhalation exposure pathway calculated using Equations 1 and 2 at N.J.A.C. 7:26D Appendix 3 are drawn from the November 2018 USEPA Regional Screening Level Tables. For contaminants with applicable inhalation toxicity factors, Equations 1 and 2 are initially evaluated with only the particulate emission factor term for all chemicals, and with only the volatilization factor term for all organic contaminants (and elemental mercury). If the criterion using only the particulate emission factor term is greater than a million parts per million, then this term is not used in the final calculation of the standards, because the particulate component of the inhalation exposure pathway is not of concern. If the criterion with only the volatilization factor term is greater than the soil saturation limit, then this term is not used in the final calculation of the standards, because the volatile component of the inhalation exposure pathway is not of concern. The volatilization factor term is also not used for inorganic contaminants (except for elemental mercury), since these contaminants are not volatile. Otherwise, both terms are used in the final calculation.

Regarding cyanide, the USEPA is incorrect in classifying the contaminant as a volatile compound. Cyanide is a negatively charged anion and is not a volatile compound. Hydrogen cyanide is a volatile gas, but that is not the listed contaminant. Regarding mercury, the Department evaluated this contaminant as a volatile element (elemental mercury) when conducting the volatile calculation for the inhalation pathway, but the volatile criterion for elemental mercury exceeded its soil saturation limit.

Regarding the general comment that most volatilization factors are less stringent than those listed by the USEPA, the Department adjusted several of the input parameters for the volatilization factor to New Jersey-specific values, as explained in the Inhalation Exposure Pathway Remediation Standards: Basis and Background, which is available at https://www.nj.gov/dep/srp/guidance/rs/index.html.

For the ingestion-dermal exposure pathway, it is necessary for the Department to carry out a process similar to the USEPA's in order to classify contaminants as volatile or semi-volatile, so that a decision may be made on whether or not to apply a dermal absorption fraction. After consideration of comments received, the Department is modifying the dermal absorption fractions at N.J.A.C. 7:26D Appendix 11 Table 1 to be consistent with those used by USEPA. The Department is also updating the human health-based criteria and soil remediation standards for the ingestion-dermal exposure pathway at N.J.A.C. 7:26D Appendix 1 Tables 1 and 2 to reflect the modifications to the dermal absorption fractions. Therefore, the Department is using the USEPA volatile classification of chemicals for the calculation of soil remediation standards for the ingestion dermal exposure pathway. This change results in an increase to the proposed soil remediation standard concentrations (that is, less stringent standards) for the ingestion-dermal exposure pathway for aldrin, 4,4’-DDE, endosulfan, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachloro-1,3-butadiene, hexachlorocyclopentadiene, hexachloroethane, lindane, 1,2,4,5-tetrachlorobenzene, and 1,2,4-trichlorobenzene.

For the purposes of assigning a dermal absorption fraction for the calculation of soil remediation standards for the ingestion-dermal exposure pathway for the 12 contaminants listed above, all are now classified as volatile, and a dermal absorption fraction is no longer assigned to them, with the exception of lindane. Lindane is a semi-volatile and the Department is changing the dermal absorption fraction from 0.1 to 0.04 to be consistent with the USEPA.

Further, the Department conducted an internal review to determine if the reclassification of a contaminant as volatile versus semi-volatile for the purposes of assigning a dermal absorption fraction for the derivation of soil remediation standards for the ingestion-dermal exposure pathway would have any implications for the other exposure pathways. The

Department determined that this reclassification would not affect any of the other exposure pathways because the ingestion-dermal exposure pathway is the only pathway for which the Department made volatile and semi-volatile classifications of contaminants when deriving remediation standards.

126. COMMENT: Proposed N.J.A.C. 7:26D Appendix 12, and other appendices, appear to derive Department remediation standards from the equations for the USEPA Regional Screening Levels, meaning they are screening values (used to determine when further investigation is warranted) and should not be used as cleanup standards. Starting on 52 N.J.R. at 566, the notice of proposal states, "Proposed new N.J.A.C. 7:26D Appendix 12 demonstrates the equivalency between the equations used to develop the proposed soil and indoor air remediation standards and the equations the United States Environmental Protection Agency (USEPA) used in its Regional Screening Levels when it developed soil and indoor air risk-based screening levels … Equations 1 and 2 in proposed N.J.A.C. 7:26D Appendix 3 – Development of soil remediation standards for the inhalation exposure pathway, and Equations 1 and 2 in proposed N.J.A.C. 7:26D Appendix 5 – Development of indoor air remediation standards for the vapor intrusion exposure pathway, are all derived from equations found in the USEPA document, Regional Screening Levels (RSLs) – Equations (November 2018)."

This is not in accordance with the USEPA's use of these levels, nor does it appear to be scientifically defensible. According to the USEPA's May 2020 Regional Screening Levels (RSLs) - User's Guide, "It should be emphasized that Screening Levels (SLs) are not cleanup standards.

We also do not recommend that the RSLs be used as cleanup levels for Superfund Sites … SLs should not be used as cleanup levels for a CERCLA site until the other remedy selections identified in the relevant portions of the NCP, 40 CFR Part 300, have been evaluated and considered …"

The Department should not use the USEPA regional screening levels when setting remediation standards but should instead utilize the USEPA IRIS values or other toxicity values in the USEPA hierarchy. The Department should use the USEPA toxicity hierarchy when setting its remediation standards. (12)

RESPONSE: The equations the Department uses to develop its soil and indoor air remediation standards are consistent with those the USEPA used to derive the USEPA's regional screening levels. The Brownfield Act, at N.J.S.A. 58:10B-12, mandates that "the Department develop soil remediation standards using exposure parameters that provide an adequate margin of safety and are consistent with the guidance and regulations for exposure assessment developed by the USEPA pursuant to the CERCLA and other statutory authorities as applicable." In order to ensure adequate protection of human health and meet the statutory requirements set forth in the Brownfield Act, the Department follows the USEPA's risk assessment methodology in the development of soil and indoor air remediation standards.

The procedure for calculating residential and nonresidential soil remediation standards for the ingestion-dermal exposure pathway is based on the USEPA's "Risk Assessment Guidance for Superfund Human Health Evaluation Manual, Part B," "Soil Screening Guidance: Technical Background Document," "Supplemental Guidance for Developing Soil Screening Levels for

Superfund Sites," and the "Regional Screening Levels RSL Users Guide." While the Department uses the same equations and exposure factors as those found in the USEPA's regional screening levels tables to develop the Department's soil remediation standards, the Department does not add the ingestion-dermal exposure pathway to the inhalation exposure pathway to derive its soil remediation standards. This approach is less conservative (results in a less stringent standard) than the methodology used to derive the USEPA's regional screening levels. The USEPA methodology for the regional screening levels adds the ingestion-dermal and inhalation exposure pathways together, resulting in a more stringent screening level. The Department's methodology evaluates the ingestion-dermal and inhalation exposure pathways separately because different health effects may be associated with the inhalation of contaminants versus contaminants entering the body through the ingestion-dermal exposure route. This approach is consistent with the recommendations in the USEPA's "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites."

For the vapor intrusion exposure pathway, the Department utilizes the risk-based approach outlined in the USEPA's "Risk Assessment Guidance for Superfund, Part F: Supplemental Guidance for Inhalation Risk Assessment" and the "Regional Screening Levels RSL Users Guide" in the development of indoor air remediation standards. This methodology is consistent with the requirements set forth in the Brownfield Act and ensures adequate protection of human health. Regarding the following of the toxicity value hierarchy, the Department uses IRIS toxicity factors as the first-tier source for the development of inhalation-based remediation standards, when available. The inhalation-based remediation standards include both indoor air remediation standards and soil remediation standards for the inhalation exposure pathway. This hierarchy is consistent with that of the USEPA. The NJDWQI toxicity factors are oral-based and, therefore, are not used as the first-tier hierarchy source for the development of inhalation-based remediation standards.

For the migration to ground water exposure pathway, the Department does not use USEPA regional screening levels in setting remediation standards. It uses the same methodology as that used by the USEPA, but applies typical New Jersey values for several parameters in the soil-water partition equation. This is consistent with the requirements of the Brownfield Act and ensures adequate protection of human health. It is also in keeping with the mandate to follow the USEPA wherever possible. However, the parameter values that go into the final regional screening levels are carefully evaluated to determine whether they need modification for New Jersey. Wherever possible, the Department applies values that are more in keeping with New Jersey geology and rules. These include the Ground Water Remediation Standards for the State, which form the endpoint for the migration to ground water exposure pathway. Some values, such as those for a contaminant’s chemical properties, remain consistent internationally. In other instances, for example, toxicity values, the Department has a hierarchy that must be followed. Additionally, the LSRP has the option to develop ARS based on site-specific conditions.

127. COMMENT: The proposed rules erode responsibility of LSRPs by proposing to establish hard and fixed standards to replace current screening levels and guidance that are not only

sufficient, but also preferable. The Department noted at its June 10, 2014, stakeholder meeting concerning this rulemaking in response to a stakeholder's question about the need for standards that "[t]here is nothing wrong with the guidance and screening levels. This effort will promulgate the indoor air values as the standards and the target remedial values for indoor air." Absent a flaw in the present system, the LSRPs should continue to be able to utilize screening levels and guidance as LSRPs are in the most advantageous position to determine which remediation methods for a site are necessary to ensure the protection of the environment and public health. The Legislature clearly intended, under the SRRA of 2009, that LSRPs are required to follow Department regulations and guidance and that the protection of public health and safety is an LSRP's foremost responsibility. Furthermore, the Legislature intended that the remediating party must initiate and complete the cleanup under the direction of an LSRP without waiting for the Department's direction and preapproval. This process has served remediating parties, the public, the environment, and the Department well with over 53,000 cases closed from 2009 to 2019. There is no need, particularly at this time, to codify guidance and screening levels as immutable standards. LSRPs should be provided the flexibility to apply their expertise in a protective manner with appropriate Department oversight. (10 and 11)

RESPONSE: The Department has provided its rationale on codifying soil and soil leachate screening levels for the migration to ground water exposure pathway, and indoor air screening levels for the vapor intrusion exposure pathways as remediation standards. See 52 N.J.R. at 567 and the Response to Comments 18 through 23 and the Response to Comments 51, 52, and 53.

Promulgation of screening levels as remediation standards does not decrease the ability of an LSRP to use his or her professional judgment. The LSRP has the latitude to use professional judgment in evaluating whether using an ARS in lieu of a default remediation standard is appropriate at a site. In addition, the LSRP has the ability to use his or her professional judgment in demonstrating compliance with remediation standards at a site.

128. COMMENT: The Department's adoption of screening levels as standards significantly elevates New Jersey to a level of stringency far greater than the USEPA requirement with virtually no validation of associated reduction of risk to human health and the environment. Additionally, the adoption of the screening levels as standards for the migration to ground water pathway and the vapor intrusion pathway, along with the mechanics and process within the rules for development of alternate remediation standards are all a direct assault on all the good work and improved efficiency of remediation born of the SRRA and the establishment of the licensed site remediation program. (3)

RESPONSE: The Brownfield Act, at N.J.S.A. 58:10B-1.2, mandates that “strict remediation standards are necessary to protect public health and safety and the environment; that these standards should be adopted based upon the risk posed by discharged hazardous substances.” Even prior to the adopted rules, LSRPs have been required to address and have addressed these pathways by developing site-specific standards from screening levels. The Department does not anticipate a reduction in efficiency from addressing these pathways as standards. In fact, promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost. The alternate remediation standards are also mandated by the Brownfield Act.

129. COMMENT: Screening levels cannot, and should not, be used as cleanup standards. The overall approach to establishing the proposed soil remediation standards has been modified from the existing approach to be consistent with the USEPA methodology of establishing screening levels that are published semiannually as the “Regional Screening Levels (RSLs).” However, the proposed soil remediation standards differ from soil screening levels in that they require remediation if the concentration in soils is exceeded. The equations and exposure parameters utilized in the derivation of the proposed soil remediation standards are identical to those employed in the calculation of the regional screening levels. The only variances from the regional screening level input parameters are related to the supporting equations, such as particulate emission factor (using meteorological data specific to the region rather than the Minnesota data used in the regional screening level calculations) and soil porosity and organic carbon content of soil. The basis for selection of these values is to be provided in documents currently being compiled by the Department. Therefore, the accuracy of the supporting documentation for the selection of these parameters cannot be determined by the regulated community. This makes the evaluation of the notice of proposal and its impacts premature.

The USEPA “Regional Screening Levels RSL User’s Guide” clearly states that the screening levels are to be used to determine whether concentrations of contaminants found at a site warrant further investigation or site cleanup or if no further investigation or action is required. The RLS User's Guide states in bold text "It should be emphasized that [screening levels] are not cleanup standards." The USEPA soil screening concentrations are based on conservative (that is, health protective) exposure assumptions that are not representative of conditions at the majority of sites. These conservative assumptions are appropriate when the calculated concentrations are used to determine whether additional investigation is required or to determine if there is a potentially unacceptable risk given site-specific conditions. Examples of the default parameters and assumptions utilized in the calculation of the soil remediation standards that are not representative of conditions routinely encountered are workers being present outside and exposed to soil and particulate matter/volatilization eight hours a day for 225 days per year. The weather conditions in New Jersey are such that precipitation in the form of rainfall or snow, as well as frost conditions, would limit exposure to soils such that the incidental ingestion and dermal contact would occur. Other states have incorporated lesser exposure frequencies to account for reasonable weather conditions.

The use of the regional screening level methodologies and exposure parameters for the establishment of soil remediation standards is not consistent with the caveats presented by the USEPA associated with the published soil screening levels. The use of "screening levels" as remediation standards will impose standards and requirements that exceed Federal requirements and result in unnecessary cost and adversely impact the competitive position of New Jersey relative to the surrounding states. Thus, the Department should not be mandating use of screening levels as cleanup standards. (3, 6, and 8)

RESPONSE: The adopted rules do not use the regional screening levels as standards. The equations and exposure factors that the Department used to develop the adopted soil remediation standards are consistent with those used to derive the USEPA regional screening levels. The Brownfield Act, at N.J.S.A. 58:10B-12, mandates that "the Department develop soil remediation standards using exposure parameters that provide an adequate margin of safety and are consistent with the guidance and regulations for exposure assessment developed by the USEPA pursuant to CERCLA and other statutory authorities as applicable." In order to ensure adequate protection of human health and meet the statutory requirements set forth in the Brownfield Act, the Department used the USEPA's Recommended Standard Default Exposure Factors for Superfund (OSWER Directive 9200.1-120) to derive the soil remediation standards for the ingestion-dermal and inhalation exposure pathways. The use of these exposure factors is consistent with the human health risk assessment methodology for the USEPA's Superfund program and can also be found in the USEPA's regional screening levels Tables for the resident and outdoor worker.

While the Department did use the same equations and exposure factors in the USEPA's regional screening levels Tables to develop the Department's soil remediation standards, the Department did not add the ingestion-dermal exposure pathway to the inhalation exposure pathway to derive its soil remediation standards. This approach is less conservative than the methodology used to derive the USEPA regional screening levels. The USEPA methodology adds the ingestion-dermal and inhalation exposure pathways together, resulting in a more stringent screening level. The Department's methodology evaluates the ingestion-dermal and inhalation exposure pathways separately because different health effects may be associated with the inhalation of contaminants versus contaminants entering the body through the ingestion-dermal exposure route. This approach is consistent with the recommendations in the USEPA's "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites."

The Brownfield Act, at N.J.S.A. 58:10B-12.c(1), requires the Department to promulgate residential and nonresidential remediation standards. The Department handles all other land use scenarios through the ARS process. If the site or area of concern is for residential or nonresidential use, as defined at N.J.A.C. 7:26D-1.5, the default residential or nonresidential soil remediation standards apply. If the site or area of concern use does not meet either of those definitions, then an ARS could potentially be developed based on an alternative land use exposure scenario. Use of this type of ARS may require institutional or engineering controls and a soil remedial action permit.

The Department uses the regional screening levels methodology to develop remediation standards that are pertinent to the State of New Jersey, which is in keeping with the mandate to follow the USEPA procedures wherever possible. However, the Department carefully evaluates the parameter values that go into the final regional screening levels to determine whether they need modification for New Jersey. Wherever possible, the Department bases its adopted standards on values that are more in keeping with New Jersey geology and rules. These include the Ground Water Remediation Standards for the State, which form the endpoint for the migration to ground water exposure pathway. Some values, such as those for a contaminant's chemical properties, remain consistent internationally. In other instances, for example, toxicity values, the Department has a hierarchy that must be followed. Additionally, the LSRP has the option to develop ARS based on site-specific conditions.

130. COMMENT: The proposed migration to ground water standards are not compliant with the statutory directives in the Brownfield Act, N.J.S.A. 58:10B-1 et seq. Rather, the Department's proposed migration to ground water standards rely on unrealistic, conservative assumptions that do not represent field conditions at most sites and areas of concern and are inconsistent with the USEPA's CERCLA guidance (the Soil Screening Guidance, (USEPA, 1996)) and the findings of the Department's Science Advisory Board. An alternative framework that is consistent with USEPA guidance and represents a practical middle-ground between the application of overly conservative default assumptions (Soil Water Partition Equation) and the need for additional site-specific investigations modeling (to support ARS) should be used. (4)

RESPONSE: The Department's soil remediation standards for the migration to ground water exposure pathway are based on generally accepted and peer reviewed scientific evidence or methodologies. The soil water partition equation used by the Department is the equation used by the USEPA in developing its regional screening levels.

In order to protect the ground water in New Jersey, the soil remediation standards for the migration to ground water exposure pathway are back calculated from the Ground Water Remediation Standards, N.J.A.C. 7:26D-2. While a detailed analysis of the ground water remediation standards is beyond the scope of this rulemaking, the adopted ground water remediation standards are based on reasonable and standard exposure scenarios that have been in use for many years and are standard risk assessment practice.

The Department did not use redundant conservative assumptions in the development of the adopted standards. The assumptions for the various parameters used in the partitioning model were based on utilization of typical or mid-range values for parameters, not conservative values. This is explained on a parameter-by-parameter basis in Migration to Ground Water Exposure Pathway Remediation Standards: Basis and Background at https://www.nj.gov/dep/srp/guidance/rs/. The Department's approach is in accordance with the Brownfield Act, N.J.S.A. 58:10B-1 et seq., which stipulates that redundantly conservative assumptions should not be used. Some of the contaminant-specific chemical and physical parameters used in the remediation standard calculations received specific comments and are responded to in greater detail in the Response to Comments 258 and 259. Other than updates to chemical properties and the ground water remediation standards, the Department's values for the parameters remain the same as they have been for many years. The Department made the most recent change in 2013, when the dilution-attenuation factor was raised from 13 to 20.

See the Response to Comment 134 for a discussion of the Department's Science Advisory Board (SAB) concerns on this issue.

131. COMMENT: Under what conditions will migration to ground water soil samples or soil leachate soil samples be unnecessary? Above a saturation point? Within the capillary fringe? Below a confirmed water table? Under no conditions? (6 and 8)

RESPONSE: Migration to ground water samples are not obtained below the water table or above the saturation point because the pathway only applies to the vadose zone. See 52 N.J.R. at 570. The capillary fringe is normally considered part of the vadose zone and may be subject to sampling if that is where the contamination is located. Soil leachate samples are not collected in the field; they are generated when testing soil samples through the Synthetic Precipitation Leaching Procedure (SPLP), and this procedure is optional. The Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway available at https://www.nj.gov/dep/srp/guidance/, and the Remediation Standards, N.J.A.C. 7:26D, provide further details on procedures that need to be followed.

132. COMMENT: Migration to Ground Water compliance options (other than numeric ARS) are not referenced in the rulemaking. These include capping options for metals/semi-volatiles and volatile organic compounds, immobile chemicals, and “Site Soil and Ground Water Analytical Data Evaluation” for metals/semi-volatiles and volatile organic compounds.” A reference to these options should be provided in the rules, similar to the reference to the Department's Soil Remediation Standards Guidance for Impact to Ground Water, available at www.nj.gov/dep/srp/srra/regs/guidance.htm, contained at N.J.A.C. 7:26D-1.1(b) prior to the proposed amendment. (4)

RESPONSE: The site-specific data for immobile contaminants, N.J.A.C. 7:26D Appendix 8 Section III(f) and the site-specific data for metals, semi-volatile contaminants, and volatile contaminants, N.J.A.C. 7:26D Appendix 8 Section III(g) are narrative standards. See 52 N.J.R. at

652. Narrative standards require no remedial action permits or deed notices pertaining to the migration to ground water exposure pathway. The capping options are considered compliance options and are beyond the scope of this rulemaking. Capping options require a soil remedial action permit and a deed restriction for the migration to ground water exposure pathway.

133. COMMENT: The Department states it is proposing standards for new pathways that are not in the existing regulations, namely soil and soil leachate remediation standards for the migration to ground water exposure pathway. See "Impact of Newly Regulated Exposure Pathways" at 52 N.J.R. 579. While the Department claims the economic impact of these changes will be minimal, it has completely ignored the impact of existing N.J.A.C. 7:26C-6.4(a)3. The application of this rule to the proposed new standards raises the potential of requiring a reevaluation of every site ever issued a final remediation document. It is incumbent on the Department to reevaluate this potential for the possible catastrophic impact on the economy or alternatively to state clearly in the adoption document, if it proceeds with this rulemaking that the "new pathways" being proposed will not require such a reevaluation. (16)

RESPONSE: It is not the Department’s intent to reopen every site that has a final remediation document to evaluate every contaminant for the migration to ground water exposure pathway and indoor air vapor intrusion exposure pathway. However, when a case re-enters the Department's Site Remediation and Waste Management Program, or is being assessed due to permitting requirements, the Department requires the person responsible for conducting the remediation to evaluate those contaminants found at closed sites that are subject to the order of magnitude provision as stated in the Response to Comments 64 and 65.

The impact to ground water (referred to as migration to ground water in the adopted rules) exposure pathway has been evaluated at sites since 1993, and the vapor intrusion exposure pathway has been evaluated at sites since 2005. Sampling results for these two exposure pathways are contained in the Department COMPASS database and were used by the Department to determine the impact of contaminants subject to the order of magnitude provisions on closed cases (cases with a final remediation document).

For the vapor intrusion exposure pathway, there is only one contaminant, 1,1-dichloroethene, that is subject to the order of magnitude provision. Data from the COMPASS data base indicates that there are only three closed cases that would trigger an order of magnitude evaluation.

For the migration to ground water exposure pathway, there are five contaminants that are subject to the order of magnitude provision. The contaminants are hexachlorocyclopentadiene, bis(2-ethylhexyl)phthalate, DDE, DDT, and copper. Data from the COMPASS database indicate that there is only one closed case that would trigger an order of magnitude evaluation for hexachlorocyclopentadiene, 105 cases for bis(2-ethylhexyl)phthalate, 68 cases for DDE, 65 cases for DDT, and 131 cases for copper. The number of effected cases is minimal considering the total number of closed cases (94,194 as of August 2020).

The Department intends to keep its existing policy concerning when an order of magnitude evaluation would be conducted. See the Response to Comment 58 for a discussion of the timing of the evaluation.

134. COMMENT: The proposed soil leachate standards are based upon the existing Impact to Ground Water Soil Remediation Standards and related guidance documents. However, the impact to ground water criteria have been recognized as being developed with extremely conservative assumptions (New Jersey Department of Environmental Protection Science Advisory Board - Final Report Response to Charge Questions on the Impact to Ground Water Soil Remediation Standards Guidance [October 20, 2011] page 8, available at https://www.nj.gov/dep/sab/Final-IGWSRS%20Review%20Report.pdf),“The [Impact to Ground Water Soil Remediation Standards] Guidance, and supporting documents and information, includes discussion and rationale for many of the methods and assumptions. However, some of the rationale and requirements are not supported by a technical or scientific discussion or are explained by reference to state laws and regulation and/or policies not in any laws or regulations. In addition, there are implicit conceptual assumptions that add to the conservatism of the [Impact to Ground Water Soil Remediation Standards] Guidance.”

The New Jersey Department of Environmental Protection Science Advisory Board document states further (page 11), “The [Impact to Ground Water Soil Remediation Standards] Guidance is useful for sites that exhibit a relatively simple range of site conditions. However, its utility is adversely impacted by the organizational issues and technical limitations and omissions identified in this report. In addition, the guidance includes several references to the need for Department review and approval that appear to contradict use by the LSRP without significant Department review and approval."

The Brownfield Act, at N.J.S.A. 58:10B-12, Adoption of remedial standards, states that the Department shall "avoid the use of redundant conservative assumptions. The Department shall avoid the use of redundant conservative assumptions by the use of parameters that provide an adequate margin of safety and which avoid the use of unrealistic conservative exposure parameters and which guidelines 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.'" (15)

RESPONSE: It is misleading to state that the impact to ground water criteria have been recognized as being developed with extremely conservative assumptions. The Department SAB comments pertain to 2008 versions of the Impact to Ground Water Guidance documents; these versions are 13 years old. The Department refuted these comments both in writing and in a meeting of the SAB at that time. In addition, two updates to the guidance documents have been made since the 2011 SAB review, and some of the SAB's recommendations have since been incorporated into current guidance.

The Department has not used redundant or conservative assumptions. Rather, the Department used typical, or mid-range values for parameters, as explained in the Migration to Ground Water Exposure Pathway Remediation Standards: Basis and Background, available at https://www.nj.gov/dep/srp/guidance/rs/index.html. Other than updates to chemical properties and the Ground Water Remediation Standards, values for the parameters remain the same as they have been for many years. The most recent change the Department made was in 2013, when the dilution-attenuation factor was raised from 13 to 20.

As discussed in the Response to Comments 175 through 181, a proposed ARS cannot be used until it is approved by the Department. Therefore, preapproval is required for those options that in the Department's experience are based on multiple and complex factors, and which may result in a person responsible for conducting the remediation spending time and resources only to be rejected. Preapproval will prevent this situation. The Department has no backlog in its review of ARS; therefore, the Department does not anticipate any delays.

As also discussed in the Response to Comments 175 through 181, the adopted rules allow some ARS without Department preapproval. See N.J.A.C. 7:26D-8.5.

135. COMMENT: The existing Impact to Ground Water Soil Remediation Standards Guidance documents, which the Department will expect LSRPs to utilize, were not developed under a stakeholder process. The SRRA, at N.J.S.A. 58:10C-14.c(3), identifies the involvement of interested parties as a requirement for developing standards for an LSRP's use. It states, "The [D]epartment shall provide interested parties the opportunity to participate in the development and review of technical guidelines issued for the remediation of contaminated sites." (15)

RESPONSE: Stakeholders were represented in the Department's Migration to Ground Water Committee, which developed the new Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway. The committee included LSRPs with expertise in hydrogeology. Additionally, the Department sent the guidance document to the Technical Guidance Committee members for stakeholder comment.

136. COMMENT: Copper, silver, and zinc, which are secondary drinking water standards based primarily on cosmetic and/or aesthetic considerations, are included in the proposed Remediation Standards, N.J.A.C. 7:26D, but should be excluded as aluminum, manganese, sodium, and iron were. (15)

137. COMMENT: The Department typically has not required remediation of aluminum, iron, manganese, silver, sodium, or zinc in soil based on their potential to impact ground water. However, the proposed standards for the migration to ground water exposure pathway include standards for silver and zinc. Based on the Department's drinking water quality standards, the standards for silver and zinc remain secondary standards, which are established for aesthetic (taste and scaling) concerns rather than for health risk. As such, silver and zinc should not have soil standards for the migration to ground water exposure pathway. (2)

RESPONSE TO COMMENTS 136 AND 137: When calculating soil remediation standards for the migration to ground water exposure pathway, the secondary drinking water standards are not used as target ground water concentrations. Rather, the Department uses the health-based Ground Water Quality Standards, N.J.A.C. 7:9C. The Department did not use secondary drinking water standards for developing the soil remediation standards for the migration to ground water exposure pathway for silver and zinc. Rather, the Department used the health-based New Jersey Ground Water Quality Criteria. In the Ground Water Quality Standards, both silver and zinc are health-based standards. The copper drinking water standard (maximum contaminant level) is a primary standard, not secondary, and is identical to the health-based ground water quality standard for copper.

138. COMMENT: Technical reviewers require policy documents to understand how to utilize the proposed new exposure pathways. A comprehensive review of the practical, economic, and social impacts of the proposed amendments requires an explanation of the Department's planned policies and implementation strategy for the various exposure pathways. For example, how will site-specific ground water quality data be integrated with the migration to ground water pathway soil results? (6 and 8)

RESPONSE: The use of ground water quality data is dependent on what is being done regarding the migration to ground water exposure pathway. The evaluation of the migration to ground water exposure pathway is concerned with potential future ground water contamination, not the current state of the ground water, so in only some cases are current ground water quality data directly used. Ground water quality data are not used when comparing the soil remediation standards for the migration to ground water exposure pathway to: (1) soil sample results; (2) soil-water partition equation ARS results; (3) ARS results when modifying the dilution-attenuation factor; (4) determine an ARS using the SPLP; (5) determine an ARS based on Seasonal Soil Compartment Model options; or (6) the immobile chemical option.

Ground water quality data are directly used in conjunction with migration to ground water soil results for the Seasonal Soil Compartment Model/Analytical Transient 1-,2-,3-Dimensional Model option (SESOIL/AT123D), in that the current ground water concentrations are used in the SESOIL/AT123D model. Ground water quality data are also used with the site-soil and ground water monitoring data evaluation option (to demonstrate no existing ground water contamination). Ground water quality data are also used in the volatile and semi-volatile capping compliance options, and in another compliance option entitled "Volatile Organic Contamination including methyl tertiary butyl ether (MTBE) and tertiary butyl alcohol (TBA) derived from discharges of Petroleum Mixtures." The Department is not including compliance options in the adopted rules. For all of the options mentioned above, where ground water data is used (except the compliance options), the "Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway" provides further details (https://www.nj.gov/dep/srp/guidance/rs/). The compliance options involve either the demonstration of uncontaminated ground water, the demonstration of non-increasing contaminant concentrations in ground water, or the demonstration of monitored natural attenuation. Department guidance documents for the compliance options are available on the remediation standards webpage (https://www.nj.gov/dep/srp/guidance/rs/).

139. COMMENT: It is reasonable to have a site where historic soil sampling exceeds the proposed migration to ground water soil remediation standard, while the ground water is nearing remediation standards. Will the Department mandate additional sampling to confirm the Contaminants of Concern in soil are below the migration to ground water standard? (6 and 8)

RESPONSE: Whether the Department will require additional sampling depends on what is being done regarding the migration to ground water exposure pathway, which option is being used, and whether ARS are being used. When the Seasonal Soil Compartment Model/Analytical Transient 1-,2-,3-Dimensional Model option is employed, resampling the soil is not necessary if ground water concentrations have dropped below the ground water remediation standards by the end of the ground water classification exception area time period. Resampling of soil is also not necessary when sites with contaminated ground water qualify for the volatile or semi-volatile capping compliance options and the cap is left in place. Another compliance option “Volatile Organic Contamination including methyl tertiary butyl ether (MTBE) and tertiary butyl alcohol (TBA) derived from discharges of Petroleum Mixtures” also does not require soil resampling. The compliance options are beyond the scope of this rulemaking, but guidance documents pertaining to their use may be found at https://www.nj.gov/dep/srp/guidance/rs/.

140. COMMENT: How will non-potable ground water designations, such as Class B and Class C standards, integrate into site-specific migration to ground water and leachate soil standards? The Ground Water Quality Standards, N.J.A.C. 7:9C, allow the designation of non-potable water

use areas, including Class B and Class C designations. The Department has not promulgated standards for these classes of ground water, despite many areas of naturally degraded water quality. The Department basis and background or a specific policy document should be issued prior to approval of the proposed amendments to assist in evaluating reasonable and technically justifiable ground water conditions, such as natural background degradation, regional impacts, excessive ground water depths, or many other conditions. (6 and 8)

RESPONSE: There are no Class B or Class C ground water standards. The Department interprets this comment as relating to Class IIIA and Class IIIB ground water standards. Class IIIA and Class IIIB ground water have narrative standards, which may require the development of site-specific ground water quality standards. This, in turn, may require the development of ARS for soil or soil leachate.

The determination of Class IIIA and IIIB ground water areas is part of the Ground Water Quality Standards, N.J.A.C. 7:9C. Therefore, this issue is beyond the scope of this rulemaking.

141. COMMENT: The Department has chosen to promulgate migration to ground water standards based on application of the soil water partition equation, previously identified as a means to estimate screening levels for this pathway by the USEPA in the Soil Screening Guidance (USEPA, 1996). The soil-water partition equation applies a range of simplifying assumptions to the migration of infiltrating rainwater and its interaction with chemicals in the vadose zone to derive a soil concentration that will not exceed a specified ground water remediation standard. As a screening level (the current regulatory compliance mechanism), this

evaluation is useful to determine where additional investigation may be necessary, including the development of site-specific criteria where a complete migration to ground water pathway appears to exist. However, application of the soil-water partition equation to develop remediation standards is not appropriate for most contaminated sites and its application in this context is unsupported. (4)

142. COMMENT: There is a range of assumptions implicit in application of the soil-water partition equation that is not representative of most contaminated sites; for example: (1) the soil-water partition equation assumes an infinite source, which rarely occurs in the field due to the typically defined nature of a release or spill, the effects of natural processes (volatilization, biodegradation, etc.) and direct human interaction (spill response, interim remedial measures, etc.); (2) the model assumes that contaminants are uniformly distributed throughout the zone of contamination and that this zone extends from the surface to the water table; and (3) there is no chemical or biological degradation in the unsaturated zone. These conditions are not representative of the majority of sites/areas of concern, as has been documented by the results of decades of vertical contaminant delineation in soils associated with numerous remedial investigations. (4)

143. COMMENT: The USEPA has identified mass-balance violations for soluble contaminants (for example, volatile organic compounds) and small sources with use of the soil-water partition equation and provided alternative models to more accurately evaluate (that is, limit) the amount of contamination migrating from soil to ground water to the total amount of contaminant present in the source. These same limitations were also clearly articulated by the

Department's Science Advisory Board (Final Report: Response to Charge Questions on the Impact to Ground Water Soil Remediation Standards Guidance, October 20, 2011), which identified options to improve the process for development of migration to ground water (including addressing the infinite source and mass-balance issues). (4)

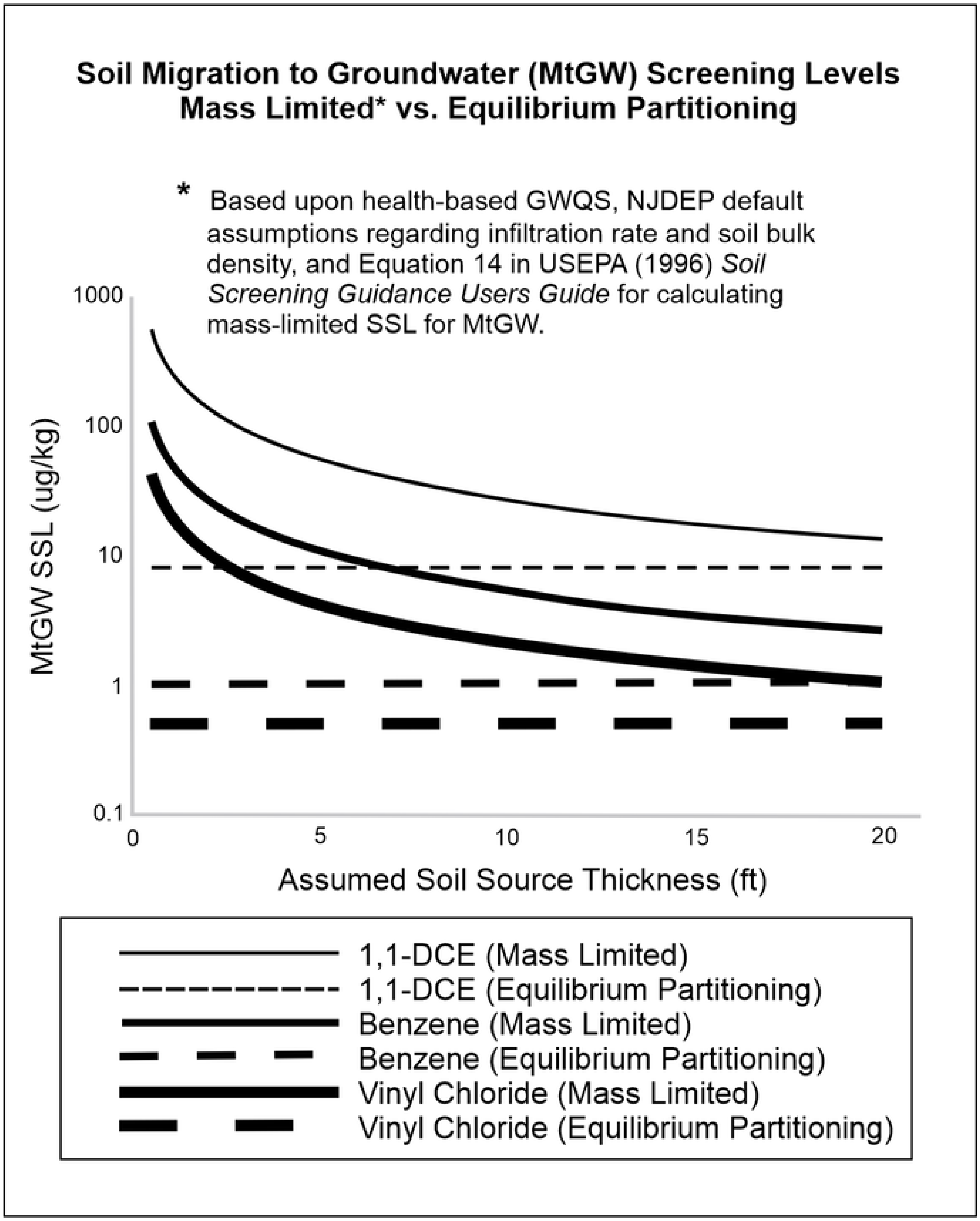
144. COMMENT: As a result of the general limitations of the soil-water partition equation to represent real-world site conditions (due to simplifying assumptions and mass-balance deficiencies), default migration to ground water criteria are typically overly conservative and result in the need for development of site-specific ARS at the majority of sites. While development of ARS (for example, SPLP analysis, modeling) is appropriate in many cases, the commenter does not believe that this process should essentially represent the default regulatory compliance mechanism. Again, the issue lies with the inherent limitations of the soil-water partition equation, and its inability to accommodate fundamental, site-specific data regarding the mass of contamination present. (4)

145. COMMENT: To address the infinite source mass-balance violations for soluble contaminants and small sources, the USEPA developed mass-limit models in the Soil Screening Guidance (USEPA, 1996) to limit the amount of contaminant migrating from soil to ground water to the total amount of contaminant in the source. Similar to the soil-water partition equation, the mass-limit model is easy to develop and implement and requires only simple algebraic equations and input parameters to calculate soil migration to ground water criteria. Significantly, one site-specific parameter is necessary to apply the model: source depth (or the thickness of the contaminated zone). Source depth (vertical delineation) is required as part of

every remedial investigation pursuant to the Technical Rules, N.J.A.C. 7:26E. As a result, all available information necessary to evaluate the migration to ground water pathway with the mass-limit model is readily available for every contaminated site once the Remedial Investigation phase is complete. (4)

146. COMMENT: A series of analyses was performed to compare the results of mass-limit model application to default output from the soil-water partition equation. An example is provided below for several volatile organic compounds (1,1-DCE, benzene and vinyl chloride). The results of mass-limit application are indicated as solid lines, which vary with the thickness of the source contaminant zone. The results of soil-water partition equation application are indicated as dashed lines (equilibrium partitioning), which are fixed at the compound-specific concentration.

As indicated, source areas of limited thickness result in higher migration to ground water criteria concentrations, and thicker source areas result in lower concentrations, with the results of the mass-limit model incrementally approaching soil-water partition equation criteria with greater thickness. This clearly represents real-world field experience: less contaminant mass will result in a lower potential for migration to ground water, which will, therefore, allow for a higher soil migration to ground water soil concentration. Note that in a number of cases, the mass-limit criterion would not fully reach the soil-water partition equation estimated concentration due to the mass-balance violations of the latter (estimated to be about 25 percent of the USEPA Soil Screening Guidance chemicals (that is, nearly all volatile organic compounds), as reported by the USEPA).



Soil Migration to Groundwater (MtGW) Screening Levels
Mass Limited* vs. Equilibrium Partitioning

* Based upon health-based GWQS, NJDEP default assumptions regarding infiltration rate and soil bulk density, and Equation 14 in USEPA (1996) *Soil Screening Guidance Users Guide* for calculating mass-limited SSL for MtGW.

The range of migration to ground water criteria concentrations estimated by the mass-limit model (within one to two orders of magnitude of the default soil-water partition equation criteria) are well within the range typically estimated by Department ARS options available to the investigator (for example SPLP, SESOIL/AT123-D). They are therefore clearly representative and require no site-specific information other than what is typically necessary for completion of a Remedial Investigation. No additional soil sampling, soil or vapor laboratory analysis, or specialized modeling efforts are necessary. (4)

147. COMMENT: When site-specific conditions are considered, a range of protective remediation standards can be calculated while ensuring protectiveness of human health and the environment. While use of the mass-limit model approach (in lieu of the soil-water partition equation) would result in a shift in the regulatory compliance paradigm away from what is currently proposed, the default migration to ground water standards would not need to be promulgated. Rather, a simple, site-specific, and easily implemented calculation would be provided for application at all sites upon completion of delineation as required in the Remedial Investigation. The results of mass-limit model application would be documented in the remedial phase report, representing the site-specific migration to ground water standard for the site or area of concern. In this context, existing soil-water partition equation guidance (and screening levels) would continue to be applied by the investigator to define the vertical limits (thickness) of the contaminant source zones to be evaluated using the mass-limit model. As is the case currently, and as proposed, the investigator would continue to have the opportunity to apply any of the Department’s technical guidance options to develop an ARS, independent of

the model results. Should the Department not accept this recommendation, the mass-limit approach should be available as an ARS option under proposed N.J.A.C. 7:26D Appendix 8 for use by the LSRP in accordance with the professional judgment that is allowed under the SRRA, as long as it is presented with the appropriate technical and scientific rationale and is demonstrated to be protective of public health and the environment. (4)

148. COMMENT: The soil-water partition equation assumes an infinite contaminant source that is never depleted. This is an extreme assumption. Use of site-specific data collected over time or information from the literature should be allowed to be used, to estimate depletion of the source, especially for recent releases. (16)

RESPONSE TO COMMENTS 141 THROUGH 148: The Department is promulgating soil remediation standards for the migration to ground water exposure pathway. This is no different than promulgating standards for the ingestion-dermal or inhalation exposure pathways, which incorporate default assumptions, in order to provide standards that require no site-specific information other than contaminant concentrations. Promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost. For the migration to ground water exposure pathway, ARS may be calculated using many site-specific parameters, as described in the Department's Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway.

The soil water partition equation in the USEPA Soil Screening Guidance document does not incorporate the assumption of an infinite source. This would imply infinite dimensions of the contamination source and/or a source that does not decrease with time. The soil water partition equation includes only a finite length of source parallel to the area of concern (100 feet). While the standards are protective of a scenario in which a uniform concentration of contaminant extends from the soil surface to the water table, there is no parameter in the soil-water partition equation that represents the vertical extent of contamination, or the location of the contamination. There is no assumption made regarding contaminant degradation or depletion over time, because there is no time parameter in the equation that could be set to an unlimited value. There is no mass-balance violation in the soil water partition equation, because this equation is a concentration-based equation, not a mass-based or time-based equation. The Department regulates contaminants on a concentration basis, not on a mass basis.

The mass-limit model is incompatible with Department rules and policies regarding the protection of ground water. The Department regulates contaminants on a concentration basis, not on a mass basis. The relevant endpoint of concern for the migration to ground water exposure pathway is the ground water. Ground water remediation standards are not adjusted for the mass of contaminant in the ground water, a reduction of the contamination source that may occur over time due to depletion or degradation, or the location of contamination relative to a potential receptor. When using the soil water partition equation, the Department is not assuming the source to be infinite, or that it will remain constant over time. It is simply comparing the concentration determined from the soil water partition equation with the concentration measured in the soil, in order to assess whether the contamination is a potential threat to ground water quality at any point in time. The mass limit model proposed by the commenter averages ground water concentrations over time in order to demonstrate compliance with the Ground Water Remediation Standards, N.J.A.C. 7:26D-2, which conflicts with ground water rules. Earlier time points may result in exceedances of the Ground Water Remediation Standards, which are balanced at later time points with ground water concentrations below the Ground Water Remediation Standards. The proposed mass-limit model does not predict the specific time period when the ground water concentration exceeds the Ground Water Remediation Standards. It only predicts that the ground water concentrations, when averaged over a long period of time (for example 70 years), do not exceed the Ground Water Remediation Standards. The Department requires that when remediation is complete, the concentrations of contaminants in ground water are below the Ground Water Remediation Standards at all times, not when averaged over a longer time period.

The default criteria are not overly conservative. They are adequately protective for sites in which no site-specific information is available other than the concentrations of contaminants. When additional site-specific information is available, the Department recommends using ARS options, which allow for the use of additional site-specific parameters.

The standards the Department proposed for the migration to ground water exposure pathway require no site-specific information, other than the concentration of a contaminant in soil. This is no different from the standards promulgated by the Department for other exposure pathways, such as ingestion-dermal and inhalation. The migration to ground water soil remediation standards (default) standards may be used, but if the investigator wishes to spend additional time or financial resources to collect site-specific information, such as the depth or thickness of the contaminant source, this information may be used to develop ARS as per the options presented in the Department's Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway.

The potential for a contaminant to migrate to ground water is a function of chemical properties, soil properties, and the contaminant concentration in soil. The mass of contaminant in the soil relates to the amount of contamination that may reach the ground water, not the potential for it to reach the ground water.

When calculating a site-specific ARS, the most recent available sampling data available may be used, if it replaces data collected at the same location at an earlier time point. Therefore, site-specific data collected over time may be taken into account. Regarding recent releases, initial site investigation often occurs well after the time of discharge and will indicate the current concentrations of contaminants on site.

Discussion of a change in the regulatory compliance paradigm is beyond the scope of this rulemaking.

149. COMMENT: The Technical Requirements, N.J.A.C. 7:26E, include directives for when all the listed environmental media should be sampled, except for soil leachate. As such, soil leachate standards should not be included in the Remediation Standards, N.J.A.C. 7:26D, except

possibly in an appendix for developing site-specific standards for the migration to ground water pathway. (2)

150. COMMENT: It is unclear why soil leachate standards are needed, as the Department SPLP calculator takes the leachate criterion into account. (2)

RESPONSE TO COMMENTS 149 AND 150: A soil leachate sample is not an environmental media sample; rather, it is an aqueous sample generated from a soil sample when conducting the SPLP test. Therefore, the Department's directives for sampling environmental media do not apply to soil leachate standards. Sampling is not required for the SPLP test; however, this test is often implemented in the early stages of site investigation and is an alternative procedure for determining compliance with the migration to ground water exposure pathway. For this reason, the Department is adopting soil leachate remediation standards.

Promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost. This is beneficial for the regulated community. Additionally, standards are more enforceable than criteria. The soil leachate remediation standards are derived from the Ground Water Remediation Standards, at N.J.A.C. 7:26D-2, which are also enforceable. The soil remediation leachate standards are adjusted from the Ground Water Remediation Standards by applying the dilution-attenuation factor of 20.

151. COMMENT: Currently soil concentrations that are below the default impact to ground water screening levels are considered compliant for the impact to ground water pathway. If the concentration exceeded the default impact to ground water screening levels, then the SPLP could be applied, and the leachate concentration used to develop a site-specific impact to ground water soil remediation standard to demonstrate compliance. With the proposed codified migration to ground water soil and soil leachate standards, will soil samples need to meet both standards, or is it implied that a soil sample concentration must meet one or the other? Clarification is needed on how the promulgation of both standards is to be applied at sites. (15)

RESPONSE: The soil and soil leachate remediation standards for the migration to ground water exposure pathways are used in the same manner that the Department has used the impact to ground water soil criteria and soil leachate criteria for several years. The adopted rules do not change the applicable procedures. In this sense, these standards are simply a change in the name of the exposure pathway. Either standard can be used to show compliance with the migration to ground water exposure pathway.

152. COMMENT: If chemicals in ground water exceed the ground water quality standards, will the Department mandate sampling for the soil leachate remediation standard? (6 and 8)

153. COMMENT: Will supplemental soil sampling for the soil leachate remediation standard be mandated by the Department, based on a statistical measure of ground water quality? (6 and 8)

154. COMMENT: Will the Department require soil leachate samples at all sites? At older sites only? At no current sites? (6 and 8)

RESPONSE TO COMMENTS 152, 153, AND 154: The Department does not require additional soil sampling in order to measure soil leachate concentrations to compare to the soil leachate remediation standards. Any supplemental soil sampling, if undertaken, is not triggered or based on ground water quality data. The migration ground water exposure pathway is used to protect against potential future contamination of ground water from a soil contamination source, and it does not necessarily relate to the current state of ground water contamination. Sampling to measure soil leachate concentrations is conducted at the discretion of the LSRP, when the LSRP decides to use the SPLP test. Soil leachate standards are used in conjunction with the SPLP option.

155. COMMENT: What actions will the Department require if the soil leachate concentrations are below the remediation standards, but ground water quality remains above standards? (6 and 8)

156. COMMENT: How will site-specific ground water quality data integrate with the soil leachate remediation standard? (6 and 8)

RESPONSE TO COMMENTS 155 AND 156: There is no direct connection between these two parameters, as far as action that the Department would take. The migration to ground water exposure pathway deals with soil that could potentially be a future source of ground water contamination. Soil leachate concentrations are used to develop ARS for the migration to ground water exposure pathway using the SPLP. Remediation of ground water is a separate issue.

157. COMMENT: The existing Department guidance document demands the maximum soil concentration undergo SPLP testing or be remediated. In other words, the maximum soil sample must be submitted for SPLP sampling and no linear projection of SPLP results are allowed. Will the Department maintain this policy for the soil leachate remediation standard? (6 and 8)

RESPONSE: The Department does not require the maximum contaminant concentrations in soil be tested through SPLP in all cases. However, since an ARS for the migration to ground water exposure pathway developed using the SPLP procedure cannot be higher than the maximum contaminant concentration in soil that is tested, the Department recommends including the highest concentration sample if the investigator is using the SPLP option to develop a site-specific migration to ground water ARS, in order to potentially avoid remediation of soil at that concentration. Extrapolation of SPLP results to concentrations higher than those tested is not allowed because the capacity of a soil to adsorb contaminant may be exceeded at concentrations higher than those tested through SPLP. Soil leachate samples are generated in the SPLP test using the selected soil samples that the LSRP decides to submit to the procedure.

Indoor Air Remediation Standards for the Vapor Intrusion Exposure Pathway, N.J.A.C. 7:26D-5

158. COMMENT: The proposed rules would weaken controversial vapor intrusion standards that were weakened by the Christie Administration and already are not protective. (13)

RESPONSE: The adopted rules do not weaken public health protections for vapor intrusion, but codify what has been the practice for several years; the remediation of sites has included the evaluation of indoor air contamination as a result of vapor intrusion since 2005. The difference is that the Department guidance the regulated community followed is now codified. To the extent that the comment refers to the adopted rules' allowance of site-specific or area-of-concern-specific standards based on parameter values specific to a site or area of concern, the Department allowed such standards prior to this rulemaking.

Promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost. It also ensures that the potential for harm to public health and safety and to the environment is minimized to acceptable levels, pursuant to the Brownfield Act, at N.J.S.A. 58:10B-12a.

Both the former indoor air screening levels and the new indoor air remediation standards contained in the Remediation Standards, N.J.A.C. 7:26D, are based on the requirements for the development of remediation standards as contained in the Brownfield Act, at N.J.S.A. 58:10B-12. The Department's promulgation of these screening levels as standards meets the requirements contained in the Brownfield Act. Relative to Brownfield Act requirements, the screening levels are protective of human health and the environment, and the promulgated remediation standards are protective of human health and the environment.

For that reason, there is no need for the Department to increase the protectiveness of the promulgated indoor air remediation standards.

159. COMMENT: The Department should reconsider the designation of indoor air standards for vapor intrusion-related investigations. As was pointed out during the Department's stakeholder meetings in 2014, there were no regulatory agencies at the time that used standards in place of screening levels. That is still the case. The USEPA, the Department of Defense, the Interstate Technology & Regulatory Council, and states that have vapor intrusion regulations all use the screening levels approach. The reason is that good science supports the use of a multiple lines of evidence approach to evaluate the vapor intrusion pathway. A single measurement in indoor air cannot be used for compliance evaluation in the way that measurements in soil or ground water are used. The measurement of low concentrations of compounds of concern in indoor air (many of the proposed standards are set at or near the analytical reporting level) are complicated by a number of factors, including background concentrations in both indoor and ambient air, air pressure and other weather conditions, the operation of HVAC systems, and other factors that contribute to the inherent variability of these measurements. The multiple lines of evidence approach allow the investigator to account for these factors.

The Department’s existing regulatory approach for the evaluation of the vapor intrusion pathway is protective of human health and the environment in the same manner as the policies of the regulatory agencies cited above. The measured compounds of concern in indoor air are compared to screening levels and when concentrations exceed thresholds, the Department's requirements for vapor concerns and immediate environmental concerns are followed. (4)

RESPONSE: The Department's purpose for adopting the indoor air remediation standards is to codify the indoor air levels to be used in the evaluation and remediation of the vapor intrusion exposure pathway at contaminated sites. See 52 N.J.R. at 567. Promulgating screening levels into remediation standards does not change how sites are evaluated and remediated for the vapor intrusion exposure pathway. Prior to the adopted rules, when the indoor air remediation standards were screening levels, an investigator would gather and evaluate existing sampling results or data to determine whether the vapor intrusion exposure pathway was complete. With this rule making, the tasks of the investigator do not change, except that results and data are now compared to an indoor air remediation standard instead of a screening level.

Adopted N.J.A.C. 7:26D-5, Indoor air remediation standards, provides that the residential and nonresidential indoor air remediation standards be used as default standards for the vapor intrusion pathway. Vapor intrusion screening levels, including ground water screening levels, soil gas screening levels, and indoor air rapid action levels are applied in the evaluation of a site or area of concern, consistent with the Technical Requirements at N.J.A.C. 7:26E-1.15.

The multiple lines of evidence approach referenced by the commenter is still to be utilized when investigating whether a vapor intrusion pathway from the regulated discharge to a potentially exposed person is complete. Unlike the single line of evidence approach (analytical results of the sample) used for soil and ground water, a multiple lines of evidence approach is appropriate when assessing the vapor intrusion pathway.

160. COMMENT: The use of the term “standard” in place of “screening level” will change the public perception of the meaning of a measured indoor air concentration. The exceedance of a screening level implies that additional testing and perhaps mitigation is required. The exceedance of a standard implies that there has been an adverse health effect. For these reasons, the Department should continue to use screening levels for indoor air and not remediation standards. (4)

RESPONSE: The Department does not anticipate that the use of the term “standard” in place of “screening level” will change the public perception of the meaning of a measured indoor air concentration. As stated in the notice of proposal Summary and in the Response to Comment 159, the Department’s purpose in adopting the indoor air remediation standards is to codify the indoor air levels to be used in the evaluation and remediation of the vapor intrusion pathway at contaminated sites. Both the former indoor air screening levels and the new indoor air remediation standards are based on the higher of the contaminants’ indoor air human health-based criteria and the contaminants’ analytical reporting limits. The process and methods used in a proper vapor intrusion investigation are not changing, as described in the Department’s Vapor Intrusion Technical Guidance.

161. COMMENT: The Department fails to identify the specific legal authority for indoor air remediation standards. (3)

162. COMMENT: The Department proposes to establish indoor air remediation standards, so that it may regulate indoor air as it does soil, surface water, and ground water. While the Department appears to be limiting the scope of its jurisdiction to vapor intrusion only (that is, a condition caused by a discharge into the ground water), it is a significant expansion because indoor air is not within the scope of the Department's authority to regulate by way of remediation standards. In particular, the Brownfield Act gives the Department the authority to adopt residential and nonresidential remediation standards for soil, ground water standards, and surface water standards, but nothing else. (1)

163. COMMENT: While the Department has been operating for years with indoor air screening levels that have been applied like standards, and the regulated community has gone along with it for all these years, it does not work to expand the Department's authority in this area. There is a substantial practical and legal distinction between a screening level and a standard. Even to the extent there is no significant difference in practice, the mere fact that screening levels were not legally challenged does not give the Department greater authority to promulgate indoor air remediation standards. (1)

164. COMMENT: The Department fails to identify the specific legal authority under which the adoption of new indoor air remediation standards is authorized. The notice of proposal references four statutes (that is, 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.) as the alleged sources of the Department's authority, but none of

these statutes grant the Department the specific authority to establish indoor air remediation standards. For example, the Brownfield Act, N.J.S.A. 58:10B-1 et seq., grants express statutory authority to the Department to "adopt minimum remediation standards for soil, ground water, and surface water quality necessary for the remediation of contamination of real property." See N.J.S.A. 58:10B-12(a). This statutory provision further requires the Department to "develop minimum remediation standards for soil, ground water, and surface water intended to be protective of public health and safety taking into account the provisions of this section."

The Department has promulgated soil, ground water, and surface water standards. See Remediation Standards, N.J.A.C. 7:26D. The terms "ground water" and "surface water" are defined, but nothing in these definitions pertain to vapor or indoor air. See N.J.A.C. 7:26D-1.5, Definitions. The term "soil" is not defined in either the Brownfield Act or in the existing Remediation Standards, N.J.A.C. 7:26D. However, the plain meaning of the term "soil" is "the upper layer of earth that may be dug or plowed and in which plants grow" and "the superficial unconsolidated and usually weathered part of the mantle of a planet and especially of the earth." See Merriam-Webster Dictionary, 2020 (definition of "soil"). Similar to "ground water" and "surface water," the term "soil" does not include vapor or indoor air. Nothing in the Brownfield Act grants the Department the express regulatory authority to promulgate indoor air remediation standards, and a search of the other statutes cited by the Department also did not find any express authority. Consequently, the Department is unduly expanding its authority to regulate indoor air.

It should be highlighted that there are statutes and regulations in place that already regulate indoor air. For example, the New Jersey Department of Health regulates indoor air through multiple regulations, including government worker safety and childcare facilities. Further, the Occupational Safety and Health Act regulates indoor air exposure for employees at private companies in New Jersey. Considering there are existing provisions in place to protect exposure to contaminants in indoor air, it is unclear why the Department feels compelled to unduly expand its authority to promulgate indoor air remediation standards, particularly when the proposed amendments lack justification or quantification of a reduction of risk to public health or the environment. (6 and 8)

RESPONSE TO COMMENTS 161, 162, 163, AND 164: The Brownfield Act, N.J.S.A. 58:10B-1 et seq., gives the Department the authority to adopt indoor air standards when those standards are related to the remediation of migrating hazardous substances in the soil, ground water, or surface water. Although the Brownfield Act does not explicitly give the Department the authority to regulate indoor quality, the promulgation of indoor air remediation standards for the vapor intrusion exposure pathway is consistent with the overall purposes of the Brownfield Act, which requires the Department to develop remediation standards for soil, ground water, or surface water quality. The adopted indoor air standards are designed to protect the public from risks posed by contaminated sites through the vapor intrusion exposure pathway and to eliminate exposure to hazardous substances from emanating from contaminated soil, ground water, or surface water. Promulgated standards ensure predictability and certainty for remediation goals, negating the regulated community's need to develop individual site-specific standards for each contaminant, which would require additional time and cost.

The Department is aware that the New Jersey Department of Health has adopted rules that include maximum indoor air contaminant levels used to determine whether a childcare center or school requires evacuation due to indoor vapors. The Department has coordinated with the Department of Health regarding indoor air, and the agencies recognize that facilities subject to Department of Health indoor air rules may also be subject to Department rules concerning indoor air remediation standards.

The Department is also aware of the issues concerning facilities subject to Occupational Safety and Health Act (OSHA) regulations. These issues are discussed in the Department’s Vapor Intrusion Technical Guidance document, which is available at https://www.nj.gov/dep/srp/guidance/vaporintrusion/.

165. COMMENT: Indoor air remediation standards below anticipated background concentrations will mandate forensic and background air evaluations. The very low concentrations proposed for the indoor air remediation standards will substantially increase the complexity and cost for vapor intrusion investigations. The proposed amendments establish the laboratory reporting limits for 10 volatile organic compounds as the indoor standards. Any detection of these compounds will be an exceedance of the indoor air standards. These “exceedances” will require further investigation as per the Department's Vapor Intrusion Technical Guidance, potentially requiring supplemental sampling, investigation activities, or

potential mitigation activities. As of August 3, 2020, the Department has not issued the revised Vapor Intrusion Technical Guidance for comments to the regulated community.

The detection of volatile organic compounds in indoor air samples from common chemicals and anthropogenic sources is well documented by many researchers, including the Department. Specifically, relevant is the 2016 Department publication "Background Levels of Volatile Organic Chemicals in Homes: A Review of Recent Literature." The Department publication identified 44 volatile organic compounds as commonly found in many New Jersey homes, including seven volatile organic compounds, for which the proposed amendments establish standards that are equal to the laboratory reporting limits.

The Department publication recognized that benzene and ethylbenzene were frequently detected in New Jersey homes above the proposed indoor air standards. A rounded value of one ug/m3 (of ethylbenzene) is appropriate as the median background concentration in New Jersey homes. The proposed indoor air remediation standard for ethylbenzene is 1.1 ug/m3; therefore, the Department has documented that approximately half of the homes tested will identify an exceedance of the indoor air remediation standard. See Background Levels of Volatile Organic Compounds in Homes: A Review of Recent Literature (https://www.nj.gov/dep/srp/guidance/vaporintrusion/vig_background_levels_of_vos.pdf). In simple terms, the Department publication predicts air samples collected from many homes will most probably exceed the proposed indoor air remediation standards for benzene, ethylbenzene, and potentially other compounds simply through normal residential activities. If these same homes are re-sampled, supplemental detections and exceedances are also probable. The person responsible for conducting the remediation will be prompted to document all conditions within each residence to assess the possible sources of the volatile organic contaminants and contributions of background sources, including an intrusive inspection of the residential space. The residents' lives will be disrupted by the inconvenience involved with the relocation of chemicals, modification of HVAC systems, scheduling and coordination of in-home sampling, completion of personal interviews to understand chemical use in and around their homes, and several other side effects.

There are many other studies of indoor air quality and vapor intrusion. Haley and Aldrich's most recent 2013 through 2015 study (by Rich Rago) of indoor air background of 84 non-residential buildings (including 25 school building samples and 59 office building samples) was conducted in 18 states with no known/suspected contaminated sites on or nearby identified sampling locations. This indoor study completed by Haley and Aldrich exemplifies the issues of unnecessarily low indoor air remediation standards for benzene, as well as petroleum compounds.

Ninety-six percent of the schools sampled in the Haley and Aldrich study detected benzene, with the median concentration of 0.671 micrograms per cubic meter (µg/m3) above the proposed indoor air remediation standard of 0.64 µg/m3, which is also the detection limit for the laboratory analysis. Benzene was detected in 91 percent of residential samples, as well as 93 percent of offices. Based on the proposed indoor air remediation standard, each of these detections would be an exceedance of the proposed remediation standard for benzene in indoor air.

All (100 percent) of the schools sampled in the Haley and Aldrich study detected ethylbenzene, with the median concentration of 0.321 µg/m3, just below the normal detection limit of 0.87 µg/m3. Ethylbenzene was detected in 86 percent of residential samples, as well as 100 percent of offices.

All (100 percent) of the schools sampled in the Haley and Aldrich study detected toluene, with the median concentration of 2.35 µg/m3, above the normal detection limit of 0.75 µg/m3. Toluene was detected in 96 percent of residential samples, as well as 100 percent of offices.

All (100 percent) of the schools sampled in the Haley and Aldrich study detected xylenes, with the median concentration of 0.786 µg/m3, very near the normal detection limit of 0.87 µg/m3. Xylenes were detected in 93 percent of residential samples, as well as 100 percent of offices.

In addition, once a remediation standard is exceeded, the person responsible for conducting the remediation and the LSRP will be required to determine the source of the chemicals in the indoor air and document the source is not from a vapor intrusion pathway. Under the current screening levels, a reasonable line-of-evidence evaluation is sufficient to document the subsurface is not the source of an indoor air screening criteria exceedance. Based on the benzene detections in indoor air studies, almost every home (93 percent), every school (96 percent), and every office (93 percent) will require multiple indoor air samples causing substantial psychological hardship on residents, students, and office workers across New Jersey.

Based on the frequency of volatile organic compound detections in indoor air and the very low proposed indoor air standards, it is unreasonable to believe the Department's position that the proposed indoor air standards will have no economic effect on the regulated community. An expensive, technically elaborate, legally defendable evaluation of an exceedance of an indoor air remediation standard will become routine upon promulgation of the standards (see benzene detection statistics above).

The Department's desire to establish "enforceable, codified remediation standards" that are easily enforceable recognizes the technical difficulty with establishing a clear, enforceable, and unquestioned forensic pathway for indoor air samples. The Department should build upon their experience and knowledge working to "enforce actions against recalcitrant parties" within the required economic evaluation. (3, 6, and 8)

RESPONSE: The Department addresses background concentrations in indoor air in guidance and regulations. The Brownfield Act, at N.J.S.A. 58:10B-12.g(4), addresses "regional natural background." The Brownfield Act mandates that "[r]emediation shall not be required beyond the regional natural background levels for any particular contaminant." See 52 N.J.R. at 576. The Brownfield Act, at N.J.S.A. 58:10B-12g(4), and the Remediation Standards, at N.J.A.C. 7:26D-1.5, define "regional natural background." Both definitions include the phrase "not been influenced by localized human activities." Accordingly, the Department does not consider contamination as a result of localized human activities to be part of regional natural background.

Background air evaluations are beyond the scope of the Remediation Standards, N.J.A.C. 7:26D. Background air evaluations are a part of a vapor intrusion investigation that is iterative in nature, as discussed in the Department's Vapor Intrusion Technical Guidance document, at https://www.nj.gov/dep/srp/guidance/vaporintrusion /. The Department recognizes that the effects of background sources on the overall indoor air quality can complicate a vapor intrusion investigation. As discussed in the Response to Comments 166 and 167, the Department's Site Remediation and Waste Management Program does not have the regulatory authority to address indoor air concentrations of benzene that are attributable to the use of consumer and building products, but it does have the authority and the legal responsibility to address indoor air concentrations of benzene that are associated with a known discharge in soil or ground water. Therefore, indoor air sampling to assess whether the vapor intrusion exposure pathway is complete, is typically the last step in the evaluation of the vapor intrusion pathway, and is only required if there is an exceedance of soil gas screening levels, or if other conditions found at N.J.A.C. 7:26E-1.15(a) are met. The term "background sources" refers to any contaminants not directly resulting from subsurface vapor intrusion and related to a regulated discharge. To aid in the identification of background sources, a list of common background indoor air sources can be found in the Department's Vapor Intrusion Technical Guidance document.

Contaminants associated with background sources, such as smoking and dry-cleaned clothes, can impact the results of a vapor intrusion investigation if not removed prior to conducting the indoor air sampling, as part of the vapor intrusion sampling event, which includes the collection of ambient air, soil gas air, and indoor air samples. In addition, when background sources of indoor air contamination are identified and removed from a building, the rooms affected should be ventilated in advance of the sampling event to minimize the potential interferences from background sources. Termination of this ventilation should end at least 24 hours before commencement of the indoor air sampling event to allow ventilation to return to normal operating conditions. In accordance with the Department's Vapor Intrusion Technical Guidance document, and pursuant to the Technical Rules, at N.J.A.C. 7:26E-1.15(c), the initial round of the vapor intrusion investigation shall be completed within 150 days after determining the need to conduct the investigation. As part of the initial vapor intrusion sampling round, the investigator shall conduct the following: investigate the vapor intrusion pathway, evaluate the results of the vapor intrusion investigation using the multiple lines of evidence approach, and determine if the vapor intrusion pathway is complete for each building being investigated. Concurrent with the vapor intrusion investigation, delineation of the ground water contamination should be implemented and up-to-date. If the vapor intrusion trigger is not ground water contamination, then the source may be soil, soil gas contamination, or vapor cloud, which needs identification to properly delineate the source. The Department believes it is appropriate to utilize the multiple lines of evidence approach in all phases of a vapor intrusion investigation, consistent with the Technical Rules, N.J.A.C. 7:26E.

Ten contaminants have residential indoor air remediation standards set at the analytical reporting limit and two contaminants have nonresidential indoor air remediation standards set at the analytical reporting limit. The basis for the establishment of indoor air remediation standards at the reporting limit for the affected contaminants is because the calculated human health-based criteria are below the analytical reporting limits and are unable to be reliably quantified. Using the greater of the health-based criterion or analytical reporting limit is the procedure the Department uses to set the Department's remediation standards, whether they are for soil, indoor air, or ground water.

In its publication, Background levels of Volatile Organic Compounds in Homes: A Review of Recent Literature, https://www.nj.gov/dep/srp/guidance/vaporintrusion /, the Department evaluated the indoor air analytical results for 49 contaminants at over 800 residences. Comparison of the data presented in the publication with the Department's proposed residential indoor air remediation standards demonstrated that of the 49 contaminants evaluated, only benzene and ethylbenzene had representative median and/or 90th percentile background indoor air concentrations above the Department's proposed residential indoor air remediation standards. The Department recognizes that background source contributions can confound the interpretation of indoor air analytical results; the Department has provided the above-referenced publication to assist in proper remedial decision making, to provide an additional line of evidence for evaluating indoor air concentrations in residences. The representative median indoor air concentrations provided at Table G-4 of the Department's Background levels of Volatile Organic Compounds in Homes: A Review of Recent Literature may be used as a line of evidence in evaluating the analytical results. However, under no circumstances should those representative median indoor air concentrations be "subtracted" from the analytical results to determine an exceedance of the indoor air remediation standards.

The Haley and Aldrich study examined the indoor air background concentrations at schools and office buildings for 11 common vapor intrusion contaminants. Four of the 11 contaminants (benzene, carbon tetrachloride, naphthalene, and trichloroethylene) evaluated in the study have residential indoor air remediation standards set at the analytical reporting limit, and one contaminant (naphthalene) has a nonresidential indoor air remediation standard set at the analytical reporting limit. Comparison of the indoor air data to the Department's indoor air remediation standards revealed that, for the nonresidential exposure pathway, the proposed nonresidential indoor air remediation standards for all 11 contaminants were well above the 90th percentile of background indoor air concentrations detected in the Haley and Aldrich study. Therefore, the Department anticipates that background indoor air investigations for the nonresidential exposure scenario will not mandate additional forensic and background air evaluations. For schools (residential exposure scenario), all contaminants, except benzene, had 90th percentile of background indoor air concentrations below the residential indoor air standards. The indoor air remediation standard for benzene (0.64 $\mu g/m^3$) is lower than both the median (0.671 $\mu g/m^3$) and 90th percentile (0.908 $\mu g/m^3$) values detected in schools in the Haley and Aldrich study. Therefore, the Department anticipates that it is possible that further examination of site conditions using multiple lines of evidence may be required for these cases.

It is important to highlight that the studies cited in the comment did not remove background sources from the buildings. The background studies' methodology is not consistent with what the Department requires in a vapor intrusion. If the proper procedures are followed, as outlined in Departmental guidance, indoor air concentrations attributable to background sources should be much lower than what was detected in the cited background indoor air studies.

166. COMMENT: The Department's proposed indoor air standards for benzene are 0.64 micrograms per cubic meter (ug/m^3) for residential and 1.64 ug/m^3 for nonresidential scenarios. However, there are studies that have documented “background” levels of benzene in indoor air in the U.S. with mean concentrations ranging from 2.6 to 5.8 ug/m^3:

https://www.ncbi.nlm.nih.gov/books/NBK138708/#ch1.s5

https://www.state.nj.us/dep/srp/guidance/vaporintrusion/vig_background_levels_of_vos.pdf.

Establishing remediation standards that are lower than typical background levels places an unreasonable burden on the remediating party to demonstrate that the exceedances are not from background sources. (4, 10, 11, and 16)

167. COMMENT: The Department's proposed residential indoor air remediation standard for benzene is 0.64 micrograms per cubic meter, which represents the level of benzene found at background. The Department conducted a review of literature regarding indoor air background levels of volatile organic compounds in homes, including seven contemporary residential background studies, as well as thorough review conducted by the USEPA. As demonstrated in these peer review papers and documents, benzene was detected in up to 100 percent of background samples tested, including 26 percent of the values greater than the existing Department indoor air screening level of two micrograms per cubic meter. Simply stated, the Department's promulgation of an indoor air standard at a level that 100 percent of homes have

already exceed due to background sources will create confusion and a significant amount of burden for both the Department and the regulated community.

A more recent 2013 through 2015 indoor air background study of 84 nonresidential buildings included 25 school building samples and 59 office building samples collected in 18 states. In all instances, there were no known or suspected contaminated sites on or near the identified sampling locations. The study's conclusions support the theory that hydrocarbons are ubiquitous in indoor air background. Again, focusing on benzene, the compound was detected in the recent studies in 91 percent of residential samples, as well as 96 percent of schools, and 93 percent of offices. (9)

RESPONSE TO COMMENTS 166 AND 167: The Department recognizes that background source contributions cause indoor air concentrations of benzene in residences and businesses to routinely exceed the adopted indoor air remediation standard. The Vapor Intrusion Technical Guidance document, https://www.nj.gov/dep/srp/guidance/vaporintrusion/, assists investigators in the proper procedures for conducting a vapor intrusion investigation when background source interferences are of concern. Indoor air sampling to assess whether the vapor intrusion exposure pathway is complete is the last step in the evaluation of the vapor intrusion pathway, due to background concerns. The vapor intrusion investigation should be conducted only if there is an exceedance of ground water screening levels and soil gas screening levels. If there is an exceedance of the soil gas screening levels, all potential indoor sources of volatile organic compounds shall be removed from the building, and the building properly ventilated before collecting indoor air samples, to minimize background source contributions. In addition, both ambient air samples and sub-slab soil gas samples should be collected, in conjunction with the indoor air samples, to assist in the evaluation of background sources. A vapor intrusion pathway is only considered complete if a source of vapors related to a discharge is identified and a pathway is complete, connecting the source (through the soil gas concentrations) to the indoor air concentrations in a building.

The studies cited by the comments did not remove background sources from the buildings, and most of the studies required that windows remained closed during the duration of the studies to prevent the dilution of indoor air concentrations. This methodology is not consistent with what is required in a vapor intrusion investigation. If the proper procedures are followed, as outlined in Departmental guidance documents, indoor air concentrations attributable to background sources should be much lower than what was detected in the cited background indoor air studies.

As part of the multiple lines of evidence approach, it is important to evaluate the concentration gradient between the sub-slab soil gas and indoor air samples when conducting an indoor air sampling event. If concentrations are determined to be much higher in the sub-slab soil gas samples versus the indoor air samples, this line of evidence suggests that a vapor intrusion pathway may be complete; whereas, if the indoor air concentrations were higher than the sub-slab soil gas samples, it is likely that a background source is the cause of the elevated indoor air concentrations. Collection of ambient air samples provides an additional line of evidence as well, to assist in determining whether a vapor intrusion pathway is complete. If higher concentrations are detected in ambient air samples, as compared to concentrations in indoor air samples, then it is likely that background sources (such as automobile exhaust) are more likely the cause for the indoor air exceedances than vapor intrusion.

Both the USEPA and the International Agency for Research on Cancer classify benzene as a known human carcinogen. As a result of benzene's volatility, inhalation is the dominant route of exposure in humans. Chronic exposure to low level concentrations of benzene has been associated with the onset of leukemia and other adverse hemotoxic effects. Due to the known human health effects associated with exposures to benzene, it is important to reduce exposure to indoor air concentrations, wherever possible. The Department's Site Remediation and Waste Management Program does not have the regulatory authority to address indoor air concentrations of benzene that are attributable to the use of consumer and building products, but it does have the authority and the legal responsibility to address indoor air concentrations of benzene that are associated with a known discharge in soil or ground water.

Interim Remediation Standards, N.J.A.C. 7:26D-6

168. COMMENT: The interim remediation standards meet the definition of a rule pursuant to the Administrative Procedure Act, at N.J.S.A. 52:14B-2, which states, "'Administrative rule' or 'rule,' when not otherwise modified, means each agency statement of general applicability and continuing effect that implements or interprets law or policy, or describes the organization, procedure or practice requirements of any agency. The term includes the amendment or repeal of any rule, but it does not include: (1) statements concerning the internal management or discipline of any agency; (2) intra-agency and inter-agency statements; and (3) agency decisions

and findings in contested cases.” Therefore, the proposed interim remediation standards must be published for public comment prior to adoption. (10 and 11)

RESPONSE: The development of interim standards and the updating of existing standards by notice of administrative change involve two separate procedures, neither of which conflict with the Administrative Procedure Act. N.J.A.C. 7:26D-6, Interim Remediation Standards, describes the process by which an interim standard will be developed and through which the public will be notified of its development. In accordance with the Administrative Procedure Act, the Department has established the data sources, equations, and procedures for the development of remediation standards, including interim standards, in the Remediation Standards, N.J.A.C. 7:26D. These rules were afforded public comment, and the Department has provided responses to those comments as part of this rulemaking. The public is, therefore, on notice, by codification of these rules, that it is these, and only these codified data sources, equations, and procedures, that the Department will use to establish interim standards. If the Department determines that it needs to use toxicity data from an alternate source or use equations or assumptions that are different than those that are set forth in this rulemaking to develop a new interim standard, the Department will conduct formal rulemaking.

The adopted rules allow the Department to use these adopted procedures to develop a standard for a contaminant for which there is no standard listed in the applicable codified tables. The Department will publish notice of the resulting standard in the New Jersey Register, and incorporate the interim remediation standard into N.J.A.C. 7:26D through a formal rulemaking, as soon as is reasonably practicable. At that time, the interim remediation standard and its derivation will be open to public scrutiny and comment. A similar process applies to the Department's Ground Water Quality Standards, N.J.A.C. 7:9C.

169. COMMENT: There is a reason why there are no interim remediation standards for surface water. Such an egregious loophole proposed by a State would violate the Federal Clean Water Act. The USEPA would never let a state get away with that and neither should New Jersey environmental groups, media, and legislators. (13)

RESPONSE: As noted in the notice of proposal, at 52 N.J.R. 571, the Surface Water Quality Standards, N.J.A.C. 7:9B, do not provide a mechanism for establishing interim standards. As the Remediation Standards, at N.J.A.C. 7:26D-3.2, adopts the Surface Water Quality Standards as surface water remediation standards, these adopted rules, likewise, do not provide a mechanism for the development of interim surface water quality standards.

170. COMMENT: The Department proposes that the person responsible for conducting a remediation may request that the Department develop an interim remediation standard pursuant to N.J.A.C. 7:26D-6, Interim remediation standards, and shall use only a Department-developed interim remediation standard. However, when requesting that the Department develop an interim remediation standard, the person requesting this should also be allowed to provide a recommended interim standard (with the assumption that the appropriate procedures set forth in this rule are followed), which would then be subject to the Department's approval. Accordingly, the proposed text should be changed to: "… and shall

only use a Department-developed or approved interim remediation standard." This could potentially alleviate the lack of resources in the Department to expedite the process for establishing an interim remediation standard using the same hierarchy of data used to develop the Remediation Standards, N.J.A.C. 7:26D, and expedite the remediation of the site. (4 and 7)

RESPONSE: There may be situations where the person responsible for conducting the remediation or the LSRP at a site could propose an interim remediation standard concentration. Accordingly, the Department is modifying N.J.A.C. 7:26D-6.2(b) upon adoption to provide that the interim remediation standards must be Department-developed "or approved."

171. COMMENT: The Department proposes to use its website to publish all interim remediation standards developed pursuant to N.J.A.C. 7:26D, and the technical basis used in their derivation. This is not a substantive change, but does the Department intend to publish all interim standards once approved and put into use? N.J.A.C. 7:26D-6.3(a) does not specify when the Department will publish the information. Should the information be published 90 days after approval so it happens on a rolling basis or should it be tied to the final remediation document? (4)

RESPONSE: The Department will create a page accessible from the Department's Site Remediation and Waste Management Program website (https://www.nj.gov/dep/srp/) that will list all interim remediation standards and include the technical basis for the derivation of each interim remediation standard. The Department will list the interim remediation standard on the website within 90 days of its approval.

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

172. COMMENT: The Department should withdraw the proposed procedure to update a remediation standard. The triggers for updating the remediation standards for soil or indoor air are: (1) a revision to the USEPA IRIS toxicity information; (2) the Department promulgates a new or revised maximum contaminant level for a drinking water constituent or a ground water quality standard based on new or revised toxicity information developed by the NJDWQI; or (3) revision or replacement of the IEUBK or the ALM Model or input parameters for lead.

There is no provision for updating a remediation standard based on the third-tier data hierarchy sources (USEPA National Center for Environmental Assessment, which develops the PPRTV, the USEPA HEAST, CalEPA, or Agency for Toxic Substances and Disease Registry). In addition, the Department stated that toxicity values had been developed from primary scientific literature. An update to a remediation standard established using scientific literature is not addressed. (3, 6, and 8)

173. COMMENT: The Department notes that soil or indoor air remediation standards shall be updated when new toxicity information for a compound: (a) becomes available in the USEPA IRIS database; (b) is used by the NJDWQI to promulgate a new maximum contaminant level; (c) is used by the Department to promulgate a new ground water quality standard, or when the USEPA revises or replaces its integrated exposure uptake biokinetic lead model. Soil leachate remediation standards and soil remediation standards for the migration to ground water exposure pathway shall be updated when a ground water quality standard is updated. This

subchapter indicates that the Department will now move forward with updates to remediation standards for all media without a public comment period. The revision of remediation standards cannot be considered an “administrative change.” The information used by the agencies listed at paragraph (a) is not always generally acceptable and free of technical controversy and challenges. Updates to the Standards must be subject to robust stakeholder review and comment and/or formal rulemaking procedures that allow for comment of proposed changes prior to adoption. (4 and 16)

RESPONSE TO COMMENTS 172 AND 173: The updating of remediation standards, N.J.A.C. 7:26D-7, comports with the requirements of the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq. The previous rules, at N.J.A.C. 7:26D-6, Updating Soil Remediation Standards, recodified with amendments as N.J.A.C. 7:26D-7, Updating Remediation Standards, require the Department to update a remediation standard when the USEPA revises the toxicity data contained in the USEPA IRIS on which the remediation standard is based. The Department effects the update through a notice of administrative change.

The 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 includes seven steps:

- Step 1. Draft Development - Before beginning to develop a draft assessment, the IRIS Program undertakes internal scoping to identify the USEPA program and regional office needs for an assessment. Scoping is followed by problem formulation. Problem formulation frames the scientific questions that will be the focus of systematic reviews conducted as part of assessment development. The

USEPA releases these scoping and problem formulation materials; a public meeting is held to obtain input from the scientific community and the general public on these materials. Draft development begins with a comprehensive search and systematic review of the scientific literature. During early stages of draft development, USEPA provides preliminary assessment materials to the public and an opportunity for public input on these materials. Announcements of public meetings and other opportunities for public input are posted on the IRIS website.

- Step 2. Agency Review - Scientists in the USEPA's program offices and regions review the draft assessment. The draft assessment is revised based on the comments received.
- Step 3. Interagency Science Consultation - Other Federal agencies, including the Executive Office of the President, review the draft assessment. The draft assessment is revised based on the comments received.
- Step 4. Public Comment and External Peer Review - The draft assessment is released for public review and comment as part of the external peer review process. The USEPA announces the availability of the draft assessment and draft peer review charge questions for public review and comment on the IRIS website. A public meeting is held to discuss the draft assessment, draft peer review charge questions, and specific science questions raised by the assessment. The IRIS Program revises the draft assessment and peer review

charge questions in response to the public's comments. Additionally, the USEPA prepares a response to major public comments received during the public comment period.

Subsequently, the draft assessment and peer review charge questions are released for external peer review. During external peer review, a public external peer review meeting is held; the public may attend the peer reviewers' discussion of the draft assessment and provide comments.

- Step 5. Revise Assessment - The IRIS Program revises the assessment to address peer review comments. The program also prepares a written response-to-comment document.
- Step 6. Final Agency Review/Interagency Science Discussion - The revised assessment is reviewed by the USEPA's program offices and regions, other Federal agencies, and the Executive Office of the President.
- Step 7. Final Assessment - The final IRIS assessment is posted to the IRIS website.

This process provides ample opportunity for public input, such that the Department's updating an existing soil or indoor air remediation standard based on a new or revised IRIS toxicity factor can be accomplished through a notice of administrative change.

Adopted N.J.A.C. 7:26D-7.2(a)2 similarly requires the Department to update remediation standards by notice of administrative change when the NJDWQI develops new or revised toxicity factors. Toxicity factors developed in conjunction with the development of drinking water standards are subject to a comprehensive internal and external peer review process similar to that of the USEPA IRIS. The process used by NJDWQI, which involves significant opportunities for public input, can be found on the NJDWQI website at www.nj.gov/dep/watersupply/pdf/dwqi-flowchart.pdf . Adopted N.J.A.C. 7:26D-7.2(a)4 allows the Department to update the remediation standard for lead when the USEPA revises or replaces its IEUBK Model and the ALM model and input parameters. The USEPA workgroups working on these lead models have processes that include significant stakeholder and general public involvement. As with the previous and adopted provision allowing the Department to update a soil remediation standard based on a change to the USEPA IRIS, the adopted rules allowing the Department to update the standards by notice based on changes to NJDWQI and USEPA toxicity factors and changes to the IEUBK and the ALM lead models are consistent with the Administrative Procedure Act. The adopted rule, which was subject to formal rulemaking under the Administrative Procedure Act, does not allow Department discretion to accept, reject, or modify the NJDWQI or USEPA values.

The process at adopted N.J.A.C. 7:26D-7 for updating the remediation standards applies only to toxicity factors contained in IRIS or developed by NJDWQI, as the process for developing/revising toxicity factors undergoes an extensive stakeholder/public comment process. Changes to remediation standards based on other input parameters or toxicity factors from other sources require formal rulemaking.

174. COMMENT: The Department's notice of proposal does not stress the hierarchy of the toxicology data established in the development of this rule. N.J.A.C. 7:26D-7.2(a)3 should be deleted as it does not specify the source of the toxicology data. (4)

RESPONSE: The hierarchy of toxicology data is not directly applicable to N.J.A.C. 7:26D-7, Updating remediation standards. This subchapter identifies that when sources of toxicology data (that is, the USEPA IRIS and the NJDWQI) are revised, the Department shall update a remediation standard accordingly.

N.J.A.C. 7:26D-7.2(a)3 states, "[t]he Department shall update a remediation standard for soil or indoor air at N.J.A.C. 7:26D Appendix 1 when the Department uses new or revised toxicity information when promulgating a new or revised ground water quality standard." The promulgation of a new or revised ground water quality standard would follow the provisions of the Administrative Procedure Act, N.J.S.A. 52:14B-1 et seq. As part of this process, the regulated community, and the general public, has the ability to comment on the toxicity factor used to develop the ground water quality standard. As public comment was provided as part of the promulgation of the ground water quality standard, updating a remediation standard using that toxicity factor can be accomplished through a notice of administrative change process. Therefore, the Department is not deleting N.J.A.C. 7:26D-7.2(a)3 on adoption.

Alternative Remediation Standards, N.J.A.C. 7:26D-8

175. COMMENT: There is no justification for the Department to require preapproval of defined ARS conditions. (3)

176. COMMENT: The proposed rules identify specific ARS that require Department approval prior to use at a site. Please clarify why the Department must approve specific ARS when the procedures for developing ARS have been clearly identified and delineated in the proposed rules and Department guidance. If the LSRP uses the appropriate identified procedures to develop an ARS, then in what case would the Department disapprove the ARS? The rules indicate that the Department will inspect submittals for compliance with the rules and can easily include inspection of an ARS as part of the document inspection procedure. How will the Department implement approval of ARS? Will preapproval be required prior to submission of a document that relies on an ARS? How will this be implemented and does the Department have the resources in place to not delay remediation of sites? Furthermore, the rules indicate that some methods that currently do not require Department approval (that is, site-specific dilution attenuation factor for migration to ground water pathway) now require Department approval. Please provide the justification for those ARS that now do not require Department approval but will under the proposed rules. Please note that a site-specific dilution attenuation factor is a simple calculation that uses a Department-developed calculator. Why would Department approval be required for this method? (15)

177. COMMENT: The pursuit of ARS, in lieu of the use of the proposed default soil remediation standards, will increase substantially under this framework. The Department requirement for review of all ARS proposals will slow the process to unacceptable turn-a-round times for Department approval (due to a lack of qualified Department resources to review ARS proposals), increase project costs, and delay project schedules. The LSRPs should be more than

capable of developing these risk-based cleanup standards and apply them as they deem necessary. A mechanism should be established that will allow for the LSRP to develop ARS without Department preapproval that provides LSRPs with flexibility in documenting and explaining the procedure. (10 and 11)

178. COMMENT: The proposed rules, while a significant step forward in some respects (for example, using updated USEPA risk equations, the restriction of route-to-route extrapolation of toxicity data, and basing the proposed migration to ground water standards on the promulgated Ground Water Quality Standards, N.J.A.C. 7:9C), do not adequately contemplate the role of the LSRP in the site remediation process. Rather, the proposed rules continue to utilize the Department's command and control language from its adoption in June 2008 that pre-dates the May 2009 SRRA, N.J.S.A. 58:10C-1 et seq. LSRPs, by the virtue of their education, experience, and ability to pass a robust comprehensive examination, have been licensed by the State specifically to supervise and report on the remediation of contaminated sites such that the remediation both meets with all of the statutory and regulatory requirements and is protective of public health, safety, and the environment. The proposed rules adversely limit the ability of an LSRP, on behalf of the remediating party, to develop site-specific and fully protective alternate remediation standards as provided by the Brownfield Act, N.J.S.A. 58:10B-1 et seq., which will reduce the speed and efficiency of site remediation, result in more cases missing the unrealistic mandatory remediation timeframes, make more cases subject to the Department's direct oversight, and place an undue burden on the Department's staffing levels for years to come.

If the Department does not anticipate the State's budget shortfall and the likely detrimental impact on staffing levels, as well as the retirement of senior staff, the preapproval of ARS required by the proposed rules will grind the remediation of contaminated sites to a halt. The Department should remove the restrictions on the development of ARS that limit the use of site-specific variables and require the Department's preapproval before implementing the remedy. Rather, the proposed rules should permit the LSRP, using his or her independent professional judgment, to develop the site-specific ARS using the USEPA's most current guidance and submit the documentation in the applicable key document that provides the basis for the site-specific variables used to calculate an ARS consistent with USEPA guidance. The Department's required preapproval of an ARS, at N.J.A.C. 7:26D-8.2 and 8.4, and as indicated in the appendices, should be eliminated. Should the Department, in its review of the key document or final remediation document, determine that the remedy was not protective, then it would still retain its powers to invalidate the final remediation document and/or refer the LSRP to the Site Remediation Professional Licensing Board. (7)

179. COMMENT: The Department appears to arbitrarily control the use of an ARS without justification or reason. The Department should consider the development of additional soil remediation standard categories or allow LSRPs to develop and implement ARS without Department approval. (6 and 8)

180. COMMENT: The Department preapproval of defined ARS conditions is unjustified. The Department is using its authority in an arbitrary manner as exemplified by the Department's

description of the use of ARS: "The Department has determined that its approval is necessary before some ARS are implemented at a site or area of concern, but not for others."

The burden to demonstrate that the requested ARS is protective rests with the person requesting the ARS. The Department fails to identify the rationale for pre-approval of ARS for several chemical pathways. An LSRP will be evaluating all environmental data and all LSRPs in good standing must apply the applicable statutes, rules, regulations, and appropriate technical guidance concerning the remediation of contaminated sites including, but not limited to, the remediation requirements set forth in the SRRA, at N.J.S.A. 58:10C-14.c. Further, the statute requires all LSRPs to protect public health and safety and the environment.

The proposed amendments should define the critical variables, exposure scenarios, and site conditions that must be evaluated and documented prior to establishing an ARS. (6 and 8)

181. COMMENT: There is no need for the Department to preapprove an ARS for the ingestion-dermal exposure pathway. The Department will be able to review the ARS at the time the remedial action permit application is submitted. Department's review and preapproval will cause undue delay in the remediation. This issue recurs in other parts of proposed N.J.A.C. 7:26D. (2)

RESPONSE TO COMMENTS 175 THROUGH 181: The Department has the statutory authority to approve the use of an ARS at a contaminated site. The Brownfield Act, at N.J.S.A. 58:10B-12.f(1), states, "Upon a determination by the department that the requested ARS satisfies the department's regulations, is protective of public health and safety … and is protective of the environment … the alternative residential use or nonresidential use soil remediation standard shall be approved by the department. The burden to demonstrate that the requested ARS is protective rests with the person requesting the alternative standard and the department may require the submission of any documentation as the department determines to be necessary in order for the person to meet that burden." Therefore, by statute, a proposed ARS cannot be used without Department preapproval.

Preapproval of complex ARS options will reduce the likelihood that the person responsible for conducting the remediation will spend time and resources to develop and implement an ARS only to have the ARS rejected by the Department. There are various reasons that the Department may reject an ARS. For example, the Department may find that the alternative exposure frequency and exposure time may not meet the statutory requirement to be protective of public health and safety, and protective of the environment.

The adopted rules do not always require case-by-case preapproval of an ARS. For the soil inhalation exposure pathway, an ARS based on determination of soil fraction of organic carbon (f_{oc}), depth of contamination, and percent vegetative cover may be considered as preapproved by the Department. See N.J.A.C. 7:26D Appendix 7 II(b). Nor must the Department preapprove, for the migration to ground water exposure pathway, modification of f_{oc}, the SPLP, the immobile chemical option, and the option requiring collection of ground water data. See N.J.A.C. 7:26D Appendix 8 at I(b).

With regard to a site-specific dilution attenuation factor, the preapproval is not of the calculation itself, but rather of the acceptability of the value or values assigned to whatever parameter is being modified. For example, when the dilution attenuation factor is being assigned a site-specific value, the ground water velocity parameters may be varied. These are hydraulic conductivity and gradient, which are based on multiple and complex factors. Without Department preapproval of such site-specific values, there is a possibility that considerable time and resources will be spent by the investigator only to have the ARS rejected by the Department.

Department preapproval for SESOIL and SESOIL/AT123D is required because they are the most complex ARS options for the migration to ground water exposure pathway. The Department estimates that problems with SESOIL submittals occur about 50 percent of the time, and corrections or additional site characterization are necessary. Nearly 100 percent of the SESOIL/AT123D submittals received to date have not been acceptable without additional work.

The adopted rules and companion ARS technical guidance documents define the critical variables, exposure scenarios, and site conditions that must be evaluated and documented prior to establishing an ARS.

182. COMMENT: The Department's denial of the complexity of the rules forecasts continued project delays and costs. During the legislative discussions during the SRRA 2.0 stakeholder meetings, there was a consistent theme that New Jersey needs to address the backlog of site remediation approvals and implement decision making processes similar to the Massachusetts program in order to have sites remediated and returned to productive use. An overall review of these proposed regulations leads one to assume that the Department intends on keeping a

command-and-control approach to the use of ARS. This has proven to be an unsuccessful model for the site remediation process in New Jersey.

Under Department case management, a backlog of cases resulted in the adoption of the LSRP program. The remedial action permit approval process is one aspect of the LSRP program that has remained under Department command/control style management. A backlog of remedial action permits pending Department approval began to grow immediately under the LSRP program, and a backlog of approvals remains today. The Department needs to inform the regulated community how it is going to efficiently manage alternative remediation permit submittals, which could be numerous given the extremely stringent proposed promulgated standards. The Department must give serious consideration to its review process and should evaluate lessons learned from its remedial action permit approval experience, which has not been managed effectively. Will the Department be able to implement a more efficient management approach to process submittals which will be more complicated than the remedial action permit applications that have been a struggle to process? The Department has acknowledged that there was not a “plan” for the remedial action permit approval process in the early days of SRRA, stating in public forums that resources were dedicated to the receptor evaluations and remedial investigation reports.

Does the Department have its plan in place for managing the ARS submittals? Does the Department have the resources and expertise to manage this important step in the process? If there is any question of the Department’s resources, abilities, or expertise, then the LSRPs should be given more authority to develop and implement ARS without Department approval, or delays and backlogs will be difficult to avoid. (6, 8, and 9)

183. COMMENT: The proposed rules modify the ARS process for the various remediation standards. In most instances, the Department needs to first approve the ARS before it may be applied at the site. The ARS that must first be approved by the Department is described, in a very complex way, in a series of appendices. This makes the proposed rules confusing and unnecessarily complex. Since the Department seems to be exercising a lot of control over this process, how effective and available will ARS be? (1)

RESPONSE TO COMMENTS 182 AND 183: As discussed in the Response to Comments 175 through 181 Department preapproval of an ARS is a statutory requirement.

The Department has adequate staffing and as of the adoption of these rules has no backlog in addressing ARS referrals, nor does it anticipate a backlog in the future. Department staff have developed and reviewed ARS since 2008, site-specific impact to ground water remediation standards since 1993, and site-specific indoor air screening levels since 2005 and have the qualifications and training to do so. In principal and in practice, the adopted rules do not change the process for developing, reviewing, and approving ARS.

184. COMMENT: Given that the Department's cleanup program was privatized through the development of the LSRP program, the affected public and impacted community have virtually no knowledge of or ability to participate in these alternative cleanups. (13)

RESPONSE: Prior to the enactment of SRRA and implementation of the licensed site remediation program, there was no requirement to notify the public of the use of ARS at a site. Any interested party may obtain information about a site by filing a request with the Department's Office of Record Access for a file review of the site, pursuant to the Open Public Records Act. www.nj.gov/dep/opra.

185. COMMENT: The LSRP should be able to modify the default parameters associated with nonresidential land use to account for site-specific exposure conditions. Though the Department cannot ensure that property conditions will remain the same (unless an institutional control is established), this limitation applies to every risk-based clean-up standard, including those for which an ARS is explicitly allowed. (4)

RESPONSE: The Department does allow for modification of exposure factors based on restricted access, with proper institutional and engineering controls. Institutional controls are required for a remedial action based on nonresidential standards or ARS developed for an alternative land use exposure scenario.

186. COMMENT: The Department should clarify whether agricultural land use is an alternative land use or a nonresidential land use. (2)

RESPONSE: The default land use for a property used for agriculture would be site-specific. In the adopted rules, the Department defines "nonresidential" as used for commercial or industrial purposes. The Department requires any land use outside of either of residential or nonresidential scenarios to have a site-specific ARS.

187. COMMENT: The ARS process could be too costly for smaller business entities. The Department should also develop more simplistic alternative standards. For example, the Department has used representative/default values for some parameters in developing the remediation standards, even though these values may vary from location to location across the State. Where easily determined, site-specific factors such as soil type and organic carbon concentration are used for the development of the remediation standards. The Department should develop different standards that are based upon varying the input factors. (10 and 11)

RESPONSE: The Department has developed calculators that allow investigators to enter parameters whose values may be altered. Research into the exposure frequency and exposure time is neither difficult nor time consuming. The Technical Requirements, N.J.A.C. 7:26E, require the establishment of the depth of contamination. Given that organic carbon content varies across soil types, collection within an area of concern is the most effective way of determining site-specific conditions. Percentage of vegetative cover is easily established with simple measurement. For the migration to ground water exposure pathway, easily measured parameters, or parameters that are required to be measured, are generally allowed to be varied in the ARS process. These parameters include soil organic carbon, depth interval of contamination, depth of ground water, the dilution-attenuation factor, the length of the contamination source parallel to the ground water flow, soil texture, and site-specific soil adsorption information, when these parameters are used in a particular ARS option. Therefore, the ARS process is not prohibitive, even for small businesses.

188. COMMENT: An ARS option should be made available for human exposure to surface water to account for site-specific exposure conditions, such as wading or swimming. (4)

RESPONSE: N.J.A.C. 7:26D-3, Surface Water Remediation Standards, are the Surface Water Quality Standards found at N.J.A.C. 7:9B. The Surface Water Quality Standards do not have a provision for the establishment of alternative surface water quality standards. Consequently, the Department has not established provisions for the development of surface water ARS. See the notice of proposal summary at 52 N.J.R. 569 and 572 for further discussion of this issue.

189. COMMENT: The ARS process requires that an investigator consider the migration to ground water exposure pathway; however, ground water use must be assessed before a health-protective soil concentration based on leaching can be reasonably determined. The ARS should include options for determining if ground water is used for potable purposes. (4)

RESPONSE: Ground water classification is regulated under the Ground Water Quality Standards, N.J.A.C. 7:9C. The determination of the ground water classification is beyond the scope of this rulemaking.

190. COMMENT: In developing remediation standards for the migration to ground water exposure pathway, the Department should establish a mechanism to readily allow for

alternative standards in those areas where ground water use is limited. This may include shallow water-bearing zones, areas of low yield, areas of existing ground water use restrictions, and/or areas containing naturally occurring constituents (for example, salinity and dissolved solids) that are disincentives to use of ground water. While the existing Ground Water Quality Standards, N.J.A.C. 7:9C, provide some relief at exceptionally high chloride and dissolved solids levels, an expansion of this concept could incentivize redevelopment in Brownfield areas. (10 and 11)

RESPONSE: An LSRP may submit to the Department a site-specific request for ARS. An expansion of various possible conditions under which ground water use is limited is beyond the scope of this rulemaking.

191. COMMENT: The Department ARS guidance document does not provide guidance regarding how the regulated community will utilize the two separate remediation standards (ingestion-dermal and inhalation) within the Technical Rules, 7:26E. The guidance document should state the ingestion-dermal pathway is most relevant to the direct contact standards and the associated investigation activities as described at N.J.A.C. 7:26E. The inhalation remediation standard would apply for delineation and site characterization in the remedial investigation phase but should not be a basis to determine attainment of site remedial goals. (6 and 8)

192. COMMENT: The Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil assumes the investigator is knowledgeable about the USEPA risk assessment process, the technical jargon, and the differences between

the Department's perspective on remedial attainment verses the USEPA risk assessment process. The initial section of the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil should be expanded to include a description of the Department's policy and practice on the use of each remediation standard pathway and the site investigation/remedial investigation/remedial action/response action outcome process. Specifically, the Technical Rules, N.J.A.C. 7:26E, reference specific actions that are required when an exceedance of the direct contact remediation standards are observed. With the Department's designation of multiple remediation standards based on multiple pathways, a clear description of the applicability of each standard would provide valuable guidance to all investigators. As one example, the Department should clearly define that the ingestion-dermal remediation standards will be used in place of the term "direct contact" in the Technical Rules. (6 and 8)

RESPONSE TO COMMENTS 191 AND 192: To the extent that the comments relate to the contents of the guidance documents, they are beyond the scope of this rulemaking. The comments on the guidance document were addressed as part of the responses to external stakeholder comments on the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil, https://www.nj.gov/dep/srp/guidance /.

As stated in the notice of proposal Summary, at 52 N.J.R. 569-570, “[t]he Department is proposing these separate residential and nonresidential soil remediation standards for the ingestion-dermal exposure pathway and the inhalation exposure pathway to emphasize that both the ingestion-dermal exposure pathway and the inhalation exposure pathway must be evaluated when remediating a contaminated site." In principal, and in practice, the process will not change for the inhalation exposure pathway and the ingestion-dermal exposure pathway from the former way of comparing soil analytical results to the soil remediation standards. In the 2008 (initial) Remediation Standards, N.J.A.C. 7:26D, the Department identified the more stringent of the two exposure pathways and defined this value as the direct contact soil remediation standard. Under the adopted rules the LSRP will identify the lower value from the two exposure pathways and compare that value to the soil analytical results. An ARS for one exposure pathway must take the other exposure pathway into account if the value is lower than the ARS value for the given exposure pathway. This process is not changed from the process prior to the adopted rules.

For a discussion of "direct contact," see the Response to Comments 84 and 85.

193. COMMENT: The Department states in the notice of proposal that different models used by the USEPA will be evaluated on a case-by-case basis. The Department should clarify what parameters will determine a positive outcome for the use of an USEPA model and a negative outcome. In other words, what is the basis for the Department's decision to accept or reject an ARS developed, evaluated, and proposed by an LSRP? Identifying these variables would assist the regulated community in developing practical and protective ARS criteria. (6 and 8)

RESPONSE: The Department references different lead models used by the USEPA in both the Remediation Standards, N.J.A.C. 7:26D, and the Alternative Remediation Standards Technical

Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil, https://www.nj.gov/dep/srp/guidance/. There are two existing lead models, the IEUBK model and the ALM model, with a third model in development. In accordance with N.J.A.C. 7:26D, Appendix 6 at III(b), because the use of different models requires Department approval, a technical consultation must be scheduled with the Department to discuss models/approaches proposed by the person responsible for conducting the remediation for the development of an ARS for lead. It is beyond the scope of this rulemaking to identify all the parameters that will determine a positive outcome and negative outcome with the use of a USEPA model versus other models, as this would require the Department to evaluate all available (public and privately developed) models.

194. COMMENT: The Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil states, "[t]he default parameters for the residential and non-residential land use for these pathways include averaging time, exposure frequency, exposure duration, exposure time, soil ingestion rate and soil adherence factor. The Department has determined that these variables represent reasonably conservative default values (but not the worst case) and are designed to be consistent with Superfund's concept of the reasonable maximum exposure (RME) protective of the majority of the population." The Department limits the default parameters and ultimately calculates two land use exposure scenarios (residential and non-residential). Other states incorporate additional default exposure scenarios, which clearly provide more reasonable default values. For instance, Pennsylvania and

Massachusetts have three default soil standard categories and New York has five. The Department should consider additional default parameters (average time, exposure frequency, exposure duration, etc.) for the development of additional default land use exposure scenarios. (6 and 8)

RESPONSE: In accordance with the Brownfield Act, N.J.S.A. 58:10B-12.c(1), the Department is required to address only residential and nonresidential exposure scenarios through promulgated remediation standards. The Department handles all other scenarios through the ARS process.

The remainder of this comment is beyond the scope of this rulemaking and was addressed as part of the responses to external stakeholder comments on the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil, which is available at https://www.nj.gov/dep/srp/guidance/.

195. COMMENT: The Department should provide its rationale for applying default parameters, such as average time and exposure frequency, in calculating residential ingestion-dermal contact soil remediation standards for soils deeper in the soil column. What is the Department's justification for applying the same default parameters and exposure scenarios to establish residential ingestion-dermal contact soil remediation standards for soils zero to five feet and for soils deeper than five feet; or deeper than 15 feet below ground surface? The default parameters should be adjusted based on depth of the soil. (6 and 8)

RESPONSE: The Technical Requirements require soil remediation standards for the ingestion-dermal and inhalation exposure pathways to be compared to soil data throughout the entire soil column to address the possibility that deeper soils may be brought to the surface, thereby resulting in potentially unacceptable exposure to site receptors. According to the Technical Requirements, at N.J.A.C. 7:26E-4.2, Remedial investigation of soil, “the person responsible for conducting the remediation shall delineate the vertical and horizontal extent of all soil contamination that is associated with a site-related area of concern in the saturated and unsaturated soil to the (1) residential direct contact soil remediation standard; or (2) the nonresidential direct contact soil remediation standard if a remedial action will be implemented that will appropriately restrict the use of the entire property and the property owner agrees to place a deed notice and engineering controls, as appropriate, on the property.” See the Tesponse to Comments 84 and 85 for further discussion on the use of the term "direct contact" in the Technical Requirements, N.J.A.C. 7:26E.

196. COMMENT: Figure 1 of the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil graphically demonstrates the impracticality of the concept that the Department will evaluate ARS as viable options to evaluate site-specific details. Within the flow chart all residential properties, school properties, childcare properties, commercial properties, and industrial properties are disallowed from using site-specific land use information.

The properties where ARS conditions are acceptable are a very, very small percentage of the land use in New Jersey. The Department should provide an evaluation of the potential land area that may be affected by these alternative land use scenarios. These land use scenarios could affect substantially less than one percent of all site remediation projects.

The automatic dismissal of alternative land use options for residential, commercial, and industrial properties limits the value of the ARS. This type of land use will become increasingly common and should be allowed and discussed within this guidance document. (6 and 8)

RESPONSE: See the Response to Comments 98, 99, 100, and 101 for a discussion of the requirements of the Brownfield Act with regard to residential and nonresidential, and the Department’s continuing policy to protect the most sensitive receptors. The remainder of this comment is beyond the scope of this rulemaking and was addressed as part of the Department's responses to external stakeholder comments on the “Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil,” which is available at https://www.nj.gov/dep/srp/guidance/.

197. COMMENT: There is no discussion/guidance regarding how to apportion the soil ingestion rate; in fact, this is one parameter that the Department does not allow to be changed. What is the basis for this position? The USEPA default soil ingestion rates (updated) acknowledge that this is a daily total ingestion rate for a typical child or adult daily activities. Is the Department implying that the soil exposure during these activities outside of the home is in addition to the established daily rate? If so, what is the basis for that? Given that the USEPA

acknowledged uncertainty, would it not be appropriate to apportion the "home" and "non-home" ingestion rates as USEPA guidance is provided for lead for intermittent non-home exposures using the time-weighted average approach? See https://semspub.epa.gov/work/11/176288.pdf. The approach identified in the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil appears to add the soil ingestion from the non-residential (non-home) exposure to the potential residential exposure (home). This would create an unnecessary redundancy. The soil ingestion rate should be based on mg/hour of the activity similar to that for sediment in the updated Chapter 5 of the USEPA Exposure Factor Handbook. In general, the exposure assumptions should be based on a per hour of specified activity unless it can be demonstrated that it is not applicable. As stated above, there are many sites where the “restricted residential” approach would be appropriate given the limited exposure to soils. The soil exposure pathway (ingestion-dermal) may be incomplete under these scenarios with an exposure of zero. Paved trails in recreational areas would also limit the direct contact exposure to soils. (6 and 8)

198. COMMENT: The Department’s Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil presents insight into Department implementation plan and proposed policy. The exposure parameters that are utilized in the ARS examples (specifically, on guidance document page 8) refer to incidental ingestion of soil and dust. The proportion of ingestion assumed to occur through soil and the

proportion assumed to be from dust is particularly important in the assessment of recreational exposures that occur outside a residential property.

According to the guidance document, the daily soil ingestion rate is one of the parameters that cannot be modified based on site-specific conditions. Therefore, the soil ingested under the recreational scenarios described is equivalent to the entire daily ingestion rate from soils present at the location of the activity. Interior dust is comprised partially from outdoor soils and is generally assumed to be the same concentration as the soils on the residential property, which supports the use of the residential soil concentration as being representative of both the soil and dust ingested under a residential exposure scenario. This assumption is not valid for the recreational scenarios and, therefore, the soil ingestion rate should be modified to reflect the time present at the recreational location in order to prevent the establishment of overly restrictive soil remediation standards inconsistent with the scientific data regarding soil/dust ingestion rates.

The Department should define information on the assumed proportions of soil and dust ingestion in the proposed regulations or, at a minimum, in the basis and background document, which is not available at this time. (6 and 8)

RESPONSE TO COMMENTS 197 AND 198: The USEPA updated some of the soil ingestion rates recently in the Exposure Factors Handbook; however, the Exposure Factors Handbook is not a Superfund-specific document. Rather, it provides a summary of the latest developments in exposure science and provides recommendations for a broad range of USEPA programs. The USEPA Office of Solid Waste and Emergency Response Human Health Regional Risk Assessors

Forum developed consensus recommendations based on the context, needs, and existing health risk assessment policy/guidance for the Superfund Program, such as ensuring that the recommended exposure factors are protective of the RME, consistent with CERCLA and the NCP. The Brownfield Act, at N.J.S.A. 58:10B-12, mandates that "the Department develop soil remediation standards using exposure parameters that provide an adequate margin of safety and are consistent with the guidance and regulations for exposure assessment developed by the USEPA pursuant to CERCLA and other statutory authorities as applicable."

The Department has made the determination that soil ingestion rates cannot be altered for the development of an ARS for soil because there is too much variability and uncertainty in the soil ingestion rate studies available and site-specific soil ingestion rate data is lacking. In order to ensure adequate protection of human health and meet the statutory requirements of the Brownfield Act, the Department requires the child and adult soil ingestion rates listed in the USEPA Recommended Standard Default Exposure Factors for Superfund (OSWER Directive 9200.1-120) to be utilized for all ingestion-dermal based soil standards that are developed, whether they be based on a residential, nonresidential, or alternative land use exposure scenario. In addition, adopted N.J.A.C. 7:26D Appendix 6 states that "an [alternative remediation standard] for the ingestion-dermal pathway may be developed based on site-specific modification of exposure duration and exposure frequency parameters for an alternative land use exposure scenario." There are no exposure time (hours per day) adjustments for incidental ingestion since exposure is evaluated as an event (one event per day) rather than over a number of hours each day.

The second part of this comment pertains to engineering and/or institutional controls. The Department has permitted, and continues to allow, various types of engineering and institutional controls to be implemented at a site, and when implemented appropriately, these controls are protective of human health and can be used to address soil contamination above soil remediation standards.

199. COMMENT: In the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil, preschool children are considered zero to six years old, but it is unlikely that there are infants engaged in the stated activities/exposure assumptions (that is, playing at the playground for 200 days a year when temperatures are above 50 degrees Fahrenheit). The Department should reevaluate these assumptions and/or annotate the discussion to indicate where age-adjusted, logical, mathematical conversions of these kinds of exposure factors are reasonable and warranted. The age-adjusted ingestion rate and age-adjusted dermal exposure currently specified in the proposed amendments are only utilized for the lifetime exposure assuming six years as a child and 20 years as an adult. These parameters are based on residential exposure to children and adults. The soil ingestion rate and dermal exposure (skin surface area) parameters are ones that the Department does not allow to be changed. Assuming 200 mg/day soil ingestion for an infant during the sports playing field scenario is not representative of actual exposure of this age group and overestimates potential exposure. The skin surface areas assumed to be exposed are the head, hands, forearms, lower legs, and feet. In the playground example, preschool age children are assumed to be exposed

five days a week for two hours per day when the temperature is greater than 50 degrees Fahrenheit. It is unrealistic to assume that preschool age children, especially infants, are playing in shorts with bare feet for two hours per day when the temperature is less than 65 to 70 degrees Fahrenheit. Soil ingestion rate and skin surface area should be included as factors that can be adjusted to be representative of alternative scenarios. (6 and 8)

RESPONSE: The age-adjusted ingestion rate and dermal exposure will still apply when calculating an ARS for a combined child/adult exposure (can be greater or less than the default six years for a child and 20 years for an adult) for the carcinogenic health endpoint. The Department's calculator includes these calculations within it for user convenience. In accordance with the Department's Remediation Standards, N.J.A.C. 7:26D, the default soil ingestion rate and skin surface area must be used when calculating a recreational ARS to ensure adequate protection of human health. However, the exposure factors for exposure time, exposure frequency, and exposure duration may be adjusted to better reflect the current and planned future use of the site.

The remainder of this comment is beyond the scope of this rulemaking and was addressed as part of the Department's responses to external stakeholder comments on the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil, which is available at https://www.nj.gov/dep/srp/guidance/.

200. COMMENT: The inability to change default parameters used in calculating the default soil remediation standards for residential or non-residential land use, except for physical

parameters for the inhalation exposure pathway, significantly limits the use of ARS. The ability to develop ARS on a site or area of concern specific basis is a core component of many other State regulatory programs and the USEPA. ARS have been proven to be protective remedial measures and should be further promoted as the Department attempts to address the impacts of climate change. For example, the development of ARS may reduce the need to install engineering controls (caps). Knowing that many of the properties requiring capping are located in urban centers, ARS may assist in reducing the "heat island effect," which is an initiative of the USEPA (https://www.epa.gov/heatislands). (6 and 8)

RESPONSE: The Department implemented methods to develop ARS in accordance with the governing legislation. As noted in the Brownfield Act, at N.J.S.A. 58:10B-12.f(1), an ARS must be based on site-specific conditions and not changes to input parameters that are not site-specific.

The “climate change” impacts are not within the scope of the Remediation Standards rulemaking. However, climate impacts are addressed within the Technical Rules, at N.J.A.C. 7:26E-1.9, which states, **“**[t]he Department encourages the use of green and sustainable practices during the remediation of contaminated sites.”

201. COMMENT: The Department has allowed use of a Soil-Water Partition Equation Calculator for modification of source area parameters; however, this is prohibited in the Fate and Transport Modeling of the ARS process. The Department should allow site-specific source area information in the ARS process. (6 and 8)

RESPONSE: For the migration to ground water exposure pathway, the source area is not used in the soil-water partition equation or in most ARS. The soil-water partition equation uses a one-dimensional parameter, specifically the length of the unsaturated zone source parallel to the ground water flow. This affects the value of the dilution-attenuation factor in the soil-water partition equation. In the ARS process, the length of the source parallel to the ground water flow may be adjusted when modifying the dilution-attenuation factor, and this modified dilution-attenuation factor may be used in the various ARS options where an ARS is calculated. This includes the soil-water partition equation, dilution-attenuation factor, SPLP, and Seasonal Soil Compartment Model (SESOIL) options. The procedures to be followed are described in the "Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway." The Seasonal Soil Compartment Model/Analytical Transient 1-,2-,3-Dimensional Model (SESOIL/AT123D) option is somewhat different in that it does actually use a specified source area directly when linking the SESOIL output to Analytical Transient 1-,2-,3-Dimensional Model AT123D input.

Regarding the inhalation exposure pathway, the soil-water partition equation is not used in the inhalation exposure pathway; rather, a volatilization factor is calculated. Site source area size is defined as 0.5 acres for residential and two acres for nonresidential scenarios. The quality control values were developed for each of these site sizes through simulations with the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) model. Using alternative site sizes would require in-house modeling assessments using AERMOD, which incorporate site size along with other exposure parameters. This is not practical for routine ARS determinations. If the LSRP considers this adjustment critical, then the LSRP should consult the Department for assistance. Increasing the site size generally decreases the standard, but the Department does not require adjustment of standards to be lower than default values for this exposure pathway.

202. COMMENT: The Department proposes to require a remedial action permit for an ARS based on a site-specific depth range of contamination, regardless of the starting depth of the remaining contamination zone. The Department should establish the maximum depth where a remedial action permit is required to confirm protection to the environment, for example, five feet below existing grade. It is reasonable to believe there will be cases where surface remedial actions have been completed and deeper inhalation exposure concentrations will undergo natural attenuation. It is financially and physically unreasonable to establish a permit requirement for all inhalation conditions. (6 and 8)

RESPONSE: SRRA, at N.J.S.A. 58:10C-19, mandates the Department to establish a permit program to regulate the operation, maintenance, and inspection of engineering or institutional controls and related systems installed as part of a remedial action of a contaminated site. Soil remediation standards based on the soil inhalation exposure pathway are developed assuming that the contamination starts at the surface. Assuming there is no exceedance of a remediation standard based on contamination starting at the surface, the Department does not require a permit, institutional control, or engineering control. In cases where soil contamination starts at depth (not at the surface) with a clean soil zone (non-contaminated area) above it, one may develop an ARS based on the depth of the contamination, factoring in the thickness of the clean soil zone above it. In that instance, the clean soil zone acts as an engineering control, and a soil remedial action permit is required. There is no limit to the thickness of the clean soil zone requiring a permit, as any excavation in the uncontaminated soil will change the parameters on which the ARS is based.

203. COMMENT: The Alternative Remediation Standard Technical Guidance for the Migration to Ground Water Pathway has not been published by the Department, so the method stated for measuring soil organic carbon cannot be evaluated at this time. (6 and 8)

204. COMMENT: The Department requires the person responsible for conducting the remediation to describe "how the input parameters were selected (that is average or lowest f_{oc} concentration). The Department should clarify the conditions where the use of the lowest f_{oc} concentration would ever be required. Utilization of the lowest f_{oc} concentration is overly conservative and not reasonably justified. Further an ambiguous description of the required parameters does not support a collaborative evaluation of the data. (6 and 8)

205. COMMENT: The Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil guidance document states, "[t]he Department's calculator will develop an appropriate f_{oc} from values entered." The Department should clearly state the rationale and basis for the selection of a reasonable f_{oc} concentration. (6 and 8)

RESPONSE TO COMMENTS 203, 204, AND 205: The Department described the process for developing an appropriate soil fraction organic carbon (f_{oc}) value in the previous Impact to Ground Water guidance document, Development of Impact to Ground Water Soil Remediation Standards using the Soil-Water Partition Equation, and in the previous Inhalation guidance document, Development of Alternative Remediation Standards for the Inhalation Pathway, https://www.nj.gov/dep/srp/guidance/rs/. The procedure remains the same in the new Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway, which the Department has released. The average of three or more values would be used unless those values differ by an order of magnitude or more, in which case the minimum value would be used based on site heterogeneity in order to be protective. When large site heterogeneity is observed, the area of concern may be separated into smaller, more homogeneous areas of concern for separate evaluation.

The method of analysis for organic carbon remains same as that currently used, which is the Lloyd Khan method. This is analytical method can be found on the Department's Remediation Standards website at https://www.nj.gov/dep/srp/guidance/rs/index.html.

206. COMMENT: The Department is requiring an institutional control and a remedial action permit for an ARS with variability in the vegetative cover. The Department has proposed a default Vegetative Cover Fraction of 50 percent, which "represents a reasonable compromise between no cover and a totally vegetated site," consistent with the USEPA Soil Screening Guidance: Technical Background Document (EPA/540/R-95/128 dated May 1996). In the

Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil, Table 1 (page 15), the Department has indicated that Vegetative Cover Fraction is "a factor which can be changed via the [alternative remediation standard] process." The Vegetative Cover Fraction includes building footprints, paved areas, graveled areas, grassed areas, landscaped areas, capped areas, areas previously remediated, and areas with clean fill or soil overlying impacted soils. Using 50 percent Vegetative Cover Fraction to develop the default soil remediation standards as is described in the draft proposed new rules and repeals to the Remediation Standards, N.J.A.C. 7:26D, dated April 2020, is overly conservative for the vast majority of impacted sites in the State. (6 and 8)

RESPONSE: The Department does not consider impervious surfaces, such as asphalt and concrete as vegetative cover, and the Vegetative Cover Fraction does not apply to non-vegetative cover/caps. Vegetative cover greater than 50 percent requires a soil remedial action permit for the site to maintain the vegetative cover. The use of 50 percent vegetative coverage is consistent with the USEPA 2002 "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites" at https://semspub.epa.gov/work/HQ/175878.pdf.

207. COMMENT: The Department should provide additional guidance regarding the establishment of a remedial action permit for a vegetative cover. The Department should clearly define site-specific parameters, including how should the vegetative cover be defined. It is reasonable to believe a grassed area may be changed to an area of shrubs, a gravel path or a compacted footpath, or a sidewalk, etc. (6 and 8)

RESPONSE: Additional guidance regarding what constitutes 50 percent vegetative cover is provided in the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil (https://www.nj.gov/dep/srp/guidance/) and the Inhalation Exposure Pathway Remediation Standards: Basis and Background (https://www.nj.gov/dep/srp/guidance/). The Department does not consider any portion of the site changed to a gravel path, sidewalk, or other non-vegetated area to be an area of vegetative cover. Likewise, the Department does not consider areas of barren soil to be vegetative cover. The percent of vegetative cover is the amount of soil covered by vegetation using standard ecological techniques (for example, grid or plot sampling). This does not mean that half of an area has vegetation while the other half does not (barren soil); rather, the entire area may appear to be covered with vegetation that does not fully cover all of the soil. This percentage of vegetation (versus soil) must be maintained and monitored to be an effective engineering control.

208. COMMENT: The Department should clarify what restrictions are necessary to make an area a "restricted access area." The Department should consider allowing the ARS for all sites, except residential land use. (2)

RESPONSE: A “restricted access area” is discussed in Departmental guidance documents found at https://www.nj.gov/dep/srp/guidance/. The Brownfield Act, at N.J.S.A. 58:10B-12.f(1), precludes the Department from allowing ARS for all sites except residential land use. The statute states, “[a] person performing a remediation of contaminated real property, in lieu of using the established minimum soil remediation standard for either residential use or nonresidential use adopted by the [D]epartment." Therefore, the use of a residential land use ARS is allowed.

New N.J.A.C. 7:26D Appendices 1 through 12

N.J.A.C. 7:26D Appendix 1

209. COMMENT: Please list chlordane separately as cis-chlordane (alpha) (CAS# 5103-71-9) and trans-chlordane (gamma) (CAS# 5103-74-2). The listing of chlordane as chlordane (alpha and gamma forms summed) (CAS# 57-74-9) is incorrect and confusing as this CAS# includes other isomers and mixtures, thus does not pertain to the summation of alpha and gamma chlordane. LSRPs continue to be confused by this situation. (17)

210. COMMENT: There are several references to Chlordane (alpha and gamma forms summed) as CAS: 57-74-9 within N.J.A.C. 7:26D Appendix 1. In these cases, the chlordane standard is based on the sum of the alpha and gamma forms; however, the CAS# provided for chlordane in the proposed rule (57-74-9) includes a mixture of other chlordane constituents including alpha and gamma. Various laboratories report the total (technical) chlordane result for chlordane (57-74-9) as exceedances of the soil remediation standards (SRS) when the alpha and gamma results (when summed) do not exceed the SRS. The Department should update the CAS numbers in the rule to list only the CAS for alpha/cis (5103-71-9) and gamma/trans (5103-74-2) chlordane and not 57-74-9. (4)

RESPONSE TO COMMENTS 209 AND 210: The chemical name chlordane, and CAS# 57-74-9, while used inconsistently across various information sources, specifically refer to the CAS chemical name 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methano-1H-indene. This chemical consists of the cis- and trans- (alpha and gamma) stereoisomers. The sum of the alpha and gamma isomers is the regulated parameter in the Remediation Standards, N.J.A.C. 7:26D, and the Department clarified this in both the previous rules and in the adopted rules by specifying it as the sum of the alpha and gamma isomers where chlordane is listed at the N.J.A.C. 7:26D Appendix Tables. There is a separate CAS number for technical chlordane (CAS# 12789-03-6), which is used in the USEPA regional tables; technical chlordane is a mixture that includes other chemicals.

211. COMMENT: The proposed residential and nonresidential ingestion dermal soil standards for 1,2-dichloropropane are incorrect. The residential noncarcinogenic human health-based value should be 3,000 milligrams per kilogram, but the Department reported the value as 7,000 milligrams per kilogram in Table 1 at N.J.A.C. 7:26D Appendix 1. Similarly, the nonresidential and noncarcinogenic human health-based value should be 52,000 milligrams per kilograms, but the Department reports it as 120,000 milligrams per kilogram in Table 2 at N.J.A.C. 7:26D Appendix 1. (6, 8, and 9)

RESPONSE: The proposed residential and nonresidential noncarcinogenic ingestion-dermal human health-based criteria listed at N.J.A.C. 7:26D Appendix 1, Tables 1 and 2, for 1,2-dichloropropane (CAS #78-87-5) were incorrect. The Department reviewed the criteria and determined that in Table 1, the residential noncarcinogenic ingestion-dermal human health-based criterion for 1,2-dichloropropane should be 3,100 mg/kg. In Table 2, the nonresidential noncarcinogenic ingestion-dermal human health-based criterion should be 52,000 mg/kg. The Department is correcting these errors on adoption. The residential (19 mg/kg) and nonresidential (98 mg/kg) soil remediation standards for the ingestion-dermal exposure pathway for 1,2-dichloropropane listed in Tables 1 and 2 at Appendix 1 do not change, because the standards are based on the carcinogenic health endpoint.

212. COMMENT: The rulemaking is missing key supporting documents and other information. In particular, the notice of proposal references several guidance documents that were not available until the comment period was well underway, depriving interested persons of a full and timely opportunity to review the notice of proposal in light of the unpublished guidance documents that the Department contends support the rulemaking. Meanwhile, the Department claims that simple and clear explanations of the process it followed are not necessary because a sophisticated reader can glean all of the details from various sections and appendices of the rulemaking document and then, in effect, reconstruct portions of the notice of proposal in order to comment upon it.

Examples of information and documents missing from the administrative record include: Input parameters from 2018 to 2020 (compare July 2014 Department issued input parameters); and the basis and background documents relied upon by the Department to develop various exposure pathways (inhalation, ingestion-dermal were not made available to the public). The

Department published similar background documents when it proposed remediation standards in 2007. If the basis documents were necessary or useful then, why not now? The regulated public places immense value on understanding why the Department made certain decisions and how it selected items to consider and prioritize. (11 and 16)

213. COMMENT: The complete rulemaking record has not been provided to the public. Additional time is necessary to analyze those documents to ensure proper due process during the public comment period. The Department should have provided the public with its complete basis and background and all supporting documentation as part of the rulemaking record, followed by enough time to analyze those documents for incorporation in comments. As published, the notice of proposal was missing key supporting documents and other information. In particular, the notice proposal references several guidance documents that were not available until the comment period was well underway, depriving interested persons of a full opportunity to review the notice of proposal in light of the unpublished guidance documents. Input parameters and implementation procedures and other information about how the Department developed numeric remediation standards were also missing. Therefore, the Department failed to include in the record information upon which it relied. Without this information, interested persons were deprived of their due process rights to submit comments, data, or arguments on the rule proposal generally, and on specific sections of the rulemaking. (6, 8, and 16)

214. COMMENT: As proposed, there is no mathematical or procedural technique to correct any errors when comparing the Department's calculations of screening level concentrations to

the Department's proposed remediation standards. So, the only alternative is for the Department to provide complete documentation, including the basis and background document so that the regulated community could fully evaluate the proposed rules. (9)

RESPONSE TO COMMENTS 212, 213, and 214: The Department provided, in the notice of proposal, the information necessary to calculate the remediation standards for all pathways, that is, the pertinent equations and parameter values. The pathway basis and background documents are unnecessary to calculate the Remediation Standards for the soil exposure pathways, because all input parameter values and equations necessary for calculation of the adopted standards were provided in the proposal in the following Appendices of the proposed N.J.A.C. 7:26D Appendix 2 (Soil – Ingestion-Dermal Exposure pathway), Appendix 3 (Soil – Inhalation Exposure Pathway), Appendix 4 (Soil and Soil Leachate – Migration to Ground Water Exposure Pathway), Appendix 5 (Indoor Air – Vapor Intrusion Exposure Pathway), Appendix 10 (Chemical and Physical Properties of Contaminants), Appendix 11 (Toxicity Factors), and Appendix 12 (Derivation of Equation Equivalency for the Development of Soil and Indoor Air Remediation Standards) (see https://www.nj.gov/dep/rules/proposals/20200406a.pdf). This information may be compared against the bases for the prior soil remediation standards, the prior impact to ground water screening levels, and prior indoor air screening levels. In addition, the Department’s basis and background documents are now available at https://www.nj.gov/dep/srp/guidance/rs/.

The bases for the derivation of the prior soil remediation standards are contained in the previous Remediation standards, N.J.A.C. 7:26D, at Appendix 2 (Soil – Ingestion-Dermal

Exposure Pathway), Appendix 3 (Soil – Inhalation Exposure Pathway) (see), the "Ingestion-dermal Exposure Pathway Soil Remediation Standards: Basis and Background" at https://www.nj.gov/dep/srp/guidance/rs/archive.html

The basis for the derivation of the prior impact to ground water exposure pathway soil and soil leachate screening levels and criteria may be found in the following documents: Development of Impact to Ground Water Soil Remediation Standards Using the Soil-Water Partition Equation see

https://www.nj.gov/dep/srp/guidance/rs/archive.htmland Development of Site-Specific Impact to Ground Water Soil Remediation Standards Using the Synthetic Precipitation Leaching Procedure (see

https://www.nj.gov/dep/srp/guidance/rs/archive.html

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The basis for the derivation of the prior Vapor Intrusion exposure pathway indoor air screening levels may be found in "Update to the New Jersey Department of Environmental Protection (NJDEP) Vapor Intrusion Screening Levels" (see https://www.nj.gov/dep/srp/guidance/vaporintrusion/vig_update_tables.pdf).

Calculators for all exposure pathways are now available.

215. COMMENT: The Department should review the residential direct contact standard for 2,3,4,6-tetrachloroethane and the nonresidential direct contact standards for acenaphthene, 4-methyl-2-pentanone, and toluene. These proposed standards appear to have only one significant figure. (2)

RESPONSE: The Department has not proposed direct contact remediation standards as was done in the prior Remediation Standards, N.J.A.C. 7:26D. Instead, the Department proposed separate soil remediation standards for the ingestion-dermal exposure pathway and the inhalation exposure pathway. There is no such compound as 2,3,4,6-tetrachloroethane. The Department reviewed the residential and nonresidential ingestion-dermal soil remediation standards listed in Tables 1 and 2 at N.J.A.C. 7:26D Appendix 1 and found that all contaminants have a soil remediation standard with two significant figures. As discussed in the Response to Comment 116, the Department removed the ingestion-dermal soil remediation standards for 4-methyl-2-pentanone from the rules because the RfD from the HEAST used to derive the standards is no longer supported for use, and there are no other reliable sources of oral toxicity information for the contaminant.

The Department did not propose nonresidential inhalation soil remediation standards for acenaphthene, 4-methyl-2-pentanone, and toluene because appropriate toxicological information was not available, the calculated human health-based criterion exceeded one-million mg/kg, or because the calculated human health-based criterion exceeded the soil saturation limit.

216. COMMENT: There is an error in both Tables 1 and 2 at proposed N.J.A.C. 7:26D Appendix 1 for benzaldehyde. The calculated carcinogenic soil remediation standard is present in the noncarcinogenic column and, therefore, the calculated noncarcinogenic value does not appear. (6 and 8)

RESPONSE: The calculated carcinogenic and noncarcinogenic ingestion-dermal human health-based criteria for benzaldehyde (CAS #100-52-7) listed at proposed Appendix 1, Tables 1 and 2, were incorrect. In Table 1, the residential carcinogenic ingestion-dermal human health-based criterion for benzaldehyde should be 170 mg/kg and the residential noncarcinogenic ingestion-dermal human health-based criterion should be 7,800 mg/kg. The Department is making these corrections to Appendix 1 Table 1 on adoption. The corrections do not change the residential ingestion-dermal soil remediation standard of 170 mg/kg for benzaldehyde listed in Table 1.

At Appendix 1 Table 2, the nonresidential carcinogenic ingestion-dermal human health-based criterion for benzaldehyde should be 910 mg/kg and the nonresidential noncarcinogenic ingestion-dermal human health-based criterion should be 130,000 mg/kg. The Department is making these corrections at Table 2 upon adoption. The corrections do not change the nonresidential ingestion-dermal soil remediation standard of 910 mg/kg for benzaldehyde listed at Table 2.

217. COMMENT: There is an error in both Tables 1 and 2 at proposed N.J.A.C. 7:26D Appendix 1 for benzo(a)pyrene. It is not clear why a noncarcinogenic soil remediation standard was not calculated as a RfD as provided at proposed N.J.A.C. 7:26D Appendix 11, Table 1. (6 and 8)

RESPONSE: The residential and nonresidential noncarcinogenic ingestion-dermal human health-based criteria for benzo(a)pyrene were missing at proposed N.J.A.C. 7:26D Appendix 1, Tables 1 and 2. The calculated values are 18 mg/kg for the residential noncarcinogenic ingestion-dermal human health-based criterion for benzo(a)pyrene and 250 mg/kg for the nonresidential noncarcinogenic ingestion-dermal human health-based criterion. The Department is making these corrections to Tables 1 and 2 upon adoption. The corrections do not affect the residential (0.51 mg/kg) and nonresidential (2.3 mg/kg) soil remediation standards for the ingestion-dermal exposure pathway since the standards are based on the carcinogenic health endpoint.

218. COMMENT: The notice of proposal Summary, at 52 N.J.R. 573, states, “[t]he Department is not proposing soil remediation standards for benzo(ghi)perylene, carbazole, 4,6‑dinitro‑2‑methylphenol, endosulfan sulfate, 2‑nitroaniline, and phenanthrene, which are in existing N.J.A.C. 7:26D Appendix 1, because these standards are based on toxicity information that the USEPA no longer supports.” Acenaphthylene has an existing soil remediation standard through the inhalation exposure pathway. The proposed standards do not include acenaphthylene, which has an existing standard and, therefore, should have been included in the text describing the changes. (6 and 8)

RESPONSE: The Department unintentionally excluded acenaphthylene from the list of contaminants that have existing soil remediation standards, but the Department is not adopting a soil remediation standard for acenaphthylene. Prior soil remediation standards for acenaphthylene have an inhalation-based value using the Nisbet and LaGoy (1992) study. Nisbet and LaGoy (1992) did not conduct original research and relied on studies using dermal application and subcutaneous injection, with one study using intrapulmonary administration (not inhalation). The Nisbet and LaGoy study develops toxicity equivalency factors for PAHs compared to benzo[a]pyrene. There were no inhalation exposure pathway toxicity data that the Department determined to be acceptable for acenaphthylene. Nor were there acceptable toxicity factors for the ingestion-dermal exposure pathway. Accordingly, the Department did not propose a soil remediation standard for acenaphthylene.

219. COMMENT: The proposed standards do not include thallium, which has an existing standard and, therefore, should have been included in the text describing the changes at 52 N.J.R. 573. (6 and 8)

RESPONSE: In 2017, as part of updating remediation standards pursuant to N.J.A.C. 7:26D-6.2 through a notice of administrative change, the Department deleted the residential and nonresidential soil remediation standards for thallium. See 49 N.J.R. 3160(a) for further detail.

220. COMMENT: Four contaminants (acetone, dichlorofluoromethane [Freon 12], trans 1,2-dichloroethene, and trichlorofluoromethane) do not have proposed indoor air remediation standards but have screening levels and, therefore, should have been included in the notice of proposal text describing the changes. (6 and 8)

RESPONSE: The Department did not propose indoor air remediation standards for acetone, dichlorodifluoromethane (Freon 12), trans 1,2-dichloroethene, and trichlorofluoromethane because the studies that were used to derive the inhalation toxicity factors for these four contaminants in the prior indoor air screening levels table (see https://www.nj.gov/dep/srp/guidance/vaporintrusion/vig_tables.pdf) are no longer supported for use. Adopted N.J.A.C. 7:26D Appendix 11 Table 3 footnotes discuss why the RfC are no longer used to derive indoor air standards for these four contaminants.

221. COMMENT: Three compounds (bromoethene, 1,3-butadiene, and 3-chloropropene) are currently listed in the "Generic Vapor Intrusion Screening Levels," but do not have a proposed standard and they are not mentioned by the Department in the proposal description of changes. (6 and 8)

RESPONSE: The Department did not propose indoor air remediation standards for bromoethene (vinyl bromide), 1,3-butadiene, and 3-chloropropene (allyl chloride) because these chemicals are not on the USEPA target compound list and they are rarely the primary contaminants that drive the remediation of a site. In addition, the Department did not propose soil or ground water remediation standards for these three compounds, and there are none in the former rules.

222. COMMENT: The notice of proposal Summary discussion, at 52 N.J.R. 574, compares the changes between prior and proposed standards. The definition of the existing standard impacts the categorization of the number of contaminants with proposed standards that are more stringent, less stringent, or the same as the existing standards. However, regardless of the definition of existing standards, the Department assessment of changes cannot be duplicated. The following tables present this information:

Soil Remediation Standards – Ingestion-Dermal – Residential Exposure Scenario

Category	NJDEP	CCNJ/SRIN based on existing SRS	CCNJ/SRIN based on human criteria (ingestion - dermal)
Proposed Soil Remediation Standards	117	118	118
Proposed - More Stringent	22	19	21
Proposed -Same	31	22	29
Proposed - Less Stringent	64	77	68

Clarification is necessary as to how the Department arrived at these numbers.

Discrepancies are apparent for the other pathways/scenarios as well.

Soil Remediation Standards – Ingestion-Dermal – Non-Residential Exposure Scenario

Category	NJDEP	CCNJ/SRIN based on existing SRS	CCNJ/SRIN based on human criteria (ingestion - dermal)
Proposed Soil Remediation Standards	113	114	114
Proposed - More Stringent	13	16	20
Proposed -Same	3	2*	2*
Proposed - Less Stringent	90	96	92

* Not the same two contaminants in both cases

The Summary mistakenly refers to this as the residential exposure scenario.

Soil Remediation Standards – Inhalation – Residential Exposure Scenario

Category	NJDEP	CCNJ/SRIN based on human health criteria (inhalation)

Proposed Soil Remediation Standards	33	38
Proposed - More Stringent	13	18
Proposed -Same	1	1
Proposed - Less Stringent	19	19

Soil Remediation Standards – Inhalation – Non-Residential Exposure Scenario

Category	**NJDEP**	**CCNJ/SRIN based on human health criteria (inhalation)**
Proposed Soil Remediation Standards	27	29
Proposed - More Stringent	1	3
Proposed -Same	0	0
Proposed - Less Stringent	26	26

(6 and 8)

RESPONSE: The Department reviewed the contaminants contained in Tables 1 through 4 at proposed N.J.A.C. 7:26D Appendix 1 (see 52 N.J.R. at 586 through 602) against the contaminants contained in Tables 1a and 1b at Appendix 1 in the prior rule (N.J.A.C. 7:26D). The Department found, with one exception, that the results of the contaminant comparison matched the narrative description of the comparison of soil remediation standards found in the notice of proposal Summary, at 52 N.J.R. 574. The notice of proposal Summary incorrectly identified the number of soil remediation standards that decreased (became more stringent) for the nonresidential exposure scenario of the ingestion-dermal exposure pathway. The number of standards should have been 20 and not 13.

The Department compared narrative description of the comparison of soil remediation standards found in the notice of proposal Summary, at 52 N.J.R. 574, against the results under the NJDEP column heading for the four tables provided at Comment 222. The Department found, with one exception, that the results of the contaminant comparison found at 52 N.J.R. 574, matched the results under the NJDEP column heading for the four tables provided at Comment 225. The nonresidential exposure scenario of the ingestion-dermal exposure pathway table provided at Comment 222 incorrectly identified the number of soil remediation standards that decreased (became more stringent) under the NJDEP column heading. The number of standards should have been 20 and not 13.

Based on the review described above, the Department believes (with the one exception noted) that the values under the NJDEP column heading of the four tables provided at Comment 222 are correct. The Department could not determine how the values under the CCNJ/SRIN column headings for the four Tables were derived.

The Department reviewed the notice of proposal Summary, at 52 N.J.R. 574, in particular the discussion for the Soil Remediation Standards – Ingestion-Dermal – Non-Residential Exposure Scenario. The heading of the section correctly states, “Nonresidential Exposure Pathway.”

223. COMMENT: The C_{sat} values provided in the Remediation Standards, N.J.A.C. 7:26D, notice of proposal tables do not match the calculated values for: 2,3,4,6-tetrachlorophenol; and 2,4,5-trichlorophenol. These C_{sat} values are also necessary for the soil and soil leachate

remediation standards for the migration to ground water exposure pathway provided at proposed N.J.A.C. 7:26D Appendix 1 Table 5. The comparison of the C_{sat} values at proposed 7:26D Appendix 1 Tables 3 and 4 and Table 5 is presented in the following discussion:

Soil and Soil Leachate Remediation Standards for the Migration to Ground Water Exposure Pathway

Contaminant	NJDEP Tables 3 and 4	CCNJ/SRIN Tables 3 and 4	NJDEP Table 5	CCNJ/SRIN Table 5
1,1'-Biphenyl	78	78	72	78
1,2-Dichloroethene (trans)	1300	1300	1100	1300
2,4-Dichlorophenol	2600	2600	2100	2600
Indeno(1,2,3-cd)pyrene	0.74	0.74	0.086	0.74
Toxaphene	85	85	110	85
2,3,4,6-Tetrachlorophenol	150	140	140	140
2,4,5-Trichlorophenol	5800	7700	5800	7700

As stated above, C_{sat} is utilized in both the calculation of volatilization and migration from soil to ground water. The equations used for the calculations at Tables 3 and 4 and Table 5 of the proposed amendments are identical. Inconsistencies were noted in the calculated C_{sat} between Tables 3 and 4 (inhalation) and Table 5 (migration from soil to ground water) of the proposed amendments.

The difference in all but the two chlorophenol contaminants did not impact the calculated migration to ground water soil remediation standard. However, the C_{sat} differences for the tetrachlorophenol and trichlorophenol prevented the calculation of the proposed soil remediation standard. Utilizing the chemical parameters provided at proposed N.J.A.C. 7:26D

Appendix 10, the C_{sat} values for these two compounds were calculated. The C_{sat} values could not be confirmed with the Appendix 10 data. The soil organic carbon-water partition coefficient (K_{oc}) is an important parameter in the C_{sat} calculation so the source of the K_{oc} values (identified in a footnote to Appendix 10 tables) was reviewed. The K_{oc} for 2,3,4,6-tetrachlorophenol was incorrectly listed at Appendix 10 as the K_{oc} for 2,4,5-trichlorophenol. The source of the incorrect K_{oc} value for 2,3,4,6-tetrachlorophenol listed at Appendix 10 is unknown. The proposed soil remediation standard was confirmed with the correct K_{oc} values from the original referenced source.

The correct K_{oc} value was used by the Department for 2,3,4,6-tetrachlorophenol in the calculation of the proposed amendments at N.J.A.C. 7:26D Appendix 1 Table 5 C_{sat} value but it was not the value listed at Appendix 10, which is why the C_{sat} values differed from Tables 3 and 4 of the proposed amendments. Apparently, at some point while the different tables were being generated, the incorrect K_{oc} values were inserted at Appendix 10.

Considering the numerous discrepancies and errors, the commenters request that the proposed amendments be withdrawn until the errors can be addressed and their impacts assessed. (6 and 8)

224. COMMENT: The proposed ground water leachate standards for two chlorophenol compounds as the soil organic carbon water partition coefficient value, K_{oc} cannot be confirmed. Therefore, the soil saturation limits, C_{sat}, could not be calculated and confirmed based on the data provided at proposed N.J.A.C. 7:26D Appendix 10. Specifically, the K_{oc} for 2,3,4,6-tetrachlorophenol was incorrectly listed at Appendix 10 as the values are 2,4,5-

trichlorophenol, but not the other way around. Also, the source of the K_{oc} value for 2,4,5-trichlorophenol is unknown. Though the correct K_{oc} value for 2,3,4,6-tetrachlorophenol was used by the Department in the calculation of the C_{sat} value in Table 5, this was not the value listed at proposed N.J.A.C. 7:26D Appendix 10, which is why these numbers differ when compared to Tables 3 and 4. (9)

RESPONSE TO COMMENTS 223 AND 224: The Department entered incorrect K_{oc} values for 2,3,4,6-tetrachlorophenol and 2,4,5-trichlorophenol at proposed N.J.A.C. 7:26D Appendix 10. The correct K_{oc} for 2,3,4,6-tetrachlorophenol is 3,140 L/kg, and the correct K_{oc} for 2,4,5-trichlorophenol is 2,340 L/kg. Additionally, an incorrect C_{sat} value was entered for 2,3,4,6-tetrachlorophenol at Appendix 1, Table 5; however, the C_{sat} value for 2,4,5-trichlorophenol is correct. The correct value is shown at Appendix 1, Tables 3 and 4, which is 150 mg/kg. The Department is correcting these errors on adoption, which eliminates the discrepancies found in the Appendix 1 Tables for these two contaminants.

In addition to 2,3,4,6-tetrachlorophenol, the Department has discovered that the C_{sat} values listed at proposed Appendix 1,Table 5 for 1,1-biphenyl, 1,2-dichloroethene (trans), 2,4-dichlorophenol, indeno(1,2,3-cd)pyrene, and toxaphene were incorrect and should be equal to the values presented at Appendix 1, Tables 3 and 4. The Department is correcting these errors upon adoption, which eliminates the discrepancies in C_{sat} values among Appendix 1, Tables 3, 4, and 5.

Although incorrect C_{sat} values were entered at proposed Appendix 1 , Table 5, the correct C_{sat} values were used in comparison to the health-based criteria. Therefore, none of these remediation standards was affected.

225. COMMENT: The Department's use of generic Category 1 distribution of carbon fractions was not sufficiently documented or justified. The ratio of distribution of fractions utilized in the calculation should be provided. (4)

RESPONSE: The ratio of distribution of carbon fractions that the Department used to derive the Category 1 extractable petroleum hydrocarbon soil remediation standard is at Table 3 – Equivalent carbon fractions, surrogates, and toxicity/exposure information, in Guidance On The Human Health Based And Ecologically Based Soil Remediation Criteria For Number 2 Fuel Oil And Diesel Fuel Oil (https://www.nj.gov/dep/srp/guidance/rs/phcguidance.pdf).

226. COMMENT: The Department's study for Category 1 products was too small to be reliable. Use of a generic distribution of aromatic and aliphatic fractions does not account for age of discharge or variations in products, which can significantly affect the ratio of fractions present in the soil comprising the total extractable petroleum hydrocarbons concentration. The Department should allow the use of a site-specific calculation for Category 1 products as with Category 2. (4)

RESPONSE: The EPH-TPH Field Study, which was used to develop the EPH Method, was modeled from the petroleum method from the Massachusetts Department of Environmental

Protection and the Total Petroleum Hydrocarbon Working Group, which has a history of a successful petroleum hydrocarbon regulation program. To ensure geographic and geologic variability, the Department gathered sampling data taken from various locations throughout New Jersey to collect empirically generated Number 2 fuel oil composition information. Based on this information, the Department used the average composition to develop the health-based criteria. For additional information see Guidance On The Human Health Based And Ecologically Based Soil Remediation Criteria For Number 2 Fuel Oil And Diesel Fuel Oil (https://www.nj.gov/dep/srp/guidance/rs/phcguidance.pdf) and Health Based and Ecological Screening Criteria for Petroleum Hydrocarbons Frequently Asked Questions (Version 4.0, August 9, 2010) (https://www.nj.gov/dep/srp/guidance/rs/eph_faq.pdf).

A site-specific calculation for Category 1 extractable petroleum hydrocarbons is not warranted; however, the Department may consider fractionation based on sample-specific data and age of discharge or variations in products when proposed as a variance from the rule with appropriate justification. While not prohibited by the Department, fractionation of Category 1 extractable petroleum hydrocarbons to derive a sample-specific value may result in additional remediation costs to account for laboratory analysis. Further, Category 2 extractable petroleum hydrocarbon calculations are sample-specific, not site-specific. If each sample evaluated for Category 1 extractable petroleum hydrocarbons is fractionated to develop a sample-specific value as necessary, that value would become the health-based soil remediation standard for that individual sample location for the ingestion-dermal exposure pathway. Consequently, as with Category 2 extractable petroleum hydrocarbons, none of compliance averaging options described in the Department's Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria would be permitted if the fractionation approach were utilized. Additionally, this would require an alternate remediation standard for each sample location as a sample-specific calculation for Category 1 extractable petroleum hydrocarbons would vary from the health-based soil remediation standard that is established by the adopted rules.

227. COMMENT: The Department should provide information about how to apply standards when petroleum mixtures are present or when petroleum types are unknown, which is a common situation. EPH guidance references that when petroleum types are unknown, to test for waste oil parameters. Is it then assumed that Category 2 (site-specific) calculation is applicable? The extractable petroleum hydrocarbons guidance says 8,000 mg/kg default product limit (for Category 1) is to be applied to unknown petroleum products. This will be a source of confusion. (4)

RESPONSE: The ingestion-dermal exposure pathway remediation standards exist for Category 1 and Category 2 extractable petroleum hydrocarbons. If mixtures of Category 1 and Category 2 extractable petroleum hydrocarbons are present, or if the extractable petroleum hydrocarbons category is unknown, the Category 2 standards should be applied. The soil remediation standard for Category 2 extractable petroleum hydrocarbons is the sample-specific calculated value that is generated from the on-line Extractable Petroleum Hydrocarbons Soil Remediation Standard calculator and is regulated by the adopted rules.

The discussion of extractable petroleum hydrocarbon product limits is beyond the scope of this rulemaking, but is addressed in the Evaluation of Extractable Petroleum Hydrocarbons in Soil Technical Guidance (2019) https://www.nj.gov/dep/srp/guidance/srra/evaluation_eph_soil_guidance.pdf?version_1_0.

228. COMMENT: The Department did not provide a link to the calculator for Category 2 extractable petroleum hydrocarbons soil remediation standards. (4)

RESPONSE: The calculators are available at https://www.nj.gov/dep/srp/guidance/rs/index.html. The Department will send a GovDelivery Communications Cloud notice that indicates the Department will accept comments concerning the calculators. The notice will also include a timeframe for receipt of comments.

N.J.A.C. 7:26D Appendices 2, 3, 4, and 5

229. COMMENT: The Department's approach to calculating noncancer health-based criteria (for example, proposed N.J.A.C. 7:26D Appendix 2, Equation 2) assumes exposure of a resident child six years of age or younger. This is a subchronic exposure scenario, which USEPA (1989) defines as an exposure that occurs over a period of two weeks to seven years. As explained by the USEPA (1989), noncancer subchronic toxicity values should be used to evaluate noncancer effects of exposure periods between two weeks and seven years. For the noncancer health-based criteria calculation, the Department is using chronic toxicity values, rather than

subchronic toxicity values, where available. This results in noncancer health-based criteria that are more conservative than necessary to be protective.

The USEPA does use the same approach in deriving the regional screening levels that are used to support investigation decision-making under CERCLA and the Resource Conservation and Recovery Act (RCRA), however the USEPA Regional Screening Levels are not remedial goals and do not take the place of a risk assessment that would use appropriate toxicity values to determine the need for, and extent of, remedial action under those programs. This specific issue was reviewed by the USEPA Science Advisory Board (1993), which recommended against the use of chronic toxicity values in evaluating a subchronic exposure scenario (that is, exposure of a six-year old’s exposure) as it “may be overly conservative.” Instead, the USEPA Science Advisory Board recommended the use of a time-weighted age-adjusted approach in which the child and adult exposure periods for the resident were included (at the time 30-years of exposure) and chronic toxicity values were used, indicating that such an approach was the “most reasonable and supportable approach.”

Since the remediation standards proposed by the Department represent remedial goals and not screening levels, in order to be consistent with current risk assessment methodologies and procedures, the Department should revise the noncancer residential health-based calculations to be based on a 26-year age-adjusted exposure duration using chronic toxicity values or to provide options for developing ARS that are based upon this more appropriate and scientifically supportable approach recommended by the USEPA and its Science Advisory Board. (4)

RESPONSE: The USEPA has identified the use of a "childhood only" scenario in the Supplemental Guidance for Developing Soil Screening Levels stating, "for noncarcinogens, the screening levels focus on 'childhood exposures' only, a conservative approach that USEPA believes is appropriate for a screening analysis and is consistent with a RME." The Department has based its standards on the most sensitive population in order to be protective of all age groups and activities.

While the Department's approach is more conservative than using the 26-year age-adjusted approach with chronic toxicity criteria, the decision to use a six-year childhood exposure with chronic data, rather than the age-adjusted approach was based on several factors:

1) The USEPA Superfund Program and the Department believe this approach is consistent with a reasonable maximum exposure;

2) Subchronic toxicity data are not available for all of the Department's standards;

3) The subchronic toxicity data that are available have not gone through the same rigorous review as the USEPA IRIS or the NJDWQI chronic toxicity values;

4) Children are often more likely to be at risk from environmental hazards than adults because of unique activity patterns and behavior. For example, children crawl and play close to the ground making them more likely to come into contact with dirt and dust, which can include toxic chemicals, and children often put their hands, toys, and other items into their mouths.

5) Children have physiological differences. For example, they eat, breathe, and drink more relative to their body mass than adults do, and their natural defenses are less developed.

Children have a more permeable blood-brain barrier; highly permeable skin; less effective filtration in nasal passages; lower levels of circulation of plasma proteins and their digestive system; metabolic pathways; renal clearances; and vital organs are still developing. In addition, the same dose of a chemical during different periods of development can have very different consequences; and

6) While the Department may be more conservative than the 26-year age-adjusted approach for noncarcinogens referenced by the commenter, the Department does not add the ingestion-dermal pathway to the inhalation pathway to derive soil remediation standards, which is a less conservative approach than USEPA's regional screening levels.

An ARS using the 26-year age-adjusted approach for non-carcinogens for a residential exposure scenario would not be an adjustment based on site-specific factors as the Brownfield Act, at N.J.S.A. 58:10B-12.f(1), allows, but rather the use of an entirely different equation than what is found in the Remediation Standards, N.J.A.C. 7:26D, to develop a residential noncarcinogenic ingestion-dermal soil remediation standard. This practice is not permitted by the Brownfield Act and, therefore, is not permitted by the Department.

230. COMMENT: USEPA-issued guidance (USEPA 2005 Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens) pertaining to cancer risks associated with early-life exposures, including potency adjustment for certain carcinogenic chemicals suspected to have a mutagenic mode of action. In accordance with this guidance, current risk assessment science/practice involves incorporating age dependent adjustment factors (ADAFs)

in assessing cancer risks associated with exposure of children under the age of 16 to these mutagenic chemicals. For exposures before the age of two, a 10-fold adjustment is incorporated. For exposures between two and younger than 16 years of age, a three-fold adjustment is incorporated. This is current risk assessment science, and the Department should include in its derivation of residential cancer health-based criteria, age dependent adjustment factors appropriately. This would include proposed N.J.A.C. 7:26D Appendix 2 (Equation 1), Appendix 3 (Equation 1), and Appendix 5 (Equation 1). (4)

RESPONSE: While the Department's Site Remediation and Waste Management Program supports the protection against cancer risks from early-life exposure in the context of the baseline risk assessment and its associated screening levels, it will not include the mutagenic mode of action in the development of its soil remediation standards at this time. In accordance with the Brownfield Act, N.J.S.A. 58:10B-1 et seq., the adopted remediation standards are based on a conservative 10^{-6} risk level for carcinogenic compounds, which is believed by the Department's Site Remediation and Waste Management Program to be protective of any additional risks incurred from early life exposure. The Department will continue to review this issue as more information becomes available, and may consider it for future rulemaking, if deemed necessary.

231. COMMENT: In order to identify the reasons for the change in numeric values from the existing to proposed soil remediation standards and indoor air remediation standards for vapor intrusion, the input parameters had to be identified for both the existing and proposed

standards. The potential reasons for the changes in the remediation standards could be a result of the use of different toxicity values or from the selection of different input parameters.

The Department should provide a table comparing the existing and proposed parameters as this would provide the basis for understanding the changes in the proposed standards. (6 and 8)

RESPONSE: The reasons for the changes in a particular remediation standard could be a result of the use of different toxicity values or from the selection of different input parameters. While a table comparing the existing and proposed parameters would be helpful in comparing the existing and proposed remediation standards for each contaminant, such a table would not provide an understanding of the basis for the adopted remediation standards. Such an understanding can only be made by comparing the bases for the derivation of the prior remediation standards and screening levels against the bases for the derivation of the adopted remediation standards.

The bases for the derivation of the proposed Remediation Standards, N.J.A.C. 7:26D, are contained in adopted Appendix 2 (Soil -Ingestion-Dermal Exposure pathway), Appendix 3 (Soil – Inhalation Exposure Pathway), Appendix 4 (Soil and Soil Leachate – Migration to Ground Water Exposure Pathway), Appendix 5 (Indoor Air – Vapor Intrusion Exposure Pathway), Appendix 10 (Chemical and Physical Properties of Contaminants), Appendix 11 (Toxicity Factors), and Appendix 12 (Derivation of Equation Equivalency for the Development of Soil and Indoor Air Remediation Standards). This information may be compared against the bases for the former soil remediation standards, the former impact to ground water screening levels, and the former indoor air screening levels.

The bases for the derivation of the former soil remediation standards are contained in the former Remediation Standards, N.J.A.C. 7:26D, at Appendix 2 (Soil – Ingestion-Dermal Exposure Pathway), Appendix 3 (Soil – Inhalation Exposure Pathway), Ingestion-Dermal Exposure Pathway Soil Remediation Standards: Basis and Background at

https://www.nj.gov/dep/srp/guidance/rs/archive.html

and Inhalation Exposure Pathway Soil Remediation Standards: Basis and Background (

https://www.nj.gov/dep/srp/guidance/rs/archive.html

The bases for the derivation of former impact to ground water exposure pathway soil and soil leachate screening levels and criteria can be found in the following documents: Development of Impact to Ground Water Soil Remediation Standards Using the Soil-Water Partition Equation at

https://www.nj.gov/dep/srp/guidance/rs/archive.html

and Development of Site-Specific Impact to Ground Water Soil Remediation Standards Using the Synthetic Precipitation Leaching Procedure at

https://www.nj.gov/dep/srp/guidance/rs/archive.html

The bases for the derivation of former vapor intrusion exposure pathway indoor air screening levels can be found in Update to the New Jersey Department of Environmental Protection (NJDEP) Vapor Intrusion Screening Levels (https://www.nj.gov/dep/srp/guidance/vaporintrusion/vig_update_tables.pdf).

232. COMMENT: The USEPA recently updated its Regional Screening Level Tables and User's Guide in May 2020. The date citation of November 2018 throughout the Appendices of

proposed N.J.A.C. 7:26D should be changed to May 2020. The calculation of the proposed standards should be updated to reflect any changes made by the USEPA since 2018. (4 and 7)

RESPONSE: At the time the Department drafted the notice of proposal to amend the Remediation Standards, the November 2018 version of the USEPA's Regional Screening Level Table was the most recent version available. The adopted standards were, in part, developed using information contained in the 2018 Regional Screening Levels Tables; therefore, the Department uses the November 2018 citation for the Regional Screening Levels Tables for consistency throughout the adopted rules.

N.J.A.C. 7:26D Appendices 6, 7, 8, and 9

Calculators

233. COMMENT: Although the Department's calculation tool is referenced, a search of the webpage site does not find the calculator. Stakeholders cannot effectively replicate or validate calculations or evaluate the guidance document without being able to review the calculator function (and the basis and background for its development as provided by the USEPA for its Regional Screening Levels calculator). The Department must the release of the calculators for the ARS to be reviewed and commented on appropriately. (6 and 8)

RESPONSE: The ARS calculators are available at https://www.nj.gov/dep/srp/guidance/rs/index.html. The Department will send a GovDelivery Communications Cloud notice that indicates the Department will accept comments concerning the calculators. The notice will also include a timeframe for receipt of comments.

The calculators provide a tool to derive an ARS; however, the calculators were not needed to evaluate the proposed Remediation Standards. All the information necessary to calculate the remediation standards for all exposure pathways, that is, the pertinent equations and parameter values, was provided in the notice of proposal. See 52 N.J.R. 566(a).

234. COMMENT: Throughout proposed N.J.A.C. 7:26D Appendices 6 through 9, the Department is proposing that, in certain instances, a specific calculator developed by the Department should be used to develop an ARS. This language should be eliminated from the rules, as it would be more appropriately included in guidance. Mandating the use of a specific calculator in the proposed rule seems unnecessary and could limit the flexibility of LSRPs to propose appropriate site-specific approaches to the Department for review and approval as allowed for by the Brownfield Act. The Department's calculators should also be subject to robust stakeholder review and comment prior to publication, consistent with other Department guidance. (4 and 7)

235. COMMENT: In many places, the rules call for the use of the Department's calculator. The calculator is not widely available, and mandatory use of an on-line calculator limits the user's flexibility and ability to conduct the necessary "what if" analysis, especially if there is no documentation for this calculator. The rules should allow the use of other means, for example a properly documented and commented spreadsheet. (16)

RESPONSE TO COMMENTS 234 AND 235: The ARS calculators are available at https://www.nj.gov/dep/srp/guidance/rs/index.html. The Department will send a GovDelivery

Communications Cloud notice that indicates the Department will accept comments concerning the calculators. The notice will also include a timeframe for receipt of comments. Use of the calculators will not inhibit flexibility as the calculators will enable substitution of parameters allowed to be changed, in accordance with the adopted rules. These calculators are designed to accommodate the existing options.

An LSRP may propose the use of an ARS that is not covered by the options in the adopted rules. In these instances, the LSRP will be required to provide the Department with justification and documentation of his or her scientific rationale. If the Department approves an ARS option not included in the adopted rules, then the Department may, with the assistance of the LSRP, develop an additional calculator.

General

236. COMMENT: While the Department allows the remediating party to vary certain parameters, the underlying target cancer risk is 10^{-6}. There are cases, such as isolated areas that are rarely accessed and only for a limited amount of time, when a higher risk may be acceptable. During the stakeholder discussions, an example was presented of a worker going to a gas valve station to inspect a gauge once a week for five minutes. Any contamination at the site is practically irrelevant for this exposure scenario. Accepting a higher risk simplifies the process or a purely verbal ARS should be used in this case. (16)

RESPONSE: Pursuant to the Brownfield Act, at N.J.S.A. 58:10B-12.d, the Department applies a cancer risk of 10^{-6} (one in one million) for carcinogens and a Hazard Quotient of one for noncarcinogens. The adopted rules and the Alternative Remediation Standards Technical Guidance for Ingestion-Dermal and Inhalation Exposure Pathways for Soil (https://www.nj.gov/dep/srp/guidance/) allow for reduced exposure assumptions for utility workers.

237. COMMENT: Proposed N.J.A.C. 7:26D Appendices 6 and 7 should describe a process for how to determine if a representative reasonable maximum exposure has been selected. (4)

RESPONSE: Reasonable maximum exposure is defined as the "highest exposure that is reasonably expected to occur at a site." This is a site-specific decision and will require background knowledge and evaluation of the site's current and future use. In the development of an ARS, exposure parameters should be selected that reflect the reasonable maximum exposure and there should be supporting documentation provided to justify the use of those parameters.

238. COMMENT: The Department should permit ARS options for other common scenarios; for example, mixed use developments with nonresidential use or parking structures on the ground floor and residential living space above. As is permitted in other states, such as Pennsylvania, these ARS options should provide opportunities for the application of realistic exposure scenarios that are reflective of the inherently different uses by residential occupants, as opposed to nonresidential occupants, at these properties. Similarly, the Department should

allow LSRPs to develop site-specific ARS for mixed use properties that are predicated on the planned use of institutional controls to control exposure. (4 and 16)

RESPONSE: An ARS may be proposed for a mixed-use setting. However, in a mixed-use setting, either the most sensitive receptor would be accounted for over the entire project, or the project could be broken down into separate units, applying different standards to different units depending on proposed property use. The Department allows for the use of engineering and institutional controls for compliance with the appropriate standards predicated on the planned use of the property.

239. COMMENT: The investigator should be able to modify the default parameters associated with nonresidential land use to account for site-specific exposure conditions. Though the Department cannot ensure that property conditions will remain the same (unless an institutional control is established), this limitation applies to every risk-based clean-up standard, including those for which an ARS is explicitly allowed. (4)

RESPONSE: The Department does allow for modification of exposure factors based on restricted access, with proper institutional and engineering controls. Institutional controls are required for a remedial action based on nonresidential standards or an ARS developed for an alternative land use exposure scenario.

240. COMMENT: The USEPA is releasing chapter updates to its Exposure Factors Handbook individually. For example, Chapter 3: Ingestion of Water and Other Select Liquids was updated

in February 2019. If the Department strives to be consistent with the USEPA, exposure factors that cannot be changed through the ARS process (for example body weight, soil ingestion rate) should be made adjustable based on Exposure Factors Handbook updates. (4 and 16)

RESPONSE: The Brownfield Act, at N.J.S.A. 58:10B-12, mandates that the Department develop soil remediation standards using exposure parameters that provide an adequate margin of safety and are consistent with the guidance and regulations for exposure assessment developed by the USEPA, pursuant to CERCLA and other statutory authorities as applicable.

In accordance with the Brownfield Act, and to ensure consistency with the USEPA's Superfund program, the Department utilizes the exposure factors listed in the USEPA's Standard Default Exposure Factors for Superfund (OSWER Directive 9200.1-120) in the development of soil remediation standards. These exposure factors are in the adopted Remediation Standards, N.J.A.C. 7:26D Appendix 2. If the USEPA updates the Standard Default Exposure Factors for Superfund, the Department will review those updates and initiate rulemaking, if needed.

For a discussion of the Exposure Factors Handbook, see the Response to Comments 197 and 198.

241. COMMENT: For adolescent receptors, body weight and skin surface area adjustments are necessary; however, the proposed rule does not permit these adjustments. (4)

RESPONSE: Adjustments to the body weight and skin surface area exposure factors for the adolescent receptor is reasonable in cases where the receptor with the greatest exposure is determined to be the adolescent trespasser. The Department has permitted these modifications in the past, but only on USEPA-led Superfund or RCRA sites in New Jersey where a trespassing adolescent could be a potential receptor. It is strongly recommended that a technical consultation be held with the Department to ensure concurrence before the modification of these exposure factors.

242. COMMENT: The USEPA 2011 Exposure Factor Handbook recommended value for life expectancy is 78 years. The USEPA's overall confidence in this value is rated as "high." The USEPA's recommended value differs from the 70 years cited in the guidance for averaging lifetime exposure to carcinogens. (4)

RESPONSE: The USEPA 2014 Recommended Default Exposure Factors for Superfund (OSWER Directive 9200.1-120) recommends 70 years for life expectancy. Consistent with the recommended standard defaults, the USEPA’s Superfund program uses a 70-year life expectancy in the human health risk assessment process and for the development of the regional screening levels. The USEPA Superfund program has not adopted the 78-year life expectancy recommended in the Exposure Factors Handbook. To ensure consistency with the exposure factors used by the USEPA Superfund program and meet the requirements set forth in the Brownfield Act, the Department will continue to use the 70-year lifetime expectancy to derive soil remediation standards.

243. COMMENT: Proposed N.J.A.C. 7:26C-3.5(d) allows the Department to extend a mandatory timeframe due to circumstances outside the control of the person remediating the contaminated site. The Department has no limit on the timeframe for review of the proposed ARS, and the person responsible for conducting the remediation has no control over (or even the ability to predict) the duration of the Department's review; therefore, proposing and submitting to the Department a proposed ARS meets the conditions of ARRCS, at N.J.A.C. 7:26C-3.5(d). This issue recurs in other parts of the proposed Remediation Standards, N.J.A.C. 7:26D. As such, the statement at proposed N.J.A.C. 7:26D Appendix 6 at I(a) and at other parts of proposed N.J.A.C. 7:26D that the need to develop an ARS is not a basis for extending the mandatory timeframes should be deleted. (2)

RESPONSE: There could be circumstances outside the control of the person responsible for conducting the remediation regarding Department approval of an ARS. Accordingly, upon adoption, the Department is modifying Appendices 6 through 9 at section I(a) of each Appendix to delete the limitation.

244. COMMENT: The Brownfield Act notes that the Legislature “found and declared that the State needs to ensure that the public health and safety and the environment are protected from the risks posed by contaminated sites and that strict standards coupled with a risk based and flexible regulatory system will result in more cleanups and thus the elimination of the public's exposure to these hazardous substances and the environmental degradation that contamination causes.” It also notes that “an alternative soil remediation standard shall be

based upon site specific factors which may include (1) physical site characteristics which may vary from those used by the department in the development of the soil remediation standards adopted pursuant to this section; or (2) a site-specific risk assessment." The proposed rule language does not provide the flexibility that would allow an LSRP and the Department to efficiently mitigate the public's potential exposure to hazardous substances through the application of other scientific methods and practices that would be appropriate on a site-specific basis.

For example, proposed N.J.A.C. 7:26D Appendix 8 (Development of Alternative Remediation Standards for Soil for the Migration to Ground Water Exposure Pathway) at II(c) states that "[w]ith prior approval by the Department, an ARS may also be developed using scientific methods other than those described in III(a) through (g) below including relevant guidance from the USEPA, other states, and other relevant, applicable, and appropriate methods and practices that ensure the protection of public health and safety and of the environment."

This language is a good example of how the proposed rule can provide for the flexibility and opportunity for site-specific assessment, required under the statute, without any impact on an LSRP's or the Department's ability to ensure protective cleanup decisions. Rule language should be revised to delete the Department's preapproval requirement "With prior approval by the Department" as discussed in the comments for proposed N.J.A.C. 7:26D-8.2 and 8.4, to provide flexibility and opportunity for the development of a site-specific ARS, as required under the statute, without any impact on a LSRP's or the Department's ability to ensure protective cleanup decisions.

In contrast, proposed N.J.A.C. 7:26D Appendices 6 and 7 do not include similar language and instead indicate that only specific options presented may be used to develop an ARS for the ingestion/dermal and inhalation exposure pathways, respectively. The Department should revise the language at proposed N.J.A.C. 7:26D Appendices 6 and 7 to include the same degree of flexibility for the development of ARS as has been included at proposed N.J.A.C. 7:26D Appendix 8. Doing so will provide LSRPs with the ability for site-specific decision-making that is protective of public health and the environment, and justifiable without sacrificing the Department's ability to oversee and control such approaches given its review and approval authority. (4 and 7)

RESPONSE: As discussed in the Response to Comments 175 through 181, the Department has the statutory authority to approve the use of an ARS at a contaminated site. A proposed ARS cannot be used until it is approved by the Department. Department preapproval of complex ARS options will minimize having the person responsible for conducting the remediation spend time and resources to develop and implement an ARS only to have the ARS rejected by the Department. As also discussed in the Response to Comments 175 through 181, the adopted rules allow implementation of some ARS without Department preapproval.

The Department's Alternative Remediation Standards Technical Guidance for the Ingestion-Dermal and Inhalation Exposure Pathways for Soil, the Alternative Remediation Standards Technical Guidance for Migration to Ground Water Exposure Pathway, and Vapor

Intrusion Exposure Pathway Technical Guidance have been written with stakeholder input. These documents are available at https://www.nj.gov/dep/srp/guidance.

The adopted rules and companion ARS technical guidance documents define the critical variables, exposure scenarios, and site conditions that must be evaluated and documented prior to establishing an ARS.

245. COMMENT: The Department's proposed rules indicate that only exposure frequency and exposure duration can be adjusted in deriving an ARS. There are other parameters that may warrant adjustment under certain exposure scenarios, including, but not limited to, soil ingestion rate, skin surface area, and adherence factor. As an example, the USEPA recommended soil ingestions rates for daily soil and outdoor settled dust for children and adults as captured in the Exposure Factors Handbook (see Table 5-1 from this source) would be more appropriate to consider as high-end soil ingestion rates for outdoor only exposure scenarios (for example passive recreational exposure) rather than the USEPA recommended default soil ingestion rates of 200 mg/day for children and 100 mg/kg for residential adults, which are upper-bound values for the presumed ingestion of soil and dust (both indoors and outdoors).

The Department should revise N.J.A.C. 7:26D Appendix 6 to not specifically limit what inputs and assumptions can be used in the development of an ARS in order to ensure the flexibility required by the Brownfield Act. The LSRP should be able to use any appropriate variable to reflect the site-specific conditions, not just the exposure duration and exposure frequency as proposed, based on the LSRP's independent professional judgment. One option would be to incorporate language similar to that which is included at proposed N.J.A.C. 7:26D Appendix 8 allowing for other scientifically justified methods to be proposed to the Department for consideration and approval. Doing so provides persons responsible for conducting a remediation, LSRPs, and the Department with the ability for good site-specific decision-making, where appropriate, that are still protective of public health and the environment and justifiable without sacrificing the Department's ability to oversee and control such approaches given their review and approval authority. (4 and 7)

246. COMMENT: Only exposure frequency and exposure duration can be varied when developing an ARS. While these are the variables with the highest mathematical impact, the Department is being prescriptive and limiting. The remediating party (or the LSRP) should be able to vary any variable that makes sense for specific site conditions. (16)

RESPONSE TO COMMENTS 245 AND 246: The Department interprets the comments as requesting that the wording at section II(c) at proposed N.J.A.C. 7:26D Appendix 8 be included at proposed N.J.A.C. 7:26D Appendix 6. Alternative methods to determine ARS (subject to Department review and approval) may be submitted for all exposure pathways. This is not specifically stated in the rules for the ingestion-dermal, inhalation, and vapor intrusion exposure pathways because they are not subject to as wide an array of ARS options as the migration to ground water exposure pathway.

For an alternative land use exposure scenario, adopted Appendix 6 provides that "an ARS for the ingestion-dermal exposure pathway may be developed based on site-specific modification of exposure duration and exposure frequency parameters for an alternative land use exposure scenario." Adjustment of the other exposure parameters for an alternative land use exposure scenario is precluded by the rules because the Department does not consider those adjustments to be site-specific, or because site-specific data is lacking to justify such a change. The Brownfield Act, at N.J.S.A.58:10B-12.f(1), mandates that ARS must be based on site-specific conditions and not changes to input parameters that are not site-specific.

Please see the Response to Comments 197 and 198 for a discussion of the USEPA Exposure Factors Handbook.

247. COMMENT: The Department should allow ARS development based on site-specific soil bulk density, in addition to the parameters already listed. The Department has not previously approved site-specific bulk density measurements due to: (1) potential soil property changes during drilling and soil core recovery; and (2) due to the Department's perception that there is a narrow range of dry soil bulk density values. With respect to objection (1), there are American Society for Testing and Materials (ASTM) and other standard methods for determining in-situ soil bulk density. With respect to objection (2), although soil bulk density tends to be between 1.3 and 1.8 grams per cubic centimeter, which is a relatively narrow range compared to other soil property parameters, this range could result in a +/- 20 percent change in an ARS. The Department should allow dry soil bulk density to be determined on a site-specific basis. (2)

RESPONSE: Soil bulk density generally varies within a relatively narrow range and has a relatively small effect on the remediation standard. For the inhalation exposure pathway, varying this parameter affects the remediation standard only when the volatile component (versus the particulate component) determines the standard. For the migration to ground water exposure pathway, the effect of bulk density is even smaller. For example, for the contaminant xylene, varying the bulk density to values between 1.2 and 1.8 is found to vary the remediation standard for xylene from its base value by less than five percent, as illustrated in the Department's Migration to Ground Water Exposure Pathway Remediation Standards: Basis and Background document. Additionally, while there are methods available to determine in-situ soil bulk density, they are not commonly employed, and they would require procedures to be developed to take into account variability in the density observed at different depths in the soil core. For these reasons, the Department has not developed a routine method to vary the bulk density of the soil at a site. However, if varying the bulk density is necessary, an LSRP is welcome to contact the Department and propose an alternative method. With proper justification and scientific rationale, the Department will consider the alternative method.

248. COMMENT: The Department should allow an institutional control and ground water monitoring for generation of ARS and compliance with soil standards through the migration to ground water exposure pathway if: (1) the discharge occurred sufficiently long ago that the impacts in the soil should have reached the ground water; (2) the site conditions (land surface elevation, location and integrity of impervious surfaces, and drainage patterns) remain the same; and (3) the ground water has not been impacted by the contaminants in the soil. Future

ground water monitoring, required based on a remedial action permit for soil, would be protective of human health and the environment. (2)

RESPONSE: Some contaminants take a long time to reach the ground water dependent on site conditions and contaminant properties. Therefore, “sufficiently long ago” will be a contaminant- and site-specific decision. Three of the Department's ARS options address this comment, as explained in the Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway. See https://www.nj.gov/dep/srp/guidance/rs/index.html. These options consider the nature of the contaminant, its location in the soil, site conditions, and its potential to migrate over a long period of time. First, the seasonal soil compartment model, N.J.A.C. 7:26D Appendix 8 at III(b), may be used to show that existing contamination in the soil will not reach the ground water in 100 years. Under these circumstances, the existing contaminant concentrations in soil may be used as the ARS. Second, N.J.A.C. 7:26D Appendix 8 at III(f) considers the migration to ground water exposure pathway to be adequately addressed for low mobility contaminants when an adequate separation distance exists between the contamination and the water table. Third, the migration to ground water exposure pathway is considered be adequately addressed when the highest contaminant concentrations are present at, or have reached, the water table and ground water contamination has not occurred (see N.J.A.C. 7:26D Appendix 8 at III(g)). In all three of these options, an institutional control and ground water monitoring is not necessary. Some migration to ground water compliance options (contained in the Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway, and beyond the scope of this rulemaking) allow for temporary exceedances in ground water remediation standards and require institutional controls and ground water monitoring.

249. COMMENT: N.J.A.C. 7:26D Appendix 8 at II(c) states, "[w]ith prior approval by the Department, an [alternative remediation standard] may also be developed using scientific methods other than those described in III(a) through (g) below including relevant guidance from the USEPA, other states, and other relevant, applicable, and appropriate methods and practices that ensure the protection of public health and safety and of the environment." This statement should apply to either all remediation standards or none. The migration to ground water pathway should not be the only pathway where other methods can be applied to generate ARS. (2)

RESPONSE: The suggestion to include the wording at N.J.A.C. 7:26D Appendix 8 II(c) at N.J.A.C. 7:26D Appendices 6, 7, and 9 is discussed in the Response to Comments 245 and 246.

For the ingestion-dermal exposure pathway, the Department provides several options at N.J.A.C. 7:26D Appendix 6 at III(a) and III(b) for the development of an ARS. "An alternative remediation standard for the ingestion-dermal exposure pathway may be based on site-specific alternative land use, which would involve an alternative exposure scenario (for example, exposure frequency and exposure duration) that is neither a residential nor nonresidential land use scenario."

For the development of an ARS for soil for the ingestion-dermal exposure pathway for lead, options at N.J.A.C. 7:26D Appendix 6 at III(b)1 through 4 are available, which include an alternative land use exposure scenario, site-specific changes (example, bioavailability) to the default values for the residential and nonresidential exposure scenarios, and the use of other models and methods. These options provide the flexibility to develop site-specific ingestion-dermal ARS that are protective of public health and the environment and are in accordance with the Brownfield Act, at N.J.S.A. 58:10B-12.f(1).

For the inhalation exposure pathway, the Department provides several options at N.J.A.C. 7:26D Appendix 7 at III(a) and III(b) for the development of an ARS. The appendix provides that an ARS for the inhalation exposure pathway may be based on a site-specific alternative land use, which would involve an alternative exposure scenario (for example, exposure frequency, exposure time, and exposure duration) that is neither a residential nor a nonresidential land use scenario. An ARS for soil for this exposure pathway may be based on site-specific parameter modifications, including depth range of contamination, soil organic carbon content (f_{oc}), and fraction of vegetative cover (V).

In addition to the options for the migration to ground water, ingestion-dermal, and inhalation exposure pathways for soil, the Department also provides options for developing ARS for indoor air. N.J.A.C. 7:26D Appendix 9 at III(a) through (c) provides options for the site-specific modification of exposure frequency and exposure time at a nonresidential use site or area of concern based on reduced workday hours or a restricted access exposure scenario.

The appropriate ARS guidance documents should be consulted for further information regarding ARS options. An LSRP is welcome to contact the Department and propose an alternative method. With proper justification and scientific rationale, the Department will consider the alternative method.

250. COMMENT: The Department should reference a webpage that will list the Department's approved alternatives to the SEVIEW software package and the conditions under which the software package may/may not be used. (2)

RESPONSE: If suitable alternatives to the SEVIEW software package become available, the Department will prepare and post guidance on the remediation standards webpage at https://nj.gov/dep/srp/guidance/rs/.

251. COMMENT: N.J.A.C. 7:26D Appendix 8 at III(d)1 should specifically reference the appropriate Department guidance for determining f_{oc}. (2)

RESPONSE: The term "appropriate Department guidance" is used at both N.J.A.C. 7:26D Appendix 7 (inhalation pathway) and Appendix 8 (migration to ground water pathway), when ARS options are being discussed. All guidance is located on the Department's remediation standards webpage (https://www.nj.gov/dep/srp/guidance/rs/). The Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway would apply in this case.

252. COMMENT: The appropriate Department guidance should be referenced at N.J.A.C. 7:26D Appendix 8 at III(f)1, rather than the characteristics of the contaminant. The existing

guidance has a list of organic compounds and metals that are considered to be immobile chemicals. The guidance further includes a list of conditions when the immobile chemicals guidance does not apply. There is no need to describe, at N.J.A.C. 7:26D, when, and for what compounds, the immobile chemical policy applies. (2)

RESPONSE: N.J.A.C. 7:26D Appendix 8 at both III(f)1 and III(g)1 contains a brief description of the conditions necessary to qualify for the option because they are narrative standards, rather than numeric standards (as at N.J.A.C. 7:26D Appendix 8 at III(a) through III(e)). The Department decided to include brief summaries of the conditions required for narrative standards, rather than listing the procedure, because the procedure is simply an assessment of the data, rather than a stepwise procedure utilized to develop a numeric standard.

253. COMMENT: The proposed rules suggest that if ground water has not been impacted and the highest concentration of vadose zone contamination is at the water table, then further remediation is not required. Site- or chemical-specific conditions may result in the highest contaminant concentrations being present elsewhere in the soil column (for example, strongly adsorbing soils, such as clay-rich units) that preclude further contaminant migration to the water table. Under such conditions, especially if discharges are historic, ground water is unlikely to become contaminated above ground water quality standards. The rules should be amended to allow for the LSRP to consider site-specific geology and geochemical conditions in the soil column, without Department preapproval, with emphasis placed on the maturity and stability of the contaminant plume. (4 and 7)

254. COMMENT: The proposed rules require the highest contaminant concentration to be at the water table. Site-specific geologic conditions may result in the highest concentrations being elsewhere in the geologic column (for example over a clay lens). The key factor here is the maturity and stability of the plume and the application should not be artificially limited. (16)

RESPONSE TO COMMENTS 253 AND 254: The option listed at N.J.A.C. 7:26D Appendix 8 at III(g) addresses those situations where the highest concentration of the contaminant is actually in contact with the ground water and no ground water contamination has occurred. In situations where the highest contaminant concentration is elsewhere in the soil column, the possibility still exists that this contamination may migrate down to the ground water in the future. For such situations, other ARS options should be used. For example, the seasonal soil compartment model may be used to show little contaminant transport over a 100-year time period. The SPLP model may be used to show that a contaminant is resistant to desorption from contaminated soil, such as contaminated clay. If a continuous clay-rich layer is observed, the aquifer of concern will actually be the aquifer above the clay layer, not an aquifer beneath the clay layer. N.J.A.C. 7:26D Appendix 8 at III(g) already takes into account site-specific geology and geochemical conditions of the vadose zone contamination via the actual observed ground water concentrations.

255. COMMENT: The USEPA has not promulgated soil leachate remediation standards for the migration to ground water exposure pathway, nor does the USEPA have comparable regional screening levels regional screening levels using SPLP. The soil leachate remediation standard is

entirely new to the New Jersey site remediation process. The Department must provide guidance and policy on how these standards will affect ongoing and historical investigations. (6 and 8)

256. COMMENT: At proposed N.J.A.C. 7:26D Appendix 8, the person responsible for conducting the remediation is instructed to use the Department SPLP calculator to generate site-specific standards. Appendix 8 does not appear to include instructions for applying the leachate criterion. (2)

RESPONSE TO COMMENTS 255 AND 256: Soil leachate remediation standards are aqueous concentrations used in conjunction with the SPLP test and its accompanying calculator. The instructions for using the leachate standards, the SPLP test, and the SPLP calculator are in the Department's Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway and in the calculator documentation. They are compared to contaminant concentrations observed in the soil leachate obtained from the SPLP test, in order to develop alternative soil remediation standards for the migration to ground water exposure pathway. The alternative soil remediation standard generated with this procedure is compared to site soil concentrations to determine compliance with the migration to ground water exposure pathway.

257. COMMENT: The Department provided only one guidance document for review and comment. The proposed amendments should be withdrawn until comprehensive guidance and policy documents may be provided for public review and comment. (6 and 8)

RESPONSE: After the close of the comment period for this rulemaking, the Department circulated its draft Alternative Remediation Standards Technical Guidance for the Migration to Ground Water Exposure Pathway and version 5.0 of its Vapor Intrusion Technical Guidance for stakeholder review. Both the final version of the guidance documents and the Department's responses to comments it received on the guidance are available on the Department's website at https://www.nj.gov/dep/srp/guidance /.

N.J.A.C. 7:26D Appendix 10

258. COMMENT: The Department K_{oc} values present an unjustified level of precision. Benzo(a)anthracene, copper (total), 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2-methylnapthalene, naphthalene, and trichloroethene (TCE) have lower K_{oc} values than USEPA K_{oc} values at proposed N.J.A.C. 7:26D Appendix 10, Chemical and Physical Properties of Contaminants. There is no explanation of why these chemicals have lower K_{oc} values or why these values were utilized, nor is there any discussion that all K_{oc} values are highly variable. The proposed amendments identify one value for K_{oc} in liters per kilogram (L/kg) for each chemical at proposed N.J.A.C. 7:26D Appendix 10. Many of the K_{oc} values at Appendix 10 are enumerated with a precision of four or five significant figures. As an example, the K_{oc} value for benzene is identified as 145.8 and ethylbenzene is identified as 446.1 (L/kg). The level of precision is deceptive for the calculation of a remediation standard and should only be used to calculate conservative screening levels as described in the original USEPA source document.

The notes at proposed N.J.A.C. 7:26D Appendix 10 identify the Superfund Soil Screening Guidance as a source for some parameters listed at Appendix 10 and a weblink to the USEPA website (https://www.epa.gov/superfund/superfund-soil-screening-guidance). "In 1996, [USEPA] issued the Soil Screening Guidance (SSG) as a tool to help standardize and accelerate the evaluation and cleanup of contaminated soils at sites on the National Priorities List (NPL). The SSG provides site managers with a tiered framework for developing risk-based, site-specific soil screening levels (SSLs) for the protection of human health." The 1996 Soil Screening Guidance document is available for download, including six technical sections and 13 appendices.

The Soil Screening Guidance Appendix K: Soil Organic Carbon (K_{oc}) / Water (K_{ow}) Partition Coefficient is directly relevant to the discussion. Table K-1 lists 31 compounds evaluated by the USEPA, the selected Log K_{ow}, calculated Log K_{oc} values and measured Log K_{oc} values for each compound. Appendix K includes a variety of K_{oc} values that various researchers have estimated for the individual chemicals. Toxicity Table 1 below demonstrates the wide variability in K_{oc} values for four common volatile organic compounds: benzene, ethylbenzene, tetrachloroethene, and trichloroethene.

Toxicity Table 1

K_{oc} Ranges Identified in 1996 Superfund Soil Screening Guidance

Chemical of Concern	Quantity of Koc Research References	USEPA Range of Koc Values	NJDEP Selected Koc Values (Appendix 10)
Benzene	13	31 to 100	145.8

Ethylbenzene	5	165 to 255	446.1
Tetrachloroethylene	15	177 to 373	94.94
Trichloroethylene	21	57 to 150	60.7

Toxicity Table 1 and the USEPA Appendix K support the following observations: 1) K_{oc} values are highly variable and affected by multiple physical conditions; 2) the selection of conservative K_{oc} values is scientifically defensible when calculating a screening level concentration that supports investigation and delineation decisions; 3) establishing a constant K_{oc} value for a chemical to support all remediation and land use decisions is not scientifically defensible; and 4) eliminating ARS pathways that evaluate site-specific retardation is not scientifically defensible.

Provide an explanation for the K_{oc} values that are presented at proposed N.J.A.C. 7:26D Appendix 10 and a separate justification of why there can be no deviation from the listed values. A statistical evaluation of the variability of each physical parameter and a sensitivity analysis are reasonable and should be included in a basis and background document for each of the proposed exposure pathways. (6 and 8)

RESPONSE: Toxicity Table 1 in the comment compares the Department's listed K_{oc} values to those contained in the USEPA Soil Screening Guidance documents (1996-2002). The Department acknowledges that the listed K_{oc} values for benzo(a)anthracene, 1,2-dichlorobenzene, 1,4-dichlorobenzene, 2-methylnapthalene, naphthalene, and trichloroethene are lower than those contained in the adopted rules. (Copper does not have a K_{oc} value.) This is because the USEPA regional screening level tables were the source of most of the listed K_{oc}

values at proposed N.J.A.C. 7:26D Appendix 10, not the USEPA Soil Screening Guidance. The 1996 USEPA Soil Screening Guidance document is 25 years old and the chemical databases contained within them are no longer updated or supported. Except for contaminants for which there are pH dependent K_{oc} values listed in the 2002 Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, K_{oc} values for the adopted rules are taken from the May 2018 USEPA Regional Screening Level Tables. The regional screening level tables are a currently maintained and more up-to-date database. The Department used the number of digits reported in the USEPA screening level tables and rounded the remediation standard after the standard was calculated.

The K_{oc} value is defined as the soil organic carbon-water partition coefficient. It is considered a constant and is dependent on soil organic carbon alone, with pH adjustments made for ionizable organic chemicals. The relatively large variability of K_{oc} values reported in the literature is due to the greater difficulty of precise experimental determination of this parameter compared to other parameters, such as the water solubility or the Henry's law constant. Additionally, experimental K_{oc} values for many contaminants are scarce. For this reason, in both the older USEPA Soil Screening Guidance documents and in the current USEPA regional screening level tables, the recommended K_{oc} values are determined by using estimation techniques, rather than by averaging experimental values. In the older USEPA screening level guidance, a calculation using an equation that correlates the K_{oc} with the octanol-water partition coefficient (K_{ow}) was used. However, in the current USEPA regional screening level documentation, correlation of measured K_{oc} values with the Molecular

Connectivity Index was found to be superior to correlation with the K_{ow} value. Therefore, the newer estimated K_{oc} values frequently diverge from those reported in older USEPA documents. The listed K_{oc} values are considered best estimates, not conservative values.

Regarding the Department's elimination of ARS pathways that evaluate site-specific retardation, which take into account site conditions other than just organic carbon, the SPLP option does in fact evaluate site-specific retardation, through its determination of a site-specific K_d value. The K_d value includes the K_{oc} parameter and also factors in other site-specific conditions other than soil organic carbon. The K_d value is inversely related to the retardation factor and serves as the parameter for estimating site-specific retardation and mobility.

A sensitivity analysis is contained in the Department remediation standards basis and background documents, which illustrate the effect of varying the various input parameters (including the K_{oc} parameter) on the value of the remediation standard. Migration to Ground Water Exposure Pathway Remediation Standards: Basis and Background at https://www.nj.gov/dep/srp/guidance/rs/.

259. COMMENT: The Department fails to technically justify its deviation from the USEPA physical characteristics and standards calculations. As provided in the Brownfield Act, at N.J.S.A. 58:10B-12(b), the Department shall base the standards on generally accepted and peer reviewed scientific evidence or methodologies; 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; and avoid the use of redundant conservative assumptions.

The Department selectively deviates from the USEPA's physical characteristics and standards calculations but maintains overly conservative characteristics that are not technically justified. The Department has defined Statewide soil and physical variables that are based on the subjective professional judgment of the staff of the Department Office of Science. The Department fails to justify the selected parameters, which stand in contrast to technical references. Specific parameters include ground water temperature, air-filled porosity, and water-filled porosity.

Ground water temperature affects the rate of chemical volatilization, the rate of diffusion of chemicals in ground water, and the rate of diffusion of chemicals in the air phase. An elevated temperature will create an exaggerated pattern of chemical movement.

The Department selected an average ground water temperature of 25 degrees Celcius (77 degrees Fahrenheit), which was the same value selected by the USEPA to represent a national average. The New Jersey Geological and Water Survey (NJGWS) has conducted multiple ground water monitoring events over many years to provide a more realistic ground water temperature. One NJGWS study, Ambient Major Ions of New Jersey, Series DGS05-2 (https://www.nj.gov/dep/njgs/geodata/dgs05-2.htm), provides five years of ground water sampling from 150 wells across New Jersey. The NJGWS website description of the research states, "The goals of the redesigned network (of wells) are to determine the status and trends of shallow ground-water quality as a function of land use related to non-point source pollution in New Jersey. Most of the shallow wells used were installed by the NJGWS or their contractors to meet the goals of the 1999 redesigned network. This network consists of 150 wells screened at the water table."

Of 150 ground water monitoring events, conducted between April and September, the average ground water temperature was 14.0 degrees Celsius and the maximum summer temperature was 23.4 degrees Celsius. The referenced study is not demonstrative of all site conditions, but exemplifies the unnecessarily conservative selection of 25 degrees Celsius.

The Department selected an air-filled soil porosity of 15 percent for all soils in New Jersey. The USEPA calculations utilize an air-filled porosity of 28 percent. This wide variation in soil characteristics is not justified.

The Department selected a water-filled soil porosity of 23 percent for all soils in New Jersey. The USEPA calculations utilize two water-filled porosity estimates: 15 percent when evaluating the soil saturation limit and 30 percent when evaluating the soil to ground water partitioning effects. The Department does not justify the selected water-filled porosity value and fails to evaluate a range of effective porosity levels in compacted soils.

The use of unnecessary conservatism in the development of criteria that are based on long-term exposures only leads to excessive costs with no added any public benefit. The commenters request that the proposed amendments be withdrawn until they can be properly developed and assessed for proper reconsideration. (6 and 8)

260. COMMENT: The Department fails to technically justify its deviation from the USEPA physical characteristics and standards calculations (3)

RESPONSE TO COMMENTS 259 AND 260: The values that the Department used for environmental parameters have been developed using well-documented procedures from the USEPA Soil Screening Level Guidance Documents, the USEPA Regional Screening Levels, and the New Jersey Geological Survey. Some input parameters are adjusted to New Jersey-specific values, as explained in the basis and background documents for the various exposure pathways. Any deviations from the USEPA in how the standards are calculated are also explained in these documents. The Department made these deviations in order to either conform to Department policy or for technical reasons.

The values are not conservative, nor do they result from redundant conservative assumptions. They were adjusted from USEPA nationally recommended values to values that are more representative of New Jersey. They are typical or mid-range values, as explained in the Migration to Ground Water Exposure Pathway Remediation Standards: Basis and Background and Inhalation Exposure Pathway Remediation Standards: Basis and Background. See https://www.nj.gov/dep/srp/guidance/rs/index.html. This basis is the same, without changes, as that contained in the 2008 Inhalation Standards: Basis and Background.

Regarding ground water temperature, the Department is not using a ground water temperature in the development of soil remediation standards. The unsaturated soil zone is the media of interest for the soil remediation standards. Values for chemical properties are generally reported at 25 degrees Celsius, and these values are typically used as reported for environmental assessment. The Department is using the USEPA regional screening level values for chemical properties.

As to air- and water-filled porosity in soil, New Jersey uses an air-filled porosity of 18 percent (not 15 percent), while the USEPA (in its Soil Screening Guidance) uses values of 13 percent and 28 percent (not just 28 percent). For water-filled porosity, New Jersey uses a value of 23 percent, while the USEPA uses values of 15 percent and 30 percent. New Jersey porosity values were calculated for a sandy loam soil, while the USEPA used a loam soil. Loam soil is not appropriate as a mid-range soil texture in New Jersey. As explained in the Department's basis and background documents, air-filled and water-filled porosities were calculated for a sandy loam soil and New Jersey climate using procedures and data sources contained in the 1996 through 2002 USEPA Soil Screening Guidance documents, along with New Jersey Geological Survey methodology regarding New Jersey climate and ground water recharge. The Department has evaluated of range of values for all input parameters used for calculation of the remediation standards in the sensitivity analyses reported in the various basis and background documents.

Concerning the two different soil moistures used for soil-water partitioning calculations and soil saturation limit calculations (used in the USEPA Soil Screening Guidance document), the soil saturation limit calculation in the USEPA document was actually contained in the inhalation pathway section of that document, and the same soil moisture was used for both the inhalation criteria and the soil saturation limit calculation for that pathway. The Department evaluates contaminant concentrations in a soil sample by comparing measured contaminant concentrations against all remediation standards and also against the soil saturation limit (which is used for both the inhalation pathway and the migration to ground water pathways).

This evaluation needs to be conducted using the same soil moisture assumptions for all comparisons. Therefore, the New Jersey-specific soil moisture content is used for migration to ground water exposure pathway calculations, inhalation exposure pathway calculations, and soil saturation limit calculations.

N.J.A.C. 7:26D Appendix 11

261. COMMENT: In the notice of proposal Summary, at 52 N.J.R. 575, under the heading of Considerations for the Development of Proposed Remediation Standards, the Department calculated remediation standards for 14 specific chemicals identified by the USEPA as Group C carcinogens, or as having “suggestive evidence of carcinogenic potential.” For these chemicals, the Department has proposed to include an additional uncertainty factor of 10 in calculating the non-cancer health-based values. According to the Department, the incorporation of this uncertainty factor in the noncancer calculation is because these chemicals “do not have carcinogenic toxicity information.” The Department should not incorporate this arbitrary uncertainty factor into the noncancer calculation or provide additional justification for why it is being considered. In addition to this being arbitrary and not scientifically supported, it is not a methodology used by the USEPA in the performance of human health risk assessment or in the calculation of conservative risk-based screening levels (for example, like the USEPA Regional Screening Levels) or cleanup goals under CERCLA or RCRA. It also creates inconsistency in how the health-based remediation standards are derived for other chemicals.

As an example, the USEPA has classified 2,3,7,8-TCDD as a Class 2B carcinogen (Carcinogenic to Humans). This means that there is more information/evidence to support the chemical as a potential human carcinogen than any Class C chemical. There is, however, still some uncertainty regarding the derivation of cancer toxicity values for 2,3,7,8-TCDD (the USEPA 2012 EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to NAS Comments, Volume 1) and the Department correctly decided to not derive cancer health-based values for 2,3,7,8-TCDD at this time. However, in contrast to the Group C carcinogens, in deriving the noncancer health-based values for 2,3,7,8-TCDD, the Department has not included the arbitrary uncertainty factor of 10. The Department's approach for 2,3,7,8-TCDD is correct, but the example demonstrates the inconsistency in how the Department is deriving certain remediation standards. The Department should not include the arbitrary and not scientifically supported uncertainty factor of 10 in deriving the noncancer health-based values for the Group C chemicals. (4)

RESPONSE: For chemicals classified as Group C carcinogens under the 1986 guidelines or suggestive carcinogens under the 2005 guidelines, there is some evidence suggesting their carcinogenic potential, but not enough to classify them as probable or likely carcinogens. The Department believes that the USEPA Superfund Program's approach is not protective for those Group C carcinogens without a slope factor, but for which qualitative data support a carcinogenic potential. For these contaminants, the Department has adopted the USEPA Office of Water approach to use the noncarcinogenic RfD with an additional uncertainty factor to account for potential carcinogenic effects (USEPA, 1985). For chemicals in which a suitable carcinogenic slope factor is available, a target cancer risk of 1 x 10^{-6} is used, as mandated by the Brownfield Act, N.J.S.A. 58:10B-1 et seq. The Department's risk assessment approach for chemicals classified as Group C (possible human carcinogens) under the 1986 guidelines or suggestive carcinogens under the 2005 guidelines is a science policy decision intended to be reasonable, public health protective, and consistent throughout various Department programs. The Department uses this policy to develop health-based standards including remediation standards, drinking water health-based MCLs, ground water quality criteria, and human health-based surface water criteria. See 52 N.J.R. at 575.

The adopted standards for 2,3,7,8-TCDD were developed using the USEPA IRIS RfD of 7E-10 mg/kg-day without the additional uncertainty factor of 10 as 2,3,7,8-TCDD is not a Group C carcinogen.

While the compound 2,3,7,8-TCDD is classified as a Class 2B carcinogen, uncertainty remains regarding the derivation and use of a cancer slope factor for this contaminant (See USEPA 2012 – EPA's Reanalysis of Key Issues Related to Dioxin Toxicity and Response to National Academy of Sciences (NAS) Comments, Volume 1.) To address the uncertainty surrounding dioxin toxicity, the USEPA initiated the Dioxin Reassessment program in 1991, to bring together the best science available nationally and internationally in an effort to better understand toxicological properties of chlorinated dioxins and furans, and other dioxin-like compounds, considered a priority health concern due the very high toxicity observed for this contaminant category through scientific evidence up to that point. This effort spurred increased toxicological research to improve the understanding of both potential cancer and non-cancer impacts from this group of contaminants. In August 2011, the USEPA announced a plan to separate the “Reanalysis of Key Issues Related to Dioxin Toxicity and Response to NAS Comments” into two volumes: Volume 1 (noncancer assessment) and Volume 2 (cancer assessment and uncertainty analysis). During the following year, on February 17, 2012, the USEPA published a non-cancer RfD for 2,3,7,8-TCDD in the USEPA IRIS (USEPA 2012). At that time, the USEPA indicated that this action concluded Volume 1, non-cancer toxicity of the Dioxin Reassessment and indicated that Volume 2, cancer-based toxicity, was ongoing and would be addressed through a future report. The USEPA also indicated that the IRIS RfD is the preferred toxicity value to use as a starting point for establishing exposure screening levels that are protective of human health. Further, the USEPA stated that the 2012 RfD is the recommended value "to be considered" for use in developing site-specific dioxin SSLs, PRGs and cleanup levels under CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan.

When Volume 2, cancer toxicity, of the Dioxin Reassessment is completed and a recommended oral cancer slope factor is included in IRIS, this new information will be considered by the Department for possible revision of the soil remediation standards for 2,3,7,8-TCDD at that time.

262. COMMENT: The Department provides no scientific basis for reducing the non-cancer effects of Group C carcinogens. Also, the Department provides no scientific basis for reducing the non-cancer RfD by an additional uncertainty factor of 10 to account for potential cancer

effects of Group C carcinogens, nor are the commenters aware of any scientific basis to support such an adjustment. A 2004 Department document states that the Department methodology for Group C carcinogens "differs somewhat from the approaches used by the USEPA drinking water program and the USEPA Superfund program but incorporates elements from both."

The USEPA Superfund program does not incorporate an additional uncertainty factor into the RfD when no slope factor is available for a Group C carcinogen and the drinking water program policy is to use a "slope factor with a 10^{-5} to 10^{-6} risk level." The Department determined that an additional uncertainty factor of 10 is necessary when using an RfD to protect for possible carcinogenic effects. The document then states that the use of the additional uncertainty factor is "consistent with USEPA's water programs as well as New Jersey's current standards and guidance for drinking water, surface water, ground water, and soil remediations." Neither of the USEPA programs cited utilize a safety factor approach in conjunction with an RfD, so it is unclear how the elements of both programs are incorporated in the decision to use a safety factor. The justification provided in the 2004 Department document is circular logic and does not provide any scientific basis for the 10-fold safety factor.

It is inappropriate to adjust toxicity values and reduce proposed soil remediation standards utilizing the Group C carcinogen policy that is not based on sound scientific principles and has not been subject to peer review. See the Brownfield Act, at N.J.S.A. 58:10B-12(b).

The notice of proposal Summary, at 52 N.J.R. 575, states that 13 contaminants are affected by the Group C carcinogen policy. However, if carcinogenic toxicity data is available, the 10-fold safety factor does not apply; the soil remediation standard is calculated as a carcinogen at the 10^{-6} risk level as are all other contaminants with carcinogenic toxicity information. Fourteen contaminants are listed in the notice of proposal Summary, at 52 N.J.R. 575 and 576, as being affected by the Group C carcinogen policy. Six of the 14 contaminants have carcinogenic slope factors and, therefore, a 10-fold safety factor is not applied. Four of the remaining eight contaminants have the Group C uncertainty factor already incorporated into the Department-derived RfD. Therefore, only four contaminants had the 10-fold safety factor incorporated in the calculation of the soil remediation standard. The language in the notice of proposal does not clearly state which of these require the incorporation in the calculation and which have already been included. This could result in the erroneous and unnecessary application of this additional safety factor when calculating ARS, as shown in the table below.

Group C Carcinogens	Ingestion	Inhalation
Atrazine	Must apply in calculation	No toxicity factor
Butylbenzylphthalate	SFO available	No toxicity factor
Dibromochloromethane (Chlorodibromomethane)	SFO available	No toxicity factor
1,4-Dichlrobenzene (p-Dichlorobenzene)	Included in NJ RfD	Not applied
1,1-Dichloroethene (1,1-Dichloroetylene)	Included in NJ RfD	Must apply in calculation
beta-HCH (beta-BHC)	Carcinogen only - SFO	No toxicity factor
Hexachloro-1,3-butadiene	SFO available	No toxicity factor
Isophorone	SFO available	Not applied
2-Methylphenol (o-cresol)	Must apply in calculation	No toxicity factor
4-Methylphenol (p-cresol)	Must apply in calculation	No toxicity factor
Methyl tert-butyl ether (MTBE)	Included in NJ RfD	IUR available
Naphthalene	Included in NJ RfD	IUR available
Tertiary butyl alcohol	Included in NJ RfD	No toxicity factor

1,1,2-Trichoroethane	SFO available	No toxicity factor

SFO – carcinogen slope factor – oral
IUR – carcinogen inhalation unit risk factor
RD – noncarcinogen reference dose - oral

Note that the proposed rule text erroneously also lists tertiary butyl ether as a Group C carcinogen rather than correctly listing tertiary butyl alcohol.

Thus, the Department should withdraw the proposed amendments, so that Group C Carcinogens can be properly addressed. There is no public benefit to the imposition of unnecessary conservatism in rulemaking. (6 and 8)

RESPONSE: The statement that neither the USEPA Superfund Program, nor the Office of Drinking Water, applies a safety factor adjustment for Group C carcinogens is incorrect. 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 under the 1986 guidelines or suggestive carcinogens under the 2005 guidelines. The Office of Drinking Water requires that the risk assessment be based on the RfD for non-carcinogenic effects, with an additional uncertainty factor of 10 to protect from possible carcinogenic effects. However, if no RfD is available, the risk assessment is based on the carcinogenic slope factor using a lifetime cancer risk level of 1 x 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 x 10^{-6}. If no carcinogenic slope factor is available, the Superfund Program requires that the RfD for non-carcinogenic effects be used without the incorporation of an additional uncertainty factor.

The Department believes that the USEPA Superfund Program approach is not protective for those Group C carcinogens without a slope factor, but for which qualitative data support a carcinogenic potential. For these contaminants, the Department has adopted the USEPA Office of Water approach to use the noncarcinogenic RfD with an additional uncertainty factor of 10 to account for potential carcinogenic effects (USEPA, 1985).

For chemicals in which a suitable carcinogenic slope factor is available, a target cancer risk of 1 x 10^{-6} is used, as mandated by the Brownfield Act, N.J.S.A. 58:10B-1 et seq. The Department's risk assessment approach for chemicals classified as Group C (possible human carcinogens) under the 1986 guidelines or suggestive carcinogens under the 2005 guidelines is a science policy decision intended to be reasonable, public health protective, and consistent throughout various Department programs. The Department uses this policy to develop Departmental health-based standards including remediation standards, drinking water health-based MCLs, ground water quality criteria, and human health-based surface water criteria. See 52 N.J.R. at 575.

The statement that the language in the proposed amendments does not clearly state which of the Group C carcinogen contaminants will require application of the additional safety factor when calculating a standard and which contaminants have a toxicity factor with the safety factor already incorporated into the RfD is also not correct. N.J.A.C. 7:26D Appendix 11, Tables 1, 2, and 3, identify the contaminants that are classified as Group C carcinogens, the toxicity factors in which a 10-fold safety factor adjustment must be applied to the RfD or RfC when calculating a standard, and the NJDWQI RfD that already incorporate a 10-fold safety factor adjustment for user convenience. Calculators for the development of site-specific ARS are available at https://www.nj.gov/dep/srp/guidance/rs/index.html. The toxicity factors listed in N.J.A.C. 7:26D Appendix 11, along with any additional uncertainty factors applied for Group C carcinogens (1986) or suggestive carcinogens (2005), are already incorporated into the calculators for user convenience.

The table of 13 Group C carcinogens in the notice of proposal Summary (52 N.J.R. at 575) incorrectly identifies “tertiary butyl alcohol” as “tertiary butyl ether.” The rule text correctly identifies the contaminant as “tertiary butyl alcohol.” See adopted N.J.A.C. 7:26D Appendix 1, Tables 1 through 6, Appendix 10, and Appendix 11 Tables 1, 2, and 3.

263. COMMENT: Only one contaminant, 1,1-dichloroethene, has a proposed indoor air remediation standard that is more stringent than the USEPA Regional Screening Levels value. The difference is based on the application of the Group C carcinogen policy, which requires a 10-fold additional safety factor. In the absence of applying this scientifically unsupported safety factor, all the Department's proposed indoor air remediation standards are the same as the USEPA regional screening level values. The commenters request that the Department withdraw the proposed amendments until errors are addressed and the public is provided with an accurate and scientific explanation allowing a proper comparison to Federal standards. (6 and 8)

RESPONSE: Under the 1986 guidelines for carcinogen risk assessment, 1,1-dichloroethene is classified as a Group C carcinogen (possible human carcinogen). There is not an inhalation unit risk (IUR) factor available from the toxicity source hierarchy, but there is a noncarcinogenic RfC available from the USEPA IRIS that can be used to develop an indoor air standard for 1,1-dichloroethene. For chemicals classified as Group C carcinogens under the 1986 guidelines, there is some evidence suggesting their carcinogenic potential, but not enough to classify them as probable or likely carcinogens.

The Department believes that the USEPA Superfund Program approach is not protective for those Group C carcinogens without an IUR, but with qualitative data available that support a carcinogenic potential. For these, the Department has adopted the USEPA Office of Water approach to use the noncarcinogenic toxicity value (RfC) with an additional uncertainty factor of 10 to account for potential carcinogenic effects (USEPA, 1985). The Department's risk assessment approach for chemicals classified as Group C (possible human carcinogens) under the 1986 guidelines or suggestive carcinogens under the 2005 guidelines is a science policy decision intended to be reasonable, public health protective, and consistent throughout various Department programs. The Department uses this policy to develop health-based standards including remediation standards, drinking water health-based MCLs, ground water quality criteria, and human health-based surface water criteria. See 52 N.J.R. at 575.

264. COMMENT: The Department must document deviations from its stated risk evaluation hierarchy. For ethylbenzene, the 2008 soil remediation standard was based on the ingestion-

dermal exposure pathway RfD as there was no calculated soil inhalation exposure pathway considered due to the lack of inhalation toxicity data. The IUR value derived from the CalEPA is now utilized for calculating a soil inhalation standard and it is more restrictive than the soil ingestion-dermal standard, which is based on the USEPA IRIS RfD. The Department's basis for the reduction in the standards is the conclusion of an International Agency for Research on Cancer (IARC) 2000 document and a National Toxicology Program (NTP) 1999 study. The data and findings from the IARC document and NTP study were available to the Department, as well as the published CalEPA IUR, at the time of the initial Soil Remediation Standards adoption in June 2008; however, the Department at the time opted to rely on the published USEPA IRIS data. The Department needs to provide a sufficient scientifically based explanation for deviating from the hierarchy for the selection of toxicity information at this time because the IARC document/NTP study contain inconclusive evidence on human exposure and their conclusions do not align with existing USEPA IRIS toxicological information. (6 and 8)

265. COMMENT: Within the proposed N.J.A.C. 7:26D Appendices, the Department's derivation of remediation standards for ethylbenzene currently treats this chemical as though it is a carcinogen. The USEPA IRIS notes that ethylbenzene is not classifiable as to human carcinogenicity (Class D). In deriving the Regional Screening Levels, the USEPA currently uses cancer toxicity values developed by the CalEPA. Since the Department's Tier 1 source for toxicity information is IRIS (with the exception of the NJDWQI), and that CalEPA is a lower tiered source for such information the Department should continue to rely on the cancer classification provided by IRIS until the USEPA completes its (re)assessment of ethylbenzene

toxicity. Doing so would ensure consistency with the Department's proposed approach for dioxin (that is, 2,3,7,8-TCDD). (4)

RESPONSE TO COMMENTS 264 AND 265: The existing USEPA IRIS carcinogenicity assessment for ethylbenzene was last conducted in 1988 and does not include a cancer effects IUR factor. The IRIS toxicity assessment for ethylbenzene identifies the contaminant as a Class D carcinogen that is "not classifiable due to a lack of animal bioassays and human studies." The IRIS assessment notes that the National Toxicology Program has plans to initiate a two-year carcinogenicity bioassay with additional metabolism and excretion studies to be conducted, as well. Discussions with the USEPA indicate that the USEPA has begun a reevaluation of the ethylbenzene IRIS toxicity assessment that was anticipated to take a number of years to complete; however, reassessment for the contaminant was suspended in 2018. Unlike dioxin, which was referenced by the commenter, the USEPA has no current plans to reassess ethylbenzene for its carcinogenicity status.

In the absence of an IRIS IUR factor, the Department used the 2007 (updated in 2009 and 2011) CalEPA IUR factor, based on more recent 1999 NTP studies, in developing the soil remediation standard for ethylbenzene for the inhalation exposure pathway because the CalEPA toxicity factor is based on the best science available, compared to the cancer toxicity information contained in the IRIS database. The CalEPA IUR factor for ethylbenzene is also used by the USEPA in the regional screening level tables and has been used by the Department for the development of indoor air screening levels/standards since 2013.

In 1999, the NTP published rat/mice inhalation studies for ethylbenzene, finding clear evidence of carcinogenic activity in male rats with increased incidence of renal tubule neoplasms. The NTP, through its studies, also found evidence of carcinogenic activity in female rats based on increased incidence of renal tubule adenomas. Evidence of carcinogenic activity was also found in male mice based on increased incidence of alveolar/bronchiolar neoplasms and in female mice based on increased incidence of hepatocellular neoplasms.

In 2007 (updated in 2009 and 2011), CalEPA adopted an ethylbenzene IUR factor based on the 1999 NTP studies. The CalEPA IUR factor was developed using the renal tubule carcinoma or adenoma incidence data in male rats as the more reliable basis for estimating human cancer potency. The CalEPA assessment outlines in detail the evaluations (including PBPK modeling) conducted as part of the development of the IUR factor to address extrapolation of the toxicity data from animals to humans. Development of the IUR factor included public and peer review of the technical document outlining the basis of the value with approval by California's Scientific Review Panel for Toxic Air Contaminants. Documentation on the CalEPA IUR value may be accessed at http://www.oehha.ca.gov/risk/ChemicalDB/index.asp.

After consideration of the above information, including further evaluation of this issue by the Department Division of Science and Research, the Department used the CalEPA IUR toxicity information (toxicity factor) in its development of the Inhalation Exposure Pathway Soil Remediation Standards, N.J.A.C. 7:26D-4. This toxicity factor was used because the value was based on updated information (the 1999 NTP study) that was unavailable at the time of the USEPA IRIS assessment. This ethylbenzene toxicity factor is also included in the USEPA Regional

Screening Levels table and in the Department's March 2013 Vapor Intrusion Screening Levels (VISL) table used by the Department in the evaluation of the Vapor Intrusion pathway.

The rulemaking process requires the Department to select input parameters, such as chemical properties and toxicity factors, as much as two years prior to rule adoption. Accordingly, for the 2008 Remediation Standards, the toxicity factors were selected in 2006. Therefore, the CalEPA toxicity factor, developed in 2007, was not available for the Department to select for the 2008 Remediation Standards.

As to the Department's approach for establishing soil remediation standards for dioxin, uncertainty remains regarding a preferred cancer slope factor for 2,3,7,8-TCDD. This is evidenced through the existence of five Tier 3 cancer slope factors that have been proposed by several Federal and state agencies, and that span several orders of magnitude (USEPA 2020). The USEPA Dioxin Reassessment is ongoing and Volume 2, cancer toxicity, is expected to be published in the future (USEPA 2012). The Department will respond through evaluation of that future information to determine if a revision to the Department's soil remediation standards for this contaminant is warranted. Until then, a Tier 1 noncancer RfD is available in USEPA IRIS for use, and the USEPA recommends its use to USEPA Regions and states as a basis for establishing site-specific, USEPA regional, or state criteria or standards. (USEPA 2012 and USEPA 2020).

266. COMMENT: The notice of proposal notes that as a result of the limited availability of inhalation exposure pathway-based toxicity data, the Department is not proposing inhalation

exposure pathway remediation standards for 28 compounds that are in the existing rules. One of these is bis(2-chloroethyl)ether, which is volatile, and a check of the USEPA IRIS indicates it has an IUR factor of 3.3x10-4 (ug/m^3)-1. There are some caveats regarding concentrations above 3E+1 ug/m^3, as above this concentration the IUR factor may not be appropriate. IRIS also mentions an on-line message, indicating some uncertainty regarding physical and chemical properties required to run the indoor air vapor intrusion models not being found during a 2003 literature search. The Department should provide justification for not including IUR factor at proposed N.J.A.C. 7:26D Appendix 11, Table 3 and the resultant derivation of indoor air standards for bis(2-chloroethyl)ether. (4)

RESPONSE: The notice of proposal summary, at 52 N.J.R. 576-577, explains that when the Department derived an IUR factor or RfC through route-to-route extrapolation, the toxicity factor was not used unless the route-to-route extrapolation was conducted via PBPK modeling. Because the IUR factor for bis(2-chloroethyl)ether is based on a route-to-route extrapolation, the Department did not use it. Upon adoption, the Department is updating N.J.A.C. 7:26D Appendix 11, Tables 2 and 3 with additional footnotes to explain when an IUR factor or RfC was derived through route-to-route extrapolation and the toxicity factor was not used.

Chemical properties were available as of 2018 for bis(2-chloroethyl)ether in the USEPA regional screening level tables, but the Department determined they were not needed for this contaminant for the inhalation exposure pathway since there was no adequate inhalation toxicity information.

In addition, to the lack of adequate inhalation toxicity information for bis(2-chloroethyl)ether, the Department calculated indoor air remediation standards only for those volatile contaminants that are on the USEPA TO-15 Method, Table 1, list of analytes, the Department Low Level USEPA TO-15 (LLTO-15) Method list of analytes, and for elemental mercury. As bis(2-chloroethyl)ether is not on the USEPA Method TO-15 or Department Method LLTO-15 analyte lists, no indoor air remediation standards for the vapor intrusion exposure pathway were proposed or adopted.

267. COMMENT: For chloroform (CASRN 67-66-3), review of the USEPA IRIS indicates that there is some equivocation in the reported toxicity values and that the USEPA is currently working to revise the assessment for inhalation exposure. Chloroform has an October 2001 IRIS IUR factor of 2.3x10-5 (ug/m3)-1 in addition to the ATSDR RfC of 9.8x10-2 mg/m3. The Department should review further the current status of the toxicity values and provide justification for not including toxicity values at N.J.A.C. 7:26D Appendix 11 Table 3 and the resultant derivation of indoor air standards for chloroform. (4)

RESPONSE: The Department used the ATSDR RfC to derive soil remediation standards for the inhalation exposure pathway and indoor air remediation standards for chloroform, which is presented at N.J.A.C. 7:26D Appendix 11 Tables 2 and 3. The Department did not use the IUR factor from the USEPA IRIS to develop inhalation-based remediation standards for chloroform because it is based on oral studies. The notice of proposal Summary, at 52 N.J.R. 576-577, explains that when an IUR factor or RfC was derived via route-to-route extrapolation, the

Department did not use the toxicity factor unless the route-to-route extrapolation was conducted through PBPK modeling. The Department is updating N.J.A.C. 7:26D Appendix 11, Tables 2 and 3 upon adoption to add footnotes to explain when an IUR factor or RfC was derived via route-to-route extrapolation and the toxicity factor was not used.

The USEPA is currently working to revise the assessment for inhalation exposure to chloroform. Upon release of the revised assessment, the Department will review the new toxicity information and determine whether it should be used to update the inhalation soil remediation standards and indoor air remediation standards for chloroform.

268. COMMENT: For 1,2-dibromo-3-chloropropane (CASRN 96-12-8), there is an October 1991 USEPA IRIS RfC of 2.0x10-4 mg/m3. The Department should provide justification for not including this RfC at proposed N.J.A.C. 7:26D Appendix 11 Table 3 and the resultant derivation of indoor air standards for 1,2-dibromo-3-chloropropane. (4)

RESPONSE: There is an RfC available from the USEPA IRIS to develop inhalation-based remediation standards for 1,2-dibromo-3-chloropropane. The Department used the IRIS RfC, as well as an IUR factor from the USEPA PPRTV, to calculate soil remediation standards for the inhalation exposure pathway. The Department did not use those toxicity factors to calculate indoor air remediation standards because indoor air remediation standards were calculated only for those volatile contaminants that are on the USEPA TO-15 Method, Table 1, list of analytes, the Department Low Level USEPA TO-15 (LLTO-15) Method list of analytes, and for elemental mercury. As 1,2-dibromo-3-chloropropane is not on the Department Low Level

USEPA TO-15 (LLTO-15) Method list of analytes no indoor air remediation standards for the vapor intrusion exposure pathway were proposed or adopted.

269. COMMENT: For 1,2-dichloropropane, the CASRN of 728-87-5 is incorrect and should be corrected to reflect the CASRN of 78-87-5 at N.J.A.C. 7:26D Appendix 11 Table 3 and throughout the remainder of the proposed rules. (4)

RESPONSE: The Department is correcting the CASRN for 1,2-dichloropropane at N.J.A.C. 7:26D Appendix 11 Table 3 upon adoption.

270. COMMENT: For 1,2-dichloroethane (CASRN 107-06-2), heptachlor (CASRN 76-44-8), heptachlor epoxide (CASRN 1024-57-3), hexachlorobenzene (CASRN 118-74-1), hexachloro-1,3-butadiene (CASRN 87-68-3), and 1,1,2-trichloroethane (CASRN 79-00-5), there are USEPA IRIS IUR factors. Justification should be provided for not including these IUR factors at Appendix 11, Table 3 and the resultant derivation of indoor air standards for these compounds. (4)

RESPONSE: There are IUR factors available from the USEPA IRIS to develop inhalation-based remediation standards for 1,2-dichloroethane, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachloro-1,3-butadiene, and 1,1,2-trichloroethane. The Department did not use these IUR factors to derive soil remediation standards for the inhalation exposure pathway or indoor air remediation standards because they are based on oral studies. The notice of proposal summary, at 52 N.J.R. 576-577, explains that when an IUR or RfC was derived through route-to-route extrapolation, the Department did not use the toxicity factor, unless the route-to-route extrapolation was conducted through PBPK modeling. Upon adoption, the Department is updating N.J.A.C. 7:26D Appendix 11, Tables 2 and 3 with additional footnotes to explain when an IUR factor or RfC was derived via route-to-route extrapolation and the toxicity factor was not used.

In addition to the lack of adequate inhalation toxicity information for heptachlor, heptachlor epoxide, and hexachlorobenzene, the Department calculated indoor air remediation standards only for those volatile contaminants that are on the USEPA TO-15 Method, Table 1, list of analytes, the Department Low Level USEPA TO-15 (LLTO-15) Method list of analytes, and for elemental mercury. Even though the USEPA has classified heptachlor, heptachlor epoxide, and hexachlorobenzene as volatiles, the contaminants are not on the USEPA Method TO-15 or Department Method LLTO-15 analyte lists and, therefore, no indoor air remediation standards for the vapor intrusion exposure pathway were proposed or adopted.

271. COMMENT: Hexachlorocyclopentadiene (CASRN 77-47-4), hexachloroethane (CASRN 67-72-1), 2-hexanone (CASRN 591-78-6), and isopropylbenzene (CASRN 98-82-2) are volatile and have USEPA IRIS RfC. Nitrobenzene (CASRN 98-95-3) is also volatile and has an IRIS IUR factor and a RfC. Justify not including the RfC for hexachlorocyclopentadiene, hexachloroethane, 2-hexanone, and isopropylbenzene, or the RfC and the IUR factor for nitrobenzene at N.J.A.C. 7:26D Appendix 11 Table 3 and the resultant derivation of indoor air standards for the contaminants. (4)

RESPONSE: There are RfCs available from the USEPA IRIS to develop inhalation-based remediation standards for hexachlorocyclopentadiene, hexachloroethane, 2-hexanone, isopropylbenzene, and nitrobenzene. In addition, nitrobenzene has an IUR factor. The Department used the IRIS RfC and the IUR factor to calculate soil remediation standards for the inhalation exposure pathway; however, they were not used to calculate indoor air remediation standards because the Department adopted indoor air remediation standards only for those volatile contaminants that are on the USEPA TO-15 Method, Table 1, list of analytes, the Department Low Level USEPA TO-15 (LLTO-15) Method list of analytes, and for elemental mercury. Methods TO-15 and LLTO-15 are the two most commonly used methods by the Department and the regulated community for analyzing volatile compounds in air. Methods TO-15 and LLTO-15 each contain a list of analytes (compounds) that can be analyzed using these two methods. The list of analytes is the basis for establishing the list of indoor air remediation standards. As none of the five contaminants are on the USEPA TO-15 Method Table 1 list of analytes or the Department Low Level USEPA TO-15 (LLTO-15) Method list of analytes, no indoor air remediation standards for the vapor intrusion exposure pathway were proposed or adopted.

N.J.A.C. 7:26D Appendix 12

272. COMMENT: The USEPA Regional Screening Levels were updated in May 2020. As the Department uses IRIS values, there will be no changes based on May 2020 USEPA Regional

Screening Levels from the last version in November 2019. The Department should consider updating the USEPA Regional Screening Levels reference to reflect most recent information. (4)

RESPONSE: At the time the Department drafted the proposed amendments to the Remediation Standards, N.J.A.C. 7:26D, the November 2018 version of the USEPA's regional screening level tables was the most recent available. The Department developed the standards, in part, using information contained in the 2018 Regional Screening Levels Tables; therefore, the notice of proposal Summary and the adopted rules cite the November 2018 Regional Screening Levels Tables for consistency.

Summary of Agency-Initiated Changes:

The Department is correcting errors at N.J.A.C. 7:26D Appendix 1, Table 1, Soil Remediation Standards for the Ingestion-Dermal Exposure Pathway - Residential. The benzaldehyde residential carcinogenic ingestion-dermal human health-based criterion was erroneously listed in the notice of proposal as "NA," but the correct value is 170 mg/kg. The benzaldehyde residential noncarcinogenic ingestion-dermal human health-based criterion was erroneously listed as 170 mg/kg, but the correct value is 7,800 mg/kg. The 1,2-dichloropropane residential noncarcinogenic ingestion-dermal human health-based criterion was erroneously listed as 7,000 mg/kg, but the correct value is 3,100 mg/kg. These corrections do not change the ingestion-dermal standards for these contaminants.

The Department is also correcting errors at N.J.A.C. 7:26D Appendix 1, Table 2, Soil Remediation Standards for the Ingestion-Dermal Exposure Pathway - Nonresidential. The benzaldehyde nonresidential carcinogenic ingestion-dermal human health-based criterion was erroneously listed as “NA,” but the correct value is 910 mg/kg. The benzaldehyde nonresidential noncarcinogenic ingestion-dermal human health-based criterion was erroneously listed as 910 mg/kg, but the correct value is 130,000 mg/kg. The 1,2-dichloropropane nonresidential noncarcinogenic ingestion-dermal human health-based criterion was erroneously listed as 120,000 mg/kg, but the correct value is 52,000 mg/kg. The analytical reporting limit of 0.01 mg/kg for 4-methyl-2-pentanone as listed in the proposal was missing a significant figure, and the Department is correcting this value on adoption to read "0.010 mg/kg." These corrections do not change the standards for these contaminants. Also, Footnote 1 was erroneously numbered “NA1,” rather than “1.” The Department is correcting the footnote on adoption.

Upon adoption, the Department is correcting errors at N.J.A.C. 7:26D Appendix 1, Table 3, Soil Remediation Standards for the Inhalation Exposure Pathway – Residential. These corrections do not change any remediation standards that the Department proposed. The column heading “Soil Saturation Concentration” is being corrected to read “Soil Saturation Limit.” Also, in the Reporting Limit column of Table 3, reporting limit values for 1,2-dibromoethane, 1,2-dichlorobenzene, 1,3-dichlorobenzene, and 1,4-dichlorobenzene were missing a significant figure and were all erroneously listed as 0.005 mg/kg. The corrected value for these four contaminants is 0.0050 mg/kg. Also, the incorrect label for the Footnote “NA” is being corrected to read, “Not applicable because soil saturation limit does not apply to this contaminant.”

The Department is correcting errors for mercury at N.J.A.C. 7:26D Appendix 1, Table 3, Soil Remediation Standards for the Inhalation Exposure Pathway – Residential, and Table 4, Soil Remediation Standards for the Inhalation Exposure Pathway – Nonresidential. The column heading “Soil Saturation Concentration” is being corrected in both Tables to read “Soil Saturation Limit.” Also, the soil saturation limit value for mercury is missing a superscript in both Tables; the correct value should read "3.1^5" mg/kg. The Department is correcting this omission and is also adding a Footnote 5 to both Tables 3 and 4, stating “Value is for elemental mercury.” Further, Footnote “NA” of both Tables 3 and 4 is being corrected to read “Not applicable because soil saturation limit does not apply to this contaminant.” These corrections do not change the standards for these contaminants.

The Department is correcting errors at N.J.A.C. 7:26D Appendix 1, Table 5, Soil Remediation Standards for the Migration to Ground Water Exposure Pathway. The Ground Water Remediation Standard for 1,1,2-trichloro-1,2,2-trifluoroethane was erroneously listed as “NA^6"; the correct value is 20,000 mg/kg. The Migration to Ground Water Soil Criterion for 1,1,2-trichloro-1,2,2-trifluoroethane was also erroneously listed as “NA^6,” but the correct value is 1,300 mg/kg. Additionally, at Table 5, the superscript for the Soil Remediation Standard for the Migration to Ground Water Exposure Pathway (mg/kg) for 1,1,2-trichloro-1,2,2-trifluoroethane was erroneously listed as “NA^6,” instead of the correct superscript of “NA^1.” The soil saturation limits for 1,1-biphenyl, 1,2-dichloroethene (trans), 2,4-dichlorophenol, indeno(1,2,3-cd)pyrene, 2,3,4,6-tetrachlorophenol, and toxaphene, were erroneously listed as 72 mg/kg, 1,100 mg/kg, 2,100 mg/kg, 0.086 mg/kg, 140 mg/kg, and 110 mg/kg, respectively.

Upon adoption, the Department is correcting the values to read 78 mg/kg, 1,300 mg/kg, 2,600 mg/kg, 0.74 mg/kg, 150 mg/kg, and 85 mg/kg, respectively. Also, the Department is correcting Table 5 Footnote 3 on adoption to read “Not applicable because soil saturation limit does not apply to this contaminant.” These corrections do not change the standards for these contaminants.

The Department is correcting errors at N.J.A.C. 7:26D Appendix 1, Table 6, Soil Leachate Remediation Standards for the Migration to Ground Water Exposure Pathway. The column heading “Soil Leachate Remediation Standard Migration to Ground Water” is missing punctuation, and the Department is changing the heading to read “Soil Leachate Remediation Standard - Migration to Ground Water.” Also, in Table 6 the Department erroneously listed the Ground Water Remediation Standard for 1,1,2-trichloro-1,2,2-trifluoroethane as “NA^3.” Upon adoption, the Department is correcting the value to 20,000 µg/L. The Soil Leachate Remediation Standard for the Migration to Ground Water Exposure Pathway for 1,1,2-trichloro-1,2,2-trifluoroethane was erroneously listed with an incorrect superscript of "3" for the “NA.” The Department is correcting the value to read "NA^1." In addition, in Table 6 Footnote 1, the word “soil” was erroneously left out of the footnote label between the words “health-based” and “criterion.” The Department is correcting the footnote label to read “Standard not applicable because the calculated health-based soil criterion exceeds the soil saturation limit.” These corrections do not change the standards for these contaminants.

The Department is also correcting errors at N.J.A.C. 7:26D Appendix 10, Chemical and Physical Properties of Contaminants. The soil organic carbon-water partition coefficients for

2,3,4,6-tetrachlorophenol and 2,4,5-trichlorophenol were erroneously listed as 2969^1 and 3140^1, respectively. The Department is correcting the values to 3140^1 and 2340^1, respectively. In addition, the Department is removing a duplicate title of Appendix 10 and correcting the internet address in Footnote 2.

The Department is modifying N.J.A.C. 7:26D Appendix 11, Toxicity Factors Used in the Development of the Remediation Standards on adoption. These modifications include correcting spacing errors, standardizing scientific notation formats, and correcting omissions of toxicity factors numbers and sources throughout Tables 1, 2, and 3 at Appendix 11. Also, at Table 1, Soil Ingestion-Dermal Toxicity Factors, the Department is correcting the listed toxicity source for 4-nitroaniline from "PPRTV" to "IRIS." In Table 3, Indoor Air Toxicity Factors, the Department is deleting the vapor intrusion toxicity factor for 1,2-dibromo-3-chlorpropane noted as "none," and replacing it with "not applicable" because a toxicity factor exists but is not applicable to the vapor intrusion exposure pathway.

Federal Standards Analysis

N.J.S.A. 52:14B-1 et seq. requires State agencies that adopt, readopt, or amend State rules that exceed any Federal standards or requirements to include in the rulemaking document a Federal standards analysis. The Department conducted this analysis for each of the remediation standards by environmental medium (soil, soil leachate, indoor air, ground water, and surface water) and exposure pathway (ingestion-dermal, inhalation, migration to ground water, and vapor intrusion), as discussed below.

Soil Remediation Standards for the Ingestion-Dermal Exposure Pathway

Federal law does not require soil remediation standards for the ingestion-dermal exposure pathway, nor has the USEPA promulgated any. Rather, the USEPA has developed and maintained Regional Screening Levels, which are provided as guidance. The Department is adopting soil remediation standards for the ingestion-dermal exposure pathway for 131 contaminants for the residential exposure scenario and 128 contaminants for the nonresidential exposure scenario. Comparison of the Department's proposed soil remediation standards for the ingestion-dermal soil exposure pathway and the USEPA Regional Screening Levels reveals that soil remediation standards for the ingestion-dermal exposure pathway of 14 contaminants are more stringent than the corresponding USEPA Regional Screening Level. The Department is adopting more stringent standards for benzene, carbon tetrachloride, chlordane, chlorobenzene, 1,2-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, trans-1,2-dichloroethene, methylene chloride, and xylene. The adopted standards for these contaminants result from the application of the Department toxicological hierarchy that was discussed in the proposal Summary. See 52 N.J.R. 566.

The adopted more stringent standards for 2-methylphenol and 4-methylphenol result from the Department's application of its Group C carcinogen policy, discussed in the proposal Summary. See 52 N.J.R. at 566. The Department is also adopting standards for 1,3-dichlorobenzene and tertiary butyl alcohol, which do not have an USEPA Regional Screening Level.

Soil Remediation Standards for the Inhalation Exposure Pathway

The promulgation of soil remediation standards for the inhalation exposure pathway is not mandated by Federal law, nor has the USEPA promulgated soil remediation standards for it. Rather, as stated above, the USEPA has developed and maintained Regional Screening Levels, which are provided as guidance instead of standards. The Department is adopting soil remediation standards for the inhalation exposure pathway for 40 contaminants for the residential exposure scenario and 30 contaminants for the nonresidential exposure scenario. Comparison of the Department's adopted soil remediation standards for the inhalation exposure pathway and the USEPA Regional Screening Levels reveals that the soil remediation standards for the inhalation exposure pathway of three contaminants are more stringent than the corresponding USEPA Regional Screening Level.

The three contaminants with the more stringent remediation standards are 1,1-dichloroethene, caprolactam, and phenol. The adopted standard for 1,1-dichloroethene for the residential and nonresidential exposure scenarios are based on application of the Department Group C carcinogen policy which is discussed in the proposal Summary. See 52 N.J.R. at 566. The adopted standard for caprolactam for the inhalation exposure pathway is also more stringent for the residential and nonresidential exposure scenarios, as the Department treats this compound as a volatile while the USEPA does not. The Department is adopting a more stringent standard for phenol for the inhalation exposure pathway for only the residential exposure scenario, as the Department treats this compound as a volatile and the USEPA does not. In the development of a health-based remediation standard for the soil inhalation exposure pathway, the Department evaluates the effect of the inhalation of contaminants adsorbed to fine soil particles and the inhalation of contaminants that volatilize from fine soil particles. The Department applies the volatilization factor to only those contaminants that are considered volatiles. Because of this, contaminants that are considered volatiles tend to pose a greater health risk compared to non-volatiles and have remediation standards that are more stringent.

Soil and Soil Leachate Remediation Standards for the Migration to Ground Water Exposure Pathway

Soil Remediation Standards

The promulgation of soil remediation standards for the migration to ground water exposure pathway using soil-water partitioning is not mandated by Federal law. The USEPA has not promulgated soil remediation standards for the migration to ground water exposure pathway using soil-water partitioning. Rather, the USEPA has developed and maintained Regional Screening Levels based on soil-water partitioning, which are provided as guidance instead of standards. The Department is adopting soil remediation standards for the migration to ground water exposure pathway using soil-water partitioning for 106 contaminants. Comparison of the Department’s adopted soil remediation standards for the migration to ground water exposure pathway using soil-water partitioning and the USEPA Regional Screening Levels reveals that the

Department's remediation standards for eight contaminants are more stringent than the corresponding USEPA Regional Screening Level.

The adopted standards for 1,3-dichlorobenzene and tertiary butyl alcohol are more stringent because there is no USEPA Regional Screening Level. The adopted standard for beryllium is more stringent because the Department's ground water quality standard (from which the standard is derived) is lower than the Federal drinking water standard. Similarly, the adopted standards for 2-butanone, dibromochloromethane, n-hexane, 4-methylphenol, and silver are more stringent because the Department's ground water quality standard (from which the standard is derived) is more stringent than the USEPA-recommended tap water concentration.

Soil Leachate Remediation Standards

The promulgation of soil leachate remediation standards for the migration to ground water exposure pathway using the SPLP is not mandated by Federal law. The USEPA has not promulgated soil leachate remediation standards for the migration to ground water exposure pathway. The USEPA has no comparable Regional Screening Levels using SPLP.

Indoor Air Remediation Standards for the Vapor Intrusion Exposure Pathway

The USEPA has not promulgated indoor air remediation standards but has developed and maintained regional screening levels, which are provided as guidance instead of standards. The Department is adopting indoor air remediation standards for 35 contaminants.

Comparison of the Department-adopted indoor air remediation standards and the USEPA regional screening levels reveals that the indoor air remediation standard of only one contaminant, 1,1-dichloroethene, is more stringent than the USEPA regional screening level for both the residential and nonresidential exposure scenarios. This difference is based on the Department Group C carcinogen policy, which is discussed further in the proposal Summary. See 52 N.J.R. 566.

Ground Water Remediation Standards

The ground water remediation standards are linked directly to the New Jersey Ground Water Quality Standards (N.J.A.C. 7:9C). The ground water quality standards provide the basis for protection of ambient ground water quality in New Jersey by establishing constituent standards for ground water pollutants. These constituent standards apply to: (i) effluent limitations and discharge requirements pursuant to the New Jersey Pollutant Discharge Elimination System (NJPDES) permitting program (N.J.A.C. 7:14A); (ii) ground water remediation standards pursuant to the Brownfield Act, N.J.S.A. 58:10B-1 et seq.; and (iii) 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 it has no Federal counterpart.

Surface Water Remediation Standards

The surface water remediation standards are linked directly to New Jersey's Surface Water Quality Standards, N.J.A.C. 7:9B. The policies and standards in the Surface Water Quality Standards are either exempt from Federal standards, or they are identical to or consistent with the Federal water quality standards. The surface water aquatic life and human health protection criteria (both narrative statements and numeric values) for New Jersey waters meet the Federal requirements as to the protection of designated uses of the waters, based on Federal Clean Water Act (CWA) guidance or guidance modified to reflect site-specific conditions, or other scientifically defensible methods.

Full text of the adopted new rules and amendments follows (additions to proposal indicated in boldface with asterisks ***thus***; deletions from proposal indicated in brackets with asterisks *[thus]*):

CHAPTER 26D

REMEDIATION STANDARDS

SUBCHAPTER 1. GENERAL INFORMATION

7:26D-1.1 Purpose

This chapter implements the Brownfield and Contaminated Site Remediation Act, N.J.S.A. 58:10B-1 et seq., and other statutes, by establishing remediation standards for ground water, surface water, soil, soil leachate, and indoor air.

7:26D-1.2 Scope

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

(b) Remediating ground water, surface water, soil, or indoor air to any applicable remediation 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, rules, or regulations; and

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

(c)-(e) (No change.)

7:26D-1.4 Applicability

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

1.-10. (No change.)

(b) The person responsible for conducting the remediation shall comply with the remediation standards set forth in this chapter, except as provided *[in]* ***at*** (b)1, 2, and 3 below. The exceptions provided *[in]* ***at*** (b)1, 2, and 3 below may be applied only to ***a site or*** an area of concern that is identified in a remedial action workplan or remedial action report.

1. The person responsible for conducting the remediation may use a standard or criterion the Department developed under N.J.S.A. 58:10B-12a, or other authority, prior to June 2, 2008, if:

i. The standard or criterion is not greater by an order of magnitude than the otherwise applicable remediation standard pursuant to this chapter;

ii. A remedial action workplan or a remedial action report containing standards or criteria developed for the site ***or an area of concern*** under N.J.S.A. 58:10B-12a, or other authority, was submitted to the Department before December 2, 2008;

NOTE: THIS IS A COURTESY COPY OF THIS RULE ADOPTION. THE OFFICIAL VERSION WILL BE PUBLISHED IN THE MAY 17, 2021 NEW JERSEY REGISTER. SHOULD THERE BE ANY DISCREPANCIES BETWEEN THIS TEXT AND THE OFFICIAL VERSION OF THE ADOPTION, THE OFFICIAL VERSION WILL GOVERN.

iii. The remedial action workplan or remedial action report was either approved by the Department or certified by a licensed site remediation professional; and

iv. The person responsible for conducting the remediation completes the remedial action within the applicable remedial action regulatory timeframe pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-5.8.

2. The person responsible for conducting the remediation may use a remediation standard that was in effect between June 2, 2008, and September 17, 2017, which the Department adopted or developed under N.J.S.A. 58:10B-12a, or other authority, if:

i. The standard is not greater by an order of magnitude than the otherwise applicable remediation standard pursuant to this chapter;

ii. A remedial action workplan or a remedial action report containing standards or criteria developed for the site ***or an area of concern*** under N.J.S.A. 58:10B-12a, or other authority, was submitted to the Department between December 2, 2008, and March 17, 2018;

iii. The remedial action workplan or remedial action report was either approved by the Department or certified by a licensed site remediation professional; and

iv. The person responsible for conducting the remediation completes the remedial action within the applicable remedial action regulatory timeframe pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-5.8.

3. The person responsible for conducting the remediation may use a remediation standard the Department adopted or developed pursuant to N.J.S.A. 58:10B-12a, or other authority, that was in effect between September 18, 2017, and *[(the effective date of this chapter)]* ***May 17, 2021**; if:

i. The standard is not greater by an order of magnitude than the otherwise applicable remediation standard pursuant to this chapter;

ii. A remedial action workplan or a remedial action report containing standards or criteria developed for the site ***or an area of concern*** under N.J.S.A. 58:10B-12a was submitted to the Department between March 18, 2018, and *[(six months after the effective date of this chapter)]* ***November 17, 2021***;

iii. The remedial action workplan or remedial action report was either approved by the Department or certified by a licensed site remediation professional; and

iv. The person responsible for conducting the remediation completes the remedial action within the applicable remedial action regulatory timeframe pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-5.8.

(c) (No change.)

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 remediation standard that is established using site-specific factors following the procedures set forth at N.J.A.C. 7:26D-8 and 7:26D Appendices 6, 7, 8, and 9.

"Area of concern" has the same meaning as the definition of the term in the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-1.8.

. . .

"Criterion" or "criteria" means, for the ingestion-dermal, inhalation, and vapor intrusion exposure pathways, the health-based value(s) that is (are) derived from the equations contained at N.J.A.C. 7:26D Appendices 2, 3, and 5 using the applicable chemical and physical properties of contaminants contained at N.J.A.C. 7:26D Appendix 10 and toxicity factors contained at N.J.A.C. 7:26D Appendix 11. For the migration to ground water exposure pathway, "criterion" or "criteria" means the soil-water partitioning value(s) that are derived from N.J.A.C. 7:26D Appendix 4, Equations 1 through 4, using the applicable chemical and physical properties of contaminants contained at N.J.A.C. 7:26D Appendix 10.

. . .

"Exposure pathway" means the routes by which contaminants in soil, water, or other media come in contact with humans. Examples include the ingestion-dermal exposure pathway, the inhalation exposure pathway, the migration to ground water exposure pathway, and the vapor intrusion exposure pathway.

"Extractable petroleum hydrocarbons" or "EPH" means extractable aliphatic and aromatic petroleum hydrocarbons identified using the Department's "Extractable Petroleum Hydrocarbons Methodology," found at http://nj.gov/dep/srp/guidance/srra/eph_method.pdf. EPH includes, but is not limited to, No. 2 heating oil and diesel fuel (Category 1), and heavier petroleum products (Category 2), but excludes the lighter petroleum products including gasoline and mineral spirits.

"Ground water" means ground water as defined pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.4.

"Ground water quality criteria" means any ground water quality criteria as defined pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.4.

"Ingestion-dermal exposure pathway" means an exposure pathway involving potential human contact with contaminants through incidental ingestion of soil and through dermal contact with soil.

"Inhalation exposure pathway" means an exposure pathway involving potential human contact with contaminants through the inhalation of particulates or vapors, or a combination of particulates and vapors, emanating from contaminated soil. This pathway is distinct from the vapor intrusion exposure pathway.

"Interim remediation standard" means a remediation standard that is established pursuant to N.J.A.C. 7:26D-6.

"Migration to ground water exposure pathway" means an exposure pathway involving the migration of contaminants in the vadose zone to ground water and subsequent potential human exposure through the ingestion of ground water.

"Nonresidential" or "NR" means used for commercial or industrial purposes.

"Person responsible for conducting the remediation" means the person responsible for conducting the remediation as defined in the Administrative Requirements for the Remediation of Contaminated Sites at N.J.A.C. 7:26C-1.3.

. . .

"Regional natural background level" means the concentration of a contaminant consistently present in the environment of 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 at N.J.A.C. 7:26E-1.8.

"Remediation standard" means the combination of a numeric standard that establish a level or concentration, and a narrative standard, as appropriate, to which a contaminant must be treated, removed, or otherwise cleaned for soil, soil leachate, ground water, surface water, or indoor air, as established by this chapter.

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

[page=847] "Residential" means used for residences, private and public schools as defined at N.J.S.A. 18A:1-1, charter schools established pursuant to N.J.S.A. 18A:36A-1 et seq., and childcare centers licensed pursuant to N.J.S.A. 30:5B-1 et seq.

. . .

"Surface Water Quality Standards" has the same meaning as the definition of the term at N.J.A.C. 7:9B-1.4.

. . .

"Vapor intrusion exposure pathway" is an exposure pathway involving potential human contact with contaminants through the inhalation of contaminated indoor air resulting from the migration of volatile contaminants from the subsurface into buildings. This pathway is distinct from the inhalation exposure pathway.

SUBCHAPTER 2. GROUND WATER REMEDIATION STANDARDS

7:26D-2.1 Purpose

This subchapter establishes the remediation standards for ground water.

7:26D-2.2 Ground water remediation standards

(a) The remediation standards for ground water are:

1.-3. (No change.)

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

i.-iv. (No change.)

v. The free and residual product removal, treatment, or containment requirements of N.J.A.C. 7:26E-5.1(e); and

vi. The contaminants have not migrated to the ground surface, structures, or air in concentrations in excess of a remediation standard.

SUBCHAPTER 3. SURFACE WATER REMEDIATION STANDARDS

7:26D-3.1 Purpose

This subchapter establishes the remediation standards for surface water.

7:26D-3.2 Surface water remediation standards

(a) The remediation standards for surface water are:

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

2. The following narrative surface water remediation standards:

i. (No change.)

ii. The surface water quality criteria at N.J.A.C. 7:9B-1.14(a) and (b);

iii. The remediation requirements at N.J.A.C. 7:26E-1 through 5 in order to both:

(1) (No change.)

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

iv. The free and residual product removal, treatment, or containment requirements of N.J.A.C. 7:26E-5.1(e).

SUBCHAPTER 4. SOIL AND SOIL LEACHATE REMEDIATION STANDARDS

7:26D-4.1 Purpose

This subchapter establishes remediation standards for soil and soil leachate.

7:26D-4.2 Soil remediation standards for the ingestion-dermal exposure pathway

(a) The soil remediation standard for the ingestion-dermal exposure pathway for each

contaminant listed at N.J.A.C. 7:26D Appendix 1, Tables 1 and 2, is:

1. The more stringent value of the carcinogenic or noncarcinogenic ingestion-dermal human health-based criterion; or

2. The reporting limit, if the reporting limit is greater than the value determined *[in]* ***at*** (a)1 above.

(b) The ingestion-dermal human health-based criteria at N.J.A.C. 7:26D Appendix 1, Tables 1 and 2, incorporated herein by reference, are the residential and nonresidential human health-based criteria for the ingestion-dermal exposure pathway, based on the equations, data sources, and conventions provided at N.J.A.C. 7:26D Appendix 2, incorporated herein by reference, using the data provided at N.J.A.C. 7:26D Appendices 10 and 11, incorporated herein by reference.

(c) N.J.A.C. 7:26D Appendix 1, Table 1 shall be used for sites where the anticipated use is residential. N.J.A.C. 7:26D Appendix 1, Table 2 shall be used for sites where the anticipated use is nonresidential.

7:26D-4.3 Soil remediation standards for the inhalation exposure pathway

(a) The soil remediation standard for the inhalation exposure pathway for each contaminant listed at N.J.A.C. 7:26D Appendix 1, Tables 3 and 4, is:

1. The more stringent value of the carcinogenic or noncarcinogenic inhalation human health-based criterion; or

2. The reporting limit, if the reporting limit is greater than the value determined *[in]* ***at*** (a)1 above.

(b) The inhalation human health-based criteria at N.J.A.C. 7:26D Appendix 1, Tables 3 and 4, incorporated herein by reference, are the residential and nonresidential human health-based criteria for the inhalation exposure pathway, based on the equations, data sources, and conventions provided at N.J.A.C. 7:26D Appendix 3, incorporated herein by reference, using the data provided at N.J.A.C. 7:26D Appendices 10 and 11, incorporated herein by reference.

(c) N.J.A.C. 7:26D Appendix 1, Table 3 shall be used for sites where the anticipated use is residential. N.J.A.C. 7:26D 1, Table 4 shall be used for sites where the anticipated use is nonresidential.

7:26D-4.4 Soil and soil leachate remediation standards for the migration to ground water exposure pathway

(a) The soil remediation standard for the migration to groundwater exposure pathway for each contaminant listed at N.J.A.C. 7:26D Appendix 1, Table 5 is the greater of:

1. The migration to ground water soil criterion; or

2. The reporting limit.

(b) The migration to ground water soil criteria at N.J.A.C. 7:26D Appendix 1, Table 5, incorporated herein by reference, are based on the equations, data sources, and conventions provided at N.J.A.C. 7:26D Appendix 4, Equations 1 through 4, incorporated herein by reference, using the data at N.J.A.C. 7:26D Appendix 10, incorporated herein by reference.

(c) The soil leachate remediation standards for the migration to ground water exposure pathway at N.J.A.C. 7:26D Appendix 1, Table 6, incorporated herein by reference, are based upon the equations, data sources, and conventions provided at N.J.A.C. 7:26D Appendix 4, Equation 5, incorporated herein by reference.

7:26D-5.2 INDOOR AIR REMEDIATION STANDARDS

(a) The indoor air remediation standards for the vapor intrusion exposure pathway for each contaminant listed at N.J.A.C. 7:26D Appendix 1, Tables 7 and 8, incorporated herein by reference, were developed as follows:

1. The more stringent value of the carcinogenic or noncarcinogenic indoor air human health-based criterion; or

2. The reporting limit, if the reporting limit is greater than the value determined *[in]* ***at*** (a)1 above.

(b) N.J.A.C. 7:26D Appendix 1, Table 7, shall be used for sites where the anticipated use is residential. N.J.A.C. 7:26D Appendix 1, Table 8, shall be used for sites where the anticipated use is nonresidential.

(c) The methodology used to develop the indoor air remediation criteria is provided at N.J.A.C. 7:26D Appendix 5, incorporated herein by reference.

SUBCHAPTER 6. INTERIM REMEDIATION STANDARDS

7:26D-6.1 Purpose

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

7:26D-6.2 Interim remediation standards

(a) The Department may establish an interim remediation standard for:

1. Soil, soil leachate, and indoor air when a contaminant is not listed at N.J.A.C. 7:26D Appendix 1; and

2. Ground water when a contaminant is not listed in the Ground Water Quality Standards, N.J.A.C. 7:9C Appendix, Table 1.

(b) The person responsible for conducting the remediation may request that the Department develop an interim remediation standard pursuant to this subchapter and shall use only a Department-developed ***or approved*** interim remediation standard.

(c) An interim remediation standard shall be developed as follows:

1. For ground water, using the procedures set forth in the Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c);

2. For soil:

i. For the ingestion-dermal exposure pathway, using the procedures set forth at N.J.A.C. 7:26D Appendix 2, incorporated herein by reference;

ii. For the inhalation exposure pathway, using the procedures set forth at N.J.A.C. 7:26D Appendix 3, incorporated herein by reference; or

iii. For the migration to ground water exposure pathway, using procedures set forth at N.J.A.C. 7:26D Appendix 4, incorporated herein by reference; or

3. For indoor air for the vapor intrusion exposure pathway, using procedures set forth at N.J.A.C. 7:26D Appendix 5, incorporated herein by reference.

7:26D-6.3 Publication and promulgation of interim remediation standards

(a) The Department shall publish on its website a listing of all interim remediation standards developed pursuant to this chapter and the technical basis used in their derivation.

(b) (No change.)

SUBCHAPTER 7. UPDATING REMEDIATION STANDARDS

7:26D-7.1 Purpose

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

7:26D-7.2 Procedures for updating remediation standards

(a) The Department shall update a remediation standard for soil or indoor air at N.J.A.C. 7:26D Appendix 1 when:

1. The USEPA revises toxicity information contained in the Integrated Risk Information System (IRIS) database;

2. The Department uses new or revised toxicity information developed by the New Jersey Drinking Water Quality Institute when promulgating a new or revised maximum contaminant level (MCL) for a drinking water constituent;

3. The Department uses new or revised toxicity information when promulgating a new or revised ground water quality standard; or

4. The USEPA revises or replaces its Integrated Environmental Uptake Biokinetic (IEUBK) Model and Adult Lead Model (ALM) and input parameters for lead.

(b) The Department shall update a soil and a soil leachate remediation standard for the migration to ground water exposure pathway at N.J.A.C. 7:26D Appendix 1 when a ground water quality criterion is updated pursuant to the Ground Water Quality Standards at N.J.A.C. 7:9C-1.7(c)5.

(c) When the Department develops an updated remediation standard, the Department shall post on its website at http://www.nj.gov/dep/rules/adminchg.html and publish in the New Jersey Register a notice of administrative change. The notice of administrative change shall identify the remediation standard to be updated including the relevant media and exposure pathway, the contaminant, the basis for the administrative change, and the revised criterion to be listed at N.J.A.C. 7:26D Appendix 1.

(d) An updated remediation standard shall be effective on the date the notice of administrative change is filed with the Office of Administrative Law.

(e) An updated remediation standard shall be applied to all sites except, in lieu of the updated remediation standard established pursuant to this subchapter, the person responsible for conducting the remediation may continue to use a remediation standard that is specified in a remedial action workplan or remedial action report for a site, provided that:

1. The remedial action workplan or remedial action report is submitted no later than six months after the effective date of the updated standard;

2. The remedial action workplan or remedial action report is approved by the Department or is certified by a licensed site remediation professional;

3. The remediation standard specified in the remedial action workplan or remedial action report for a given contaminant is not greater by an order of magnitude than the updated remediation standard; and

4. The remedial action shall comply with the applicable regulatory timeframes pursuant to the Technical Requirements for Site Remediation at N.J.A.C. 7:26E-5.

SUBCHAPTER 8. ALTERNATIVE REMEDIATION STANDARDS

7:26D-8.1 Purpose

(a) This subchapter sets forth the procedures for the development and approval of alternative remediation standards for:

1. Soil for the ingestion-dermal exposure pathway and inhalation exposure pathway;

2. Soil and soil leachate for the migration to ground water exposure pathway; and

3. Indoor air for the vapor intrusion exposure pathway.

7:26D-8.2 Applicability

An alternative remediation standard developed pursuant to this subchapter in lieu of a remediation standard established by N.J.A.C. 7:26D-2, 3, 4, 5, or 6, shall be used only at the site or area of concern for which it is developed and approved.

7:26D-8.3 Development of an alternative remediation standard

(a) An alternative remediation standard for a site or area of concern:

1. May be developed for soil, for the following exposure pathways:

i. Ingestion-dermal exposure pathway using the procedures at N.J.A.C. 7:26D Appendix 6, incorporated herein by reference;

ii. Inhalation exposure pathway using the procedures at N.J.A.C. 7:26D Appendix 7, incorporated herein by reference; and

iii. Migration to ground water exposure pathway using the procedures at N.J.A.C. 7:26D Appendix 8, incorporated herein by reference;

2. May be developed for indoor air, for the vapor intrusion exposure pathway, using the procedures at N.J.A.C. 7:26D Appendix 9, incorporated herein by reference.

(b) The Department may, upon its own initiative and in accordance with N.J.S.A. 58:10B-12.f(2), require the development and use of an alternative remediation standard for a particular contaminant for a particular site or area of concern that is either more or less stringent than the remediation standards established by this chapter.

(c) The person responsible for conducting the remediation who develops an alternative remediation standard that requires prior approval from the Department shall follow the approval process outlined at N.J.A.C. 7:26D-8.4.

(d) The person responsible for conducting the remediation who develops an alternative remediation standard that does not require prior approval from the Department shall follow the process outlined at N.J.A.C. 7:26D-8.5.

(e) In accordance with the Site Remediation Reform Act, at N.J.S.A. 58:10C-21, the alternative remediation standards developed pursuant to this subchapter shall be subject to the Department inspection and review process as described in the Site Remediation Reform Act at N.J.S.A. 58:10C-21a.

7:26D-8.4 Approval process for alternative remediation standards requiring prior approval from the Department

(a) Except as provided at N.J.A.C. 7:26D-8.5, the person responsible for conducting the remediation shall obtain prior approval from the [page=849] Department, in accordance with (b) and (c) below, for an alternative remediation standard developed pursuant to this subchapter before using the alternative remediation standard at a specific site or area of concern.

(b) For each proposed alternative remediation standard, the person responsible for conducting the remediation shall collect and submit to the Department, along with the appropriate form(s) found on the Department's website at www.nj.gov/dep/srp/srra/forms, the information indicated for the proposed alternative remediation standard as described at N.J.A.C. 7:26D Appendices 6 through 9, incorporated herein by reference.

(c) The Department shall review the information the person responsible for conducting the remediation submits in accordance with (b) above, and shall respond as follows:

1. If the Department determines that the submitted information is acceptable, then the Department shall provide the person responsible for conducting the remediation with a written approval for the use of the alternative soil remediation standard at the specific site or area of concern; or

2. If the Department determines that the submitted information is deficient, then the Department shall provide comments to the person responsible for conducting the remediation describing the deficiencies, in which case:

i. The person responsible for conducting the remediation may correct the deficiencies and may resubmit the information to the Department for its review pursuant to (c) above; or

ii. The person responsible for conducting the remediation may withdraw the request for approval of a proposed alternative remediation standard.

(d) The person responsible for conducting the remediation shall not use the proposed alternative remediation standard if that person does not correct a deficiency noted by the Department pursuant to N.J.A.C. 7:26D-8.4(c)2.

7:26D-8.5 Process for the development of alternative remediation standards not requiring prior approval by the Department

(a) When the person responsible for conducting the remediation is not required to obtain prior approval from the Department for the implementation of an alternative remediation standard developed pursuant to this subchapter, the person responsible shall:

1. For each proposed alternative remediation standard, collect the information indicated for each applicable exposure pathway as described at N.J.A.C. 7:26D Appendices 6, 7, 8, and 9, incorporated herein by reference; and

2. Submit to the Department the information described in (a)1 above with the applicable remedial phase report or workplan pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E.

APPENDIX 1

REMEDIATION STANDARDS TABLES

Table 1--Soil Remediation Standards for the Ingestion-Dermal Exposure Pathway -- Residential (mg/kg)

(All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Residential Carcinogenic Ingestion-Dermal Human Health-based Criterion	Residential Noncarcinogenic Ingestion-Dermal Human Health-based Criterion	Reporting Limit	Soil Remediation Standard Ingestion-Dermal *[--]* Residential
Acenaphthene	83-32-9	NA	3,600	0.17	3,600
Acetone (2-Propanone)	67-64-1	NA	70,000	0.010	70,000
Acetophenone	98-86-2	NA	7,800	0.33	7,800
Aldrin	309-00-2	*[0.032]* *0.041*	*[1.9]* *2.3*	0.0017	*[0.032]* *0.041*
Aluminum (total)	7429-90-5	NA	78,000	20	78,000
Anthracene	120-12-7	NA	18,000	0.17	18,000
Antimony (total)	7440-36-0	NA	31	1.0	31
Arsenic (total)	7440-38-2	0.43	22	0.50	19[1]
Atrazine	1912-24-9	NA	220	0.33	220
Barium (total)	7440-39-3	NA	16,000	5.0	16,000
Benzaldehyde	100-52-7	*[NA]* *170*	*[170]* *7,800*	0.33	170
Benzene	71-43-2	3.0	310	0.0050	3.0
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	5.1	NA	0.17	5.1
Benzo(a)pyrene	50-32-8	0.51	*[NA]* *18*	0.17	0.51
Benzo(b)fluoranthene	205-99-2	5.1	NA	0.17	5.1

(3,4-Benzofluoranthene)					
Benzo(k)fluoranthene	207-08-9	51	NA	0.17	51
Beryllium	7440-41-7	NA	160	0.50	160
1,1'-Biphenyl	92-52-4	87	39,000	0.17	87
Bis(2-chloroethoxy)methane	111-91-1	NA	190	0.17	190
Bis(2-chloroethyl)ether	111-44-4	0.63	NA	0.33	0.63
Bis(2-ethylhexyl)phthalate	117-81-7	39	1,300	0.17	39
Bromodichloromethane (Dichlorobromomethane)	75-27-4	11	1,600	0.0050	11
Bromoform	75-25-2	88	1,600	0.0050	88
Bromomethane (Methyl bromide)	74-83-9	NA	110	0.0050	110
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	47,000	0.010	47,000
Butylbenzyl phthalate	85-68-7	290	13,000	0.17	290
Cadmium	7440-43-9	NA	71	0.50	71
Caprolactam	105-60-2	NA	32,000	0.33	32,000
Carbon disulfide	75-15-0	NA	NA	0.0050	NA
Carbon tetrachloride	56-23-5	7.6	310	0.0050	7.6
Chlordane (alpha and gamma forms summed)	57-74-9	0.27	36	0.0017	0.27
4-Chloroaniline	106-47-8	2.7	250	0.17	2.7
Chlorobenzene	108-90-7	NA	510	0.0050	510
Chloroethane (Ethyl chloride)	75-00-3	NA	NA	0.0050	NA

Chloroform	67-66-3	NA	780	0.0050	780
Chloromethane (Methyl chloride)	74-87-3	NA	NA	0.0050	NA
2-Chloronaphthalene	91-58-7	NA	4,800	0.17	4,800
2-Chlorophenol (o-Chlorophenol)	95-57-8	NA	390	0.17	390
Chrysene	218-01-9	510	NA	0.17	510
Cobalt (total)	7440-48-4	NA	23	0.50	23
Copper (total)	7440-50-8	NA	3,100	1.0	3,100
Cyanide	57-12-5	NA	47	0.50	47
Cyclohexane	110-82-7	NA	NA	0.0050	NA
4,4'-DDD (p,p'-TDE)	72-54-8	2.3	NA	0.0033	2.3
4,4'-DDE (p,p'-DDX)	72-55-9	*[1.6]* ***2.0***	NA	0.0033	*[1.6]* ***2.0***
4,4'-DDT	50-29-3	1.9	37	0.0033	1.9
Dibenz(a,h)anthracene	53-70-3	0.51	NA	0.17	0.51
Dibromochloromethane (Chlorodibromomethane)	124-48-1	8.3	1,600	0.0050	8.3
1,2-Dibromo-3-chloropropane	96-12-8	0.87	16	0.0050	0.87
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.35	700	0.0050	0.35
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	6,700	0.0050	6,700
1,3-Dichlorobenzene	541-73-1	NA	6,700	0.0050	6,700

(m-Dichlorobenzene)					
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA	780	0.0050	780
3,3'-Dichlorobenzidine	91-94-1	1.2	NA	0.33	1.2
Dichlorodifluoromethane (Freon 12)	75-71-8	NA	16,000	0.0050	16,000
1,1-Dichloroethane	75-34-3	120	16,000	0.0050	120
1,2-Dichloroethane	107-06-2	5.8	NA	0.0050	5.8
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA	11	0.0050	11
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA	780	0.0050	780
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA	1,300	0.0050	1,300
2,4-Dichlorophenol	120-83-2	NA	190	0.17	190
1,2-Dichloropropane	78-87-5	19	*[7,000]* ***3,100***	0.0050	19
1,3-Dichloropropene (total)	542-75-6	7.0	2,300	0.0050	7.0
Dieldrin	60-57-1	0.034	3.2	0.0033	0.034
Diethylphthalate	84-66-2	NA	51,000	0.17	51,000

2,4-Dimethylphenol	105-67-9	NA	1,300	0.17	1,300
Di-n-butyl phthalate	84-74-2	NA	6,300	0.17	6,300
2,4-Dinitrophenol	51-28-5	NA	130	0.33	130
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	0.80	NA	0.17	0.80
Di-n-octyl phthalate	117-84-0	NA	630	0.33	630
1,4-Dioxane	123-91-1	7.0	2,300	0.067	7.0
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	NA	*[380]* ***470***	0.0033	*[380]* ***470***
Endrin	72-20-8	NA	19	0.0033	19
Ethylbenzene	100-41-4	NA	7,800	0.0050	7,800
Extractable Petroleum Hydrocarbons (Category 1)	various	NA	5,300^3	80	5,300^3
Extractable Petroleum Hydrocarbons (Category 2)	various	NA	Sample-specific^4	80	Sample-specific^4
Fluoranthene	206-44-0	NA	2,400	0.33	2,400
Fluorene	86-73-7	NA	2,400	0.17	2,400
alpha-HCH (alpha-BHC)	319-84-6	0.086	510	0.0017	0.086
beta-HCH (beta-BHC)	319-85-7	0.30	NA	0.0017	0.30
Heptachlor	76-44-8	*[0.12]* ***0.15***	*[32]* ***39***	0.0017	*[0.12]* ***0.15***
Heptachlor epoxide	1024-57-3	*[0.060]* ***0.076***	*[0.82]* ***1***	0.0017	*[0.060]* ***0.076***
Hexachlorobenzene	118-74-1	*[0.34]* ***0.43***	*[51]* ***63***	0.17	*[0.34]* ***0.43***

Hexachloro-1,3-butadiene	87-68-3	*[7.0]* ***8.9***	*[63]* ***78***	0.17	*[7.0]* ***8.9***
Hexachlorocyclopentadiene	77-47-4	NA	*[380]* ***470***	0.33	*[380]* ***470***
Hexachloroethane	67-72-1	*[14]* ***17***	*[44]* ***55***	0.17	*[14]* ***17***
n-Hexane	110-54-3	NA	*[4,700]* ***NA***	-[7]	*[4,700]* ***NA***
2-Hexanone	591-78-6	NA	390	0.010	390
Indeno(1,2,3-cd)pyrene	193-39-5	5.1	NA	0.17	5.1
Isophorone	78-59-1	570	13,000	0.17	570
Isopropylbenzene	98-82-8	NA	7,800	0.0050	7,800
Lead (total)	7439-92-1	NA	NA	0.50	400[5]
Lindane (gamma-HCH)(gamma-BHC)	58-89-9	*[0.49]* ***0.57***	*[19]* ***21***	0.0017	*[0.49]* ***0.57***
Manganese (total)	7439-96-5	NA	1,900	0.50	1,900
Mercury (total)	7439-97-6	NA	23	0.10	23
Methoxychlor	72-43-5	NA	320	0.017	320
Methyl acetate	79-20-9	NA	78,000	0.0050	78,000
Methylene chloride (Dichloromethane)	75-09-2	50	470	0.0050	50
2-Methylnaphthalene	91-57-6	NA	240	0.17	240
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	*[6,300]* ***NA***	0.010	*[6,300]* ***NA***
2-Methylphenol (o-cresol)	95-48-7	NA	320	0.33	320
4-Methylphenol (p-cresol)	106-44-5	NA	630	0.33	630
Methyl tert-butyl ether (MTBE)	1634-04-4	NA	780	0.0050	780

Naphthalene	91-20-3	NA	2,500	0.17	2,500
Nickel (total)	7440-02-0	NA	1,600	0.50	1,600
4-Nitroaniline	100-01-6	27	250	0.33	27
Nitrobenzene	98-95-3	NA	160	0.17	160
N-Nitrosodi-n-propylamine	621-64-7	0.078	NA	0.17	0.17[2]
N-Nitrosodiphenylamine	86-30-6	110	NA	0.17	110
2,2'-oxybis (1-chloropropane)	108-60-1	NA	3,100	0.33	3,100
Pentachlorophenol	87-86-5	1.0	250	0.33	1.0
Phenol	108-95-2	NA	19,000	0.33	19,000
Polychlorinated biphenyls (PCBs)	1336-36-3	0.25	NA	0.030	0.25
Pyrene	129-00-0	NA	1,800	0.17	1,800
Selenium (total)	7782-49-2	NA	390	2.5	390
Silver (total)	7440-22-4	NA	390	0.50	390
Styrene	100-42-5	NA	16,000	0.0050	16,000
Tertiary butyl alcohol (TBA)	75-65-0	NA	1,400	0.10	1,400
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	*[19]* ***23***	0.17	*[19]* ***23***
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NA	0.000051	0.0000010	0.000051[6]
1,1,2,2-Tetrachloroethane	79-34-5	3.5	1,600	0.0050	3.5
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	330	470	0.0050	330
2,3,4,6-Tetrachlorophenol	58-90-2	NA	1,900	0.17	1,900
Toluene	108-88-3	NA	6,300	0.0050	6,300

Toxaphene	8001-35-2	0.49	NA	0.17	0.49
1,2,4-Trichlorobenzene	120-82-1	NA	*[630]* ***780***	0.0050	*[630]* ***780***
1,1,1-Trichloroethane	71-55-6	NA	160,000	0.0050	160,000
1,1,2-Trichloroethane	79-00-5	12	310	0.0050	12
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	15	39	0.0050	15
Trichlorofluoromethane (Freon 11)	75-69-4	NA	23,000	0.0050	23,000
2,4,5-Trichlorophenol	95-95-4	NA	6,300	0.20	6,300
2,4,6-Trichlorophenol	88-06-2	49	63	0.20	49
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA	NA	0.0050	NA
1,2,4-Trimethylbenzene	95-63-6	NA	780	0.076	780
Vanadium (total)	7440-62-2	NA	390	2.5	390
Vinyl chloride	75-01-4	0.97	230	0.0050	0.97
Xylenes (total)	1330-20-7	NA	12,000	0.0050	12,000
Zinc (total)	7440-66-6	NA	23,000	1.0	23,000

NA-Not applicable because appropriate toxicological information is not available

[1] Standard is based on natural background

[2] Standard set at reporting limit

[3] Special calculation for EPH--see at N.J.A.C. 7:26D Appendix 2

[4] Sample-specific calculation using EPH calculator--see at N.J.A.C. 7:26D Appendix 2

[5] Standard based on the Integrated Exposure Uptake Biokinetic (IEUBK) model for lead in children

[6] This standard is used for comparison to site soil data that have been converted to sample-specific TCDD-TEQ values through application of the Toxicity Equivalence Factor Methodology (USEPA 2010) and using the WHO 2005 Mammalian Toxic Equivalency Factors (TEFs)

[7] Although n-Hexane does not have a specific reporting limit, quantification is required to be less than the applicable remediation standard

Table 2 – Soil Remediation Standards for the Ingestion-Dermal Exposure Pathway - Nonresidential (mg/kg)

(All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Nonresidential Carcinogenic Ingestion-Dermal Human Health-based Criterion	Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-based Criterion	Reporting Limit	Soil Remediation Standard Ingestion-Dermal *[--]* Nonresidential
Acenaphthene	83-32-9	NA	50,000	0.17	50,000
Acetone (2-Propanone)	67-64-1	NA	1,200,000	0.010	NA[1]
Acetophenone	98-86-2	NA	130,000	0.33	130,000
Aldrin	309-00-2	*[0.15]* ***0.21***	*[27]* ***39***	0.0017	*[0.15]* ***0.21***
Aluminum (total)	7429-90-5	NA	1,300,000	20	NA[1]
Anthracene	120-12-7	NA	250,000	0.17	250,000
Antimony (total)	7440-36-0	NA	520	1.0	520
Arsenic (total)	7440-38-2	2.1	350	0.50	19[2]

Atrazine	1912-24-9	NA	3,200	0.33	3,200
Barium (total)	7440-39-3	NA	260,000	5.0	260,000
Benzaldehyde	100-52-7	*[NA]* ***910***	*[910]* ***130,000***	0.33	910
Benzene	71-43-2	16	5,200	0.0050	16
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	23	NA	0.17	23
Benzo(a)pyrene	50-32-8	2.3	*[NA]* ***250***	0.17	2.3
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	23	NA	0.17	23
Benzo(k)fluoranthene	207-08-9	230	NA	0.17	230
Beryllium	7440-41-7	NA	2,600	0.50	2,600
1,1'-Biphenyl	92-52-4	450	650,000	0.17	450
Bis(2-chloroethoxy)methane	111-91-1	NA	2,700	0.17	2,700
Bis(2-chloroethyl)ether	111-44-4	3.3	NA	0.33	3.3
Bis(2-ethylhexyl)phthalate	117-81-7	180	18,000	0.17	180
Bromodichloromethane (Dichlorobromomethane)	75-27-4	59	26,000	0.0050	59

Bromoform	75-25-2	460	26,000	0.0050	460
Bromomethane (Methyl bromide)	74-83-9	NA	1,800	0.0050	1,800
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	780,000	0.010	780,000
Butylbenzyl phthalate	85-68-7	1,300	180,000	0.17	1,300
Cadmium	7440-43-9	NA	1,100	0.50	1,100
Caprolactam	105-60-2	NA	460,000	0.33	460,000
Carbon disulfide	75-15-0	NA	NA	0.0050	NA
Carbon tetrachloride	56-23-5	40	5,200	0.0050	40
Chlordane (alpha and gamma forms summed)	57-74-9	1.4	550	0.0017	1.4
4-Chloroaniline	106-47-8	13	3,600	0.17	13
Chlorobenzene	108-90-7	NA	8,400	0.0050	8,400
Chloroethane (Ethyl chloride)	75-00-3	NA	NA	0.0050	NA
Chloroform	67-66-3	NA	13,000	0.0050	13,000
Chloromethane (Methyl chloride)	74-87-3	NA	NA	0.0050	NA
2-Chloronaphthalene	91-58-7	NA	67,000	0.17	67,000
2-Chlorophenol (o-Chlorophenol)	95-57-8	NA	6,500	0.17	6,500

Chrysene	218-01-9	2,300	NA	0.17	2,300
Cobalt (total)	7440-48-4	NA	390	0.50	390
Copper (total)	7440-50-8	NA	52,000	1.0	52,000
Cyanide	57-12-5	NA	780	0.50	780
Cyclohexane	110-82-7	NA	NA	0.0050	NA
4,4'-DDD (p,p'-TDE)	72-54-8	11	NA	0.0033	11
4,4'-DDE (p,p'-DDX)	72-55-9	*[7.5]* ****11****	NA	0.0033	*[7.5]* ****11****
4,4'-DDT	50-29-3	9.5	580	0.0033	9.5
Dibenz(a,h)anthracene	53-70-3	2.3	NA	0.17	2.3
Dibromochloromethane (Chlorodibromomethane)	124-48-1	43	26,000	0.0050	43
1,2-Dibromo-3-chloropropane	96-12-8	4.5	260	0.0050	4.5
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	1.8	12,000	0.0050	1.8
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	110,000	0.0050	110,000
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA	110,000	0.0050	110,000

1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA	13,000	0.0050	13,000
3,3'-Dichlorobenzidine	91-94-1	5.7	NA	0.33	5.7
Dichlorodifluoromethane (Freon 12)	75-71-8	NA	260,000	0.0050	260,000
1,1-Dichloroethane	75-34-3	640	260,000	0.0050	640
1,2-Dichloroethane	107-06-2	30	NA	0.0050	30
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA	180	0.0050	180
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA	13,000	0.0050	13,000
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA	22,000	0.0050	22,000
2,4-Dichlorophenol	120-83-2	NA	2,700	0.17	2,700
1,2-Dichloropropane	78-87-5	98	*[120,000]* ***52,000***	0.0050	98

1,3-Dichloropropene (total)	542-75-6	36	39,000	0.0050	36
Dieldrin	60-57-1	0.16	46	0.0033	0.16
Diethylphthalate	84-66-2	NA	730,000	0.17	730,000
2,4-Dimethylphenol	105-67-9	NA	18,000	0.17	18,000
Di-n-butyl phthalate	84-74-2	NA	91,000	0.17	91,000
2,4-Dinitrophenol	51-28-5	NA	1,800	0.33	1,800
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	3.8	NA	0.17	3.8
Di-n-octyl phthalate	117-84-0	NA	9,100	0.33	9,100
1,4-Dioxane	123-91-1	36	39,000	0.067	36
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	NA	*[5,500]* ***7,800***	0.0033	*[5,500]* ***7,800***
Endrin	72-20-8	NA	270	0.0033	270
Ethylbenzene	100-41-4	NA	130,000	0.0050	130,000
Extractable Petroleum Hydrocarbons (Category 1)	various	NA	75,000[3]	80	75,000[3]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA	Sample-specific[4]	80	Sample-specific[4]
Fluoranthene	206-44-0	NA	33,000	0.33	33,000

Fluorene	86-73-7	NA	33,000	0.17	33,000
alpha-HCH (alpha-BHC)	319-84-6	0.41	7,300	0.0017	0.41
beta-HCH (beta-BHC)	319-85-7	1.4	NA	0.0017	1.4
Heptachlor	76-44-8	*[0.57]* ***0.81***	*[460]* ***650***	0.0017	*[0.57]* ***0.81***
Heptachlor epoxide	1024-57-3	*[0.28]* ***0.40***	*[12]* ***17***	0.0017	*[0.28]* ***0.40***
Hexachlorobenzene	118-74-1	*[1.6]* ***2.3***	*[730]* ***1,000***	0.17	*[1.6]* ***2.3***
Hexachloro-1,3-butadiene	87-68-3	*[33]* ***47***	*[910]* ***1,300***	0.17	*[33]* ***47***
Hexachlorocyclopentadiene	77-47-4	NA	*[5,500]* ***7,800***	0.33	*[5,500]* ***7,800***
Hexachloroethane	67-72-1	*[64]* ***91***	*[640]* ***910***	0.17	*[64]* ***91***
n-Hexane	110-54-3	NA	*[78,000]* ***NA***	-[7]	*[78,000]* ***NA***
2-Hexanone	591-78-6	NA	6,500	0.010	6,500
Indeno(1,2,3-cd)pyrene	193-39-5	23	NA	0.17	23
Isophorone	78-59-1	2,700	180,000	0.17	2,700
Isopropylbenzene	98-82-8	NA	130,000	0.0050	130,000
Lead (total)	7439-92-1	NA	NA	0.5	800[5]
Lindane (gamma-HCH)(gamma-BHC)	58-89-9	*[2.3]* ***2.8***	*[270]* ***330***	0.0017	*[2.3]* ***2.8***

Manganese (total)	7439-96-5	NA	31,000	0.50	31,000
Mercury (total)	7439-97-6	NA	390	0.10	390
Methoxychlor	72-43-5	NA	4,600	0.017	4,600
Methyl acetate	79-20-9	NA	1,300,000	0.0050	NA[1]
Methylene chloride (Dichloromethane)	75-09-2	260	7,800	0.0050	260
2-Methylnaphthalene	91-57-6	NA	3,300	0.17	3,300
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	*[100,000]* ***NA***	*[0.01]* ***0.010***	*[100,000]* ***NA***
2-Methylphenol (o-cresol)	95-48-7	NA	4,600	0.33	4,600
4-Methylphenol (p-cresol)	106-44-5	NA	9,100	0.33	9,100
Methyl tert-butyl ether (MTBE)	1634-04-4	NA	13,000	0.0050	13,000
Naphthalene	91-20-3	NA	34,000	0.17	34,000
Nickel (total)	7440-02-0	NA	26,000	0.50	26,000
4-Nitroaniline	100-01-6	130	3,600	0.33	130
Nitrobenzene	98-95-3	NA	2,600	0.17	2,600
N-Nitrosodi-n-propylamine	621-64-7	0.36	NA	0.17	0.36
N-Nitrosodiphenylamine	86-30-6	520	NA	0.17	520

2,2'-oxybis(1-chloropropane)	108-60-1	NA	52,000	0.33	52,000
Pentachlorophenol	87-86-5	4.4	3,200	0.33	4.4
Phenol	108-95-2	NA	270,000	0.33	270,000
Polychlorinated biphenyls (PCBs)	1336-36-3	1.1	NA	0.030	1.1
Pyrene	129-00-0	NA	25,000	0.17	25,000
Selenium (total)	7782-49-2	NA	6,500	2.5	6,500
Silver (total)	7440-22-4	NA	6,500	0.50	6,500
Styrene	100-42-5	NA	260,000	0.0050	260,000
Tertiary butyl alcohol (TBA)	75-65-0	NA	23,000	0.10	23,000
1,2,4,5-Tetrachlorobenzene	95-94-3	NA	*[270]* ***390***	0.17	*[270]* ***390***
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NA	0.00081	0.0000010	0.00081[6]
1,1,2,2-Tetrachloroethane	79-34-5	18	26,000	0.0050	18
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1,700	7,800	0.0050	1,700
2,3,4,6-Tetrachlorophenol	58-90-2	NA	27,000	0.17	27,000
Toluene	108-88-3	NA	100,000	0.0050	100,000
Toxaphene	8001-35-2	2.3	NA	0.17	2.3

1,2,4-Trichlorobenzene	120-82-1	NA	*[9,100]* ***13,000***	0.0050	*[9,100]* ***13,000***
1,1,1-Trichloroethane	71-55-6	NA	2,600,000	0.0050	NA[1]
1,1,2-Trichloroethane	79-00-5	64	5,200	0.0050	64
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	79	650	0.0050	79
Trichlorofluoromethane (Freon 11)	75-69-4	NA	390,000	0.0050	390,000
2,4,5-Trichlorophenol	95-95-4	NA	91,000	0.20	91,000
2,4,6-Trichlorophenol	88-06-2	230	910	0.20	230
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA	NA	0.0050	NA
1,2,4-Trimethylbenzene	95-63-6	NA	13,000	0.076	13,000
Vanadium (total)	7440-62-2	NA	6,500	2.5	6,500
Vinyl chloride	75-01-4	5.0	3,900	0.0050	5.0
Xylenes (total)	1330-20-7	NA	190,000	0.0050	190,000
Zinc (total)	7440-66-6	NA	390,000	1.0	390,000

NA-Not applicable because appropriate toxicological information is not available

[NA][1]-Standard not applicable because calculated health-based criterion exceeds one million mg/kg

[2] Standard is based on natural background

[3] Special calculation for EPH- see N.J.A.C. 7:26D Appendix 2

[4] Sample-specific calculation using EPH calculator--see N.J.A.C. 7:26D Appendix 2

[5] Standard based on the Adult Lead Model (ALM)

[6] This standard is used for comparison to site soil data that have been converted to sample-specific TCDD-TEQ values through application of the Toxicity Equivalence Factor Methodology (USEPA 2010) and using the WHO 2005 Mammalian Toxic Equivalency Factors (TEFs)

[7] Although n-Hexane does not have a specific reporting limit, quantification is required to be less than the applicable remediation standard

Table 3 – Soil Remediation Standards for the Inhalation Exposure Pathway – Residential (mg/kg)

(All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Carcinogenic Inhalation Human Health-based Criterion	Noncarcinogenic Inhalation Human Health-based Criterion	Soil Saturation *[Concentration]* ***Limit***	Reporting Limit	Soil Remediation Standard Inhalation Residential
Acenaphthene	83-32-9	NA[1]	NA[1]	40	0.17	NA[1]
Acetone (2-Propanone)	67-64-1	NA[1]	NA[1]	160,000	0.010	NA[1]
Acetophenone	98-86-2	NA[1]	NA[1]	1,600	0.33	NA[1]
Aldrin	309-00-2	NA[1]	NA[1]	2.8	0.0017	NA[1]
Aluminum (total)	7429-90-5	NA[1]	NA[2]	NA	20	NA[2]
Anthracene	120-12-7	NA[1]	NA[1]	1.4	0.17	NA[1]
Antimony (total)	7440-36-0	NA[1]	NA[1]	NA	1.0	NA[1]
Arsenic (total)	7440-38-2	1,100	NA[1]	NA	0.50	1,100
Atrazine	1912-24-9	NA[1]	NA[1]	21	0.33	NA[1]
Barium (total)	7440-39-3	NA[1]	870,000	NA	5.0	870,000
Benzaldehyde	100-52-7	NA[1]	NA[1]	1,200	0.33	NA[1]

Benzene	71-43-2	2.2	190	850	0.0050	2.2
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	78,000[4]	NA[1]	3.3	0.17	78,000[4]
Benzo(a)pyrene	50-32-8	7,800[4]	3,500[4]	1.9	0.17	3,500[4]
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	78,000[4]	NA[1]	1.8	0.17	78,000[4]
Benzo(k)fluoranthene	207-08-9	780,000[4]	NA[1]	0.94	0.17	780,000[4]
Beryllium	7440-41-7	2,000	35,000	NA	0.50	2,000
1,1'-Biphenyl	92-52-4	NA[1]	NA[1]	78	0.17	NA[1]
Bis(2-chloroethoxy)methane	111-91-1	NA[1]	NA[1]	1,400	0.17	NA[1]
Bis(2-chloroethyl)ether	111-44-4	NA[1]	NA[1]	3,700	0.33	NA[1]
Bis(2-ethylhexyl)phthalate	117-81-7	NA[1]	NA[1]	65	0.17	NA[1]
Bromodichloromethane (Dichlorobromomethane)	75-27-4	NA[1]	NA[1]	690	0.0050	NA[1]
Bromoform	75-25-2	NA[1]	NA[1]	680	0.0050	NA[1]
Bromomethane (Methyl bromide)	74-83-9	NA[1]	18	3,300	0.0050	18
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA[1]	NA[2,3]	36,000	0.010	NA[2,3]
Butylbenzyl phthalate	85-68-7	NA[1]	NA[1]	39	0.17	NA[1]
Cadmium	7440-43-9	2,600	17,000	NA	0.50	2,600
Caprolactam	105-60-2	NA[1]	290	160,000	0.33	290

Carbon disulfide	75-15-0	NA[1]	NA[2,3]	580	0.0050	NA[2,3]
Carbon tetrachloride	56-23-5	1.4	NA[2,3]	300	0.0050	1.4
Chlordane (alpha and gamma forms summed)	57-74-9	NA[1]	NA[2,3]	7.6	0.0017	NA[2,3]
4-Chloroaniline	106-47-8	NA[1]	NA[1]	1,500	0.17	NA[1]
Chlorobenzene	108-90-7	NA[1]	NA[2,3]	320	0.0050	NA[2,3]
Chloroethane (Ethyl chloride)	75-00-3	NA[1]	NA[2,3]	1,700	0.0050	NA[2,3]
Chloroform	67-66-3	NA[1]	590	1,900	0.0050	590
Chloromethane (Methyl chloride)	74-87-3	NA[1]	270	1,200	0.0050	270
2-Chloronaphthalene	91-58-7	NA[1]	NA[1]	60	0.17	NA[1]
2-Chlorophenol (o-Chlorophenol)	95-57-8	NA[1]	NA[1]	11,000	0.17	NA[1]
Chrysene	218-01-9	NA[2,3]	NA[1]	0.72	0.17	NA[2,3]
Cobalt (total)	7440-48-4	520	10,000	NA	0.50	520
Copper (total)	7440-50-8	NA[1]	NA[1]	NA	1.0	NA[1]
Cyanide	57-12-5	NA[1]	NA[2]	NA	0.50	NA[2]
Cyclohexane	110-82-7	NA[1]	NA[2,3]	65	0.0050	NA[2,3]
4,4'-DDD (p,p'-TDE)	72-54-8	NA[1]	NA[1]	21	0.0033	NA[1]
4,4'-DDE (p,p'-DDX)	72-55-9	NA[1]	NA[1]	9.4	0.0033	NA[1]
4,4'-DDT	50-29-3	NA[1]	NA[1]	1.9	0.0033	NA[1]
Dibenz(a,h)anthracene	53-70-3	7,800[4]	NA[1]	9.5	0.17	7,800[4]

Dibromochloromethane (Chlorodibromomethane)	124-48-1	NA[1]	NA[1]	600	0.0050	NA[1]
1,2-Dibromo-3-chloropropane	96-12-8	0.026	11	470	0.0050	0.026
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.085	170	920	*[0.005]* ***0.0050***	0.085
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA[1]	NA[2,3]	140	*[0.005]* ***0.0050***	NA[2,3]
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA[1]	NA[1]	110	*[0.005]* ***0.0050***	NA[1]
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA[1]	NA[2,3]	74	*[0.005]* ***0.0050***	NA[2,3]
3,3'-Dichlorobenzidine	91-94-1	NA[1]	NA[1]	20	0.33	NA[1]
Dichlorodifluoromethane (Freon 12)	75-71-8	NA[1]	NA[1]	540	0.0050	NA[1]
1,1-Dichloroethane	75-34-3	NA[1]	NA[1]	1,200	0.0050	NA[1]
1,2-Dichloroethane	107-06-2	NA[1]	71	2,000	0.0050	71
1,1-Dichloroethene (1,1-	75-35-4	NA[1]	52	830	0.0050	52

Dichloroethylene)						
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA[1]	NA[1]	1,600	0.0050	NA[1]
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA[1]	NA[1]	1,300	0.0050	NA[1]
2,4-Dichlorophenol	120-83-2	NA[1]	NA[1]	2,600	0.17	NA[1]
1,2-Dichloropropane	78-87-5	5.7	31	810	0.0050	5.7
1,3-Dichloropropene (total)	542-75-6	4.8	140	880	0.0050	4.8
Dieldrin	60-57-1	NA[1]	NA[1]	7.9	0.0033	NA[1]
Diethylphthalate	84-66-2	NA[1]	NA[1]	390	0.17	NA[1]
2,4-Dimethylphenol	105-67-9	NA[1]	NA[1]	8,900	0.17	NA[1]
Di-n-butyl phthalate	84-74-2	NA[1]	NA[1]	28	0.17	NA[1]
2,4-Dinitrophenol	51-28-5	NA[1]	NA[1]	430	0.33	NA[1]
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	NA[1]	NA[1]	360	0.17	NA[1]
Di-n-octyl phthalate	117-84-0	NA[1]	NA[1]	6.2	0.33	NA[1]
1,4-Dioxane	123-91-1	45	2,500	160,000	0.067	45
Endosulfan I and Endosulfan II (alpha and	115-29-7	NA[1]	NA[1]	4.4	0.0033	NA[1]

beta) (summed)						
Endrin	72-20-8	NA[1]	NA[1]	10	0.0033	NA[1]
Ethylbenzene	100-41-4	10	NA[2,3]	180	0.0050	10
Extractable Petroleum Hydrocarbons (Category 1)	various	NA[1]	NA[1]	NA	80	NA[1]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA[1]	NA[1]	NA	80	NA[1]
Fluoranthene	206-44-0	NA[1]	NA[1]	29	0.33	NA[1]
Fluorene	86-73-7	NA[1]	NA[1]	31	0.17	NA
alpha-HCH (alpha-BHC)	319-84-6	NA[1]	NA[1]	12	0.0017	NA[1]
beta-HCH (beta-BHC)	319-85-7	NA[1]	NA[1]	1.4	0.0017	NA[1]
Heptachlor	76-44-8	NA[1]	NA[1]	15	0.0017	NA[1]
Heptachlor epoxide	1024-57-3	NA[1]	NA[1]	4.1	0.0017	NA[1]
Hexachlorobenzene	118-74-1	NA[1]	NA[1]	0.078	0.17	NA[1]
Hexachloro-1,3-butadiene	87-68-3	NA[1]	NA[1]	6.1	0.17	NA[1]
Hexachlorocyclopentadiene	77-47-4	NA[1]	2.7	5.6	0.33	2.7
Hexachloroethane	67-72-1	NA[1]	NA[2,3]	28	0.17	NA[2,3]
n-Hexane	110-54-3	NA[1]	NA[2,3]	88	NA	NA[2,3]
2-Hexanone	591-78-6	NA[1]	1,000	3,200	0.010	1,000
Indeno(1,2,3-cd)pyrene	193-39-5	78,000[4]	NA[1]	0.74	0.17	78,000[4]
Isophorone	78-59-1	NA[1]	NA[2,3]	3,400	0.17	NA[2,3]
Isopropylbenzene	98-82-8	NA[1]	NA[2,3]	98	0.0050	NA[2,3]
Lead (total)	7439-92-1	NA[1]	NA[1]	NA	0.50	NA[1]

Lindane (gamma-HCH) (gamma-BHC)	58-89-9	NA[1]	NA[1]	42	0.0017	NA[1]
Manganese (total)	7439-96-5	NA[1]	87,000	NA	0.50	87,000
Mercury (total)	7439-97-6	NA[1]	520,000[4]	*[3.1]* ***3.1[5]***	0.10	520,000[4]
Methoxychlor	72-43-5	NA[1]	NA[1]	5.4	0.017	NA[1]
Methyl acetate	79-20-9	NA[1]	NA[1]	39,000	0.0050	NA[1]
Methylene chloride (Dichloromethane)	75-09-2	1,400	NA[2,3]	2,800	0.0050	1,400
2-Methylnaphthalene	91-57-6	NA[1]	NA[1]	130	0.17	NA[1]
4-Methyl-2-pentanone (MIBK)	108-10-1	NA[1]	NA[2,3]	3,400	0.010	NA[2,3]
2-Methylphenol (o-cresol)	95-48-7	NA[1]	NA[1]	20,000	0.33	NA[1]
4-Methylphenol (p-cresol)	106-44-5	NA[1]	NA[1]	16,000	0.33	NA[1]
Methyl tert-butyl ether (MTBE)	1634-04-4	140	NA[2,3]	9,100	0.0050	140
Naphthalene	91-20-3	5.7	NA[2,3]	100	0.17	5.7
Nickel (total)	7440-02-0	20,000	24,000	NA	0.50	20,000
4-Nitroaniline	100-01-6	NA[1]	NA[2,3]	270	0.33	NA[2,3]
Nitrobenzene	98-95-3	7.5	1,000	1,300	0.17	7.5
N-Nitrosodi-n-propylamine	621-64-7	NA[1]	NA[1]	9,200	0.17	NA[1]
N-Nitrosodiphenylamine	86-30-6	NA[1]	NA[1]	190	0.17	NA[1]

2,2'-oxybis(1-chloropropane)	108-60-1	NA[1]	NA[1]	540	0.33	NA[1]
Pentachlorophenol	87-86-5	NA[1]	NA[1]	140	0.33	NA[1]
Phenol	108-95-2	NA[1]	39,000	44,000	0.33	39,000
Polychlorinated biphenyls (PCBs)	1336-36-3	NA[1]	NA[1]	110	0.030	NA[1]
Pyrene	129-00-0	NA[1]	NA[1]	15	0.17	NA[1]
Selenium (total)	7782-49-2	NA[1]	NA[1]	NA	2.5	NA[1]
Silver (total)	7440-22-4	NA[1]	NA[1]	NA	0.50	NA[1]
Styrene	100-42-5	NA[1]	NA[2,3]	330	0.0050	NA[2,3]
Tertiary butyl alcohol (TBA)	75-65-0	NA[1]	NA[1]	160,000	0.10	NA[1]
1,2,4,5-Tetrachlorobenzene	95-94-3	NA[1]	NA[1]	2.7	0.17	NA[1]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NA[1]	NA[1]	0.10	0.0000010	NA[1]
1,1,2,2-Tetrachloroethane	79-34-5	NA[1]	NA[1]	980	0.0050	NA[1]
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	47	NA[2,3]	89	0.0050	47
2,3,4,6-Tetrachlorophenol	58-90-2	NA[1]	NA[1]	150	0.17	NA[1]
Toluene	108-88-3	NA[1]	NA[2,3]	340	0.0050	NA[2,3]
Toxaphene	8001-35-2	NA[1]	NA[1]	85	0.17	NA[1]
1,2,4-Trichlorobenzene	120-82-1	NA[1]	94	140	0.0050	94
1,1,1-Trichloroethane	71-55-6	NA[1]	NA[2,3]	420	0.0050	NA[2,3]

1,1,2-Trichloroethane	79-00-5	NA[1]	NA[1]	1,300	0.0050	NA[1]
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	3.0	9.1	410	0.0050	3.0
Trichlorofluoromethane (Freon 11)	75-69-4	NA[1]	NA[1]	790	0.0050	NA[1]
2,4,5-Trichlorophenol	95-95-4	NA[1]	NA[1]	5,800	0.20	NA[1]
2,4,6-Trichlorophenol	88-06-2	NA[1]	NA[1]	1,700	0.20	NA[1]
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA[1]	NA[2,3]	530	0.0050	NA[2,3]
1,2,4-Trimethylbenzene	95-63-6	NA[1]	NA[2,3]	80	0.076	NA[2,3]
Vanadium (total)	7440-62-2	NA[1]	170,000	NA	2.5	170,000
Vinyl chloride	75-01-4	1.4	220	2,900	0.0050	1.4
Xylenes (total)	1330-20-7	NA[1]	NA[2,3]	100	0.0050	NA[2,3]
Zinc (total)	7440-66-6	NA[1]	NA[1]	NA	1.0	NA[1]

NA--Not applicable because soil saturation *[concentrations do not exist for metals]* *limit does not apply to this contaminant*

NA[1]--Not applicable because appropriate toxicological information is not available

NA[2]--Standard not applicable because the calculated health-based criterion exceeds one million mg/kg

NA[3]--Standard not applicable because the calculated health-based criterion exceeds the soil saturation limit

[4] Exceeds soil saturation limit; however, health-based criterion based on particulate portion of the equation

[5] Value is for elemental mercury

Table 4 – Soil Remediation Standards for the Inhalation Exposure Pathway – Nonresidential

(mg/kg) (All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Carcinogenic Inhalation Human Health-based Criterion	Noncarcinogenic Inhalation Human Health-based Criterion	Soil Saturation *[Concentration]* ***Limit***	Reporting Limit	Soil Remediation Standard Inhalation Nonresidential
Acenaphthene	83-32-9	NA[1]	NA[1]	40	0.17	NA[1]
Acetone (2-Propanone)	67-64-1	NA[1]	NA[1]	160,000	0.010	NA[1]
Acetophenone	98-86-2	NA[1]	NA[1]	1,600	0.33	NA[1]
Aldrin	309-00-2	NA[1]	NA[1]	2.8	0.0017	NA[1]
Aluminum (total)	7429-90-5	NA[1]	NA[2]	NA	20	NA[2]
Anthracene	120-12-7	NA[1]	NA[1]	1.4	0.17	NA[1]
Antimony (total)	7440-36-0	NA[1]	NA[1]	NA	1.0	NA[1]
Arsenic (total)	7440-38-2	5,200	NA[1]	NA	0.50	5,200
Atrazine	1912-24-9	NA[1]	NA[1]	21	0.33	NA[1]
Barium (total)	7440-39-3	NA[1]	NA[2]	NA	5.0	NA[2]
Benzaldehyde	100-52-7	NA[1]	NA[1]	1,200	0.33	NA[1]
Benzene	71-43-2	11	NA[2,3]	850	0.0050	11
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	370,000[4]	NA[1]	3.3	0.17	370,000[4]
Benzo(a)pyrene	50-32-8	37,000[4]	16,000[4]	1.9	0.17	16,000[4]
Benzo(b)fluoranthene (3,4-	205-99-2	370,000[4]	NA[1]	1.8	0.17	370,000[4]

Benzofluoranthene)						
Benzo(k)fluoranthene	207-08-9	NA^{2,3}	NA^{1}	0.94	0.17	NA^{2,3}
Beryllium	7440-41-7	9,300	160,000	NA	0.50	9,300
1,1'-Biphenyl	92-52-4	NA^{1}	NA^{1}	78	0.17	NA^{1}
Bis(2-chloroethoxy) methane	111-91-1	NA^{1}	NA^{1}	1,400	0.17	NA^{1}
Bis(2-chloroethyl)ether	111-44-4	NA^{1}	NA^{1}	3,700	0.33	NA^{1}
Bis(2-ethylhexyl)phthalate	117-81-7	NA^{1}	NA^{1}	65	0.17	NA^{1}
Bromodichloromethane (Dichlorobromomethane)	75-27-4	NA^{1}	NA^{1}	690	0.0050	NA^{1}
Bromoform	75-25-2	NA^{1}	NA^{1}	680	0.0050	NA^{1}
Bromomethane (Methyl bromide)	74-83-9	NA^{1}	82	3,300	0.0050	82
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA^{1}	NA^{2,3}	36,000	0.010	NA^{2,3}
Butylbenzyl phthalate	85-68-7	NA^{1}	NA^{1}	39	0.17	NA^{1}
Cadmium	7440-43-9	12,000	80,000	NA	0.50	12,000
Caprolactam	105-60-2	NA^{1}	1,300	160,000	0.33	1,300
Carbon disulfide	75-15-0	NA^{1}	NA^{2,3}	580	0.0050	NA^{2,3}
Carbon tetrachloride	56-23-5	6.9	NA^{2,3}	300	0.0050	6.9
Chlordane (alpha and gamma forms summed)	57-74-9	NA^{1}	NA^{2,3}	7.6	0.0017	NA^{2,3}
4-Chloroaniline	106-47-8	NA^{1}	NA^{1}	1,500	0.17	NA^{1}

Chlorobenzene	108-90-7	NA[1]	NA[2,3]	320	0.0050	NA[2,3]
Chloroethane (Ethyl chloride)	75-00-3	NA[1]	NA[2,3]	1,700	0.0050	NA[2,3]
Chloroform	67-66-3	NA[1]	NA[2,3]	1,900	0.0050	NA[2,3]
Chloromethane (Methyl chloride)	74-87-3	NA[1]	1,200	1,200	0.0050	1,200
2-Chloronaphthalene	91-58-7	NA[1]	NA[1]	60	0.17	NA[1]
2-Chlorophenol (o-Chlorophenol)	95-57-8	NA[1]	NA[1]	11,000	0.17	NA[1]
Chrysene	218-01-9	NA[2,3]	NA[1]	0.72	0.17	NA[2,3]
Cobalt (total)	7440-48-4	2,500	48,000	NA	0.50	2,500
Copper (total)	7440-50-8	NA[1]	NA[1]	NA	1.0	NA[1]
Cyanide	57-12-5	NA[1]	NA[2]	NA	0.50	NA[2]
Cyclohexane	110-82-7	NA[1]	NA[2,3]	65	0.0050	NA[2,3]
4,4'-DDD (p,p'-TDE)	72-54-8	NA[1]	NA[1]	21	0.0033	NA[1]
4,4'-DDE (p,p'-DDX)	72-55-9	NA[1]	NA[1]	9.4	0.0033	NA[1]
4,4'-DDT	50-29-3	NA[1]	NA[1]	1.9	0.0033	NA[1]
Dibenz(a,h)anthracene	53-70-3	37,000[4]	NA[1]	9.5	0.17	37,000[4]
Dibromochloromethane (Chlorodibromomethane)	124-48-1	NA[1]	NA[1]	600	0.0050	NA[1]
1,2-Dibromo-3-chloropropane	96-12-8	0.12	52	470	0.0050	0.12
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.41	780	920	0.0050	0.41

1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA[1]	NA[2,3]	140	0.0050	NA[2,3]
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA[1]	NA[1]	110	0.0050	NA[1]
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA[1]	NA[2,3]	74	0.0050	NA[2,3]
3,3'-Dichlorobenzidine	91-94-1	NA[1]	NA[1]	20	0.33	NA[1]
Dichlorodifluoromethane (Freon 12)	75-71-8	NA[1]	NA[1]	540	0.0050	NA[1]
1,1-Dichloroethane	75-34-3	NA[1]	NA[1]	1,200	0.0050	NA[1]
1,2-Dichloroethane	107-06-2	NA[1]	320	2,000	0.0050	320
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA[1]	240	830	0.0050	240
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA[1]	NA[1]	1,600	0.0050	NA[1]
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA[1]	NA[1]	1,300	0.0050	NA[1]

2,4-Dichlorophenol	120-83-2	NA[1]	NA[1]	2,600	0.17	NA[1]
1,2-Dichloropropane	78-87-5	27	140	810	0.0050	27
1,3-Dichloropropene (total)	542-75-6	23	650	880	0.0050	23
Dieldrin	60-57-1	NA[1]	NA[1]	7.9	0.0033	NA[1]
Diethylphthalate	84-66-2	NA[1]	NA[1]	390	0.17	NA[1]
2,4-Dimethylphenol	105-67-9	NA[1]	NA[1]	8,900	0.17	NA[1]
Di-n-butyl phthalate	84-74-2	NA[1]	NA[1]	28	0.17	NA[1]
2,4-Dinitrophenol	51-28-5	NA[1]	NA[1]	430	0.33	NA[1]
2,4-Dinitrotoluene /2,6-Dinitrotoluene (mixture)	25321-14-6	NA[1]	NA[1]	360	0.17	NA[1]
Di-n-octyl phthalate	117-84-0	NA[1]	NA[1]	6.2	0.33	NA[1]
1,4-Dioxane	123-91-1	210	11,000	160,000	0.067	210
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	NA[1]	NA[1]	4.4	0.0033	NA[1]
Endrin	72-20-8	NA[1]	NA[1]	10	0.0033	NA[1]
Ethylbenzene	100-41-4	48	NA[2,3]	180	0.0050	48
Extractable Petroleum Hydrocarbons (Category 1)	various	NA[1]	NA[1]	NA	80	NA[1]
Extractable Petroleum Hydrocarbon	various	NA[1]	NA[1]	NA	80	NA[1]

s (Category 2)						
Fluoranthene	206-44-0	NA[1]	NA[1]	29	0.33	NA[1]
Fluorene	86-73-7	NA[1]	NA[1]	31	0.17	NA[1]
alpha-HCH (alpha-BHC)	319-84-6	NA[1]	NA[1]	12	0.0017	NA[1]
beta-HCH (beta-BHC)	319-85-7	NA[1]	NA[1]	1.4	0.0017	NA[1]
Heptachlor	76-44-8	NA[1]	NA[1]	15	0.0017	NA[1]
Heptachlor epoxide	1024-57-3	NA[1]	NA[1]	4.1	0.0017	NA[1]
Hexachlorobenzene	118-74-1	NA[1]	NA[1]	0.078	0.17	NA[1]
Hexachloro-1,3-butadiene	87-68-3	NA[1]	NA[1]	6.1	0.17	NA[1]
Hexachlorocyclopentadiene	77-47-4	NA[1]	NA[2,3]	5.6	0.33	NA[2,3]
Hexachloroethane	67-72-1	NA[1]	NA[2,3]	28	0.17	NA[2,3]
n-Hexane	110-54-3	NA[1]	NA[2,3]	88	NA	NA[2,3]
2-Hexanone	591-78-6	NA[1]	NA[2,3]	3,200	0.010	NA[2,3]
Indeno(1,2,3-cd)pyrene	193-39-5	370,000[4]	NA[1]	0.74	0.17	370,000[4]
Isophorone	78-59-1	NA[1]	NA[2,3]	3,400	0.17	NA[2,3]
Isopropylbenzene	98-82-8	NA[1]	NA[2,3]	98	0.0050	NA[2,3]
Lead (total)	7439-92-1	NA[1]	NA[1]	NA	0.50	NA[1]
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	NA[1]	NA[1]	42	0.0017	NA[1]
Manganese (total)	7439-96-5	NA[1]	400,000	NA	0.50	400,000
Mercury (total)	7439-97-6	NA[1]	NA[2,3]	*[3.1]* *3.1[5]*	0.10	NA[2,3]
Methoxychlor	72-43-5	NA[1]	NA[1]	5.4	0.017	NA[1]

Methyl acetate	79-20-9	NA[1]	NA[1]	39,000	0.0050	NA[1]
Methylene chloride (Dichloromethane)	75-09-2	NA[2,3]	NA[2,3]	2,800	0.0050	NA[2,3]
2-Methylnaphthalene	91-57-6	NA[1]	NA[1]	130	0.17	NA[1]
4-Methyl-2-pentanone (MIBK)	108-10-1	NA[1]	NA[2,3]	3,400	0.010	NA[2,3]
2-Methylphenol (o-cresol)	95-48-7	NA[1]	NA[1]	20,000	0.33	NA[1]
4-Methylphenol (p-cresol)	106-44-5	NA[1]	NA[1]	16,000	0.33	NA[1]
Methyl tert-butyl ether (MTBE)	1634-04-4	650	NA[2,3]	9,100	0.0050	650
Naphthalene	91-20-3	27	NA[2,3]	100	0.17	27
Nickel (total)	7440-02-0	93,000	110,000	NA	0.50	93,000
4-Nitroaniline	100-01-6	NA[1]	NA[2,3]	270	0.33	NA[2,3]
Nitrobenzene	98-95-3	36	NA[2,3]	1,300	0.17	36
N-Nitrosodi-n-propylamine	621-64-7	NA[1]	NA[1]	9,200	0.17	NA[1]
N-Nitrosodiphenylamine	86-30-6	NA[1]	NA[1]	190	0.17	NA[1]
2,2'-oxybis(1-chloropropane)	108-60-1	NA[1]	NA[1]	540	0.33	NA[1]
Pentachlorophenol	87-86-5	NA[1]	NA[1]	140	0.33	NA[1]
Phenol	108-95-2	NA[1]	NA[2,3]	44,000	0.33	NA[2,3]
Polychlorinated biphenyls (PCBs)	1336-36-3	NA[1]	NA[1]	110	0.030	NA[1]
Pyrene	129-00-0	NA[1]	NA[1]	15	0.17	NA[1]

Selenium (total)	7782-49-2	NA[1]	NA[1]	NA	2.5	NA[1]
Silver (total)	7440-22-4	NA[1]	NA[1]	NA	0.50	NA[1]
Styrene	100-42-5	NA[1]	NA[2,3]	330	0.0050	NA[2,3]
Tertiary butyl alcohol (TBA)	75-65-0	NA[1]	NA[1]	160,000	0.10	NA[1]
1,2,4,5-Tetrachlorobenzene	95-94-3	NA[1]	NA[1]	2.7	0.17	NA[1]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	NA[1]	NA[1]	0.10	0.0000010	NA[1]
1,1,2,2-Tetrachloroethane	79-34-5	NA[1]	NA[1]	980	0.0050	NA[1]
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	NA[2,3]	NA[2,3]	89	0.0050	NA[2,3]
2,3,4,6-Tetrachlorophenol	58-90-2	NA[1]	NA[1]	150	0.17	NA[1]
Toluene	108-88-3	NA[1]	NA[2,3]	340	0.0050	NA[2,3]
Toxaphene	8001-35-2	NA[1]	NA[1]	85	0.17	NA[1]
1,2,4-Trichlorobenzene	120-82-1	NA[1]	NA[2,3]	140	0.0050	NA[2,3]
1,1,1-Trichloroethane	71-55-6	NA[1]	NA[2,3]	420	0.0050	NA[2,3]
1,1,2-Trichloroethane	79-00-5	NA[1]	NA[1]	1,300	0.0050	NA[1]
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	14	42	410	0.0050	14
Trichlorofluoromethane (Freon 11)	75-69-4	NA[1]	NA[1]	790	0.0050	NA[1]

2,4,5-Trichlorophenol	95-95-4	NA[1]	NA[1]	5,800	0.20	NA[1]
2,4,6-Trichlorophenol	88-06-2	NA[1]	NA[1]	1,700	0.20	NA[1]
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA[1]	NA[2,3]	530	0.0050	NA[2,3]
1,2,4-Trimethylbenzene	95-63-6	NA[1]	NA[2,3]	80	0.076	NA[2,3]
Vanadium (total)	7440-62-2	NA[1]	800,000	NA	2.5	800,000
Vinyl chloride	75-01-4	6.4	1,000	2,900	0.0050	6.4
Xylenes (total)	1330-20-7	NA[1]	NA[2,3]	100	0.0050	NA[2,3]
Zinc (total)	7440-66-6	NA[1]	NA[1]	NA	1.0	NA[1]

NA-Not applicable because soil saturation limit does not apply to this contaminant

NA[1] Not applicable because appropriate toxicological information is not available

NA[2] Standard not applicable because the calculated health-based criterion exceeds one million mg/kg

NA[3] Standard not applicable because the calculated health-based criterion exceeds the soil saturation limit

[4] Exceeds soil saturation limit; however, health-based criterion based on particulate portion of the equation

[5] Value is for elemental mercury

Table 5--Soil Remediation Standards for the Migration to Ground Water Exposure Pathway (mg/kg)

(All ground water remediation standards are rounded to one significant figure[A]; all other numeric values are rounded to two significant figures)

Contaminant	CAS No.	Ground Water Remediation Standard (μg/L)	Migration to Ground Water Soil Criterion (mg/kg)	Soil Saturation Limit (mg/kg)	Reporting Limit (mg/kg)	*[Migration to Ground Water]* Soil Remediation Standard ***Migration to**

						Ground Water* (mg/kg)
Acenaphthene	83-32-9	400	82	40	0.17	NA[1]
Acetone (2-Propanone)	67-64-1	6,000	19	160,000	0.010	19
Acetophenone	98-86-2	700	3.6	1,600	0.33	3.6
Aldrin	309-00-2	0.04	0.13	2.8	0.0017	0.13
Aluminum (total)	7429-90-5	NA[2]	NA[2]	NA[3]	20	NA[2]
Anthracene	120-12-7	2,000	1,300	1.4	0.17	NA[1]
Antimony (total)	7440-36-0	6	5.4	NA[3]	1.0	5.4
Arsenic (total)	7440-38-2	3	1.6	NA[3]	0.50	19[4]
Atrazine	1912-24-9	3	0.036	21	0.33	0.33[5]
Barium (total)	7440-39-3	6,000	2,100	NA[3]	5.0	2,100
Benzaldehyde	100-52-7	NA[6]	NA[6]	1,200	0.33	NA[6]
Benzene	71-43-2	1	0.0094	850	0.0050	0.0094
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.1	0.71	3.3	0.17	0.71
Benzo(a)pyrene	50-32-8	0.1	2.3	1.9	0.17	NA[1]
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.2	4.8	1.8	0.17	NA[1]
Benzo(k)fluoranthene	207-08-9	0.5	12	0.94	0.17	NA[1]
Beryllium	7440-41-7	1	0.70	NA[3]	0.50	0.70
1,1'-Biphenyl	92-52-4	400	83	*[72]* ***78***	0.17	NA[1]

Bis(2-chloroethoxy)methane	111-91-1	NA[6]	NA[6]	1,400	0.17	NA[6]
Bis(2-chloroethyl)ether	111-44-4	7	0.030	3,700	0.33	0.33[5]
Bis(2-ethylhexyl)phthalate	117-81-7	3	14	65	0.17	14
Bromodichloromethane (Dichlorobromomethane)	75-27-4	1	0.0045	690	0.0050	0.0050[5]
Bromoform	75-25-2	4	0.018	680	0.0050	0.018
Bromomethane	74-83-9	10	0.043	3,300	0.0050	0.043
(Methyl bromide)						
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	300	0.98	36,000	0.010	0.98
Butylbenzyl phthalate	85-68-7	100	29	39	0.17	29
Cadmium	7440-43-9	4	1.9	NA[3]	0.50	1.9
Caprolactam	105-60-2	4,000	16	160,000	0.33	16
Carbon disulfide	75-15-0	700	3.7	580	0.0050	3.7
Carbon tetrachloride	56-23-5	1	0.0075	300	0.0050	0.0075
Chlordane (alpha and gamma forms summed)	57-74-9	0.5	1.4	7.6	0.0017	1.4
4-Chloroaniline	106-47-8	30	0.23	1,500	0.17	0.23
Chlorobenzene	108-90-7	50	0.64	320	0.0050	0.64
Chloroethane (Ethyl chloride)	75-00-3	NA[6]	NA[6]	1,700	0.0050	NA[6]
Chloroform	67-66-3	70	0.33	1,900	0.0050	0.33
Chloromethane (Methyl chloride)	74-87-3	NA[6]	NA[6]	1,200	0.0050	NA[6]

2-Chloronaphthalene	91-58-7	600	61	60	0.17	NA[1]
2-Chlorophenol (o-Chlorophenol)	95-57-8	40	0.76	11,000	0.17	0.76
Chrysene	218-01-9	5	36	0.72	0.17	NA[1]
Cobalt (total)	7440-48-4	100	90	NA[3]	0.50	90
Copper (total)	7440-50-8	1,300	910	NA[3]	1.0	910
Cyanide	57-12-5	100	20	NA[3]	0.50	20
Cyclohexane	110-82-7	NA[6]	NA[6]	65	0.0050	NA[6]
4,4'-DDD (p,p'-TDE)	72-54-8	0.1	0.47	21	0.0033	0.47
4,4'-DDE (p,p'-DDX)	72-55-9	0.1	0.47	9.4	0.0033	0.47
4,4'-DDT	50-29-3	0.1	0.67	1.9	0.0033	0.67
Dibenz(a,h)anthracene	53-70-3	0.3	23	9.5	0.17	NA[1]
Dibromochloromethane (Chlorodibromomethane)	124-48-1	1	0.0044	600	0.0050	0.0050[5]
1,2-Dibromo-3-chloropropane	96-12-8	0.02	0.00015	470	0.0050	0.0050[5]
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.03	0.00014	920	0.0050	0.0050[5]
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	600	11	140	0.0050	11
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	600	11	110	0.0050	11
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	75	1.4	74	0.0050	1.4
3,3'-Dichlorobenzidine	91-94-1	30	3.9	20	0.33	3.9
Dichlorodifluoromethane (Freon 12)	75-71-8	1,000	38	540	0.0050	38

1,1-Dichloroethane	75-34-3	50	0.24	1,200	0.0050	0.24
1,2-Dichloroethane	107-06-2	2	0.0095	2,000	0.0050	0.0095
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	1	0.0069	830	0.0050	0.0069
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	70	0.35	1,600	0.0050	0.35
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	100	0.56	*[1,100]* *1,300*	0.0050	0.56
2,4-Dichlorophenol	120-83-2	20	0.19	*[2,100]* *2,600*	0.17	0.19
1,2-Dichloropropane	78-87-5	1	0.0058	810	0.0050	0.0058
1,3-Dichloropropene (total)	542-75-6	1	0.0063	880	0.0050	0.0063
Dieldrin	60-57-1	0.03	0.024	7.9	0.0033	0.024
Diethylphthalate	84-66-2	6,000	44	390	0.17	44
2,4-Dimethylphenol	105-67-9	100	2.3	8,900	0.17	2.3
Di-n-butyl phthalate	84-74-2	700	35	28	0.17	NA[1]
2,4-Dinitrophenol	51-28-5	40	0.12	430	0.33	0.33[5]
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	10	0.27	360	0.17	0.27
Di-n-octyl phthalate	117-84-0	100	560	6.2	0.33	NA[1]
1,4-Dioxane	123-91-1	0.4	0.0013	160,000	0.067	0.067[5]
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	40	11	4.4	0.0033	NA[1]
Endrin	72-20-8	2	1.6	10	0.0033	1.6

Ethylbenzene	100-41-4	700	15	180	0.0050	15
Extractable Petroleum Hydrocarbons (Category 1)	various	NA[6]	NA[6]	NA[3]	80	NA[6]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA[6]	NA[6]	NA[3]	80	NA[6]
Fluoranthene	206-44-0	300	670	29	0.33	NA[1]
Fluorene	86-73-7	300	110	31	0.17	NA[1]
alpha-HCH (alpha-BHC)	319-84-6	0.02	0.0023	12	0.0017	0.0023
beta-HCH (beta-BHC)	319-85-7	0.04	0.0046	1.4	0.0017	0.0046
Heptachlor	76-44-8	0.05	0.083	15	0.0017	0.083
Heptachlor epoxide	1024-57-3	0.2	0.081	4.1	0.0017	0.081
Hexachlorobenzene	118-74-1	0.02	0.0050	0.078	0.17	0.17[5]
Hexachloro-1,3-butadiene	87-68-3	1	0.038	6.1	0.17	0.17[5]
Hexachlorocyclopentadiene	77-47-4	40	2.5	5.6	0.33	2.5
Hexachloroethane	67-72-1	7	0.079	28	0.17	0.17[5]
n-Hexane	110-54-3	30	5.5	88	-	5.5
2-Hexanone	591-78-6	40	0.15	3,200	0.010	0.15
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	16	*[0.086]* ***0.74***	0.17	NA[1]
Isophorone	78-59-1	40	0.23	3,400	0.17	0.23
Isopropylbenzene	98-82-8	700	22	98	0.0050	22
Lead (total)	7439-92-1	5	90	NA[3]	0.50	90

Lindane (gamma-HCH) (gamma-BHC)	58-89-9	0.03	0.0035	42	0.0017	0.0035
Manganese (total)	7439-96-5	NA[2]	NA[2]	NA[3]	0.50	NA[2]
Mercury (total)	7439-97-6	2	0.014	NA[3]	0.10	0.10[5]
Methoxychlor	72-43-5	40	43	5.4	0.017	NA[1]
Methyl acetate	79-20-9	7,000	22	39,000	0.0050	22
Methylene chloride (Dichloromethane)	75-09-2	3	0.013	2,800	0.0050	0.013
2-Methylnaphthalene	91-57-6	30	3.1	130	0.17	3.1
4-Methyl-2-pentanone (MIBK)	108-10-1	NA[6]	NA[6]	3,400	0.010	NA[6]
2-Methylphenol (o-cresol)	95-48-7	50	0.77	20,000	0.33	0.77
4-Methylphenol (p-cresol)	106-44-5	50	0.75	16,000	0.33	0.75
Methyl tert-butyl ether (MTBE)	1634-04-4	70	0.25	9,100	0.0050	0.25
Naphthalene	91-20-3	300	19	100	0.17	19
Nickel (total)	7440-02-0	100	48	NA[3]	0.50	48
4-Nitroaniline	100-01-6	NA[6]	NA[6]	270	0.33	NA[6]
Nitrobenzene	98-95-3	6	0.073	1,300	0.17	0.17[5]
N-Nitrosodi-n-propylamine	621-64-7	10	0.14	9,200	0.17	0.17[5]
N-Nitrosodiphenylamine	86-30-6	10	1.1	190	0.17	1.1
2,2'-oxybis(1-chloropropane)	108-60-1	300	1.9	540	0.33	1.9
Pentachlorophenol	87-86-5	0.3	0.062	140	0.33	0.33[5]
Phenol	108-95-2	2,000	21	44,000	0.33	21

Polychlorinated biphenyls (PCBs)	1336-36-3	0.5	1.6	110	0.030	1.6
Pyrene	129-00-0	200	440	15	0.17	NA[1]
Selenium (total)	7782-49-2	40	11	NA[3]	2.5	11
Silver (total)	7440-22-4	40	0.33	NA[3]	0.50	0.50[5]
Styrene	100-42-5	100	2.1	330	0.0050	2.1
Tertiary butyl alcohol (TBA)	75-65-0	100	0.32	160,000	0.10	0.32
1,2,4,5-Tetrachlorobenzene	95-94-3	NA[6]	NA[6]	2.7	0.17	NA[6]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	0.00001	0.00010	0.10	0.0000010	0.00010[7]
1,1,2,2-Tetrachloroethane	79-34-5	1	0.0069	980	0.0050	0.0069
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1	0.0086	89	0.0050	0.0086
2,3,4,6-Tetrachlorophenol	58-90-2	200	26	*[140]* *150*	0.17	26
Toluene	108-88-3	600	7.8	340	0.0050	7.8
Toxaphene	8001-35-2	2	6.2	*[110]* *85*	0.17	6.2
1,2,4-Trichlorobenzene	120-82-1	9	0.52	140	0.0050	0.52
1,1,1-Trichloroethane	71-55-6	30	0.20	420	0.0050	0.20
1,1,2-Trichloroethane	79-00-5	3	0.017	1,300	0.0050	0.017
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1	0.0065	410	0.0050	0.0065
Trichlorofluoromethane (Freon 11)	75-69-4	2,000	29	790	0.0050	29
2,4,5-Trichlorophenol	95-95-4	700	68	5,800	0.20	68

2,4,6-Trichlorophenol	88-06-2	20	0.86	1,700	0.20	0.86
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	*[NA[6]]* ***20,000***	*[NA[6]]* ***1,300***	530	0.0050	*[NA[6]]* ***NA[1]***
1,2,4-Trimethylbenzene	95-63-6	NA[6]	NA[6]	80	0.076	NA[6]
Vanadium (total)	7440-62-2	NA[6]	NA[6]	NA[3]	2.5	NA[6]
Vinyl chloride	75-01-4	1	0.0067	2,900	0.0050	0.0067
Xylenes (total)	1330-20-7	1,000	19	100	0.0050	19
Zinc (total)	7440-66-6	2,000	930	NA[3]	1.0	930

[A] The ground water remediation standards are listed using one significant figure to be consistent with the Ground Water Quality Standards, N.J.A.C. 7:9C

NA-Not applicable

[1] Standard not applicable because the calculated health-based criterion exceeds the soil saturation limit

[2] Standard not applicable because ground water remediation standard is a secondary standard

[3] Not applicable because soil saturation *[concentrations do not exist for metals and a soil saturation concentration for EPH has not been determined]* ***limit does not apply to this contaminant***

[4] Standard is based on natural background

[5] Standard set to reporting limit

[6] Standard not applicable because a ground water remediation standard does not exist

[7] This standard is used for comparison to site soil data that have been converted to sample-specific TCDD-TEQ values through application of the Toxicity Equivalence Factor Methodology (USEPA 2010) and using the WHO 2005 Mammalian Toxic Equivalency Factors (TEFs)

Table 6--Soil Leachate Remediation Standards for the Migration to Ground Water Exposure Pathway (µg/L)

(All ground water remediation standards are rounded to one significant figure[A]; all other numeric values are rounded to two significant figures)

Contaminant	CAS No.	Ground Water Remediation Standard ug/L	Soil Leachate Remediation *[Standard Migration]* ***Standard-Migration*** **ug/L**

			to Ground Water
Acenaphthene	83-32-9	400	NA[1]
Acetone (2-Propanone)	67-64-1	6,000	120,000
Acetophenone	98-86-2	700	14,000
Aldrin	309-00-2	0.04	0.80
Aluminum (total)	7429-90-5	NA[2]	NA[2]
Anthracene	120-12-7	2,000	NA[1]
Antimony (total)	7440-36-0	6	120
Arsenic (total)	7440-38-2	3	60
Atrazine	1912-24-9	3	60
Barium (total)	7440-39-3	6,000	120,000
Benzaldehyde	100-52-7	NA[3]	NA[3]
Benzene	71-43-2	1	20
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.1	2.0
Benzo(a)pyrene	50-32-8	0.1	NA[1]
Benzo(b)fluoranthene (3,4-Benzofluoranthene)	205-99-2	0.2	NA[1]
Benzo(k)fluoranthene	207-08-9	0.5	NA[1]
Beryllium	7440-41-7	1	20
1,1'-Biphenyl	92-52-4	400	NA[1]
Bis(2-chloroethoxy)methane	111-91-1	NA[3]	NA[3]
Bis(2-chloroethyl)ether	111-44-4	7	140

Bis(2-ethylhexyl)phthalate	117-81-7	3	60
Bromodichloromethane (Dichlorobromomethane)	75-27-4	1	20
Bromoform	75-25-2	4	80
Bromomethane (Methyl bromide)	74-83-9	10	200
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	300	6,000
Butylbenzyl phthalate	85-68-7	100	2,000
Cadmium	7440-43-9	4	80
Caprolactam	105-60-2	4,000	80,000
Carbon disulfide	75-15-0	700	14,000
Carbon tetrachloride	56-23-5	1	20
Chlordane (alpha and gamma forms summed)	57-74-9	0.5	10
4-Chloroaniline	106-47-8	30	600
Chlorobenzene	108-90-7	50	1,000
Chloroethane (Ethyl chloride)	75-00-3	NA[3]	NA[3]
Chloroform	67-66-3	70	1,400
Chloromethane (Methyl chloride)	74-87-3	NA[3]	NA[3]
2-Chloronaphthalene	91-58-7	600	NA[1]
2-Chlorophenol (o-Chlorophenol)	95-57-8	40	800
Chrysene	218-01-9	5	NA[1]

Cobalt (total)	7440-48-4	100	2,000
Copper (total)	7440-50-8	1,300	26,000
Cyanide	57-12-5	100	2,000
Cyclohexane	110-82-7	NA[3]	NA[3]
4,4'-DDD (p,p'-TDE)	72-54-8	0.1	2.0
4,4'-DDE (p,p'-DDX)	72-55-9	0.1	2.0
4,4'-DDT	50-29-3	0.1	2.0
Dibenz(a,h)anthracene	53-70-3	0.3	NA[1]
Dibromochloromethane (Chlorodibromomethane)	124-48-1	1	20
1,2-Dibromo-3-chloropropane	96-12-8	0.02	0.40
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.03	0.60
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	600	12,000
1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	600	12,000
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	75	1,500
3,3'-Dichlorobenzidine	91-94-1	30	600
Dichlorodifluoromethane (Freon 12)	75-71-8	1,000	20,000
1,1-Dichloroethane	75-34-3	50	1,000
1,2-Dichloroethane	107-06-2	2	40
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	1	20

1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	70	1,400
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	100	2,000
2,4-Dichlorophenol	120-83-2	20	400
1,2-Dichloropropane	78-87-5	1	20
1,3-Dichloropropene (total)	542-75-6	1	20
Dieldrin	60-57-1	0.03	0.60
Diethylphthalate	84-66-2	6,000	120,000
2,4-Dimethylphenol	105-67-9	100	2,000
Di-n-butyl phthalate	84-74-2	700	NA[1]
2,4-Dinitrophenol	51-28-5	40	800
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	10	200
Di-n-octyl phthalate	117-84-0	100	NA[1]
1,4-Dioxane	123-91-1	0.4	8.0
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	40	NA[1]
Endrin	72-20-8	2	40
Ethylbenzene	100-41-4	700	14,000
Extractable Petroleum Hydrocarbons (Category 1)	various	NA[3]	NA[3]
Extractable Petroleum Hydrocarbons (Category 2)	various	NA[3]	NA[3]

Fluoranthene	206-44-0	300	NA[1]
Fluorene	86-73-7	300	NA[1]
alpha-HCH (alpha-BHC)	319-84-6	0.02	0.40
beta-HCH (beta-BHC)	319-85-7	0.04	0.80
Heptachlor	76-44-8	0.05	1.0
Heptachlor epoxide	1024-57-3	0.2	4.0
Hexachlorobenzene	118-74-1	0.02	0.40
Hexachloro-1,3-butadiene	87-68-3	1	20
Hexachlorocyclopentadiene	77-47-4	40	800
Hexachloroethane	67-72-1	7	140
n-Hexane	110-54-3	30	600
2-Hexanone	591-78-6	40	800
Indeno(1,2,3-cd)pyrene	193-39-5	0.2	NA[1]
Isophorone	78-59-1	40	800
Isopropylbenzene	98-82-8	700	14,000
Lead (total)	7439-92-1	5	100
Lindane (gamma-HCH)(gamma-BHC)	58-89-9	0.03	0.60
Manganese (total)	7439-96-5	NA[2]	NA[2]
Mercury (total)	7439-97-6	2	40
Methoxychlor	72-43-5	40	NA[1]
Methyl acetate	79-20-9	7,000	140,000

Methylene chloride (Dichloromethane)	75-09-2	3	60
2-Methylnaphthalene	91-57-6	30	600
4-Methyl-2-pentanone (MIBK)	108-10-1	NA[3]	NA[3]
2-Methylphenol (o-cresol)	95-48-7	50	1,000
4-Methylphenol (p-cresol)	106-44-5	50	1,000
Methyl tert-butyl ether (MTBE)	1634-04-4	70	1,400
Naphthalene	91-20-3	300	6,000
Nickel (total)	7440-02-0	100	2,000
4-Nitroaniline	100-01-6	NA[3]	NA[3]
Nitrobenzene	98-95-3	6	120
N-Nitrosodi-n-propylamine	621-64-7	10	200
N-Nitrosodiphenylamine	86-30-6	10	200
2,2'-oxybis(1-chloropropane)	108-60-1	300	6,000
Pentachlorophenol	87-86-5	0.3	6.0
Phenol	108-95-2	2,000	40,000
Polychlorinated biphenyls (PCBs)	1336-36-3	0.5	10
Pyrene	129-00-0	200	NA[1]
Selenium (total)	7782-49-2	40	800
Silver (total)	7440-22-4	40	800
Styrene	100-42-5	100	2,000
Tertiary butyl alcohol (TBA)	75-65-0	100	2,000

1,2,4,5-Tetrachlorobenzene	95-94-3	NA[3]	NA[3]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	0.00001	0.00020[4]
1,1,2,2-Tetrachloroethane	79-34-5	1	20
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	1	20
2,3,4,6-Tetrachlorophenol	58-90-2	200	4,000
Toluene	108-88-3	600	12,000
Toxaphene	8001-35-2	2	40
1,2,4-Trichlorobenzene	120-82-1	9	180
1,1,1-Trichloroethane	71-55-6	30	600
1,1,2-Trichloroethane	79-00-5	3	60
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1	20
Trichlorofluoromethane (Freon 11)	75-69-4	2,000	40,000
2,4,5-Trichlorophenol	95-95-4	700	14,000
2,4,6-Trichlorophenol	88-06-2	20	400
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	*[NA[3]]* ***20,000***	*[NA[3]]* ***NA[1]***
1,2,4-Trimethylbenzene	95-63-6	NA[3]	NA[3]
Vanadium (total)	7440-62-2	NA[3]	NA[3]
Vinyl chloride	75-01-4	1	20
Xylenes (total)	1330-20-7	1,000	20,000
Zinc (total)	7440-66-6	2,000	40,000

[A] The ground water remediation standards are listed using one significant figure to be consistent with the Ground Water Quality Standards, N.J.A.C. 7:9C

NA-Not applicable

[1] Standard not applicable because the calculated health-based ***soil*** criterion exceeds the soil saturation limit

[2] Not applicable because ground water remediation standard is a secondary standard

[3] Not applicable because a ground water remediation standard does not exist

[4] This standard is used for comparison to site soil leachate data that have been converted to sample-specific TCDD-TEQ values through application of the Toxicity Equivalence Factor Methodology (USEPA 2010) and using the WHO 2005 Mammalian Toxic Equivalency Factors (TEFs)

Table 7--Indoor Air Remediation Standards for the Vapor Intrusion Exposure Pathway -- Residential (µg/m^3)

(All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Carcinogenic Indoor Air Human Health-based Criterion	Noncarcinogenic Indoor Air Human Health-based Criterion	Reporting Limit	Indoor Air Remediation Standard Residential
Acetone	67-64-1	NA	NA	12	NA
Benzene	71-43-2	0.36	31	0.64	0.64[1]
Bromodichloromethane	75-27-4	NA	NA	1.3	NA
Bromoform	75-25-2	NA	NA	2.1	NA
Bromomethane (Methyl bromide)	74-83-9	NA	5.2	0.78	5.2
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	5,200	1.5	5,200
Carbon disulfide	75-15-0	NA	730	1.6	730
Carbon tetrachloride	56-23-5	0.47	100	1.3	1.3[1]
Chlorobenzene	108-90-7	NA	52	0.92	52
Chloroethane (Ethyl chloride)	75-00-3	NA	10,000	1.3	10,000

Chloroform	67-66-3	NA	100	0.98	100
Chloromethane (Methyl chloride)	74-87-3	NA	94	1.0	94
Cyclohexane	110-82-7	NA	6,300	0.69	6,300
Dibromochloromethane	124-48-1	NA	NA	1.7	NA
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.0047	9.4	1.5	1.5[1]
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	210	1.2	210
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA	830	1.2	830
Dichlorodifluoromethane (Freon 12)	75-71-8	NA	NA	2.5	NA
1,1-Dichloroethane	75-34-3	NA	NA	0.81	NA
1,2-Dichloroethane	107-06-2	NA	7.3	0.81	7.3
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA	21	0.79	21
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	NA	NA	0.79	NA
1,2-Dichloroethene (trans) (t-1,2-	156-60-5	NA	NA	0.79	NA

Dichloroethylene)					
1,2-Dichloropropane	78-87-5	0.76	4.2	0.92	0.92[1]
1,3-Dichloropropene (total)	542-75-6	0.70	21	0.91	0.91[1]
1,4-Dioxane	123-91-1	0.56	31	0.72	0.72[1]
Ethylbenzene	100-41-4	1.1	1,000	0.87	1.1
Hexachlorobutadiene	87-68-3	NA	NA	2.1	NA
n-Hexane	110-54-3	NA	730	0.70	730
Mercury (elemental)	7439-97-6	NA	0.31	1.0	1.0[1]
Methylene chloride (Dichloromethane)	75-09-2	280	630	1.7	280
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	3,100	2.0	3,100
Methyl tert-butyl ether (MTBE)	1634-04-4	11	3,100	0.72	11
Naphthalene	91-20-3	0.083	3.1	2.6	2.6[1]
Styrene	100-42-5	NA	1,000	0.85	1,000
1,1,2,2-Tetrachloroethane	79-34-5	NA	NA	1.4	NA
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	11	42	1.4	11
Toluene	108-88-3	NA	5,200	0.75	5,200
1,2,4-Trichlorobenzene	120-82-1	NA	2.1	3.7	3.7[1]
1,1,1-Trichloroethane	71-55-6	NA	5,200	1.1	5,200
1,1,2-Trichloroethane	79-00-5	NA	NA	1.1	NA

Trichloroethene (TCE) (Trichloroethylene)	79-01-6	0.68	2.1	1.1	1.1[1]
Trichlorofluoromethane	75-69-4	NA	NA	1.1	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA	5,200	1.5	5,200
1,2,4-Trimethylbenzene	95-63-6	NA	63	0.98	63
Vinyl chloride	75-01-4	0.64	100	0.51	0.64
Xylenes (total)	1330-20-7	NA	100	0.87	100

NA-Not applicable because appropriate toxicological information is not available

[1] Standard set at reporting limit

Table 8--Indoor Air Remediation Standards for the Vapor Intrusion Exposure Pathway -- Nonresidential ($\mu g/m^3$)

(All numeric values are rounded to two significant figures)

Contaminant	CAS No.	Carcinogenic Indoor Air Human Health-based Criterion	Noncarcinogenic Indoor Air Human Health-based Criterion	Reporting Limit	Indoor Air Remediation Standard Nonresidential
Acetone	67-64-1	NA	NA	12	NA
Benzene	71-43-2	1.6	130	0.64	1.6
Bromodichloromethane	75-27-4	NA	NA	1.3	NA
Bromoform	75-25-2	NA	NA	2.1	NA
Bromomethane (Methyl bromide)	74-83-9	NA	22	0.78	22
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	NA	22,000	1.5	22,000
Carbon disulfide	75-15-0	NA	3,100	1.6	3,100

Carbon tetrachloride	56-23-5	2.0	440	1.3	2.0
Chlorobenzene	108-90-7	NA	220	0.92	220
Chloroethane (Ethyl chloride)	75-00-3	NA	44,000	1.3	44,000
Chloroform	67-66-3	NA	430	0.98	430
Chloromethane (Methyl chloride)	74-87-3	NA	390	1.0	390
Cyclohexane	110-82-7	NA	26,000	0.69	26,000
Dibromochloromethane	124-48-1	NA	NA	1.7	NA
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	0.020	39	1.5	1.5[1]
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	NA	880	1.2	880
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	NA	3,500	1.2	3,500
Dichlorodifluoromethane (Freon 12)	75-71-8	NA	NA	2.5	NA
1,1-Dichloroethane	75-34-3	NA	NA	0.81	NA
1,2-Dichloroethane	107-06-2	NA	31	0.81	31
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	NA	88	0.79	88
1,2-Dichloroethene (cis) (c-1,2-	156-59-2	NA	NA	0.79	NA

Dichloroethylene)					
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	NA	NA	0.79	NA
1,2-Dichloropropane	78-87-5	3.3	18	0.92	3.3
1,3-Dichloropropene (total)	542-75-6	3.1	88	0.91	3.1
1,4-Dioxane	123-91-1	2.5	130	0.72	2.5
Ethylbenzene	100-41-4	4.9	4,400	0.87	4.9
Hexachlorobutadiene	87-68-3	NA	NA	2.1	NA
n-Hexane	110-54-3	NA	3,100	0.70	3,100
Mercury (elemental)	7439-97-6	NA	1.3	1.0	1.3
Methylene chloride (Dichloromethane)	75-09-2	1,200	2,600	1.7	1,200
4-Methyl-2-pentanone (MIBK)	108-10-1	NA	13,000	2.0	13,000
Methyl tert-butyl ether (MTBE)	1634-04-4	47	13,000	0.72	47
Naphthalene	91-20-3	0.36	13	2.6	2.6[1]
Styrene	100-42-5	NA	4,400	0.85	4,400
1,1,2,2-Tetrachloroethane	79-34-5	NA	NA	1.4	NA
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	47	180	1.4	47
Toluene	108-88-3	NA	22,000	0.75	22,000
1,2,4-Trichlorobenzene	120-82-1	NA	8.8	3.7	8.8

1,1,1-Trichloroethane	71-55-6	NA	22,000	1.1	22,000
1,1,2-Trichloroethane	79-00-5	NA	NA	1.1	NA
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	3.0	8.8	1.1	3.0
Trichlorofluoromethane	75-69-4	NA	NA	1.1	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	NA	22,000	1.5	22,000
1,2,4-Trimethylbenzene	95-63-6	NA	260	0.98	260
Vinyl chloride	75-01-4	2.8	440	0.51	2.8
Xylenes (total)	1330-20-7	NA	440	0.87	440

NA-Not applicable because appropriate toxicological information is not available

[1] Standard set at reporting limit

APPENDIX 2

DEVELOPMENT OF SOIL REMEDIATION STANDARDS FOR THE INGESTION-DERMAL EXPOSURE PATHWAY

This appendix describes the procedures and equations used by the Department to develop the soil remediation standards for the ingestion-dermal exposure pathway as contained in N.J.A.C. 7:26D Appendix 1 Tables 1 and 2. This appendix is also used to develop interim soil remediation standards for the ingestion-dermal exposure pathway pursuant to N.J.A.C. 7:26D-6 and for updating soil remediation standards for the ingestion-dermal exposure pathway pursuant to N.J.A.C. 7:26D-7.

If the calculated soil criterion for a contaminant for the ingestion-dermal exposure pathway is greater than one million mg/kg, a soil remediation standard for the ingestion-dermal exposure pathway for that contaminant does not apply.

If the calculated soil criterion for a contaminant for the ingestion-dermal exposure pathway is less than the reporting limit for that contaminant, the soil remediation standard for the ingestion-dermal exposure pathway for that contaminant defaults to the soil reporting limit.

Equations 1 through 4 below are derived from the USEPA, Regional Screening Levels (RSLs)--Equations (November 2018). A detailed explanation of the derivation of Equations 1 through 4 is contained at N.J.A.C. 7:26D Appendix 12.

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Equation 1--Residential Carcinogenic Ingestion-Dermal Human Health-Based Criteria

$$ID_c = \frac{TR * AT * LT}{(10^{-6} kg / mg) * [(CSF_O * IFS_{adj}) + (CSF_D * DFS_{adj} * ABS_d)]}$$

Parameter	Definition	Units	Default
ID_c	Carcinogenic ingestion-dermal human health-based criterion	mg/kg	Chemical specific
TR	Target cancer risk	unitless	1×10^{-6}
AT	Averaging time	days/year	365
LT	Lifetime	years	70
CSF_o	Oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
IFS_{adj}	Age-adjusted soil ingestion rate	mg/kg	36,750
CSF_D	Dermal cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
DFS_{adj}	Age-adjusted soil dermal contact factor	mg/kg	103,390
ABS_d	Dermal absorption fraction	unitless	Chemical specific

Where:

$$IFS_{adj} = \frac{EF_c * ED_c * IR_c}{BW_c} + \frac{EF_a * ED_a * IR_a}{BW_a}$$

Parameter	Definition	Units	Default
IFS_{adj}	Age-adjusted soil ingestion rate	mg/kg	36,750
EF_c	Exposure frequency-child	days/year	350
EF_a	Exposure frequency-adult	days/year	350
ED_c	Exposure duration-child	years	6
ED_a	Exposure duration-adult	years	20
IR_c	Soil ingestion rate-child	mg/day	200
IR_a	Soil ingestion rate-adult	mg/day	100
BW_c	Body weight-child	kg	15
BW_a	Body weight-adult	kg	80

Where:

$$DFS_{adj} = \frac{EF_c * ED_c * SA_c * AF_c}{BW_c} + \frac{EF_a * ED_a * SA_a * AF_a}{BW_a}$$

Parameter	Definition	Units	Default
DFS_{adj}	Age-adjusted soil dermal contact factor	mg/kg	103,390
EF_c	Exposure frequency-child	days/year	350

EF_a	Exposure frequency-adult	days/year	350
ED_c	Exposure duration-child	years	6
ED_a	Exposure duration-adult	years	20
SA_c	Skin surface area-child	cm^2/day	2,373
SA_a	Skin surface area-adult	cm^2/day	6,032
AF_c	Soil adherence factor-child	mg/cm^2	0.2
AF_a	Soil adherence factor-adult	mg/cm^2	0.07
BW_c	Body weight-child	kg	15
BW_a	Body weight-adult	kg	80

Where:

$$CSF_D = \frac{CSF_O}{GIABS}$$

Parameter	Definition	Units	Default
CSF_D	Dermal cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
CSF_O	Oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
$GIABS$	Gastro-intestinal absorption fraction	unitless	Chemical specific

Equation 2--Residential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria

$$ID_{nc} = \frac{THQ * AT * ED * BW}{(EF * ED * 10^{-6}\, kg/mg) * [(\frac{1}{RfD_O} * IR) + (\frac{1}{RfD_D} * SA * AF * ABS_d)]}$$

Parameter	Definition	Units	Default
ID_{nc}	Noncarcinogenic ingestion-dermal human health-based criterion	mg/kg	Chemical specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	days/year	365
ED	Exposure duration	years	6
BW	Body weight-child	kg	15
EF	Exposure frequency	days/year	350
RfD_O	Oral reference dose	mg/kg-day	Chemical specific
IR	Soil ingestion rate-child	mg/day	200
RfD_D	Dermal reference dose	mg/kg-day	Chemical specific
SA	Skin surface area-child	cm^2/day	2,373
AF	Soil adherence factor-child	mg/cm^2	0.2
ABS_d	Dermal absorption fraction	unitless	Chemical specific

Where:

$$RfD_D = RfD_O * GIABS$$

Parameter	Definition	Units	Default
RfD_D	Dermal reference dose	mg/kg-day	Chemical specific
RfD_O	Oral reference dose	mg/kg-day	Chemical specific
GIABS	Gastro-intestinal absorption fraction	unitless	Chemical specific

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Equation 3--Nonresidential Carcinogenic Ingestion-Dermal Human Health-Based Criteria

$$ID_c = \frac{TR * AT * LT * BW}{EF * ED * 10^{-6}\,kg/mg * [(CSF_O * IR) + (CSF_D * SA * AF * ABS_d)]}$$

Parameter	Definition	Units	Default
ID_c	Carcinogenic ingestion-dermal human health-based criterion	mg/kg	Chemical specific
TR	Target cancer risk	unitless	1×10^{-6}
AT	Averaging time	days/year	365
LT	Lifetime	years	70
BW	Body weight - adult	kg	80
EF	Exposure frequency-outdoor worker	days/year	225
ED	Exposure duration	years	25
CSF_o	Oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
IR	Soil ingestion rate-outdoor worker	mg/day	100

CSF_D	Dermal cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
SA	Skin surface area-worker	cm^2/day	3,527
AF	Soil adherence factor-worker	mg/cm^2	0.12
ABS_d	Dermal absorption fraction	unitless	Chemical specific

Where:

$$CSF_D = \frac{CSF_O}{GIABS}$$

Parameter	Definition	Units	Default
CSF_D	Dermal cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
CSF_O	Oral cancer slope factor	$(mg/kg\text{-}day)^{-1}$	Chemical specific
$GIABS$	Gastro-intestinal absorption fraction	unitless	Chemical specific

Equation 4--Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria

$$ID_{nc} = \frac{THQ * AT * ED * BW}{(EF * ED * 10^{-6}\,kg/mg) * [(\frac{1}{RfD_O} * IR) + (\frac{1}{RfD_D} * SA * AF * ABS_d)]}$$

Parameter	Definition	Units	Default
ID_{nc}	Noncarcinogenic ingestion-dermal human health-based criterion	mg/kg	Chemical specific

THQ	Target hazard quotient	unitless	1
AT	Averaging time	days/year	365
ED	Exposure duration	years	25
BW	Body weight-adult	kg	80
EF	Exposure frequency-outdoor worker	days/year	225
RfD_O	Oral reference dose	mg/kg-day	Chemical specific
IR	Soil ingestion rate-outdoor worker	mg/day	100
RfD_D	Dermal reference dose	mg/kg-day	Chemical specific
SA	Skin surface area- worker	cm^2/day	3,527
AF	Soil adherence factor-worker	mg/cm^2	0.12
ABS_d	Dermal absorption fraction	unitless	Chemical specific

Where:

$$RfD_D = RfD_O * GIABS$$

Parameter	Definition	Units	Default
RfD_D	Dermal reference dose	mg/kg-day	Chemical specific
RfD_O	Oral reference dose	mg/kg-day	Chemical specific
GIABS	Gastro-intestinal absorption fraction	unitless	Chemical specific

Equation 5--Residential and Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria for EPH

$$ID_{nc} = \frac{THQ}{\frac{f_{(1)}}{ECFV_{(1)}} + \frac{f_{(2)}}{ECFV_{(2)}} + \frac{f_{(3)}}{ECFV_{(3)}} + \frac{f_{(4)}}{ECFV_{(4)}} + \frac{f_{(5)}}{ECFV_{(5)}} + \frac{f_{(6)}}{ECFV_{(6)}} + \frac{f_{(7)}}{ECFV_{(7)}} + \frac{f_{(8)}}{ECFV_{(8)}}}$$

Parameter	Definition	Units	Default
ID_{nc}	Noncarcinogenic soil criterion for the ingestion-dermal exposure pathway	mg/kg	Chemical specific
THQ	Target hazard quotient	unitless	1
f	Equivalent carbon weight fraction	unitless	Chemical specific
$ECFV$	Equivalent carbon fraction value	mg/kg	Chemical specific

ID_{nc} is the noncarcinogenic soil criterion for the ingestion-dermal exposure pathway for total EPH for the EPH composition established by the eight equivalent carbon (EC) range fractions. This equation was used to calculate a single numeric total EPH soil criterion for EPH (Category 1). This equation will be used to calculate a sample-specific total EPH soil criterion for all EPH (Category 2) using the Department's online EPH Calculator.

The equivalent carbon fraction value (ECFV) equation and default input variables are the same as used to calculate the noncarcinogenic soil criteria for the specific individual contaminants for the ingestion-dermal absorption exposure pathway shown in Equations 2 and 4. That is, each EC range is treated as if it is a single contaminant.

APPENDIX 3

DEVELOPMENT OF SOIL REMEDIATION STANDARDS FOR THE INHALATION EXPOSURE PATHWAY

This appendix describes the procedures and equations used by the Department to develop the soil remediation standards for the inhalation exposure pathway as contained at N.J.A.C. 7:26D Appendix 1, Tables 3 and 4. This appendix is also used to develop interim soil remediation standards for the inhalation exposure pathway pursuant to N.J.A.C. 7:26D-6 and for updating soil remediation standards for the inhalation exposure pathway pursuant to N.J.A.C. 7:26D-7.

If a calculated soil criterion for a contaminant for the inhalation exposure pathway is greater than its soil saturation limit for the volatile portion of the equation, the volatile component of the equation is not applicable in the development of the soil criterion for the inhalation exposure pathway.

If the calculated soil criterion for a contaminant for the inhalation exposure pathway is greater than one million parts per million, a soil remediation standard for that contaminant for the inhalation exposure pathway does not apply.

If the calculated soil criterion for a contaminant for the inhalation exposure pathway is less than the soil reporting limit for that contaminant, the soil remediation standard for that contaminant for the inhalation exposure pathway defaults to the soil reporting limit.

Equations 1 through 7 below are derived from the USEPA, Regional Screening Levels (RSLs)--Equations (November 2018). A detailed explanation of the derivation of Equations 1 and 2 is contained at N.J.A.C. 7:26D Appendix 12.

Equation 1--Carcinogenic Inhalation Human Health-Based Criteria

$$Inh_c = \frac{TR * AT * LT}{IUR * 1000\,{}^{\mu g}/_{mg} * EF * \left(\frac{1}{VF} + \frac{1}{PEF}\right) * ED * ET * \frac{1 day}{24 hours}}$$

Parameter	Definition	Units	Default
Inh_c	Carcinogenic inhalation human health-based criterion	mg/kg	Chemical specific
TR	Target cancer risk	unitless	1×10^{-6}
AT	Averaging time	days/year	365
LT	Lifetime	years	70
IUR	Inhalation unit risk factor	$(\mu g/m^3)^{-1}$	Chemical specific
EF	Exposure frequency	days/year	350 (Residential) 225 (Nonresidential)
VF	Soil-to-air volatilization factor	m^3/kg	Chemical specific

PEF	Particulate emission factor	m^3/kg	1.67×10^9 (Residential) 1.64×10^9(Nonresidential)
ED	Exposure duration	years	26 (Residential) 25 (Nonresidential)
ET	Exposure time	hours/day	24 (Residential) 8 (Nonresidential)

Equation 2--Noncarcinogenic Inhalation Human Health-Based Criteria

$$Inh_{nc} = \frac{THQ * AT * ED}{EF * ED * ET * \frac{1 day}{24 hours} * \frac{1}{RfC} * \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

Parameter	Definition	Units	Default
Inh_{nc}	Noncarcinogenic inhalation human health-based criterion	mg/kg	Chemical specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	days/year	365
EF	Exposure frequency	days/year	350 (Residential) 225 (Nonresidential)
ED	Exposure duration	years	26 (Residential) 25 (Nonresidential)
ET	Exposure time	hours/day	24 (Residential) 8 (Nonresidential)
RfC	Reference concentration	mg/m^3	Chemical specific
VF	Soil-to-air volatilization factor	m^3/kg	Chemical specific

PEF	Particulate emission factor	m^3/kg	1.67×10^9 (Residential) 1.64×10^9(Nonresidential)

Equation 3--Volatilization Factor (VF)

$$VF = Q/C * \frac{(3.14 * D_A * T)^{1/2}}{(2 * \rho_b * D_A)} * 10^{-4}\, m^2/cm^2$$

Parameter	Definition	Units	Default
VF	Soil-to-air volatilization factor	m^3/kg	Chemical specific
Q/C	Inverse concentration at center of source	$(g/m^2\text{-}s)/$ (kg/m^3)	86.6 (Residential) 85 (Nonresidential)
D_A	Apparent diffusivity	cm^2/s	Chemical specific
T	Exposure interval	seconds	8.20×10^8
ρ_b	Dry soil bulk density	g/cm^3	1.5

Equation 4--Apparent Diffusivity (D_A)

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

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
ρ_b	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)

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

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--Particulate Emission Factor (PEF)

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

Parameter	Definition	Units	Default
PEF	Particulate emission factor	m^3/kg	1.67×10^9(Residential) 1.64×10^9(Nonresidential)
Q/C	Inverse concentration at center of source	$(g/m^2\text{-}s)/(kg/m^3)$	86.6 (Residential) 85 (Nonresidential)
v	Percent vegetative cover	percent	50
Um	Mean annual wind speed	m/s	4.56
Ut	Equivalent threshold value of wind speed at 7 m	m/s	11.32
F(x)	Function dependent on Um/Ut derived using Cowherd et al. (1985)	unitless	0.159

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Equation 7--Soil Saturation Limit (C_{sat})

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

Parameter	Definition	Units	Default
C_{sat}	Soil saturation limit	mg/kg	Chemical specific
S	Water solubility	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

APPENDIX 4

DEVELOPMENT OF THE SOIL AND SOIL LEACHATE REMEDIATION STANDARDS FOR THE MIGRATION TO GROUND WATER EXPOSURE PATHWAY

This appendix describes the procedures used by the Department to develop the soil and soil leachate remediation standards for the migration to ground water exposure pathway as contained at N.J.A.C. 7:26D Appendix 1, Tables 5 and 6. This appendix is also used to develop interim soil and soil leachate remediation standards for the migration to ground water exposure pathway pursuant to N.J.A.C. 7:26D-6 and for updating soil and soil leachate remediation standards for the migration to ground water exposure pathway pursuant to N.J.A.C. 7:26D-7.

If a calculated soil criterion for a contaminant for the migration to ground water exposure pathway is greater than its soil saturation limit, a soil remediation standard for the migration to ground water exposure pathway does not apply.

If a calculated soil criterion for a contaminant for migration to ground water exposure pathway is less than the soil reporting limit for that contaminant, the soil remediation standard for the migration to ground water remediation exposure pathway defaults to the soil reporting limit.

Equation 1a--Migration to Ground Water Soil-Water Partitioning Criteria for Inorganic Contaminants

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 22)

$$MGW_c = GWRS * \frac{mg}{1000\mu g} * \left\{ K_d + \frac{\theta_w + (\theta_a * H')}{\rho_b} \right\} * DAF$$

Parameter	Definition	Units	Default
MGW_c	Migration to ground water soil-water partitioning criterion	mg/kg	Chemical specific
$GWRS$	Ground water remediation standard	µg/L	Chemical specific

K_d	Soil-water partition coefficient	L/kg	Chemical specific
Θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
Θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18
H'	Henry's law constant	unitless	Chemical specific
ρ_b	Dry soil bulk density	kg/L	1.5
DAF	Dilution-attenuation factor	unitless	20

Equation 1b--Migration to Ground Water Soil-Water Partitioning Criteria for Organic Contaminants

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 24)

$$MGW_c = GWRS * \frac{mg}{1000\mu g} * \left\{ (K_{oc} * f_{oc}) + \frac{\theta_w + (\theta_a * H')}{\rho_b} \right\} * DAF$$

Parameter	Definition	Units	Default
MGW_c	Migration to ground water soil-water partitioning criterion	mg/kg	Chemical specific
$GWRS$	Ground water remediation standard	µg/L	Chemical specific
K_{oc}	Soil organic carbon-water partition coefficient	L/kg	Chemical specific
f_{oc}	Organic carbon content of soil	kg/kg	0.002
Θ_w	Water-filled soil porosity	L_{water}/L_{soil}	0.23
Θ_a	Air-filled soil porosity	L_{air}/L_{soil}	0.18

H'	Henry's law constant	unitless	Chemical specific
ρ_b	Dry soil bulk density	kg/L	1.5
DAF	Dilution-attenuation factor	unitless	20

Equation 2--Dilution-Attenuation Factor

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 37)

$$DAF = 1 + \frac{K * i * d}{I * L}$$

Parameter	Definition	Units	Default
DAF	Dilution-attenuation factor	unitless	20
K	Aquifer hydraulic conductivity	m/year	15,808
i	Hydraulic gradient	m/m	0.003
d	Mixing zone depth	m	3.4
I	Infiltration rate	m/year	0.28
L	Length of area of concern parallel to ground water flow	m	30.5

Equation 3--Mixing Zone Depth

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Equation 45)

$$d = (0.0112 * L^2)^{0.5} + d_a * \{1 - \exp[(-L * I)/(K * i * d_a)]\}$$

Parameter	Definition	Units	Default
d	Mixing zone depth	m	3.4
L	Length of area of concern parallel to ground water flow	m	30.5
d_a	Aquifer thickness	m	3.5
I	Infiltration rate	m/year	0.28
K	Aquifer hydraulic conductivity	m/year	15,808
i	Hydraulic gradient	m/m	0.003

Equation 4--Soil Saturation Limit

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

$$C_{sat} = \frac{S}{\rho_b} * [(K_{oc} * f_{oc} * \rho_b) + \theta_w + (H' * \theta_a)]$$

Parameter	Definition	Units	Default
C_{sat}	Soil saturation limit	mg/kg	Chemical specific
S	Water solubility	mg/L	Chemical specific
ρ_b	Dry soil bulk density	kg/L	1.5
K_{oc}	Soil organic carbon-water partition coefficient	L/kg	Chemical specific
f_{oc}	Organic carbon content of soil	kg/kg	0.002

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

Equation 5--Soil Leachate Remediation Standards for the Migration to Ground Water Exposure Pathway

Source: USEPA Soil Screening Guidance: Technical Background Document EPA/540/R-95/128 (May 1996) (Target soil leachate concentration parameter in Equations 22 and 24)

$$MGW_{leachate} = GWRS * DAF$$

Parameter	Definition	Units	Default
$MGW_{leachate}$	Soil leachate remediation standard for the migration to ground water exposure pathway	µg/L	Chemical specific
$GWRS$	Ground water remediation standard	µg/L	Chemical specific
DAF	Dilution-attenuation factor	unitless	20

APPENDIX 5

DEVELOPMENT OF INDOOR AIR REMEDIATION STANDARDS FOR THE VAPOR INTRUSION EXPOSURE PATHWAY

This appendix describes the procedures and equations used by the Department to develop the indoor air remediation standards for the vapor intrusion exposure pathway as contained at N.J.A.C. 7:26D Appendix 1, Tables 7 and 8. This appendix is also used to develop interim indoor air remediation standards for the vapor intrusion exposure pathway pursuant to N.J.A.C. 7:26D-6 and for updating indoor air remediation standards for the vapor intrusion exposure pathway pursuant to N.J.A.C. 7:26D-7.

If the calculated indoor air human health-based criterion for a contaminant is less than the reporting limit, the indoor air remediation standard defaults to the reporting limit.

Equations 1 and 2 below are derived from the USEPA, Regional Screening Levels (RSLs)--Equations (November 2018). A detailed explanation of the derivation of Equations 1 and 2 is contained at N.J.A.C. 7:26D Appendix 12.

Equation 1--Carcinogenic Indoor Air Human Health-Based Criteria

$$IA_c = \frac{TR * AT * LT}{EF * ED * ET * \frac{1}{24} \frac{day}{hours} * IUR}$$

Parameter	Definition	Units	Default
IA_c	Carcinogenic indoor air human health-based criterion	µg/m^3	Chemical specific
TR	Target cancer risk	unitless	1 x 10^{-6}
AT	Averaging time	days/year	365
LT	Lifetime	years	70
EF	Exposure frequency	days/year	350 (Residential) 250 (Nonresidential-indoor worker)
ED	Exposure duration	years	26 (Residential) 25 (Nonresidential)
ET	Exposure time	hours/day	24 (Residential) 8 (Nonresidential)
IUR	Inhalation unit risk	(µg/m^3)$^{-1}$	Chemical specific

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Equation 2--Noncarcinogenic Indoor Air Human Health-Based Criteria

$$IA_{nc} = \frac{THQ * AT * ED * \frac{1000\ \mu g}{mg}}{EF * ED * ET * \frac{1}{24}\frac{day}{hours} * \frac{1}{RfC}}$$

Parameter	Definition	Units	Default
IA_{nc}	Noncarcinogenic indoor air human health-based criterion	$\mu g/m^3$	Chemical specific
THQ	Target hazard quotient	unitless	1
AT	Averaging time	days/year	365
ED	Exposure duration	years	26 (Residential) 25 (Nonresidential)
EF	Exposure frequency	days/year	350 (Residential) 250 (Nonresidential-indoor worker)
ET	Exposure time	hours/day	24 (Residential) 8 (Nonresidential)
RfC	Inhalation reference concentration	mg/m^3	Chemical specific

APPENDIX 6

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS FOR SOIL FOR THE INGESTION-

DERMAL EXPOSURE PATHWAY

Pursuant to N.J.A.C. 7:26D-8.3(a)1i, an alternative remediation standard (ARS) for soil for the ingestion-dermal exposure pathway may be developed for a site or an area of concern in accordance with the procedures provided in this appendix.

I. Overview

(a) An ARS for this exposure pathway may be developed at any time. *[However, the need to develop an ARS shall not be a basis for extending an applicable mandatory timeframe, as set forth in the Administrative Requirements for the Remediation of Contaminated Sites, N.J.A.C. 7:26C.]*

(b) The ARS options listed in III(a) of this appendix are applicable to carcinogenic and noncarcinogenic health end-points.

(c) An ARS for this exposure pathway may be developed based on site-specific alternative land uses in accordance with III(a) and III(b)1 of this appendix.

(d) An ARS for this exposure pathway may be developed based on site-specific modification of parameters in accordance with III(b)2 and 3 of this appendix.

(e) An ARS for lead for this exposure pathway may be developed based on use of other models and methods pursuant to III(b)4 of this appendix.

(b) The ARS options listed in III(a) of this appendix are applicable to carcinogenic and noncarcinogenic health end-points.

(c) An ARS for this exposure pathway may be developed based on site-specific alternative land uses in accordance with III(a) and III(b)1 of this appendix.

(d) An ARS for this exposure pathway may be developed based on site-specific modification of parameters in accordance with III(b)2 and 3 of this appendix.

(e) An ARS for lead for this exposure pathway may be developed based on use of other models and methods pursuant to III(b)4 of this appendix.

II. Required Approvals and Permits

(a) An ARS developed in accordance with III(a) and III(b) of this appendix must be approved by the Department prior to use at the specific site or area of concern.

(b) The Department shall require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS developed pursuant to III(a) and III(b)1 and 3 of this appendix to ensure that the continued use of the ARS remains valid.

(c) The Department shall not require the use of an institutional control, engineering control, and a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS developed pursuant to III(b)2 of this appendix.

(d) Depending on the site-specific conditions the Department may require the use of an institutional control, engineering control, and a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS developed pursuant to III(b)4 of this appendix.

III. Options and Procedures

(a) An ARS may be based on a site-specific alternative land use, which would involve an alternative exposure scenario (for example, exposure frequency and exposure duration) that is neither a residential nor a nonresidential land use scenario.

1. Examples of alternative land uses include, but are not limited to:

i. Active recreational land use, such as sports playing fields and playgrounds;

ii. Passive recreational land use, such as land and trails used for walking, cycling, and hunting;

iii. Restricted access areas, such as right-of-way areas used for the inspection and repair of utilities; and

iv. Infrequent access areas, such as ecological preservation and conservation areas.

2. The following actions shall be taken when developing an ARS pursuant to this appendix:

i. Determine the intended use of the site and the appropriate exposure frequency (EF) and exposure duration (ED) associated with the intended land use in accordance with Department guidance located on the Department's website;

ii. Use the EF and ED in the Department's calculator located on the Department's website to calculate an alternative ingestion-dermal remediation standard; and

iii. Provide the following information to the Department in addition to the applicable form found on the Department's website:

(1) The resultant ARS and the modified input parameters used in the Department's calculator;

(2) A description and basis of how the input parameters were selected; and

(3) A description of any institutional controls and engineering controls associated with the ARS.

(b) For lead contamination, an ARS for this exposure pathway can be developed as follows:

1. Alternative Land Use Scenarios

i. An ARS for lead for an alternative land use may be based on the assessment of non-continuous nonresidential exposures identified in the USEPA's Assessing Intermittent or Variable Exposures at Lead Sites (USEPA, 2003)[1]; and

ii. Prior to the development of an ARS under III(b) of this appendix, consultation with the Department shall be required in accordance with Department guidance.

2. Site-Specific Changes to Default Values--Residential Exposure Scenario

i. An ARS for lead for a residential scenario may be based on input parameters identified by the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) (USEPA, 1994)[2]; and

ii. Prior to the development of an ARS for lead under III(b) of this appendix, consultation with the Department shall be required in accordance with Department guidance.

3. Site-Specific Changes to Default Values-Nonresidential Exposure Scenario

i. An ARS for lead for a nonresidential scenario may be based on the 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)[3]; and

ii. Prior to the development of an ARS under III(b) of this appendix, consultation with the Department shall be required in accordance with Department guidance.

4. Other models and methods

i. With prior approval by the Department, an ARS for lead may also be developed using scientific models and methods other than those described in III(b)2 or 3 above.

[1] USEPA. 2003. Assessing Intermittent or Variable Exposures at Lead Sites, Office of Solid Waste and Emergency Response, OSWER 9285.7-76.

[2] 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.

[3] USEPA. 1996. 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.

APPENDIX 7

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS FOR SOIL FOR THE INHALATION EXPOSURE PATHWAY

Pursuant to N.J.A.C. 7:26D-8.3(a)1ii, an alternative remediation standard (ARS) for soil for the inhalation exposure pathway may be developed for a site or an area of concern in accordance with the procedures provided in this appendix.

I. Overview

(a) An ARS for this exposure pathway may be developed at any time. *[However, the need to develop an ARS shall not be a basis for extending an applicable mandatory timeframe, as set forth in the Administrative Requirements for the Remediation of Contaminated Sites, N.J.A.C. 7:26C.]*

(b) The ARS options listed in III of this appendix are applicable to carcinogenic and noncarcinogenic health end-points.

(c) The ARS options outlined in III of this appendix may be utilized for residential and nonresidential land use scenarios, as well as alternative land use scenarios described in III(a) of this appendix.

(d) An ARS for this exposure pathway may be developed based on modification of site-specific exposure parameters listed in III(b) of this appendix.

II. Required Approvals and Permits

(a) An ARS developed in accordance with III(a) of this appendix must be approved by the Department prior to use at the specific site or area of concern.

(b) An ARS developed in accordance with III(b) of this appendix does not require approval by the Department prior to use at the specific site or area of concern.

(c) The Department shall require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7 for an ARS developed pursuant to III(a), III(b)1iv, and III(b)3 of this appendix to ensure that the continued use of the ARS remains valid.

(d) The Department shall not require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7 for an ARS developed pursuant to III(b)1v and III(b)2 of this appendix.

III. Options and Procedures

(a) An ARS for this exposure pathway may be based on a site-specific alternative land use, which would involve an alternative exposure scenario (for example, exposure frequency, exposure time, and exposure duration) that is neither a residential nor a nonresidential land use scenario.

1. Examples of alternative land uses include, but are not limited to:

i. Active recreational land use, such as sports playing fields and playgrounds;

ii. Passive recreational land use, such as land and trails used for walking, cycling, and hunting; and

iii. Access areas, such as right-of-way areas used for the inspection and repair of utilities.

2. The following actions shall be taken when developing an ARS pursuant to this appendix:

i. Determine the intended use of the site and the appropriate exposure frequency (EF), exposure time (ET), and exposure duration (ED) associated with the intended land use in accordance with Department guidance;

ii. Use the EF, ET, and ED in the Department's calculator located on the Department's website to calculate the ARS; and

iii. Submit the following information to the Department in addition to the applicable form found on the Department's website:

(1) The resultant ARS and the modified input parameters used in the Department's calculator;

(2) A description and basis of how the input parameters were selected; and

(3) A description of institutional controls and engineering controls associated with the ARS.

(b) An ARS for soil for this exposure pathway may be based site-specific parameter modifications as follows:

1. Depth Range of Contamination:

i. Determine the actual depth range of contamination by delineation sampling pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-4, and Department guidance;

ii. Use the actual depth range of contamination in the Department's calculator located on the Department's website to calculate an alternative inhalation remediation standard;

iii. Provide the following information to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

(1) The resultant ARS and the modified input parameters used in the Department's calculator;

(2) A description and basis of how the input parameters were selected, including all related laboratory results; and

(3) A description of any institutional controls and engineering controls associated with the ARS;

iv. The Department shall require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS based on a site-specific depth range of contamination that begins at a depth greater than zero feet below ground surface to ensure that the continued use of the ARS remains valid; and

v. The Department shall not require the use of an institutional control, engineering control, or a remedial action permit, pursuant to N.J.A.C. 7:26C-7, for an ARS based on a site-specific depth range of contamination that begins at the ground surface.

2. Soil Organic Carbon Content (foc):

i. Collect and analyze samples for determining foc in accordance with the appropriate Department guidance;

ii. Input the appropriate foc value(s) in the Department's calculator located on the Department's website when calculating an alternative inhalation remediation standard; and

iii. Provide the following to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

(1) The resultant ARS and the modified input parameters used in the Department's calculator; and

(2) A description and basis of how the input parameters were selected, including all related laboratory results.

3. Fraction of Vegetative Cover (V):

i. Determine V on the site in accordance with the appropriate Department guidance;

ii. Use V in the Department's calculator located on the Department's website to calculate the ARS for soil for the inhalation exposure pathway; and

iii. Provide the following information to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

(1) The resultant ARS and the modified input parameters used in the Department's calculator;

(2) A description and basis of how the input parameters were selected, including all measurements and calculations; and

(3) A description of any institutional controls and engineering controls associated with the ARS.

APPENDIX 8

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS FOR SOIL FOR THE MIGRATION TO

GROUND WATER EXPOSURE PATHWAY

Pursuant to N.J.A.C. 7:26D-8.3(a)1iii, an alternative remediation standard (ARS) for soil for the migration to ground water exposure pathway may be developed for a site or an area of concern in accordance with the procedures provided in this appendix.

I. Overview

(a) An ARS for soil for this exposure pathway may be developed at any time. *[However, the need to develop an ARS shall not be a basis for extending an applicable mandatory timeframe, as set forth in the Administrative Requirements for the Remediation of Contaminated Sites, N.J.A.C. 7:26C.]*

(b) An ARS may be developed based on the site-specific options described in III of this appendix and submitted to the Department with the appropriate form(s).

II. Required Approvals and Permits

(a) An ARS developed in accordance with III(a), III(b), and III(c) of this appendix must be approved by the Department prior to use at the specific site or area of concern.

(b) An ARS developed in accordance with III(d), III(e), III(f), and III(g) of this appendix does not require approval by the Department prior to use at the specific site or area of concern.

(c) With prior approval by the Department, an ARS may also be developed using scientific methods other than those described in III(a) though (g) below including relevant guidance from the USEPA, other states, and other relevant, applicable, and appropriate methods and practices that ensure the protection of public health and safety and of the environment.

(d) With the exception noted in III(c) of this appendix, an ARS developed pursuant to this appendix does not require the use of an institutional control, engineering control, and a remedial action permit, pursuant to N.J.A.C. 7:26C-7.

III. Options and Procedures

(a) Determination of a site-specific Dilution-Attenuation Factor (DAF) as follows:

1. Measure the length of the area of concern parallel to the ground water flow, the aquifer hydraulic conductivity, the aquifer gradient and, if necessary, aquifer thickness in accordance with the appropriate Department guidance.

2. Input the appropriate values into the Department's calculators (DAF calculator or Soil-Water Partition Equation calculator) located on the Department's website.

3. Provide the following to the Department in addition to the applicable form found on the Department's website:

i. The resultant ARS and the modified input parameters used in the Department's DAF calculator or the Department's Soil-Water Partition Equation calculator; and

ii. Documentation of the determination and basis of the site-specific parameters used to determine the DAF including all related tables, figures, and laboratory results.

(b) Seasonal Soil Compartment Model (SESOIL) modeling as follows:

1. Delineate contamination and determine the depth to ground water in accordance with the appropriate Department guidance.

2. If desired, determine soil texture in accordance with the appropriate Department guidance.

3. If desired, determine soil organic carbon content according to III(d) of this appendix.

4. Input the appropriate parameters into the SESOIL model in accordance with the appropriate Department guidance.

5. Provide the following to the Department in addition to the applicable form found on the Department's website:

i. For each ARS determined using the SESOIL model, a SESOIL model table showing the measured contaminant concentrations as a function of depth and the modeled SESOIL concentrations, results from the most current version of the SEVIEW model software of the SESOIL CLIMATE report, the SESOIL HYDROLOGIC CYCLE report, the SESOIL PROFILE AND LOAD REPORT, and the SESOIL POLLUTANT CYCLE report. The project file (*.prj file) from the SEVIEW project shall also be submitted; and

ii. A description and basis of how the SESOIL input parameters were determined, including all related tables, figures, and laboratory results.

6. An alternative software package equivalent to SEVIEW that has been authorized by the Department may be used as a substitute for SEVIEW in application of III(b) of this appendix.

(c) Seasonal Soil Compartment Model/Analytical Transient 1 ,2-,3-Dimensional (SESOIL/AT123D) modeling as follows:

1. The SESOIL/AT123D model shall only be used when:

i. The contaminated ground water plume has been delineated in accordance with the Technical Requirements for Site Remediation, N.J.A.C. 7:26E and appropriate Department guidance;

ii. A Classification Exception Area (CEA) exists for contaminated ground water on the site; and

iii. An impermeable cap does not and will not exist above the vadose zone contamination. Any permeable cap used shall allow unrestricted ground water recharge.

2. Delineate the vadose zone contamination and determine the depth to ground water in accordance with the appropriate Department guidance.

3. Determine the soil organic carbon for both the vadose zone and the aquifer according to III(d) of this appendix.

4. Determine the soil texture for the vadose zone in accordance with the appropriate Department guidance.

5. If desired, determine the aquifer texture in accordance with the appropriate Department guidance.

6. Input the appropriate parameters into the SESOIL/AT123D model in accordance with the appropriate Department guidance.

7. Provide the following to the Department, in addition to the applicable form found on the Department's website:

i. For each ARS determined using the combined SESOIL/AT123D model, a SESOIL model table showing the measured vadose zone contaminant concentrations as a function of depth and the modeled SESOIL concentrations, a map of the delineated ground water plume (with concentration isopleths) showing AT123D ground water sources and the concentrations and dimensions used in the model for each source, the SEVIEW project map, results from the most current version of the SEVIEW model software of the SESOIL CLIMATE report, the SESOIL HYDROLOGIC CYCLE report, the SESOIL PROFILE AND LOAD REPORT, the SESOIL POLLUTANT CYCLE report, an AT123D Point of Compliance Report at the downgradient edge of the Area of Concern at the centerline of the plume at the surface of the water table, and an AT123D Point of Compliance Report at the maximum extent of the plume at the centerline of the plume at the surface of the water table. For each AT123D Point of Compliance Report, the numerical concentration of the contaminant at the last time step (end of the CEA time period) shall be shown in an EXCEL window pasted on to the report. The project file (*.prj file) from the SEVIEW project shall also be submitted; and

ii. A description and basis of how the SESOIL/AT123D input parameters were determined, including all related tables, figures, and laboratory results.

8. Except for the existing CEA and the remedial action permit, the Department shall not require the use of any additional institutional control, engineering control, or a remedial action permit, pursuant to N.J.A.C. 7:26C-7 for an ARS based on site-specific SESOIL/AT123D modeling.

9. An alternative software package equivalent to SEVIEW that has been authorized by the Department may be used as a substitute for SEVIEW in application of III(c) of this appendix.

(d) A site-specific soil organic carbon content (foc) in the Soil Water Partition Equation, found at N.J.A.C. 7:26D Appendix 4 as follows:

1. Collect and analyze samples for determining foc in accordance with the appropriate Department guidance.

2. Input the appropriate foc value(s) in the Department's foc calculator located on the Department's website to determine the site-specific foc value.

3. Input the site-specific foc value into the Soil-Water Partition Equation calculator located on the Department's website in order to determine the alternative remediation standard.

4. Provide the following to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

i. The resultant ARS and the modified input parameters used in the Department's foc and soil-water partition calculators; and

ii. A description and basis of how the soil organic carbon content was selected, including all related tables, figures, and laboratory results.

(e) The Synthetic Precipitation Leaching Procedure (SPLP) ARS options contained in technical guidance issued by the Department, except when combining with a site-specific DAF as provided in III(a) of this appendix. The procedure shall be as follows:

1. Collect samples and implement the SPLP procedure in accordance with the appropriate Department guidance.

2. Input the appropriate values into the Department's SPLP calculator located on the Department's website.

3. Provide the following to the Department in addition to the applicable form found on the Department's website with the applicable remedial phase report:

i. The resultant ARS and the modified input parameters used in the Department's SPLP calculator; and

ii. A description and basis of how the samples were selected, including all related laboratory results.

(f) Site-specific data for immobile contaminants only when:

1. The contaminant exhibits a very low mobility in soil as defined by a high soil organic carbon-water partition coefficient (Koc) or a high soil-water partition coefficient (Kd), factors that increase a contaminant's mobility are not present, and a clean zone of two feet or greater exists between the contamination and the water table, as described in appropriate Department guidance.

2. The procedure shall be as follows:

i. Collect and analyze soil samples in accordance with the appropriate Department guidance; and

ii. Provide a description and basis of how the samples were used to demonstrate compliance with the migration to ground water exposure pathway, including all related tables, figures, and laboratory results, to the Department, in addition to the applicable form found on the Department's website with the applicable remedial phase report.

3. If compliance with the migration to ground water exposure pathway is determined by the site-specific conditions in III(f)1 of this appendix only, then the numeric standards in this chapter shall not apply, but the pathway will be deemed to have been satisfactorily addressed on a narrative basis.

(g) Site-specific data for metals, semi-volatile contaminants, and volatile contaminants only when:

1. The highest concentrations of remaining contamination are located at the water table and no ground water impact above the ground water remediation standard is observed as demonstrated by ground water sampling, as described in appropriate Department guidance.

2. The procedure shall be as follows:

i. Collect and analyze soil and ground water samples in accordance with the appropriate Department guidance; and

ii. Provide a description and basis of how the samples were used to demonstrate compliance with the migration to ground water exposure pathway, including all related tables, figures, and laboratory results, to the Department, in addition to the applicable form from the Department's website with the applicable remedial phase report.

3. If compliance with the migration to ground water exposure pathway is determined by the site-specific conditions in III(g) of this appendix only, then the numeric standards in this chapter shall not apply, but the pathway will be deemed to have been satisfactorily addressed on a narrative basis.

APPENDIX 9

DEVELOPMENT OF ALTERNATIVE REMEDIATION STANDARDS FOR INDOOR AIR FOR THE VAPOR INTRUSION EXPOSURE PATHWAY

Pursuant to N.J.A.C. 7:26D-8.3(a)2, an alternative remediation standard (ARS) for indoor air for the vapor intrusion exposure pathway may be developed for a site or an area of concern in accordance with the procedures provided in this appendix.

I. Overview

(a) An ARS for this exposure pathway may be developed at any time. *[However, the need to develop an ARS shall not be a basis for extending an applicable mandatory timeframe, as provided in the Administrative Requirements for the Remediation of Contaminated Sites, N.J.A.C. 7:26C.]*

(b) The ARS options listed in III of this appendix are applicable to carcinogenic and noncarcinogenic health end-points.

(c) The ARS options outlined in III of this appendix may be utilized for nonresidential buildings, but they are not applicable to residential buildings.

(d) An ARS may be developed based on modification of site-specific exposure parameters listed in III of this appendix.

II. Required Approvals and Permits

(a) An ARS developed in accordance with this appendix must be approved by the Department prior to use at the specific site or area of concern.

(b) The Department shall require the use of an institutional control, engineering control (as needed), and a remedial action permit, pursuant to N.J.A.C. 7:26C-7 for an ARS developed pursuant to this appendix to ensure that the continued use of the ARS remains valid.

III. Options and Procedures

(a) An ARS developed pursuant to this appendix is limited to site-specific modification of the following exposure parameters:

1. An alternative exposure frequency (EF) parameter representative of site-specific use that is incorporated in the applicable indoor air Equation 1 and 2 at N.J.A.C. 7:26D Appendix 5; or

2. An alternative exposure time (ET) parameter representative of site-specific use that is incorporated in the applicable indoor air Equation 1 and 2 at N.J.A.C. 7:26D Appendix 5.

(b) Examples where or when site-specific modification of exposure parameters may be acceptable include, but are not limited to:

1. A small generating station;

2. An isolated storage facility;

3. A restricted access area of a nonresidential building, such as a basement; or4. Workday hours differing from eight hours.

(c) In developing an ARS pursuant to this appendix, the following supporting information, in addition to the applicable form found on the Department's website, shall be submitted to the Department:

1. The resultant ARS and the modified input parameters used in the Department's ARS calculator;

2. Support documentation justifying:

i. The basis for the site-specific parameters used to determine the ARS;

ii. The adequacy of proposed monitoring; and

iii. The adequacy of the institutional and engineering controls;

3. An overview of the history and contamination at the site or area of concern pertinent to the vapor intrusion exposure pathway including:

i. A description of any vapor intrusion investigation related to the ARS;

ii. The extent of soil and ground water contamination at the site affecting the vapor intrusion exposure pathway;

iii. A description of the subject building(s) and a scaled map of the site and surrounding area, identifying the subject building(s) and associated analytical results, including soil gas;

iv. Identification of the uses in the subject building(s) and the locations where receptors are present within the building(s);

v. A summary table presenting the analytical results, in accordance with N.J.A.C. 7:26E-1.6(b)6; and

4. Additional information used to develop the ARS.

APPENDIX 10

CHEMICAL AND PHYSICAL PROPERTIES OF CONTAMINANTS

[Chemical and Physical Properties of Contaminants]

Contaminant	CAS No.	Water Solubility (mg/L)	Henry's Law Constant (atm-m^3/mol, $25_{degrees}$C)	Henry's Law Constant (dimensionless, $25_{degrees}$C)	Air Diffusivity (cm^2/sec)	Water Diffusivity (cm^2/sec)	Soil Organic Carbon-Water Partition Coefficient, K_{oc} (L/kg)	Soil-Water Partition Coefficient, K_d (L/kg)
Acenaphthene	83-32-9	3.9	1.84E-04	7.5224E-03	5.0614E-02	8.3300E-06	5027	NA
Acetone (2-Propanone)	67-64-1	1000000	3.50E-05	1.4309E-03	1.0592E-01	1.1471E-05	2.364	NA
Acetophenone	98-86-2	6130	1.04E-05	4.2518E-04	6.5222E-02	8.7228E-06	51.85	NA
Aldrin	309-00-2	0.017	4.40E-05	1.7989E-03	2.2812E-02	5.8402E-06	82020	NA
Aluminum (total)	7429-90-5	NA	NA	NA	NA	NA	NA	1500
Anthracene	120-12-7	0.0434	5.56E-05	2.2731E-03	3.8973E-02	7.8522E-06	16360	NA
Antimony (total)	7440-36-0	NA	NA	NA	NA	NA	NA	45
Arsenic (total)	7440-38-2	NA	NA	NA	NA	NA	NA	26[1]
Atrazine	1912-24-9	34.7	2.36E-09	9.6484E-08	2.6466E-02	6.8378E-06	224.5	NA
Barium (total)	7440-39-3	NA	NA	NA	NA	NA	NA	17[1]
Benzaldehyde	100-52-7	6950	2.67E-05	1.0916E-03	7.4393E-02	9.4627E-06	11.09	NA
Benzene	71-43-2	1790	5.55E-03	2.2690E-01	8.9534E-02	1.0263E-05	145.8	NA
Benzo(a)anthracene (1,2-Benzanthracene)	56-55-3	0.0094	1.20E-05	4.9059E-04	2.6144E-02	6.7495E-06	176900	NA
Benzo(a)pyrene	50-32-8	0.00162	4.57E-07	1.8683E-05	4.7583E-02	5.5597E-06	587400	NA
Benzo(b)fluoranthene(3,4-Benzofluoranthene)	205-99-2	0.0015	6.57E-07	2.6860E-05	4.7583E-02	5.5597E-06	599400	NA
Benzo(k)fluoranthene	207-08-9	0.0008	5.84E-07	2.3875E-05	4.7583E-02	5.5597E-06	587400	NA
Beryllium	7440-41-7	NA	NA	NA	NA	NA	NA	35[1]

1,1'-Biphenyl	92-52-4	7.48	3.08E-04	1.2592E-02	4.7059E-02	7.5618E-06	5129	NA
Bis(2-chloroethoxy)methane	111-91-1	7800	3.85E-06	1.5740E-04	6.1186E-02	7.1492E-06	14.38	NA
Bis(2-chloroethyl)ether	111-44-4	17200	1.70E-05	6.9501E-04	5.6719E-02	8.7070E-06	32.21	NA
Bis(2-ethylhexyl)phthalate	117-81-7	0.27	2.70E-07	1.1038E-05	1.7340E-02	4.1807E-06	119600	NA
Bromodichloromethane (Dichlorobromomethane)	75-27-4	3032	2.12E-03	8.6672E-02	5.6263E-02	1.0731E-05	31.82	NA
Bromoform	75-25-2	3100	5.35E-04	2.1872E-02	3.5732E-02	1.0356E-05	31.82	NA
Bromomethane (Methyl bromide)	74-83-9	15200	7.34E-03	3.0008E-01	1.0050E-01	1.3468E-05	13.22	NA
2-Butanone (Methyl ethyl ketone) (MEK)	78-93-3	223000	5.69E-05	2.3262E-03	9.1446E-02	1.0193E-05	4.51	NA
Butylbenzyl phthalate	85-68-7	2.69	1.26E-06	5.1513E-05	2.0832E-02	5.1733E-06	7155	NA
Cadmium	7440-43-9	NA	NA	NA	NA	NA	NA	23[1]
Caprolactam	105-60-2	772000	2.53E-08	1.0343E-06	6.9242E-02	8.9994E-06	24.5	NA
Carbon disulfide	75-15-0	2160	1.44E-02	5.8872E-01	1.0644E-01	1.2977E-05	21.73	NA
Carbon tetrachloride	56-23-5	793	2.76E-02	1.1284E+00	5.7143E-02	9.7849E-06	43.89	NA
Chlordane (alpha and gamma forms summed)	57-74-9	0.056[2]	4.86E-05[2]	1.9869E-03[2]	1.7900E-02[3]	4.3700E-06[3]	67540[5]	NA
4-Chloroaniline	106-47-8	3900	1.16E-06	4.7424E-05	7.0385E-02	1.0253E-05	112.7	NA
Chlorobenzene	108-90-7	498	3.11E-03	1.2715E-01	7.2130E-02	9.4765E-06	233.9	NA
Chloroethane (Ethyl chloride)	75-00-3	6710	1.11E-02	4.5380E-01	1.0376E-01	1.1619E-05	21.73	NA

Chloroform	67-66-3	7950	3.67E-03	1.5004E-01	7.6920E-02	1.0891E-05	31.82	NA
Chloromethane	74-87-3	5320	8.82E-03	3.6059E-01	1.2396E-01	1.3648E-05	13.22	NA
(Methyl chloride)								
2-Chloronaphthalene	91-58-7	11.7	3.20E-04	1.3082E-02	4.4691E-02	7.7301E-06	2478	NA
2-Chlorophenol (o-Chlorophenol)	95-57-8	11300	1.12E-05	4.57890E-04	6.6118E-02	9.4784E-06	398[1]	NA
Chrysene	218-01-9	0.002	5.23E-06	2.1382E-04	2.6114E-02	6.7495E-06	180500	NA
Cobalt (total)	7440-48-4	NA	NA	NA	NA	NA	NA	45
Copper (total)	7440-50-8	NA	NA	NA	NA	NA	NA	35
Cyanide	57-12-5	NA	NA	NA	NA	NA	NA	9.9
Cyclohexane	110-82-7	55	1.50E-01	6.1325E+00	7.9973E-02	9.1077E-06	145.8	NA
4,4'-DDD (p,p'-TDE)	72-54-8	0.09	6.60E-06	2.6983E-04	4.0608E-02	4.7447E-06	117500	NA
4,4'-DDE (p,p'-DDX)	72-55-9	0.04	4.16E-05	1.7007E-03	2.3000E-02	5.8592E-06	117500	NA
4,4'-DDT	50-29-3	0.0055	8.32E-06	3.4015E-04	3.7933E-02	4.4322E-06	168600	NA
Dibenz(a,h)anthracene	53-70-3	0.00249	1.41E-07	5.7645E-06	4.4567E-02	5.2073E-06	1912000	NA
Dibromochloromethane (Chlorodibromomethane)	124-48-1	2700	7.83E-04	3.2011E-02	3.6636E-02	1.0561E-05	31.82	NA
1,2-Dibromo-3-chloropropane	96-12-8	1230	1.47E-04	6.0098E-03	3.2135E-02	8.9048E-06	115.8	NA
1,2-Dibromoethane (Ethylene dibromide)	106-93-4	3910	6.50E-04	2.6574E-02	4.3035E-02	1.0439E-05	39.6	NA
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	156	1.92E-03	7.8496E-02	5.6170E-02	8.9213E-06	382.9	NA

1,3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	125[2]	2.63E-03[2]	1.0751E-01[2]	6.9200E-02[4]	7.8600E-06[4]	375.3[5]	NA
1,4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	81.3	2.41E-03	9.8528E-02	5.5043E-02	8.6797E-06	375.3	NA
3,3'-Dichlorobenzidine	91-94-1	3.1	2.84E-11	1.1611E-09	4.7482E-02	5.5478E-06	3190	NA
Dichlorodifluoromethane (Freon 12)	75-71-8	280	3.43E-01	1.4023E+01	7.6029E-02	1.0839E-05	43.89	NA
1,1-Dichloroethane	75-34-3	5040	5.62E-03	2.2976E-01	8.3645E-02	1.0621E-05	31.82	NA
1,2-Dichloroethane	107-06-2	8600	1.18E-03	4.8242E-02	8.5722E-02	1.0995E-05	39.6	NA
1,1-Dichloroethene (1,1-Dichloroethylene)	75-35-4	2420	2.61E-02	1.0670E+00	8.6311E-02	1.0956E-05	31.82	NA
1,2-Dichloroethene (cis) (c-1,2-Dichloroethylene)	156-59-2	6410	4.08E-03	1.6680E-01	8.8406E-02	1.1335E-05	39.6	NA
1,2-Dichloroethene (trans) (t-1,2-Dichloroethylene)	156-60-5	4520	9.38E-03	3.8348E-01	8.7609E-02	1.1191E-05	39.6	NA
2,4-Dichlorophenol	120-83-2	5500	4.29E-06	1.7538E-04	4.8577E-02	8.6786E-06	159[1]	NA
1,2-Dichloropropane	78-87-5	2800	2.82E-03	1.1529E-01	7.3340E-02	9.7252E-06	60.7	NA
1,3-Dichloropropene (total)	542-75-6	2800	3.55E-03	1.4513E-01	7.6272E-02	1.0123E-05	72.17	NA
Dieldrin	60-57-1	0.195	1.00E-05	4.0883E-04	2.3286E-02	6.0062E-06	20090	NA
Diethylphthalate	84-66-2	1080	6.10E-07	2.4939E-05	2.6074E-02	6.7227E-06	104.9	NA
2,4-Dimethylphenol	105-67-9	7870	9.51E-07	3.8879E-05	6.2245E-02	8.3140E-06	491.8	NA
Di-n-butyl phthalate	84-74-2	11.2	1.81E-06	7.3998E-05	2.1436E-02	5.3255E-06	1157	NA

2,4-Dinitrophenol	51-28-5	2790	8.60E-08	3.5159E-06	4.06670E-02	9.0756E-06	0.0178[1]	NA
2,4-Dinitrotoluene/2,6-Dinitrotoluene (mixture)	25321-14-6	270	3.97E-07	1.6230E-05	5.9131E-02	6.9090E-06	587.4	NA
Di-n-octyl phthalate	117-84-0	0.022	2.57E-06	1.0506E-04	3.5559E-02	4.1548E-06	140800.00	NA
1,4-Dioxane	123-91-1	1000000	4.80E-06	1.9624E-04	8.7374E-02	1.0541E-05	2.633	NA
Endosulfan I and Endosulfan II (alpha and beta) (summed)	115-29-7	0.325	6.50E-05	2.6574E-03	2.2484E-02	5.7628E-06	6761	NA
Endrin	72-20-8	0.25	6.36E-06	2.600E-04	3.6158E-02	4.2248E-06	20090	NA
Ethylbenzene	100-41-4	169	7.88E-03	3.2216E-01	6.8465E-02	8.4558E-06	446.1	NA
Extractable Petroleum Hydrocarbons (Category 1)	various	NA	NA	NA	NA	NA	NA	NA
Extractable Petroleum Hydrocarbons (Category 2)	various	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	206-44-0	0.26	8.86E-06	3.6222E-04	2.7596E-02	7.1827E-06	55450	NA
Fluorene	86-73-7	1.69	9.62E-05	3.9329E-03	4.3974E-02	7.8890E-06	9160	NA
alpha-HCH (alpha-BHC)	319-84-6	2	6.70E-06	2.7392E-04	4.3284E-02	5.0574E-06	2807	NA
beta-HCH (beta-BHC)	319-85-7	0.24	4.40E-06	1.7988E-05	2.7667E-02	7.3955E-06	2807	NA
Heptachlor	76-44-8	0.18	2.94E-04	1.2020E-02	2.2344E-02	5.6959E-06	41260	NA
Heptachlor epoxide	1024-57-3	0.2	2.10E-05	8.5854E-04	2.4001E-02	6.2475E-06	10110	NA
Hexachlorobenzene	118-74-1	0.0062	1.70E-03	6.9501E-02	2.8974E-02	7.8497E-06	6195	NA
Hexachloro-1,3-butadiene	87-68-3	3.2	1.03E-02	4.2110E-01	2.6744E-02	7.0264E-06	845.2	NA

Hexachlorocyclopentadiene	77-47-4	1.8	2.70E-02	1.1038E+00	2.7238E-02	7.2170E-06	1404	NA
Hexachloroethane	67-72-1	50	3.89E-03	1.5904E-01	3.2094E-02	8.8904E-06	196.8	NA
n-Hexane	110-54-3	9.5	1.80E+00	7.3590E+01	7.3108E-02	8.1658E-06	131.5	NA
2-Hexanone	591-78-6	17200	9.32E-05	3.8103E-03	7.0356E-02	8.4404E-06	14.98	NA
Indeno(1,2,3-cd)pyrene	193-39-5	0.00019	3.48E-07	1.4227E-05	4.4784E-02	5.2327E-06	1951000	NA
Isophorone	78-59-1	12000	6.64E-06	2.7146E-04	5.2505E-02	7.5296E-06	65.15	NA
Isopropylbenzene	98-82-8	61.3	1.15E-02	4.7016E-01	6.0304E-02	7.8566E-06	697.8	NA
Lead (total)	7439-92-1	NA	NA	NA	NA	NA	NA	900
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	7.3	5.14E-06	2.1014E-04	4.3284E-02	5.0574E-06	2807	NA
Manganese (total)	7439-96-5	NA	NA	NA	NA	NA	NA	65
Mercury (total)	7439-97-6	NA	NA	NA	NA	NA	NA	0.20[1]
Methoxychlor	72-43-5	0.1	2.03E-07	8.2993E-06	2.2085E-02	5.5926E-06	26890	NA
Methyl acetate	79-20-9	243000	1.15E-04	4.7016E-03	9.5776E-02	1.1008E-05	3.064	NA
Methylene chloride (Dichloromethane)	75-09-2	13000	3.25E-03	1.3287E-01	9.9936E-02	1.2512E-05	21.73	NA
2-Methylnaphthalene	91-57-6	24.6	5.18E-04	2.1177E-02	5.2432E-02	7.7811E-06	2478	NA
4-Methyl-2-pentanone (MIBK)	108-10-1	19000	1.38E-04	5.6419E-03	6.9780E-02	8.3477E-06	12.6	NA
2-Methylphenol (o-cresol)	95-48-7	25900	1.20E-06	4.9060E-05	7.2835E-02	9.3168E-06	306.5	NA
4-Methylphenol (p-cresol)	106-44-5	21500	1.00E-06	4.0883E-05	7.2394E-02	9.2397E-06	300.4	NA

Methyl tert-butyl ether (MTBE)	1634-04-4	51000	5.87E-04	2.3998E-02	7.5267E-02	8.5904E-06	11.56	NA
Naphthalene	91-20-3	31	4.40E-04	1.7988E-02	6.0499E-02	8.3770E-06	1544	NA
Nickel (total)	7440-02-0	NA	NA	NA	NA	NA	NA	24[1]
4-Nitroaniline	100-01-6	728	1.26E-09	5.153E-08	6.3660E-02	9.7545E-06	109.1	NA
Nitrobenzene	98-95-3	2090	2.40E-05	9.8119E-04	6.8054E-02	9.4494E-06	226.4	NA
N-Nitrosodi-n-propylamine	621-64-7	13000	5.38E-06	2.1995E-04	5.6440E-02	7.7580E-06	275.4	NA
N-Nitrosodiphenylamine	86-30-6	35	1.21E-06	4.9648E-05	5.5886E-02	6.5299E-06	2632	NA
2,2'-oxybis	108-60-1	1700	7.42E-05	3.0335E-03	3.9889E-02	7.3606E-06	82.92	NA
(1-chloropropane)								
Pentachlorophenol	87-86-5	14	2.45E-08	1.0016E-06	2.9520E-02	8.0121E-06	5100[1]	NA
Phenol	108-95-2	82800	3.33E-07	1.3614E-05	8.3398E-02	1.0254E-05	187.2	NA
Polychlorinated biphenyls (PCBs)	1336-36-3	0.7	4.15E-04	1.6966E-02	2.4340E-02	6.2671E-06	78100	NA
Pyrene	129-00-0	0.135	1.19E-05	4.8651E-04	2.7787E-02	7.2479E-06	54340	NA
Selenium (total)	7782-49-2	NA	NA	NA	NA	NA	NA	14[1]
Silver (total)	7440-22-4	NA	NA	NA	NA	NA	NA	0.26[1]
Styrene	100-42-5	310	2.75E-03	1.1243E-01	7.1114E-02	8.7838E-06	446.1	NA
Tertiary butyl alcohol (TBA)	75-65-0	1000000[2]	9.05E-06[2]	3.6996E-04[2]	9.8500E-02[3]	1.1400E-05[3]	2.111[5]	NA
1,2,4,5-Tetrachlorobenzene	95-94-3	0.595	1.00E-03	4.0883E-02	3.1896E-02	8.7531E-06	2220	NA
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	0.0002	5.00E-05	2.0442E-03	4.7028E-02	6.7568E-06	249100	NA

1,1,2,2-Tetrachloroethane	79-34-5	2830	3.67E-04	1.5004E-02	4.8921E-02	9.2902E-06	94.94	NA
Tetrachloroethene (PCE) (Tetrachloroethylene)	127-18-4	206	1.77E-02	7.2363E-01	5.0466E-02	9.4551E-06	94.94	NA
2,3,4,6-Tetrachlorophenol	58-90-2	23	8.84E-06	3.6140E-04	5.0338E-02	5.8816E-06	*[2969[1]]* ***3140[1]***	NA
Toluene	108-88-3	526	6.64E-03	2.7146E-01	7.7804E-02	9.2043E-06	233.9	NA
Toxaphene	8001-35-2	0.55	6.00E-06	2.4530E-04	3.2439E-02	3.7902E-06	77200	NA
1,2,4-Trichlorobenzene	120-82-1	49	1.42E-03	5.8054E-02	3.9599E-02	8.4033E-06	1356	NA
1,1,1-Trichloroethane	71-55-6	1290	1.72E-02	7.0319E-01	6.4817E-02	9.5990E-06	43.89	NA
1,1,2-Trichloroethane	79-00-5	4590	8.24E-04	3.3688E-02	6.6890E-02	1.0026E-05	60.7	NA
Trichloroethene (TCE) (Trichloroethylene)	79-01-6	1280	9.85E-03	4.0270E-01	6.8662E-02	1.0221E-05	60.7	NA
Trichlorofluoromethane (Freon 11)	75-69-4	1100	9.70E-02	3.9657E+00	6.5356E-02	1.0048E-05	43.89	NA
2,4,5-Trichlorophenol	95-95-4	1200	1.62E-06	6.6230E-05	3.1394E-02	8.0893E-06	*[3140[1]]* ***2340[1]***	NA
2,4,6-Trichlorophenol	88-06-2	800	2.60E-06	1.0630E-04	3.1395E-02	8.0896E-06	999[1]	NA
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon TF)	76-13-1	170	5.26E-01	2.1504E+01	3.7566E-02	8.5920E-06	196.8	NA
1,2,4-Trimethylbenzene	95-63-6	57	6.16E-03	2.5184E-01	Worries. Thanks!	7.9208E-06	614.3	NA
Vanadium (total)	7440-62-2	NA	NA	NA	NA	NA	NA	1000
Vinyl chloride	75-01-4	8800	2.78E-02	1.1365E+00	1.0712E-01	1.2004E-05	21.73	NA
Xylenes (total)	1330-20-7	106	6.63E-03	2.7105E-01	6.8515E-02	8.4640E-06	382.9	NA

Zinc (total)	7440-66-6	NA	NA	NA	NA	NA	NA	23[1]

NA = Not applicable

All values from USEPA Regional Screening Level Tables (http://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables , referenced May 2018), unless otherwise indicated. This website only posts the USEPA's most recent tables. Past tables may be obtained by contacting the USEPA.

[1] Kd or Koc value listed for pH 5.3 in Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, United States Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, DC, December 2002 (http://www.epa.gov/superfund/superfund-soil-screening-guidance)

[2] Experimental values from the USEPA's Estimation Program Interface Suite, V 4.11 *[(http://www.eregional screening Tablepa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface)]* ***(http://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface)***

[3] Calculated using the USEPA's WATER9 calculator, V 3.0. (http://www3.epa.gov/ttn/chief/software/water/index.html)

[4] From the USEPA's WATER9 calculator, V 3.0 database (http://www3.epa.gov/ttn/chief/software/water/index.html)

[5] Molecular Connectivity Index values from USEPA's Estimation Program Interface Suite, V 4.11 (http://www.epa.gov/tsca-screening-tools/epi-suitetm-estimation-program-interface)

APPENDIX 11

TOXICITY FACTORS USED IN THE DEVELOPMENT OF THE REMEDIATION STANDARDS

Table 1 – Soil Ingestion-Dermal Toxicity Factors

Contaminant	CAS No.	Soil Ingestion-dermal Recommendation	Soil Ingestion-dermal Toxicity Factor(s)
Acenaphthene	83-32-9	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1994) 0.06 mg/kg-day ABS 0.13
Acetone	67-64-1	IRIS RfD	IRIS RfD (2003) 0.9 mg/kg-day
Acetophenone	98-86-2	IRIS RfD	IRIS RfD (1989) 0.1 mg/kg-day

Aldrin	309-00-2	IRIS Slope Factor (SF) *[with a dermal absorption fraction (ABS)]* RfD *[with a dermal absorption fraction (ABS)]*	IRIS SF (1993) 17 (mg/kg-day)-1 IRIS RfD (1988) 0.00003 mg/kg-day *[ABS 0.1]*
Aluminum	7429-90-5	PPRTV RfD	PPRTV RfD (2006) 1.0 mg/kg-day
Anthracene	120-12-7	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1993) 0.3 mg/kg-day ABS 0.13
Antimony	7440-36-0	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1991) 0.0004 mg/kg-day GIABS 0.15
Arsenic	7440-38-2	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1998) 1.5 (mg/kg-day)-1 IRIS RfD (1993) 0.0003 mg/kg-day ABS 0.03
Atrazine	1912-24-9	IRIS RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	IRIS RfD (1993) 0.035 mg/kg-day ABS 0.1 Group C carcinogen factor 10
Barium	7440-39-3	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (2005) 0.2 mg/kg-day GIABS 0.07
Benzaldehyde	100-52-7	PPRTV Slope Factor (SF) IRIS RfD	PPRTV SF (2015*)* 4E-03 (mg/kg-day)-1 IRIS RfD (1988) 0.1 mg/kg-day
Benzene	71-43-2	NJDWQI Slope Factor (SF) IRIS RfD[1]	NJDWQI SF (1994) 0.23 (mg/kg-day)-1 IRIS RfD (2003) 0.004 mg/kg-day
Benzo(a)anthracene	56-55-3	IRIS Slope Factor (SF)(benzo(a)pyrene - adjusted for benzo(a)pyrene) with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E-01(mg/kg-day)-1 (adjusted for benzo(a)anthracene) ABS 0.13
Benzo(a)pyrene	50-32-8	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E+00 (mg/kg-day)-1 IRIS RfD (2017) *[3.0E-4]* ***3.0E-04*** mg/kg-day ABS 0.13
Benzo(b)fluoranthene	205-99-2	IRIS Slope Factor (SF)(benzo(a)pyrene -	IRIS SF (2017) 1.0E-01 (mg/kg-day)-1

		adjusted for benzo(b)fluoranthene) with a dermal absorption fraction (ABS)	(adjusted for benzo(b)fluoranthene) ABS 0.13
Benzo(k)fluoranthene	207-08-9	IRIS Slope Factor (SF)(benzo(a)pyrene - adjusted for benzo(k)fluoranthene) with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E-02(mg/kg-day)-1 (adjusted for benzo(k)fluoranthene) ABS 0.13
Beryllium	7440-41-7	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1998) 0.002 mg/kg-day GIABS 0.007
1,1'-Biphenyl	92-52-4	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2013) 0.008 (mg/kg-day)-1 IRIS RfD (2013) 0.5 mg/kg-day
Bis(2-chloroethoxy) methane	111-91-1	PPRTV RfD with a dermal absorption fraction (ABS)	PPRTV RfD (2006) 0.003 mg/kg-day ABS 0.1
Bis(2-chloroethyl) ether	111-44-4	IRIS Slope Factor (SF)	IRIS SF (1994) 1.1 (mg/kg-day)-1
Bis(2-ethylhexyl) phthalate	117-81-7	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1993) 0.014 (mg/kg-day)-1 IRIS RfD (2013) 0.02 mg/kg-day ABS 0.1
Bromodichloromethane	75-27-4	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (1993) 0.062 (mg/kg-day)-1 IRIS RfD (1991) 0.02 mg/kg-day
Bromoform	75-25-2	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (1991) 0.0079 (mg/kg-day)-1 IRIS RfD (1991) 0.02 mg/kg-day
Bromomethane	74-83-9	IRIS RfD	IRIS RfD (1991) 0.0014 mg/kg-day
2-Butanone	78-93-3	IRIS RfD[2]	IRIS RfD (2003) 0.6 mg/kg-day
Butylbenzylphthalate	85-68-7	PPRTV Slope Factor (SF) with a dermal absorption fraction (ABS)*[.]* IRIS RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	PPRTV SF (2002) 0.0019 (mg/kg-day)-1 IRIS RfD (2013) 0.2 mg/kg-day ABS 0.1 Group C carcinogen factor 10
Cadmium	7440-43-9	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1994) 0.001 mg/kg-day

		and gastrointestinal absorption fraction (GIABS)	ABS 0.001 GIABS 0.025
Caprolactam	105-60-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1988) 0.5 mg/kg-day ABS 0.1
Carbon disulfide	75-15-0	No ingestion-based toxicity factors are available	None
Carbon tetrachloride	56-23-5	NJDWQI Slope Factor (SF) IRIS RfD*[.]*	NJDWQI SF (1994) 0.091 (mg/kg-day)-1 IRIS RfD (2011) 0.004 mg/kg-day
Chlordane (alpha plus gamma mixture)	57-74-9	NJDWQI Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	NJDWQI SF (2001) 2.3 (mg/kg-day)-1 IRIS RfD (1998) 0.0005 mg/kg-day ABS 0.04
4-Chloroaniline	106-47-8	PPRTV Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	PPRTV SF (2008) 0.2 (mg/kg-day)-1 IRIS RfD (1995) 0.004 mg/kg-day ABS 0.1
Chlorobenzene	108-90-7	NJDWQI RfD	NJDWQI RfD (1994) 0.0065 mg/kg-day
Chloroethane	75-00-3	No ingestion-based toxicity factors are available	None
Chloroform	67-66-3	IRIS RfD^3	IRIS RfD (2001) 0.01 mg/kg-day
Chloromethane	74-87-3	No ingestion-based toxicity factors are available	None
2-Chloronaphthalene	91-58-7	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1990) 0.08 mg/kg-day ABS 0.13
2-Chlorophenol	95-57-8	IRIS RfD	IRIS RfD (1993) 0.005 mg/kg-day
Chrysene	218-01-9	IRIS Slope Factor (SF) (benzo(a)pyrene-adjusted for chrysene) with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E-03 (mg/kg-day)-1 (adjusted for chrysene) ABS 0.13
Cobalt	7440-48-4	PPRTV RfD	PPRTV RfD (2008) 0.0003 mg/kg-day
Copper	7440-50-8	HEAST RfD	HEAST RfD (1997) 0.04 mg/kg-day
Cyanide	57-12-5	IRIS RfD	IRIS RfD (2010) 0.0006 mg/kg-day
Cyclohexane	110-82-7	No ingestion-based toxicity factors are available	None

4,4'-DDD	72-54-8	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1988) 0.24 (mg/kg-day)-1 ABS 0.1
4,4'-DDE	72-55-9	IRIS SF *[with a dermal absorption fraction (ABS)]*	IRIS SF (1988) 0.34 (mg/kg-day)-1 *[ABS 0.1]*
4,4'-DDT	50-29-3	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1991) 0.34 (mg/kg-day)-1 IRIS RfD (1996) 0.0005 mg/kg-day ABS 0.03
Dibenz(a,h)anthracene	53-70-3	IRIS Slope Factor (SF) (benzo(a)pyrene-adjusted for dibenz(a,h)anthracene) with a dermal absorption fraction (ABS)	IRIS SF (2017) 1.0E+00 (mg/kg-day)-1 (adjusted for dibenz(a,h)anthracene) ABS 0.13
Dibromochloromethane	124-48-1	IRIS Slope Factor (SF) IRIS RfD and a Group C carcinogen factor	IRIS SF (1992) 0.084 (mg/kg-day)-1 IRIS RfD (1991) 0.02 mg/kg-day Group C carcinogen factor ***10***
1,2-Dibromo-3-chloropropane	96-12-8	PPRTV Slope Factor (SF) PPRTV RfD	PPRTV SF (2006) 0.8 (mg/kg-day)-1 PPRTV RfD (2006) 0.0002 mg/kg-day
1,2-Dibromoethane	106-93-4	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2004) 2.0 (mg/kg-day)-1 IRIS RfD (2004) 0.009 mg/kg-day
1,2-Dichlorobenzene	95-50-1	NJDWQI RfD	NJDWQI RfD (1994) 0.086 mg/kg-day
1,3-Dichlorobenzene	541-73-1	NJDWQI RfD	NJDWQI RfD (1994) 0.086 mg/kg-day
1,4-Dichlorobenzene	106-46-7	NJDWQI RfD with a Group C carcinogen factor[4]	NJDWQI RfD (1994) 0.01 mg/kg-day (RfD includes Group C Carcinogen factor adjustment of 10)
3,3'-Dichlorobenzidine	91-94-1	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1993) 0.45 (mg/kg-day)-1 ABS 0.1
Dichlorodifluoromethane	75-71-8	IRIS RfD	IRIS RfD (1995) 0.2 mg/kg-day
1,1-Dichloroethane	75-34-3	CalEPA Slope Factor (SF) PPRTV RfD[5]	CalEPA SF (1992) 0.0057 (mg/kg-day)-1 PPRTV RfD (2006) 0.2 mg/kg-day

1,2-Dichloroethane	107-06-2	NJDWQI Slope Factor (SF)[6]	NJDWQI SF (1994) 0.12 (mg/kg-day)-1
1,1-Dichloroethene	75-35-4	NJDWQI RfD with a Group C carcinogen factor	NJDWQI RfD (1994) 0.00014 mg/kg-day (RfD includes Group C Carcinogen factor adjustment of 10)
cis-1,2-Dichloroethene	156-59-2	NJDWQI RfD	NJDWQI RfD (1994) 0.01 mg/kg-day
trans-1,2-Dichloroethene	156-60-5	NJDWQI RfD	NJDWQI RfD (1994) 0.017 mg/kg-day
2,4-Dichlorophenol	120-83-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1988) 0.003 mg/kg-day ABS 0.1
1,2-Dichloropropane	78-87-5	PPRTV Slope Factor (SF) PPRTV RfD	PPRTV SF (2016) 0.037 (mg/kg-day)-1 PPRTV RfD (2016) 0.04 mg/kg-day
1,3-Dichloropropene (cis and trans)	542-75-6	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2000) 0.1 (mg/kg-day)-1 IRIS RfD (2000) 0.03 mg/kg-day
Dieldrin	60-57-1	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (1993) 16 (mg/kg-day)-1 IRIS RfD (1990) 0.00005 mg/kg-day ABS 0.1
Diethylphthalate	84-66-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1993) 0.8 mg/kg-day ABS 0.1
2,4-Dimethylphenol	105-67-9	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1990) 0.02 mg/kg-day ABS 0.1
Di-n-butylphthalate	84-74-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1990) 0.1 mg/kg-day ABS 0.1
2,4-Dinitrophenol	51-28-5	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1991) 0.002 mg/kg-day ABS 0.1
2,4-Dinitrotoluene /2,6-Dinitrotoluene (mixture)	25321-14-6	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1990) 0.68 (mg/kg-day)-1 ABS 0.1
Di-n-octylphthalate	117-84-0	PPRTV RfD with a dermal absorption fraction (ABS)	PPRTV RfD (2012) 0.01 mg/kg-day ABS 0.1
1,4-Dioxane	123-91-1	IRIS Slope Factor (SF) IRIS RfD	IRIS SF (2013) 0.1 (mg/kg-day)-1 IRIS RfD (2010)

			0.03 mg/kg-day
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	IRIS RfD *[with a dermal absorption fraction (ABS)]*	IRIS RfD (1994) 0.006 mg/kg-day *[ABS 0.1]*
Endrin	72-20-8	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1991) 0.0003 mg/kg-day ABS 0.1
Ethylbenzene	100-41-4	IRIS RfD[7]	IRIS RfD (1991) 0.1 mg/kg-day
Extractable Petroleum Hydrocarbons (EPH) (Category 1)	various	N.J.A.C. 7:26D-Appendix 2, Equation 5	See Table 1a-EPH Toxicity (below)
Extractable Petroleum Hydrocarbons (EPH) (Category 2)	various	N.J.A.C. 7:26D-Appendix 2, Equation 5	See Table 1a-EPH Toxicity (below)
Fluoranthene	206-44-0	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1993) 0.04 mg/kg-day ABS 0.13
Fluorene	86-73-7	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1990) 0.04 mg/kg-day ABS 0.13
alpha-HCH (alpha-BHC)	319-84-6	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) ATSDR RfD with a dermal absorption fraction (ABS)	IRIS SF (1993) 6.3 (mg/kg-day)-1 ATSDR RfD (2013) 0.008 mg/kg-day ABS 0.1
beta-HCH (beta-BHC)	319-85-7	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) and Group C carcinogen factor	IRIS SF (1993) 1.8 (mg/kg-day)-1 ABS 0.1 Group C carcinogen factor 10
Heptachlor	76-44-8	IRIS Slope Factor (SF) *[with a dermal absorption fraction (ABS)]* IRIS RfD *[with a dermal absorption fraction (ABS)]*	IRIS SF (1993) 4.5 (mg/kg-day)-1 IRIS RfD (1991) 0.0005 mg/kg-day *[ABS 0.1]*
Heptachlor epoxide	1024-57-3	IRIS Slope Factor (SF) *[with a dermal absorption fraction (ABS)]* IRIS RfD *[with a dermal absorption fraction (ABS)]*	IRIS SF (1993) 9.1 (mg/kg-day)-1 IRIS RfD (1991) 0.000013 mg/kg-day *[ABS 0.1]*
Hexachlorobenzene	118-74-1	IRIS Slope Factor (SF) *[with a dermal absorption fraction (ABS)]* IRIS RfD *[with a dermal absorption fraction (ABS)]*	IRIS SF (1996) 1.6 (mg/kg-day)-1 IRIS RfD (1991) 0.0008 mg/kg-day *[ABS 0.1]*
Hexachloro-1,3-butadiene	87-68-3	IRIS Slope Factor (SF) *[with a dermal absorption fraction (ABS)]*	IRIS SF (1991) 0.078 (mg/kg-day)-1 PPRTV RfD (2007) 0.001 mg/kg-day

		PPRTV RfD with *[a dermal absorption fraction (ABS) and]* a Group C carcinogen factor	*[ABS 0.1]* Group C carcinogen factor 10
Hexachlorocyclopentadiene	77-47-4	IRIS RfD *[with a dermal absorption fraction (ABS)]*	IRIS RfD (2001) 0.006 mg/kg-day *[ABS 0.1]*
Hexachloroethane	67-72-1	IRIS Slope Factor (SF) *[with a dermal absorption fraction (ABS)]* IRIS RfD *[with a dermal absorption fraction (ABS)]*	IRIS SF (2011) 0.04 (mg/kg-day)-1 IRIS RfD (2003) 0.0007 mg/kg-day *[ABS 0.1]*
n-Hexane	110-54-3	*[HEAST RfD]* ***No ingestion-based toxicity factors are available**[17]*	*[HEAST RfD (1997) 0.06 mg/kg-day]* ***None***
2-Hexanone	591-78-6	IRIS RfD	IRIS RfD (2009) 0.005 mg/kg-day
Indeno(1,2,3-cd) pyrene	193-39-5	IRIS Slope Factor (SF) (benzo(a)pyrene--adjusted for indeno(1,2,3-cd)pyrene) with a dermal absorption fraction (ABS).	IRIS SF (2017) 1.0E-01(mg/kg-day)-1 (adjusted for indeno(1,2,3-cd)pyrene) ABS 0.13
Isophorone	78-59-1	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	IRIS SF (1992) 0.00095 (mg/kg-day)-1 IRIS RfD (2003) 0.2 mg/kg-day ABS 0.1 Group C carcinogen factor 10
Isopropylbenzene	98-82-8	IRIS RfD	IRIS RfD (1997) 0.1 mg/kg-day
Lead	7439-92-1	USEPA IEUBK model for children USEPA ALM for adults	IEUBK (1994) Children ALM (1996) Adults
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	CalEPA Slope Factor *[SF]* ***(SF)*** with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	CalEPA SF (1992) 1.1 (mg/kg-day)-1 IRIS RfD (1988) 0.0003 mg/kg-day ABS *[0.1]* ***0.04***
Manganese	7439-96-5	EPA RSL RfD	EPA RSL RfD (2018) 0.024 mg/kg-day
Mercury	7439-97-6	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1995) 0.0003 mg/kg-day GIABS 0.07
Methoxychlor	72-43-5	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1991) 0.005 mg/kg-day ABS 0.1
Methyl acetate	79-20-9	HEAST RfD	HEAST RfD (1997)

			1.0 mg/kg-day
Methylene chloride	75-09-2	NJDWQI Slope Factor (SF) IRIS RfD	NJDWQI SF (1994) 0.014 (mg/kg-day)-1 IRIS RfD (2011) 0.006 mg/kg-day
2-Methylnaphthalene	91-57-6	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (2003) 0.004 mg/kg-day ABS 0.13
4-Methyl-2-pentanone	108-10-1	*[HEAST RfD]* ***No ingestion-based toxicity factors are available****	*[HEAST RfD (1997) 0.08 mg/kg-day]* ***None****
2-Methylphenol	95-48-7	IRIS RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	IRIS RfD (2008) 0.05 mg/kg-day ABS 0.1 Group C carcinogen factor 10
4-Methylphenol	106-44-5	ATSDR RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	ATSDR RfD (2013) 0.1 mg/kg-day ABS 0.1 Group C carcinogen factor 10
Methyl tert-butyl ether (MTBE)	1634-04-4	NJDWQI RfD with a Group C carcinogen factor[8]	NJDWQI RfD (1994) 0.01 mg/kg-day (RfD includes Group C Carcinogen factor adjustment of 10)
Naphthalene	91-20-3	NJDWQI RfD with a dermal absorption fraction (ABS) and a Group C carcinogen factor	NJDWQI RfD (1994) 0.041 mg/kg-day ABS 0.13 (RfD includes Group C Carcinogen factor adjustment of 10)
Nickel	7440-02-0	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1996) 0.02 mg/kg-day GIABS 0.04
4-Nitroaniline	100-01-6	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) PPRTV RfD with a dermal absorption fraction (ABS)	*[PPRTV]* ***IRIS**** SF (2009) 0.02 (mg/kg-day)-1 PPRTV RfD (2009) 0.004 mg/kg-day ABS 0.1
Nitrobenzene	98-95-3	IRIS RfD	IRIS RfD (2009) 0.002 mg/kg-day
N-Nitroso-di-n-propylamine	621-64-7	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1993) 7.0 (mg/kg-day)-1 ABS 0.1
N-Nitrosodiphenylamine	86-30-6	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1993) 0.0049 (mg/kg-day)-1 ABS 0.1
2,2'-Oxybis(1-choloropropane)	108-60-1	IRIS RfD	IRIS RfD (1991)

			0.04 mg/kg-day
Pentachlorophenol	87-86-5	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) IRIS RfD with a dermal absorption fraction (ABS)	IRIS SF (2010) 0.4 (mg/kg-day)-1 IRIS RfD (2010) 0.005 mg/kg-day ABS 0.25
Phenol	108-95-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (2002) 0.3 mg/kg-day ABS 0.1
Polychlorinated biphenyls (PCBs)	1336-36-3	NJDWQI Slope Factor (SF) with a dermal absorption fraction (ABS)	NJDWQI SF (1994) 2 (mg/kg-day)-1 ABS 0.14
Pyrene	129-00-0	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1993) 0.03 mg/kg-day ABS 0.13
Selenium	7782-49-2	IRIS RfD	IRIS RfD (1991) 0.005 mg/kg-day
Silver	7440-22-4	IRIS RfD with a gastrointestinal absorption fraction (GIABS)	IRIS RfD (1996) 0.005 mg/kg-day GIABS 0.04
Styrene	100-42-5	IRIS RfD	IRIS RfD (1990) 0.2 mg/kg-day
Tertiary butyl alcohol (TBA)	75-65-0	NJDEP RfD with a Group C carcinogen factor	NJDEP RfD (1997) 0.018 mg/kg-day (RfD includes Group C Carcinogen factor adjustment of 10)
1,2,4,5-Tetrachlorobenzene	95-94-3	IRIS RfD *[with a dermal absorption fraction (ABS)]*	IRIS RfD (1991) 0.0003 mg/kg-day *[ABS 0.1]*
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (2012) 7E-10 mg/kg-day ABS 0.03
1,1,2,2-Tetrachloroethane	79-34-5	IRIS Slope Factor (SF) IRIS RfD[9]	IRIS SF (2010) 0.2 (mg/kg-day)-1 IRIS RfD (2010) 0.02 mg/kg-day
Tetrachloroethene (PCE)	127-18-4	IRIS Slope Factor (SF) IRIS RfD[10]	IRIS SF (2012) 0.0021 (mg/kg-day)-1 IRIS RfD (2012) 0.006 mg/kg-day
2,3,4,6-Tetrachlorophenol	58-90-2	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1992) 0.03 mg/kg-day ABS 0.1
Toluene	108-88-3	IRIS RfD	IRIS RfD (2005) 0.08 mg/kg-day

Toxaphene	8001-35-2	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS)	IRIS SF (1991) 1.1 (mg/kg-day)-1 ABS 0.1
1,2,4-Trichlorobenzene	120-82-1	IRIS RfD[11]	IRIS RfD (1996) 0.01 mg/kg-day *[ABS 0.1]*
1,1,1-Trichloroethane	71-55-6	IRIS RfD[12]	IRIS RfD (2007) 2 mg/kg-day
1,1,2-Trichloroethane	79-00-5	IRIS Slope Factor (SF) IRIS RfD with a Group C carcinogen factor[13]	IRIS SF (1994) 0.057 (mg/kg-day)-1 IRIS RfD (1994) 0.004 mg/kg-day Group C carcinogen factor 10
Trichloroethene (TCE)	79-01-6	IRIS Slope Factor (SF)[14] IRIS RfD	IRIS SF (2011) 0.046 (mg/kg-day)-1 IRIS RfD (2011) 0.0005 mg/kg-day
Trichlorofluoromethane	75-69-4	IRIS RfD	IRIS RfD (1992) 0.3 mg/kg-day
2,4,5-Trichlorophenol	95-95-4	IRIS RfD with a dermal absorption fraction (ABS)	IRIS RfD (1988) 0.1 mg/kg-day ABS 0.1
2,4,6-Trichlorophenol	88-06-2	IRIS Slope Factor (SF) with a dermal absorption fraction (ABS) PPRTV RfD with a dermal absorption fraction (ABS)	IRIS SF (1994) 0.011 (mg/kg-day)-1 PPRTV RfD (2007) 0.001 mg/kg-day ABS 0.1
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	No ingestion-based toxicity factors are available[15]	None
1,2,4-Trimethylbenzene	95-63-6	IRIS RfD	IRIS RfD (2016) 0.01 mg/kg-day
Vanadium	7440-62-2	EPA RSL RfD with a gastrointestinal absorption fraction (GIABS)	EPA RSL RfD (2018) 0.005 mg/kg-day GIABS 0.026
Vinyl Chloride	75-01-4	IRIS Slope Factor (SF) IRIS RfD[16]	IRIS SF (2000) 0.72 (mg/kg-day)-1 IRIS RfD (2000) 0.003 mg/kg-day
Xylenes	1330-20-7	NJDWQI RfD	NJDWQI RfD (1994) 0.15 mg/kg-day
Zinc	7440-66-6	IRIS RfD	IRIS RfD (2005) 0.3 mg/kg-day

Table 1a – EPH Toxicity

Applies to both:

EPH - Category 1 (Number 2 Heating Oil/Diesel Fuel)

EPH - Category 2 (Heavier petroleum products)

Note: EPH excludes lighter petroleum products including gasoline and mineral spirits

Effective Carbon Range Aliphatics	Surrogate	Toxicity Factor	Toxicity Factor Reference Source
9 - 12	PHC Mixture	RfD 0.10 mg/kg-day ABS 0.1	Canada 2000 and MADEP 2003
12 - 16	PHC Mixture	RfD 0.10 mg/kg-day ABS 0.1	Canada 2000 and MADEP 2003
16 - 21	White Mineral Oil	RfD 2.0 mg/kg-day ABS 0.1	TPHCWG 1997 and MADEP 2003
21 - 40	White Mineral Oil	RfD 2.0 mg/kg-day ABS 0.1	TPHCWG 1997 and MADEP 2003

Effective Carbon Range Aromatics	Surrogate	Toxicity Factor	Toxicity Factor Reference Source
10 - 12	Naphthalene	RfD 0.041 mg/kg-day ABS 0.13	NJDWQI (1994)
12 - 16	Acenaphthene	RfD 0.06 mg/kg-day ABS 0.13	IRIS (1994)
16 - 21	Fluorene	RfD 0.04 mg/kg-day ABS 0.13	IRIS (1990)
21 - 36	Fluoranthene	RfD 0.04 mg/kg-day ABS 0.13	IRIS (1993)

[1] Both the NJDWQI slope factor and IRIS RfD for benzene are based on a route to route conversion of an inhalation study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[2] Although a NJDWQI RfD for 2-butanone exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route to route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route to route conversion of toxicity factors.

[3] Although a CalEPA slope factor for chloroform exists, the USEPA believes there is a threshold effect for cancer. As such, an RfD based soil remediation standard is protective of both cancer and non-cancer health endpoints.

[4] Although a CalEPA Slope Factor for 1,4-dichlorobenzene exists, there are questions about the study used to develop the slope factor. As such, the Department has decided not to develop an ingestion-dermal soil remediation standard for 1,4-dichlorobenzene using this slope factor.

[5] Although a NJDWQI RfD for 1,1-dichloroethane exists, it is based on an inhalation route to route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route to route conversion of toxicity factors.

[6] Although a PPRTV RfD for 1,2-dichloroethane exists, it is listed as an appendix value. PPRTV appendix values are based on a study(s) that has flaws as determined by the USEPA. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix values to develop soil remediation standards.

[7] Although a CalEPA slope factor for ethylbenzene exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route-to-route conversion of toxicity factors.

[8] Although a CalEPA slope factor for methyl tert-butyl ether exists, there are questions about the study used to develop the slope factor. As such, the Department has decided not to develop an ingestion-dermal soil remediation standard for methyl tert-butyl ether using this slope factor.

[9] Although an NJDWQI RfD for 1,1,2,2-tetrachloroethane exists, the Department has decided to use an IRIS RfD to develop a non-cancer-based ingestion-dermal soil remediation standard as the IRIS RfD is based on a newer toxicology assessment.

[10] Although an NJDWQI slope factor for tetrachloroethene exists, the Department has decided that the existing IRIS Slope Factor is a scientifically better toxicity value to develop a cancer-based ingestion-dermal soil remediation standard. The IRIS slope factor uses the newest PBPK models (extrapolating from an inhalation unit risk factor to an oral slope factor). An ingestion-dermal soil remediation standard for tetrachloroethene can also be developed using an IRIS RfD. The RfD uses the newest PBPK models (extrapolating from an inhalation RfC to oral RfD).

[11] Although an NJDWQI RfD for 1,2,4-trichlorobenzene exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route-to-route conversion of toxicity factors. In addition, a USEPA PPRTV slope factor for 1,2,4-trichlorobenzene is available, however the Slope Factor is based on a controversial mouse liver tumor study that many researchers have dismissed. The Department has decided not to develop an ingestion-dermal soil remediation standard based on the PPRTV slope factor.

[12] Although an NJDWQI RfD for 1,1,1-trichloroethane exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with USEPA policy concerning route-to-route conversion of toxicity factors.

[13] Although an NJDWQI slope factor for 1,1,2-trichloroethane exists, the Department determined that the IRIS slope factor is a scientifically better toxicity value to develop a cancer-based ingestion-dermal soil remediation standard.

[14] Although an NJDWQI slope factor for trichloroethene exists, the Department determined that the IRIS slope factor is a scientifically better toxicity value to develop a cancer-based ingestion-dermal soil remediation standard. The IRIS slope factor uses the newest PBPK models (extrapolating from an inhalation unit risk factor to an oral slope factor).

[15] Although an IRIS RfD for 1,1,2-Trichloro-1,2,2-trifluoroethane exists, it is based on an inhalation route-to-route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with USEPA policy concerning route-to-route conversion of toxicity factors.

[16] Although an NJDWQI slope factor exists for vinyl chloride, the Department determined that the IRIS slope factor is a scientifically better toxicity value to develop a cancer-based ingestion-dermal soil remediation standard.

[17] Although an NJDWQI RfD (1994) for n-hexane exists, it is based on an inhalation route to route conversion. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route to route conversion of toxicity factors. This policy conforms with USEPA policy concerning route to route conversion of toxicity factors.

Table 2 – Soil Inhalation Toxicity Factors

Contaminant	CAS No.	Soil Inhalation Recommendation	Soil Inhalation Toxicity Factor(s)
Acenaphthene	83-32-9	No inhalation-based toxicity factors are available***[18]***	None

Acetone	67-64-1	No inhalation-based toxicity factors are available[1]	None
Acetophenone	98-86-2	No inhalation-based toxicity factors are available[2]	None
Aldrin	309-00-2	No inhalation-based toxicity factors are available***17***	None
Aluminum	7429-90-5	PPRTV RfC	PPRTV RfC (2006) 5E-03 mg/m3
Anthracene	120-12-7	No inhalation-based toxicity factors are available***18***	None
Antimony	7440-36-0	No inhalation-based toxicity factors are available***19***	None
Arsenic	7440-38-2	IRIS IUR	IRIS IUR (1998) 4.3E-03 (ug/m3)-1
Atrazine	1912-24-9	No inhalation-based toxicity factors are available	None
Barium	7440-39-3	HEAST RfC	HEAST RfC (1997) 5E-04 mg/m3
Benzaldehyde	100-52-7	No inhalation-based toxicity factors are available	None
Benzene	71-43-2	IRIS IUR IRIS RfC	IRIS IUR (2000) 7.8E-06 (ug/m3)-1 IRIS RfC (2003) 3E-02 mg/m3
Benzo(a)anthracene	56-55-3	IRIS IUR (benzo(a)pyrene)	IRIS IUR (2017)

		adjusted for benzo(a)anthracene	6.0E-05 (ug/m3)-1 v (adjusted for benzo(a)anthracene)
Benzo(a)pyrene	50-32-8	IRIS IUR IRIS RfC	IRIS IUR (2017) 6.0E-04 (ug/m3)-1 IRIS RfC (2017) 2.0E-06 mg/m3
Benzo(b)fluoranthene	205-99-2	IRIS IUR (benzo(a)pyrene) adjusted for benzo(b)fluoranthene	IRIS IUR (2017) 6.0E-05 (ug/m3)-1 (adjusted for benzo(b)fluoranthene)
Benzo(k)fluoranthene	207-08-9	IRIS IUR (benzo(a)pyrene) adjusted for benzo(k) fluoranthene	IRIS IUR (2017) 6.0E-06 (ug/m3)-1 (adjusted for benzo(k) fluoranthene)
Beryllium	7440-41-7	IRIS IUR IRIS RfC	IRIS IUR (1998) 2.4E-03 (ug/m3)-1 IRIS RfC (1998) 2E-05 mg/m3
1,1'-Biphenyl	92-52-4	No inhalation-based toxicity factors are available	None
Bis(2-chloroethoxy) methane	111-91-1	No inhalation-based toxicity factors are available	None
Bis(2-chloroethyl) ether	111-44-4	No inhalation-based toxicity factors are available*17*	None
Bis(2-ethylhexyl) phthalate	117-81-7	No inhalation-based toxicity factors are available*17*	None

Bromodichloromethane	75-27-4	No inhalation-based toxicity factors are available*[17]*	None
Bromoform	75-25-2	No inhalation-based toxicity factors are available*[17]*	None
Bromomethane	74-83-9	IRIS RfC	IRIS RfC (1992) 5E-03 mg/m3
2-Butanone	78-93-3	IRIS RfC[3]	IRIS RfC (2003) 5E+00 mg/m3
Butylbenzylphthalate	85-68-7	No inhalation-based toxicity factors are available	None
Cadmium	7440-43-9	IRIS IUR ATSDR RfC	IRIS IUR (1992) 1.8E-03 (ug/m3)-1 ATSDR RfC (2013) 1E-05 mg/m3
Caprolactam	105-60-2	CalEPA RfC	CalEPA RfC (2013) 2.2E-03 mg/m3
Carbon disulfide	75-15-0	IRIS RfC	IRIS RfC (1995) 7E-01 mg/m3
Carbon tetrachloride	56-23-5	IRIS IUR IRIS RfC	IRIS IUR (2010) 6E-06 (ug/m3)-1 IRIS RfC (2010) 1E-01 mg/m3 7
Chlordane (alpha plus gamma mixture)	57-74-9	IRIS RfC	IRIS RfC (1998) 7E-04 mg/m3

4-Chloroaniline	106-47-8	No inhalation-based toxicity factors are available	None
Chlorobenzene	108-90-7	PPRTV RfC	PPRTV RfC (2006) 5E-02 mg/m3
Chloroethane	75-00-3	IRIS RfC	IRIS RfC (1991) 1E+01 mg/m3
Chloroform	67-66-3	ATSDR RfC __*No other inhalation-based toxicity factors are available[17]*__	ATSDR RfC (2013) 9.8E-02 mg/m3
Chloromethane	74-87-3	IRIS RfC[4]	IRIS RfC (2001) 9E-02 mg/m3
2-Chloronaphthalene	91-58-7	No inhalation-based toxicity factors are available	None
2-Chlorophenol	95-57-8	No inhalation-based toxicity factors are available*[17]*	None
Chrysene	218-01-9	IRIS IUR (benzo(a)pyrene) adjusted for chrysene	IRIS IUR (2017) 6.0E-07 (ug/m3)-1 (adjusted for chrysene)
Cobalt	7440-48-4	PPRTV IUR PPRTV RfC*[.]*	PPRTV IUR (2008) 9E-03(ug/m3)-1 PPRTV RfC (2008) 6E-06 mg/m3
Copper	7440-50-8	No inhalation-based toxicity factors are available[5]	None
Cyanide	57-12-5	IRIS RfC	IRIS RfC (2010) 8E-04 mg/m3

Cyclohexane	110-82-7	IRIS RfC	IRIS RfC (2003) 6E+00 mg/m3
4,4'-DDD	72-54-8	No inhalation-based toxicity factors are available*17*	None
4,4'-DDE	72-55-9	No inhalation-based toxicity factors are available*17*	None
4,4'-DDT	50-29-3	No inhalation-based toxicity factors are available*17*	None
Dibenz(a,h)anthracene	53-70-3	IRIS IUR (benzo(a)pyrene) adjusted for dibenzo(a,h) anthracene	IRIS IUR (2017) 6.0E-04(ug/m3)-1 (adjusted for dibenzo(a,h) anthracene)
Dibromochloromethane	124-48-1	No inhalation-based toxicity factors are available*17*	None
1,2-Dibromo-3-chloropropane	96-12-8	PPRTV IUR IRIS RfC	PPRTV IUR (2006) 6E-03 (ug/m3)-1 IRIS RfC (1991) 2E-04 mg/m3
1,2-Dibromoethane	106-93-4	IRIS IUR IRIS RfC	IRIS IUR (2004) 6E-04 (ug/m3)-1 IRIS RfC (2004) 9E-03 mg/m3
1,2-Dichlorobenzene	95-50-1	HEAST RfC	HEAST RfC (1997) 2E-01 mg/m3
1,3-Dichlorobenzene	541-73-1	No inhalation-based toxicity factors are available	None
1,4-Dichlorobenzene	106-46-7	IRIS RfC	IRIS RfC (1994) 8E-01 mg/m3

		No other inhalation-based toxicity factors are available[17]	
3,3'-Dichlorobenzidine	91-94-1	No inhalation-based toxicity factors are available	None
Dichlorodifluoromethane	75-71-8	No inhalation-based toxicity factors are available[6]	None
1,1-Dichloroethane	75-34-3	No inhalation-based toxicity factors are available[7]	None
1,2-Dichloroethane	107-06-2	PPRTV RfC ***No other inhalation-based toxicity factors are available[17]***	PPRTV RfC (2010) 7E-03 mg/m3
1,1-Dichloroethene	75-35-4	A soil inhalation remediation standard can be developed using an IRIS RfC with a Group C carcinogen factor	IRIS RfC (2002/2005) 2E-01 mg/m3 RfC Group C carcinogen factor 10
cis-1,2-Dichloroethene	156-59-2	No inhalation-based toxicity factors are available	None
trans-1,2-Dichloroethene	156-60-5	No inhalation-based toxicity factors are available[8]	None
2,4-Dichlorophenol	120-83-2	No inhalation-based toxicity factors are available***[17]***	None
1,2-Dichloropropane	78-87-5	PPRTV IUR IRIS RfC	PPRTV IUR (2016) 3.7E-06 (ug/m3)-1 IRIS RfC (1991) 4E-03 mg/m3

1,3-Dichloropropene (cis and trans)	542-75-6	IRIS IUR IRIS RfC	IRIS IUR (2000) 4E-06 (ug/m3)-1 IRIS RfC (2000) 2E-02 mg/m3
Dieldrin	60-57-1	No inhalation-based toxicity factors are available	None
Diethylphthalate	84-66-2	No inhalation-based toxicity factors are available*17*	None
2,4-Dimethylphenol	105-67-9	No inhalation-based toxicity factors are available*17*	None
Di-n-butylphthalate	84-74-2	No inhalation-based toxicity factors are available*17*	None
2,4-Dinitrophenol	51-28-5	No inhalation-based toxicity factors are available*17*	None
2,4-Dinitrotoluene /2,6-Dinitrotoluene (mixture)	25321-14-6	No inhalation-based toxicity factors are available*17*	None
Di-n-octylphthalate	117-84-0	No inhalation-based toxicity factors are available[9]	None
1,4-Dioxane	123-91-1	IRIS IUR IRIS RfC	IRIS IUR (2013) 5.0E-06 (ug/m3)-1 IRIS RfC (2013) 3E-02 mg/m3
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	No inhalation-based toxicity factors are available*17*	None

Endrin	72-20-8	No inhalation-based toxicity factors are available*[17]*	None
Ethylbenzene	100-41-4	CalEPA IUR IRIS RfC	CalEPA IUR (2007) 2.5E-06 (ug/m3)-1 IRIS RfC (1991) 1E+00 mg/m3
Extractable Petroleum Hydrocarbons (EPH) (Category 1)	various	No inhalation-based toxicity factors are available	None
Extractable Petroleum Hydrocarbons (EPH) (category 2)	various	No inhalation-based toxicity factors are available	None
Fluoranthene	206-44-0	No inhalation-based toxicity factors are available*[18]*	None
Fluorene	86-73-7	No inhalation-based toxicity factors are available*[18]*	None
alpha-HCH (alpha-BHC)	319-84-6	No inhalation-based toxicity factors are available*[17]*	None
beta-HCH (beta-BHC)	319-85-7	No inhalation-based toxicity factors are available*[17]*	None
Heptachlor	76-44-8	No inhalation-based toxicity factors are available*[17]*	None
Heptachlor epoxide	1024-57-3	No inhalation-based toxicity factors are available*[17]*	None
Hexachlorobenzene	118-74-1	No inhalation-based toxicity factors are available*[17]*	None

Hexachloro-1,3-butadiene	87-68-3	No inhalation-based toxicity factors are available*[17]*	None
Hexachlorocyclopentadiene	77-47-4	IRIS RfC	IRIS RfC (2001) 2E-04 mg/m3
Hexachloroethane	67-72-1	IRIS RfC	IRIS RfC (2011) 3E-02 mg/m3
n-Hexane	110-54-3	IRIS RfC	IRIS RfC (2005) 7E-01 mg/m3
2-Hexanone	591-78-6	IRIS RfC	IRIS RfC (2009) 3E-02 mg/m3
Indeno(1,2,3,-cd) pyrene	193-39-5	IRIS IUR (benzo(a)pyrene) adjusted for indeno(1,2,3,-cd) pyrene.	IRIS IUR (2017) 6.0E-05 (ug/m3)-1 (adjusted for indeno(1,2,3,-cd) pyrene)
Isophorone	78-59-1	CalEPA RfC	CalEPA RfC (2001) 2E-00 mg/m3
Isopropylbenzene	98-82-8	IRIS RfC	IRIS RfC (1997) 4E-01 mg/m3
Lead	7439-92-1	No inhalation-based toxicity factors are available*[17]*	None
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	No inhalation-based toxicity factors are available*[17]*	None
Manganese	7439-96-5	IRIS RfC*[.]*	IRIS RfC (1993) 5E-05 mg/m3
Mercury	7439-97-6	IRIS RfC	IRIS RfC (1995)

			3E-04 mg/m3
Methoxychlor	72-43-5	No inhalation-based toxicity factors are available***17***	None
Methyl acetate	79-20-9	No inhalation-based toxicity factors are available	None
Methylene chloride	75-09-2	IRIS IUR IRIS RfC	IRIS IUR (2011) *[1E-8]* ***1E-08*** (ug/m3)-1 IRIS RfC (2011) 6E-01 mg/m3
2-Methylnaphthalene	91-57-6	No inhalation-based toxicity factors are available***18***	None
4-Methyl-2-pentanone	108-10-1	IRIS RfC	IRIS RfC (2003) *[3E+0]* ***3E+00*** mg/m3
2-Methylphenol	95-48-7	No inhalation-based toxicity factors are available***17***	None
4-Methylphenol	106-44-5	No inhalation-based toxicity factors are available***17***	None
Methyl tert-butyl ether (MTBE)	1634-04-4	***CalEPA IUR*** IRIS RfC with a Group C carcinogen factor *[CalEPA IUR.]*	CalEPA IUR (1999) 2.6E-07 (ug/m3)-1 IRIS RfC (1993) *[3E+0]* ***3E+00*** mg/m3 Group C carcinogen factor 10
Naphthalene	91-20-3	CalEPA IUR IRIS RfC with a Group C carcinogen factor	CalEPA IUR (2011) 3.4E-05 (ug/m3)-1 IRIS RfC (1998)

			3E-03 mg/m3 Group C carcinogen factor 10
Nickel	7440-02-0	IRIS IUR CalEPA RfC*[.]*	IRIS IUR (1987/2006) 2.4E-04 (ug/m3)-1 CalEPA RfC (2012) 1.4E-05 mg/m3
4-Nitroaniline	100-01-6	PPRTV RfC	PPRTV RfC (2009) 6E-03 mg/m3
Nitrobenzene	98-95-3	IRIS IUR IRIS RfC	IRIS IUR (2009) 4E-05 (ug/m3)-1 IRIS RfC (2009) 9E-03 mg/m3
N-Nitroso-di-n-propylamine	621-64-7	No inhalation-based toxicity factors are available*17*	None
N-Nitrosodiphenylamine	86-30-6	No inhalation-based toxicity factors are available*17*	None
2,2'-Oxybis(1-choloropropane)	108-60-1	No inhalation-based toxicity factors are available	None
Pentachlorophenol	87-86-5	No inhalation-based toxicity factors are available*17*	None
Phenol	108-95-2	CalEPA RfC	CalEPA RfC (2000) 2E-01 mg/m3
Polychlorinated biphenyls (PCBs)	1336-36-3	No inhalation-based toxicity factors are available*17*	None

Pyrene	129-00-0	No inhalation-based toxicity factors are available***18***	None
Selenium	7782-49-2	No inhalation-based toxicity factors are available	None
Silver	7440-22-4	No inhalation-based toxicity factors are available***17***	None
Styrene	100-42-5	IRIS RfC[10]	IRIS RfC (1992) *[1E+0]* ***1E+00*** mg/m3
Tertiary butyl alcohol (TBA)	75-65-0	No inhalation-based toxicity factors are available***17***	None
1,2,4,5-Tetrachlorobenzene	95-94-3	No inhalation-based toxicity factors are available	None
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	No inhalation-based toxicity factors are available	None
1,1,2,2-Tetrachloroethane	79-34-5	No inhalation-based toxicity factors are available***17***	None
Tetrachloroethene (PCE)	127-18-4	IRIS IUR IRIS RfC	IRIS IUR (2012) 2.6E-07 (ug/m3)-1 IRIS RfC (2012) 4E-02 mg/m3
2,3,4,6-Tetrachlorophenol	58-90-2	No inhalation-based toxicity factors are available	None
Toluene	108-88-3	IRIS RfC	IRIS RfC (2005) *[5E+0]* ***5E+00*** mg/m3

Toxaphene	8001-35-2	No inhalation-based toxicity factors are available**[*17*]**	None
1,2,4-Trichlorobenzene	120-82-1	PPRTV RfC	PPRTV RfC (2009) 2E-03 mg/m3
1,1,1-Trichloroethane	71-55-6	IRIS RfC[11]	IRIS RfC (2007) *[5E+0]* ***5E+00*** mg/m3
1,1,2-Trichloroethane	79-00-5	No inhalation-based toxicity factors are available[12]	None
Trichloroethene (TCE)	79-01-6	IRIS IUR IRIS RfC[13]	IRIS IUR (2011) *[4.1E-6]* ***4.1E-06*** (ug/m3)-1 IRIS RfC (2011) *[2E-3]* ***2E-03*** mg/m3
Trichlorofluoromethane	75-69-4	No inhalation-based toxicity factors are available[14]	None
2,4,5-Trichlorophenol	95-95-4	No inhalation-based toxicity factors are available**[*17*]**	None
2,4,6-Trichlorophenol	88-06-2	No inhalation-based toxicity factors are available**[*17*]**	None
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	PPRTV RfC	PPRTV RfC (2016) 5E+00 mg/m3
1,2,4-Trimethylbenzene	95-63-6	IRIS RfC	IRIS RfC (2016) 6E-02 mg/m3
Vanadium	7440-62-2	ATSDR RfC	ATSDR RfC (2012) 1E-04 mg/m3

Vinyl Chloride	75-01-4	IRIS IUR IRIS RfC[15]	IRIS IUR (2000) *[4.4E-6]* ***4.4E-06*** (ug/m3)-1 IRIS RfC (2000) *[1E-1]* ***1E-01*** mg/m3
Xylenes	1330-20-7	IRIS RfC	IRIS RfC (2003) 1.E-01 mg/m3
Zinc	7440-66-6	No inhalation-based toxicity factors are available[16]	None

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[1] An ATSDR RfC exists for acetone using the results of the Stewart 1975 study. The USEPA IRIS notes that this study should only be used in the development of a short-term exposure RfC and not a long-term (chronic) exposure RfC.

[2] A HEAST RfC exists for acetophenone, but a subsequent PPRTV review (2010) questions the use of the HEAST RfC.

[3] A NJDWQI RfC exists for 2-butanone, but the IRIS RfC has been determined by the Department to be more appropriate. The existing NJDWQI RfC is based on a route-to-route conversion of a NJDWQI RfD. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with USEPA policy concerning route-to-route conversion of toxicity factors.

[4] A HEAST IUR exists for chloromethane, but a subsequent PPRTV review (2012) states that the use of the HEAST IUR is "Inadequate for an assessment of carcinogenic potential."

[5] A CalEPA RfC that once existed for copper has been retracted by CalEPA.

[6] A HEAST RfC and a PPRTV RfC exist for dichlorodifluoromethane. Both RfCs are derived using the same study (Prendergast 1967). The PPRTV is listed as an appendix value. The PPRTV RfC is listed as an appendix value because the Prendergast study was determined by the USEPA to have flaws. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix values to develop soil remediation standards. As the HEAST RfC developed using the Prendergast study, the Department decided not to use this RfC in the development of a soil remediation standard.

[7] A HEAST RfC exists for 1,1-dichloroethane, but a subsequent PPRTV review (2006) indicated that data were inadequate to derive a chronic exposure RfC for 1,1-dichloroethane. ***A CalEPA IUR also exists for 1,1-dichloroethane but is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors.***

[8] A PPRTV RfC exists for trans-1,2-dichloroethene but a subsequent IRIS assessment (2010) stated "the available inhalation data from the Freund study are insufficient to support reference value derivation and RfC."

[9] A 1985 USEPA IUR that once existed for di-n-octylphthalate has been retracted by the USEPA.

[10] A HEAST 1991 IUR exists for styrene but USEPA NCEA does not recommend its use.

[11] Although an NJDWQI RfC exists for 1,1,1-trichloroethane, the Department determined that the IRIS RfC is a scientifically better toxicity value to develop a non-cancer-based soil inhalation remediation standard.

[12] Although a PPRTV RfC for 1,1,2-trichloroethane exists, it is listed as an appendix value. The PPRTV appendix value is based on a study that was determined by USEPA to have flaws. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix values to develop soil remediation standards. ***An IRIS IUR also exists for 1,1,2-trichloroethane but is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of soil remediation standards based on route-to-route conversion of toxicity factors.***

[13] The IRIS RfC for trichloroethene is based on a route-to-route conversion of an ingestion study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[14] A HEAST RfC exists for trichlorofluoromethane, but a subsequent PPRTV review (2009) indicated that data used to derive the RfC were inadequate.

[15] The IRIS RfC for vinyl chloride is based on a route-to-route conversion of an ingestion study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[16] A CalEPA RfC that once existed for zinc has been retracted by CalEPA.

***[17] There is an inhalation toxicity factor available for this contaminant, but it is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted with physiologically-based pharmacokinetic modeling, for the development of soil remediation standards based on route-to-route conversion of toxicity factors.**

[18] The 2008 inhalation toxicity factor was based on an equivalency factor from Nisbet and LaGoy (1992). Nisbet and LaGoy did not conduct any original research and relied on studies using dermal application and subcutaneous injection, with one study using intrapulmonary administration (not inhalation). The Nisbet and LaGoy study develops TEFs for PAHs compared to B[a]P. The Department did not use this study because it was not derived from an inhalation study.
[19] The former IRIS RfC was withdrawn.*

Table 3--Indoor Air Toxicity Factors

Contaminant	CAS No.	VI Recommendation	VI Toxicity Factor(s)

Acenaphthene	83-32-9	Not applicable	Not applicable
Acetone	67-64-1	No inhalation-based toxicity factors are available[1]	None
Acetophenone	98-86-2	Not applicable	Not applicable
Aldrin	309-00-2	Not applicable	Not applicable
Aluminum	7429-90-5	Not applicable	Not applicable
Anthracene	120-12-7	Not applicable	Not applicable
Antimony	7440-36-0	Not applicable	Not applicable
Arsenic	7440-38-2	Not applicable	Not applicable
Atrazine	1912-24-9	Not applicable	Not applicable
Barium	7440-39-3	Not applicable	Not applicable
Benzaldehyde	100-52-7	Not applicable	Not applicable
Benzene	71-43-2	IRIS IUR IRIS RfC*[.]*	IRIS IUR (2000) 7.8E-06 (ug/m3)-1 IRIS RfC (2003) 3E-02 mg/m3
Benzo(a)anthracene	56-55-3	Not applicable	Not applicable
Benzo(a)pyrene	50-32-8	Not applicable	Not applicable
Benzo(b)fluoranthene	205-99-2	Not applicable	Not applicable
Benzo(k)fluoranthene	207-08-9	Not applicable	Not applicable
Beryllium	7440-41-7	Not applicable	Not applicable
1,1'-Biphenyl	92-52-4	Not applicable	Not applicable
Bis(2-chloroethoxy) methane	111-91-1	Not applicable	Not applicable
Bis(2-chloroethyl) ether	111-44-4	Not applicable	Not applicable
Bis(2-ethylhexyl) phthalate	117-81-7	Not applicable	Not applicable
Bromodichloromethane	75-27-4	No inhalation-based toxicity factors are available*[13]*	None
Bromoform	75-25-2	No inhalation-based toxicity factors are available*[13]*	None
Bromomethane	74-83-9	IRIS RfC	IRIS RfC (1992) 5E-03 mg/m3

2-Butanone	78-93-3	VI standard can be developed using IRIS RfC[2]	IRIS RfC (2003) 5E+00 mg/m3
Butylbenzylphthalate	85-68-7	Not applicable	Not applicable
Cadmium	7440-43-9	Not applicable	Not applicable
Caprolactam	105-60-2	Not applicable	Not applicable
Carbon disulfide	75-15-0	IRIS RfC	IRIS RfC (1995) 7E-01 mg/m3
Carbon tetrachloride	56-23-5	IRIS IUR IRIS RfC	IRIS IUR (2010) 6E-06 (ug/m3)-1 IRIS RfC (2010) 1E-01 mg/m3
Chlordane (alpha plus gamma mixture)	57-74-9	Not applicable	Not applicable
4-Chloroaniline	106-47-8	Not applicable	Not applicable
Chlorobenzene	108-90-7	PPRTV RfC	PPRTV RfC (2006) 5E-02 mg/m3
Chloroethane	75-00-3	IRIS RfC	IRIS RfC (1991) 1E+01 mg/m3
Chloroform	67-66-3	ATSDR RfC ***No other inhalation-based toxicity factors are available[13]***	ATSDR RfC (2013) 9.8E-02 mg/m3
Chloromethane	74-87-3	IRIS RfC[3]	IRIS RfC (2001) 9E-02 mg/m3
2-Chloronaphthalene	91-58-7	Not applicable	Not applicable
2-Chlorophenol	95-57-8	Not applicable	Not applicable
Chrysene	218-01-9	Not applicable	Not applicable
Cobalt	7440-48-4	Not applicable	Not applicable
Copper	7440-50-8	Not applicable	Not applicable
Cyanide	57-12-5	Not applicable	Not applicable
Cyclohexane	110-82-7	IRIS RfC	IRIS RfC (2003) 6E+00 mg/m3
4,4'-DDD	72-54-8	Not applicable	Not applicable
4,4'-DDE	72-55-9	Not applicable	Not applicable
4,4'-DDT	50-29-3	Not applicable	Not applicable
Dibenz(a,h)anthracene	53-70-3	Not applicable	Not applicable
Dibromochloromethane	124-48-1	No inhalation-based toxicity factors are available***[13]***	None

1,2-Dibromo-3-chloropropane	96-12-8	Not applicable	*[None]* ***Not applicable***
1,2-Dibromoethane	106-93-4	IRIS IUR IRIS RfC	IRIS IUR (2004) 6E-04 (ug/m3)-1 IRIS RfC (2004) 9E-03 mg/m3
1,2-Dichlorobenzene	95-50-1	HEAST RfC	HEAST RfC (1997) 2E-01 mg/m3
1,3-Dichlorobenzene	541-73-1	No inhalation-based toxicity factors are available	None
1,4-Dichlorobenzene	106-46-7	IRIS RfC ***No other inhalation-based toxicity factors are available[13]***	IRIS RfC (1996) 8E-01 mg/m3
3,3'-Dichlorobenzidine	91-94-1	Not applicable	Not applicable
Dichlorodifluoromethane	75-71-8	No inhalation-based toxicity factors are available[4]	None
1,1-Dichloroethane	75-34-3	No inhalation-based toxicity factors are available[5]	None
1,2-Dichloroethane	107-06-2	PPRTV RfC ***No other inhalation-based toxicity factors are available[13]**	PPRTV RfC (2010) 7E-03 mg/m3
1,1-Dichloroethene	75-35-4	IRIS RfC with a Group C carcinogen factor	IRIS RfC (2002/2005) 2E-01 mg/m3 Group C carcinogen factor 10
cis-1,2-Dichloroethene	156-59-2	No inhalation-based toxicity factors are available	None
trans-1,2-Dichloroethene	156-60-5	No inhalation-based toxicity factors are available[6]	None
2,4-Dichlorophenol	120-83-2	Not applicable	Not applicable
1,2-Dichloropropane	*[728-87-5]* ***78-87-5***	PPRTV IUR IRIS RfC	PPRTV IUR (2016) 3.7E-06 (ug/m3)-1 IRIS RfC (1991) 4E-03 mg/m3
1,3-Dichloropropene (cis and trans)	5422-75-6	IRIS IUR IRIS RfC	IRIS IUR (2000) 4E-06 (ug/m3)-1 IRIS RfC (2000) 2E-02 mg/m3
Dieldrin	60-57-1	Not applicable	Not applicable

Diethylphthalate	84-66-2	Not applicable	Not applicable
2,4-Dimethylphenol	105-67-9	Not applicable	Not applicable
Di-n-butylphthalate	84-74-2	Not applicable	Not applicable
2,4-Dinitrophenol	51-28-5	Not applicable	Not applicable
2,4-Dinitrotoluene /2,6-Dinitrotoluene (mixture)	25321-14-6	Not applicable	Not applicable
Di-n-octyl phthalate	117-84-0	Not applicable	Not applicable
1,4-Dioxane	123-91-1	IRIS IUR IRIS RfC	IRIS IUR (2013) 5.0E-06 (ug/m3)-1 IRIS RfC (2013) 3E-02 mg/m3
Endosulfan I and Endosulfan II (alpha and beta)	115-29-7	Not applicable	Not applicable
Endrin	72-20-8	Not applicable	Not applicable
Ethylbenzene	100-41-4	CalEPA IUR IRIS RfC	CalEPA IUR (2007) 2.5E-06 (ug/m3)-1 IRIS RfC (1991) 1E+00 mg/m3
Extractable Petroleum Hydrocarbons (EPH) (Category 1)	various	Not applicable	Not applicable
Extractable Petroleum Hydrocarbons (EPH) (Category 2)	various	Not applicable	Not applicable
Fluoranthene	206-44-0	Not applicable	Not applicable
Fluorene	86-73-7	Not applicable	Not applicable
alpha-HCH (alpha-BHC)	319-84-6	Not applicable	Not applicable
beta-HCH (beta-BHC)	319-85-7	Not applicable	Not applicable
Heptachlor	76-44-8	Not applicable	Not applicable
Heptachlor epoxide	1024-57-3	Not applicable	Not applicable
Hexachlorobenzene	118-74-1	Not applicable	Not applicable
Hexachloro-1,3-butadiene	87-68-3	*[Not applicable]* ***No inhalation-based toxicity factors are available[13]***	*[Not applicable]* ***None***
Hexachlorocyclopentadiene	77-47-4	Not applicable	Not applicable
Hexachloroethane	67-72-1	Not applicable	Not applicable
n-Hexane	110-54-3	IRIS RfC	IRIS RfC (2005)

			7E-01 mg/m3
2-Hexanone	591-78-6	Not applicable	Not applicable
Indeno(1,2,3,-cd) pyrene	193-39-5	Not applicable	Not applicable
Isophorone	78-59-1	Not applicable	Not applicable
Isopropylbenzene	98-82-8	Not applicable	Not applicable
Lead	7439-92-1	Not applicable	Not applicable
Lindane (gamma-HCH) (gamma-BHC)	58-89-9	Not applicable	Not applicable
Manganese	7439-96-5	Not applicable	Not applicable
Mercury	7439-97-6	IRIS RfC	IRIS RfC (1995) 3E-04 mg/m3
Methoxychlor	72-43-5	Not applicable	Not applicable
Methyl acetate	79-20-9	No inhalation-based toxicity factors are available	None
Methylene chloride	75-09-2	IRIS IUR ***IRIS*** RfC	IRIS IUR (2011) *[1E-8]* ***1E-08*** (ug/m3)-1 IRIS RfC (2011) 6E-01 mg/m3
2-Methylnaphthalene	91-57-6	Not applicable	Not applicable
4-Methyl-2-pentanone	108-10-1	IRIS RfC	IRIS RfC (2003) *[3E+0]* ***3E+00*** mg/m3
2-Methylphenol	95-48-7	Not applicable	Not applicable
4-Methylphenol	106-44-5	Not applicable	Not applicable
Methyl tert-butyl ether (MTBE)	1634-04-4	***CalEPA IUR*** IRIS RfC *[CalEPA IUR]*	CalEPA IUR (1999) 2.6E-07 (ug/m3)-1 IRIS RfC (1993) *[3E+0]* ***3E+00*** mg/m3
Naphthalene	91-20-3	CalEPA IUR IRIS RfC with a Group C carcinogen factor	CalEPA IUR (2004) 3.4E-05 (ug/m3)-1 IRIS RfC (1998) 3E-03 mg/m3 Group C carcinogen
Nickel	7440-02-0	Not applicable	Not applicable
4-Nitroaniline	100-01-6	Not applicable	Not applicable
Nitrobenzene	98-95-3	Not applicable	Not applicable
N-Nitroso-di-n propylamine	621-64-7	Not applicable	Not applicable
N-Nitrosodiphenylamine	86-30-6	Not applicable	Not applicable
2,2'-Oxybis(1-choloropropane)	108-60-1	Not applicable	Not applicable

Pentachlorophenol	87-86-5	Not applicable	Not applicable
Phenol	108-95-2	Not applicable	Not applicable
Polychlorinated biphenyls (PCBs)	1336-36-3	Not applicable	Not applicable
Pyrene	129-00-0	Not applicable	Not applicable
Selenium	7782-49-2	Not applicable	Not applicable
Silver	7440-22-4	Not applicable	Not applicable
Styrene	100-42-5	VI standard can be developed using IRIS RfC[7]	IRIS RfC (1993) *[1E+0]* ***1E+00*** mg/m3
Tertiary butyl alcohol (TBA)	75-65-0	No inhalation-based toxicity factors are available[*13*]	None
1,2,4,5-Tetrachlorobenzene	95-94-3	Not applicable	Not applicable
2,3,7,8-Tetrachlorodibenzo-p-dioxin	1746-01-6	Not applicable	Not applicable
1,1,2,2-Tetrachloroethane	79-34-5	No inhalation-based toxicity factors are available[*13*]	None
Tetrachloroethene (PCE)	127-18-4	IRIS IUR IRIS RfC	IRIS IUR (2012) 2.6E-07 (ug/m3)-1 IRIS RfC (2012) 4E-02 mg/m3
2,3,4,6-Tetrachlorophenol	58-90-2	Not applicable	Not applicable
Toluene	108-88-3	IRIS RfC	IRIS RfC (2005) *[5E+0]* ***5E+00*** mg/m3
Toxaphene	8001-35-2	Not applicable	Not applicable
1,2,4-Trichlorobenzene	120-82-1	PPRTV RfC	PPRTV RfC (2009) 2E-03 mg/m3
1,1,1-Trichloroethane	71-55-6	IRIS RfC[8]	IRIS RfC (2007) *[5E+0]* ***5E+00*** mg/m3
1,1,2-Trichloroethane	79-00-5	No inhalation-based toxicity factors are available[9]	None
Trichloroethene (TCE)	79-01-6	IRIS IUR IRIS RfC[10]	IRIS IUR (2011) *[4.1E-6]* ***4.1E-06*** (ug/m3)-1 IRIS RfC (2011) *[2E-3]* ***2E-03*** mg/m3

Trichlorofluoromethane	75-69-4	No inhalation-based toxicity factors are available[11]	None
2,4,5-Trichlorophenol	95-95-4	Not applicable	Not applicable
2,4,6-Trichlorophenol	88-06-2	Not applicable	Not applicable
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	PPRTV RfC	PPRTV RfC (2016) 5E+00 mg/m3
1,2,4-Trimethylbenzene	95-63-6	IRIS RfC	IRIS RfC (2016) 6E-02 mg/m3
Vanadium	7440-62-2	Not applicable	Not applicable
Vinyl Chloride	75-01-4	IRIS IUR. IRIS RfC[12]	IRIS IUR (2000) *[4.4E-6]* ***4.4E-06*** (ug/m3)-1 IRIS RfC (2000) *[1E-1]* ***1E-01*** mg/m3
Xylenes	1330-20-7	IRIS RfC	IRIS RfC (2003) 1.E-01 mg/m3
Zinc	7440-66-6	Not applicable	Not applicable

[1] An ATSDR RfC exists for acetone using the results of the Stewart 1975 study. The USEPA IRIS notes that this study should only be used in the development of a short-term exposure RfC and not a long-term (chronic) exposure RfC.

[2] A NJDWQI RfC exists for 2-butanone, but the IRIS RfC has been determined by the Department to be more appropriate. The existing NJDWQI RfC is based on a route-to-route conversion of a NJDWQI RfD. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of *[soil]* ***indoor air*** remediation standards based on route-to-route conversion of toxicity factors. This policy conforms with the USEPA policy concerning route-to-route conversion of toxicity factors.

[3] A HEAST IUR exists for chloromethane, but a subsequent PPRTV review (2012) states that the use of the HEAST IUR is "Inadequate for an assessment of carcinogenic potential."

[4] A HEAST RfC and a PPRTV RfC exist for dichlorodifluoromethane. Both RfCs are derived using the same study (Prendergast 1967). The PPRTV is listed as an appendix value. The PPRTV RfC is listed as an appendix value because the Prendergast study was determined by the USEPA to have flaws. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix values to develop remediation standards. As the HEAST RfC was developed using the Prendergast study data, the Department decided not to use this RfC in the development of a remediation standard.

[5] A HEAST RfC exists for 1,1-dichloroethane, but a subsequent PPRTV review (2006) indicated that data were inadequate to derive a chronic exposure RfC for 1,1-dichloroethane. ***A CalEPA IUR also exists for 1,1-dichloroethane but is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of indoor air remediation standards based on route-to-route conversion of toxicity factors.***

[6] A PPRTV RfC exists for trans-1,2-dichloroethene but a subsequent IRIS assessment (2010) stated "the available inhalation data from the Freund study are insufficient to support reference value derivation and RfC."

[7] A HEAST 1991 IUR exists for styrene but the USEPA NCEA does not recommend its use.

[8] Although an NJDWQI RfC exists for 1,1,1-trichloroethane, the Department determined that the IRIS RfC is a scientifically better toxicity value to develop a non-cancer-based soil inhalation remediation standard.

[9] Although a PPRTV RfC for 1,1,2-trichloroethane exists, it is listed as an appendix value. The PPRTV appendix value is based on a study that was determined by the USEPA to have flaws. It is the Department's Site Remediation and Waste Management Program policy not to use PPRTV appendix [page=908] values to develop *[soil]* remediation standards. ***An IRIS IUR also exists for 1,1,2-trichloroethane but is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted, for the development of indoor air remediation standards based on route-to-route conversion of toxicity factors.***

[10] The IRIS RfC for trichloroethene is based on a route-to-route conversion of an ingestion study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[11] A HEAST RfC exists for trichlorofluoromethane, but a subsequent PPRTV review (2009) indicated that data used to derive the RfC were inadequate.

[12] The IRIS RfC for vinyl chloride is based on a route-to-route conversion of an ingestion study, which was determined to be acceptable by the USEPA as substantiated by additional evaluation including physiologically-based pharmacokinetic modeling.

[13] There is an inhalation toxicity factor available for this contaminant, but it is based on a route-to-route conversion of an oral study. The Department's Site Remediation and Waste Management Program policy does not allow, except where warranted with physiologically-based pharmacokinetic modeling, for the development of indoor air remediation standards based on route-to-route conversion of toxicity factors.

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APPENDIX 12

DERIVATION OF EQUATION EQUIVALENCY USED FOR THE DEVELOPMENT OF SOIL AND INDOOR AIR REMEDIATION STANDARDS

This appendix demonstrates the equivalency between the equations used by the Department in the development of the soil and indoor air remediation standards, and the equations used by the USEPA in the development of soil and indoor air risk-based screening levels. This appendix demonstrates the equivalency for the following Department soil and indoor air remediation standard equations:

- N.J.A.C. 7:26D Appendix 2, Equation 1, Residential Carcinogenic Ingestion-Dermal Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 2, Equation 2, Residential Noncarcinogenic Ingestion-Dermal Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 2, Equation 3, Nonresidential Carcinogenic Ingestion-Dermal Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 2, Equation 4, Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 3, Equation 1, Carcinogenic Inhalation Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 3, Equation 2, Noncarcinogenic Inhalation Human Health-based Criterion Equation;
- N.J.A.C. 7:26D Appendix 5, Equation 1, Carcinogenic Indoor Air Human Health-based Criterion Equation; and
- N.J.A.C. 7:26D Appendix 5, Equation 2, Noncarcinogenic Indoor Air Human Health-based Criterion Equation.

N.J.A.C. 7:26D Appendix 2, Equation 1-Residential Carcinogenic Ingestion-Dermal Human Health-Based Criterion Equation

The origin of the Department residential soil remediation standard for the ingestion-dermal exposure pathway for a carcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{\text{res-soil-ca-tot}}\left(\text{mg/kg}\right) = \frac{1}{\dfrac{1}{SL_{\text{res-soil-ca-ing}}} + \dfrac{1}{SL_{\text{res-soil-ca-der}}} + \dfrac{1}{SL_{\text{res-soil-ca-inh}}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by deleting the inhalation related screening level term:

$$\frac{1}{SL_{res-soil-ca-inh}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the ingestion and dermal aspects, which is designated:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{res-soil-ca-ing}}\right) + \left(\frac{1}{SL_{res-soil-ca-der}}\right)}$$

The RSLE states that:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing}\left(mg/kg\right) = \frac{TR \times AT_{res}\left(\frac{365\ \text{days}}{\text{year}} \times LT\ (70\ \text{years})\right)}{CSF_o\left(\frac{mg}{kg\text{-}day}\right)^{-1} \times RBA \times IFS_{res\text{-}adj}\left(\frac{36{,}750\ mg}{kg}\right) \times \left(\frac{10^{-6}kg}{mg}\right)}$$

and

$$SL_{res\text{-}soil\text{-}ca\text{-}der}\left(mg/kg\right) = \frac{TR \times AT_{res}\left(\frac{365\ \text{days}}{\text{year}} \times LT\ (70\ \text{years})\right)}{\left(\frac{CSF_o\left(\frac{mg}{kg\text{-}day}\right)^{-1}}{GIABS}\right) \times DFS_{res\text{-}adj}\left(\frac{103{,}390\ mg}{kg}\right) \times ABS_d \times \left(\frac{10^{-6}kg}{mg}\right)}$$

The above two equations include the units for the listed input parameters. Deleting the units simplify the two equations to:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing} = \frac{TR\ \text{x}\ AT_{res}\ \text{x}\ LT}{CSF_o\ \text{x}\ RBA\ \text{x}\ IFS_{res-adj}\ \text{x}\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

And

$$SL_{res\text{-}soil\text{-}ca\text{-}der} = \frac{TR \text{ x } AT_{res} \text{ x } LT}{\left(\frac{CSF_o}{GIABS}\right) \text{ x } DFS_{res-adj} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Because

$$\mathbf{GIABS = \frac{CSF_o}{CSF_d}}$$

the second equation further simplifies to:

$$SL_{res-soil-ca-der} = \frac{TR \text{ x } AT_{res} \text{ x } LT}{CSF_d \text{ x } DFS_{res-adj} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Starting with the Department-modified base USEPA equation, as described above:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{res-soil-ca-ing}}\right) + \left(\frac{1}{SL_{res-soil-ca-der}}\right)}$$

1. Insert the simplified equations for $SL_{res\text{-}soil\text{-}ca\text{-}ing}$ and $SL_{res\text{-}soil\text{-}ca\text{-}der}$ described above into the denominator of the $SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}derm}$ equation, which then becomes:

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$$\frac{1}{\left[\left[\frac{1}{\left(\frac{TR \text{ x } AT_{res} \text{ x } LT}{CSF_o \text{ x } RBA \text{ x } IFS_{res-adj} \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}\right)}\right] + \left[\frac{1}{\left(\frac{TR \text{ x } AT_{res} \text{ x } LT}{CSF_d \text{ x } DFS_{res-adj} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}\right)}\right]\right]}$$

2. Simplify the reciprocal (in the denominator of the equation immediately above) containing the equivalent expression of $SL_{res\text{-}soil\text{-}ca\text{-}ing}$ by multiplying it by the term:

$$\frac{CSF_o \text{ x } RBA \text{ x } IFS_{res-adj} \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}{CSF_o \text{ x } RBA \text{ x } IFS_{res-adj} \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}$$

This is the same as multiplying the reciprocal of the expression by 1.

3. Similarly, simplify the reciprocal containing the equivalent expression of $SL_{res\text{-}soil\text{-}ca\text{-}der}$ by multiplying it by the term:

$$\frac{CSF_d \text{ x } DFS_{res-adj} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}{CSF_d \text{ x } DFS_{res-adj} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Again, this is effectively multiplying by 1.

4. This results in the expression:

$$\frac{1}{\left(\frac{CSF_o \text{ x } RBA \text{ x } IFS_{res-adj} \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}{TR \text{ x } AT_{res} \text{ x } LT}\right) + \left(\frac{CSF_d \text{ x } DFS_{res-adj} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\ kg}{mg}\right)}{TR \text{ x } AT_{res} \text{ x } LT}\right)}$$

5. After separating the common term

$$\left(\frac{10^{-6}\ kg}{mg}\right)$$

from both expressions in the denominator, multiply both the numerator and the denominator of the entire equation by the expression:

$$TR \text{ x } AT_{res} \text{ x } LT$$

Performing steps 1 through 5 above results in the following expression:

$$SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}derm} = \frac{TR \text{ x } AT_{res} \text{ x } LT}{\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right) \text{ x } \left[\left(CSF_o \text{ x } RBA \text{ x } IFS_{res-adj}\right) + \left(CSF_d \text{ x } DFS_{res-adj} \text{ x } ABS_d\right)\right]}$$

This USEPA terminology (immediately above), which is for a residential land use scenario involving a carcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
TR	*TR*	Target cancer risk
AT_{res}	*AT*	Averaging time
LT	*LT*	Lifetime
CSF_o	CSF_o	Oral cancer slope factor
RBA	*None*	Relative Bio-availability
$IFS_{res\text{-}adj}$	IFS_{adj}	Age-adjusted soil ingestion rate
CSF_d	CSF_D	Dermal cancer slope factor
$DFS_{res\text{-}adj}$	DFS_{adj}	Age-adjusted soil dermal contact factor
ABS_d	ABS_d	Dermal absorption fraction
$10^{-6}kg$	$10^{-6}kg$	Unit conversion factor
mg	*mg*	
GIABS	*GIABS*	Gastro-intestinal absorption fraction

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$ID_c = \frac{TR \ x \ AT \ x \ LT}{\left(\frac{10^{-6}\,kg}{mg}\right) x \left[\left(CSF_o \ x \ IFS_{adj}\right) + \left(CSF_D \ x \ DFS_{adj} \ x \ ABS_d\right)\right]}$$

Note that the USEPA term $SL_{res\text{-}soil\text{-}ca\text{-}ing\text{-}derm}$ is the equivalent of the Department term ID_c. In addition, there is no Department RBA parameter because the value is usually 1. Consequently, an RBA parameter does not appear in the translated equation. The equation presented immediately above is equivalent to the Department equation presented at N.J.A.C. 7:26D Appendix 2 as Equation 1 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 2, Equation 1 is:

$$ID_c = \frac{TR * AT * LT}{(10^{-6} kg / mg) * [(CSF_O * IFS_{adj}) + (CSF_D * DFS_{adj} * ABS_d)]}$$

N.J.A.C. 7:26D Appendix 2, Equation 2-Residential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria Equation

The origin of the Department residential soil remediation standard for the ingestion-dermal exposure pathway for a noncarcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}soil\text{-}nc\text{-}tot\text{-}c}\,(mg/kg) = \frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c}} + \frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c}} + \frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}c}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by deleting the inhalation related screening level term:

$$\frac{1}{SL_{res-soil-nc-inh-c}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the ingestion and dermal aspects, which is designated:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c} = \frac{1}{\left(\frac{1}{SL_{res-soil-nc-ing-c}}\right) + \left(\frac{1}{SL_{res-soil-nc-der-c}}\right)}$$

The Department calculation of the residential noncarcinogenic ingestion-dermal criterion is based on a child exposure scenario. As such, the RSLE states that:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c}\,(mg/kg) = \frac{THQ \times AT_{res\text{-}c}\left(\frac{365\ days}{year} \times ED_{res\text{-}c}\,(6\ years)\right) \times BW_{res\text{-}c}\,(15\ kg)}{EF_{res\text{-}c}\left(\frac{350\ days}{year}\right) \times ED_{res\text{-}c}\,(6\ years) \times \frac{RBA}{RfD_0\left(\frac{mg}{kg\text{-}day}\right)} \times IRS_{res\text{-}c}\left(\frac{200\ mg}{day}\right) \times \frac{10^{-6}kg}{1\,mg}}$$

and

$$SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c}\,(mg/kg) = \frac{THQ \times AT_{res\text{-}c}\left(\frac{365\ days}{year} \times ED_{res\text{-}c}\,(6\ years)\right) \times BW_{res\text{-}c}\,(15\ kg)}{EF_{res\text{-}c}\left(\frac{350\ days}{year}\right) \times ED_{res\text{-}c}\,(6\ years) \times \frac{1}{\left[RfD_0\left(\frac{mg}{kg\text{-}day}\right) \times GIABS\right]} \times SA_{res\text{-}c}\left(\frac{2373\ cm^2}{day}\right) \times AF_{res\text{-}c}\left(\frac{0.2\ mg}{cm^2}\right) \times ABS_d \times \frac{10^{-6}kg}{1mg}}$$

The above two equations include the units for the listed input parameters. Deleting the units simplify the two equations to:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c} = \frac{THQ\ x\ AT_{res-c}\ x\ ED_{res-c}\ x\ BW_{res-c}}{EF_{res-c}\ x\ ED_{res-c}\ x\ \left(\frac{RBA}{RDO_0}\right)\ x\ IRS\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

and

$$SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c} = \frac{THQ\ x\ AT_{res-c}\ x\ ED_{res-c}\ x\ BW_{res-c}}{EF_{res-c}\ x\ ED_{res-c}\ x\ \left(\frac{1}{RfD_0\ x\ GIABS}\right)\ x\ SA_{res-c}\ x\ AF_{res-c}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Because

$$\mathbf{GIABS} = \frac{RfD_D}{RfD_0}$$

the second equation further simplifies to:

$$SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c} = \frac{THQ\ x\ AT_{res-c}\ x\ ED_{res-c}\ x\ BW_{res-c}}{EF_{res-c}\ x\ ED_{res-c}\ x\ \left(\frac{1}{RfD_D}\right)\ x\ SA_{res-c}\ x\ AF_{res-c}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Starting with the Department-modified base USEPA equation, as described above:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c} = \frac{1}{\left(\frac{1}{SL_{res-soil-nc-ing-c}}\right) + \left(\frac{1}{SL_{res-soil-nc-der-c}}\right)}$$

1. Insert the simplified equations for $SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}c}$ and $SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}c}$ described above into the denominator of the $SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c}$ equation, which then becomes:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c} =$$

$$\frac{1}{\left[\frac{1}{\left(\frac{THQ \text{ x } AT_{res-c} \text{ x } ED_{res-c} \text{ x } BW_{res-c}}{EF_{res-c} \text{ x } ED_{res-c} \text{ x } \left(\frac{RBA}{RDO_0}\right) \text{ x } IRS \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}\right)}\right] + \left[\frac{1}{\left(\frac{THQ \text{ x } AT_{res-c} \text{ x } ED_{res-c} \text{ x } BW_{res-c}}{EF_{res-c} \text{ x } ED_{res-c} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{res-c} \text{ x } AF_{res-c} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}\right)}\right]}$$

2. Simplify the reciprocals in the denominator of the equation immediately above (similar to what was done in the derivation of N.J.A.C. 7:26D Appendix 2, Equation 1 above) using the respective terms:

$$\frac{EF_{res-c} \text{ x } ED_{res-c} \text{ x } \left(\frac{RBA}{RDO_0}\right) \text{ x } IRS \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{EF_{res-c} \text{ x } ED_{res-c} \text{ x } \left(\frac{RBA}{RDO_0}\right) \text{ x } IRS \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

and

$$\frac{EF_{res-c} \text{ x } ED_{res-c} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{res-c} \text{ x } AF_{res-c} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{EF_{res-c} \text{ x } ED_{res-c} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{res-c} \text{ x } AF_{res-c} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

Again, this is the same as multiplying each of the reciprocals in the equation denominator by 1.

3. This results in the following:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c} =$$

$$\frac{1}{\left(\frac{EF_{res-c} \text{ x } ED_{res-c} \text{ x } \left(\frac{RBA}{RfD_0}\right) \text{ x } IRS \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{THQ \text{ x } AT_{res-c} \text{ x } ED_{res-c} \text{ x } BW_{res-c}}\right) + \left(\frac{EF_{res-c} \text{ x } ED_{res-c} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{res-c} \text{ x } AF_{res-c} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{THQ \text{ x } AT_{res-c} \text{ x } ED_{res-c} \text{ x } BW_{res-c}}\right)}$$

4. After separating out the common terms

$$\left(\frac{10^{-6}\ \mathrm{kg}}{\mathrm{mg}}\right)$$

and

$$\left(\mathrm{EF}_{\mathrm{res-c}}\ \mathrm{x}\ \mathrm{ED}_{\mathrm{res-c}}\right)$$

from both expressions in the denominator, multiply both the numerator and the denominator of the entire equation by the expression:

$$\mathrm{THQ}\ \mathrm{x}\ \mathrm{AT}_{\mathrm{res-c}}\ \mathrm{x}\ \mathrm{ED}_{\mathrm{res-c}}\ \mathrm{x}\ \mathrm{BW}_{\mathrm{res-c}}$$

Performing steps 1 through 4 above results in the following expression:

$$\mathrm{SL}_{\mathrm{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c}} =$$

$$\frac{\mathrm{THQ}\ \mathrm{x}\ \mathrm{AT}_{\mathrm{res-c}}\ \mathrm{x}\ \mathrm{ED}_{\mathrm{res-c}}\ \mathrm{x}\ \mathrm{BW}_{\mathrm{res-c}}}{\left[\left(\left(\frac{\mathrm{RBA}}{\mathrm{RfD_0}}\right)\ \mathrm{x}\ \mathrm{IRS}\right) + \left(\left(\frac{1}{\mathrm{RfD_D}}\right)\ \mathrm{x}\ \mathrm{SA}_{\mathrm{res-c}}\ \mathrm{x}\ \mathrm{AF}_{\mathrm{res-c}}\ \mathrm{x}\ \mathrm{ABS_d}\right)\right]\ \mathrm{x}\ \left(\mathrm{EF}_{\mathrm{res-c}}\ \mathrm{x}\ \mathrm{ED}_{\mathrm{res-c}}\right)\ \mathrm{x}\ \left(\frac{10^{-6}\ \mathrm{kg}}{\mathrm{mg}}\right)}$$

This USEPA terminology (immediately above), which is for a residential land use scenario involving a noncarcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
THQ	*THQ*	Target hazard quotient
$\mathrm{AT}_{\mathrm{res-c}}$	*AT*	Averaging time
$\mathrm{EF}_{\mathrm{res-c}}$	*EF*	Exposure frequency-child
$\mathrm{BW}_{\mathrm{res-c}}$	*BW*	Body weight - child
$\mathrm{ED}_{\mathrm{res-c}}$	*ED*	Exposure duration - child
RBA	None	Relative Bio-availability
$\mathrm{RfD_o}$	RfD_o	Oral reference dose

IRS	IR	Soil ingestion rate - child
RfD_D	RfD_D	Dermal reference dose
$SA_{res\text{-}c}$	SA	Skin surface area - child
$AF_{res\text{-}c}$	AF	Soil adherence factor - child
ABS_d	ABS_d	Dermal absorption fraction
$10^{-6}kg$	$10^{-6}kg$	Unit conversion factor
mg	mg	
GIABS	$GIABS$	Gastro-intestinal absorption fraction

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c} = \frac{THQ \ x \ AT \ x \ ED \ x \ BW}{(EF \ x \ ED) \ x \ \left(\frac{10^{-6} \, kg}{mg}\right) \ x \left[\left(\left(\frac{1}{RfD_0}\right) \ x \ IR\right) + \left(\frac{1}{RfD_D} \ x \ SA \ x \ AF \ x \ ABS_d\right)\right]}$$

Note that the USEPA term $SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}der\text{-}c}$ is the equivalent of the Department term ID_{nc}. In addition, there is no Department RBA parameter because the value is usually 1. Consequently, an RBA parameter does not appear in the translated equation. The equation presented immediately above is [page=914] equivalent to the Department equation presented in N.J.A.C. 7:26D Appendix 2 as Equation 2 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 2, Equation 2 is:

$$ID_{nc} = \frac{THQ * AT * ED * BW}{(EF * ED * 10^{-6} \, kg / mg) * [(\frac{1}{RfD_O} * IR) + (\frac{1}{RfD_D} * SA * AF * ABS_d)]}$$

N.J.A.C. 7:26D Appendix 2, Equation 3-Nonresidential Carcinogenic Ingestion-Dermal Human Health-Based Criteria

The origin of the Department nonresidential soil remediation standard for the ingestion-dermal exposure pathway for a carcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{ow\text{-}soil\text{-}ca\text{-}tot}\,(mg/kg) = \frac{1}{\frac{1}{SL_{ow\text{-}soil\text{-}ca\text{-}ing}} + \frac{1}{SL_{ow\text{-}soil\text{-}ca\text{-}der}} + \frac{1}{SL_{ow\text{-}soil\text{-}ca\text{-}inh}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by deleting the inhalation related screening level term:

$$\frac{1}{SL_{ow-soil-ca-inh}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the ingestion and dermal aspects, which is designated:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{ow-soil-ca-ing}}\right) + \left(\frac{1}{SL_{ow-soil-ca-der}}\right)}$$

The Department calculation of the nonresidential carcinogenic ingestion-dermal criterion is based on an adult outdoor worker exposure scenario.

As such, the RSLE states:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing}\,(mg/kg) = \frac{TR \times AT_{ow}\left(\frac{365\ days}{year} \times LT\ (70\ years)\right) \times BW_{ow}\ (80\ kg)}{EF_{ow}\left(225\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times CSF_{o}\left(\frac{mg}{kg\text{-}day}\right)^{-1} \times RBA \times IR_{ow}\left(100\ \frac{mg}{day}\right) \times \left(\frac{10^{-6}\ kg}{1\ mg}\right)}$$

and

$$SL_{ow\text{-}soil\text{-}ca\text{-}der}\,(mg/kg) = \frac{TR \times AT_{ow}\left(\frac{365\ days}{year} \times LT\ (70\ years)\right) \times BW_{ow}\ (80\ kg)}{EF_{ow}\left(225\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times \left(\frac{CSF_{o}\left(\frac{mg}{kg\text{-}day}\right)^{-1}}{GIABS}\right) \times SA_{ow}\left(\frac{3527\ cm^2}{day}\right) \times AF_{ow}\left(\frac{0.12\ mg}{cm^2}\right) \times ABS_{d} \times \left(\frac{10^{-6}\ kg}{1\ mg}\right)}$$

The above two equations include the units for the listed input parameters. Deleting the units simplify the two equations to:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing} = \frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times CSF_{o} \times RBA \times IR_{ow} \times \left(\frac{10^{-6}\,kg}{mg}\right)}$$

And

$$SL_{ow\text{-}soil\text{-}ca\text{-}der} = \frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times \left(\frac{CSF_{o}}{GIABS}\right) \times SA_{ow} \times AF_{ow} \times ABS_{d} \times \left(\frac{10^{-6}\,kg}{mg}\right)}$$

Because

$$GIABS = \frac{CSF_{o}}{CSF_{D}}$$

the second equation further simplifies to:

[page=915]

$$SL_{ow\text{-}soil\text{-}ca\text{-}der} = \frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times CSF_{D} \times SA_{ow} \times AF_{ow} \times ABS_{d} \times \left(\frac{10^{-6}\,kg}{mg}\right)}$$

Starting with the Department-modified base USEPA equation, as described above:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{ow-soil-ca-ing}}\right) + \left(\frac{1}{SL_{ow-soil-ca-der}}\right)}$$

1. Insert the simplified equations for $SL_{ow\text{-}soil\text{-}ca\text{-}ing}$ and $SL_{ow\text{-}soil\text{-}ca\text{-}der}$ described above into the denominator of the $SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der}$ equation, which then becomes:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{1}{\left[\left[\frac{1}{\left(\frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times CSF_{o} \times RBA \times IR_{ow} \times \left(\frac{10^{-6}\,kg}{mg}\right)}\right)}\right] + \left[\frac{1}{\left(\frac{TR \times AT_{ow} \times LT \times BW_{ow}}{EF_{ow} \times ED_{ow} \times CSF_{D} \times SA_{ow} \times AF_{ow} \times ABS_{d} \times \left(\frac{10^{-6}\,kg}{mg}\right)}\right)}\right]\right]}$$

2. Simplify the reciprocals in the equation denominator immediately above (similar to what was done in the derivation of N.J.A.C. 7:26D Appendix 2, Equation 1 above) using the respective terms:

$$\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } CSF_{o} \text{ x } RBA \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{EF_{ow} \text{ x } ED_{ow} \text{ x } CSF_{o} \text{ x } RBA \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

and

$$\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } CSF_{D} \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_{d} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{EF_{ow} \text{ x } ED_{ow} \text{ x } CSF_{D} \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_{d} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

Again, this is the same as multiplying the reciprocals in the equation denominator by 1.

3. This results in the following:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} =$$

$$\frac{1}{\left(\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } CSF_{o} \text{ x } RBA \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{TR \text{ x } AT_{ow} \text{ x } LT \text{ x } BW_{ow}}\right) + \left(\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } CSF_{D} \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_{d} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{TR \text{ x } AT_{ow} \text{ x } LT \text{ x } BW_{ow}}\right)}$$

4. After separating out the common terms (EF_{OW} x ED_{OW}) and

$$\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)$$

from both expressions in the denominator, multiply both the numerator and the denominator of the entire equation by the expression:

$$TR \text{ x } AT_{ow} \text{ x } LT \text{ x } BW_{ow}$$

Performing steps 1 through 4 above results in the following expression:

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$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{TR \text{ x } AT_{ow} \text{ x } LT \text{ x } BW_{ow}}{(EF_{ow} \text{ x } ED_{ow}) \text{ x } \left(\frac{10^{-6}\,kg}{mg}\right) \text{ x } \left((CSF_o \text{ x } RBA \text{ x } IR_{ow}) + (CSF_D \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d)\right)}$$

This USEPA terminology (immediately above), which is for a nonresidential land use scenario involving a carcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
TR	*TR*	Target cancer risk
AT_{ow}	*AT*	Averaging time - outdoor worker
LT	*LT*	Lifetime
CSF_o	CSF_o	Oral cancer slope factor
RBA	None	Relative Bio-availability
IR_{ow}	*IR*	Soil ingestion rate-outdoor worker
CSF_d	CSF_D	Dermal cancer slope factor
AF_{ow}	*AF*	Soil adherence factor-outdoor worker
ABS_d	ABS_d	Dermal absorption fraction
$10^{-6}kg$	$10^{-6}kg$	Unit conversion factor
mg	*mg*	
GIABS	*GIABS*	Gastro-intestinal absorption fraction

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der} = \frac{TR \; x \; AT \; x \; LT \; x \; BW}{(EF \; x \; ED) \; x \left(\frac{10^{-6}\,kg}{mg}\right) x \left((CSF_o \; x \; IR) + (CSF_D \; x \; SA \; x \; AF \; x \; ABS_d)\right)}$$

Note that the USEPA term $SL_{ow\text{-}soil\text{-}ca\text{-}ing\text{-}der}$ is the equivalent of the Department term ID_c. In addition, there is no Department RBA parameter because the value is usually 1. Consequently, an RBA parameter does not appear in the translated equation. The equation presented immediately above is equivalent to the Department equation presented in N.J.A.C. 7:26D Appendix 2 as Equation 3 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 2, Equation 3 is:

$$ID_c = \frac{TR * AT * LT * BW}{EF * ED * 10^{-6}\,kg/mg * [(CSF_O * IR) + (CSF_D * SA * AF * ABS_d)]}$$

N.J.A.C. 7:26D Appendix 2, Equation 4--Nonresidential Noncarcinogenic Ingestion-Dermal Human Health-Based Criteria

The origin of the Department nonresidential soil remediation standard for the ingestion-dermal exposure pathway for a noncarcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{ow\text{-}soil\text{-}nc\text{-}tot}\,(mg/kg) = \frac{1}{\frac{1}{SL_{ow\text{-}soil\text{-}nc\text{-}ing}} + \frac{1}{SL_{ow\text{-}soil\text{-}nc\text{-}der}} + \frac{1}{SL_{ow\text{-}soil\text{-}nc\text{-}inh}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by deleting the inhalation related screening level term:

$$\frac{1}{SL_{ow-soil-nc-inh}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the ingestion and dermal aspects, which is designated:

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$$SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der} = \frac{1}{\left(\frac{1}{SL_{ow-soil-nc-ing}}\right) + \left(\frac{1}{SL_{ow-soil-nc-der}}\right)}$$

The Department calculation of the nonresidential noncarcinogenic ingestion-dermal criterion is based on an adult outdoor worker exposure scenario. As such, the RSLE states:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing}(mg/kg) = \frac{THQ \times AT_{ow\text{-}a}\left(\frac{365\ days}{year} \times ED_{ow}\ (25\ years)\right) \times BW_{ow}\ (80\ kg)}{EF_{ow}\left(225\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times \frac{RBA}{RfD_o\left(\frac{mg}{kg\text{-}day}\right)} \times IR_{ow}\left(100\ \frac{mg}{day}\right) \times \left(\frac{10^{-6}\ kg}{1\ mg}\right)}$$

and

$$SL_{ow\text{-}soil\text{-}nc\text{-}der}(mg/kg) = \frac{THQ \times AT_{ow\text{-}a}\left(\frac{365\ days}{year} \times ED_{ow}\ (25\ years)\right) \times BW_{ow}\ (80\ kg)}{EF_{ow}\left(225\ \frac{days}{year}\right) \times ED_{ow}\ (25\ years) \times \left(\frac{1}{RfD_o\left(\frac{mg}{kg\text{-}day}\right) \times GIABS}\right) \times SA_{ow}\left(\frac{3527\ cm^2}{day}\right) \times AF_{ow}\left(\frac{0.12\ mg}{cm^2}\right) \times ABS_d \times \left(\frac{10^{-6}\ kg}{1\ mg}\right)}$$

The above two equations include the units for the listed input parameters. Deleting the units simplify the two equations to:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing} = \frac{THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}}{EF_{ow}\ x\ ED_{ow}\ x\ \left(\frac{RBA}{RfD_o}\right)\ x\ IR_{ow}\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

and

$$SL_{ow\text{-}soil\text{-}nc\text{-}der} = \frac{THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}}{EF_{ow}\ x\ ED_{ow}\ x\ \left(\frac{1}{RfD_o\ x\ GIABS}\right)\ x\ SA_{ow}\ x\ AF_{ow}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Because

$$\mathbf{GIABS} = \frac{RfD_D}{RfD_O}$$

the second equation further simplifies to:

$$SL_{ow\text{-}soil\text{-}nc\text{-}der} = \frac{THQ\ x\ AT_{ow}\ x\ ED_{ow}\ x\ BW_{ow}}{EF_{ow}\ x\ ED_{ow}\ x\ \left(\frac{1}{RfD_D}\right)\ x\ SA_{ow}\ x\ AF_{ow}\ x\ ABS_d\ x\ \left(\frac{10^{-6}\ kg}{mg}\right)}$$

Starting with the Department-modified base USEPA equation, as described above:

1. Insert the simplified equations for $SL_{ow\text{-}soil\text{-}nc\text{-}ing}$ and $SL_{ow\text{-}soil\text{-}nc\text{-}der}$ described above into the denominator of the $SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der}$ equation which then becomes:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der} =$$

$$\frac{1}{\left[\frac{1}{\left(\frac{THQ \text{ x } AT_{ow} \text{ x } ED_{ow} \text{ x } BW_{ow}}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{RBA}{RfD_o}\right) \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}\right)}\right] + \left[\frac{1}{\left(\frac{THQ \text{ x } AT_{ow} \text{ x } ED_{ow} \text{ x } BW_{ow}}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}\right)}\right]}$$

2. Simplify the reciprocals in the equation denominator immediately above (similar to what was done in the derivation of N.J.A.C. 7:26D Appendix 2, Equation 1 above) using the respective terms:

$$\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{RBA}{RfD_o}\right) \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{RBA}{RfD_o}\right) \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

and

$$\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}$$

Again, this is the same as multiplying each of the reciprocals in the equation denominator by 1.

3. This results in the following:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der} =$$

$$\frac{1}{\left(\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{RBA}{RfD_o}\right) \text{ x } IR_{ow} \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{THQ \text{ x } AT_{ow} \text{ x } ED_{ow} \text{ x } BW_{ow}}\right) + \left(\frac{EF_{ow} \text{ x } ED_{ow} \text{ x } \left(\frac{1}{RfD_D}\right) \text{ x } SA_{ow} \text{ x } AF_{ow} \text{ x } ABS_d \text{ x } \left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)}{THQ \text{ x } AT_{ow} \text{ x } ED_{ow} \text{ x } BW_{ow}}\right)}$$

4. After separating out the common terms

$$\left(\frac{10^{-6}\text{ kg}}{\text{mg}}\right)$$

and $(\mathbf{EF_{ow}} \text{ x } \mathbf{ED_{ow}})$ from both expressions in the denominator, multiply both the numerator and the denominator of the entire equation by the term:

$$\text{THQ x } \text{AT}_{ow} \text{ x } \text{ED}_{ow} \text{ x } \text{BW}_{ow}$$

Performing steps 1 through 4 above results in the following expression:

$$\text{SLow-soil-nc-ing-der} \quad =$$

$$\frac{\text{THQ x AT}_{ow} \text{ x ED}_{ow} \text{ x BW}_{ow}}{(\text{EF}_{ow} \text{ x ED}_{ow}) \text{ x } \left(\frac{10^{-6}\,\text{kg}}{\text{mg}}\right) \left[\left(\left(\frac{\text{RBA}}{\text{RfD}_0}\right) \text{ x IR}_{ow}\right) + \left(\left(\frac{1}{\text{RfD}_D}\right) \text{ x SA}_{ow} \text{ x AF}_{ow} \text{ x ABS}_d\right)\right]}$$

This USEPA terminology (immediately above), which is for a nonresidential land use scenario involving a noncarcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
THQ	*THQ*	Target hazard quotient
AT_{ow}	*T*	Averaging time-outdoor worker
EF_{ow}	*EF*	Exposure frequency-outdoor worker
BW_{ow}	*BW*	Body weight-outdoor worker
ED_{ow}	*ED*	Exposure duration-outdoor worker
RBA	None	Relative Bio-availability
RfD_o	*RfD_o*	Oral reference dose
IR_{ow}	*IR*	Soil ingestion rate-outdoor worker
RfD_D	*RfD_D*	Dermal reference dose
SA_{ow}	*SA*	Skin surface area-outdoor worker

AF_{ow}	AF	Soil adherence factor-outdoor worker
ABS_d	ABS_d	Dermal absorption fraction
$\frac{10^{-6} kg}{mg}$	$\frac{10^{-6} kg}{mg}$	Unit conversion factor
GIABS	*GIABS*	Gastro-intestinal absorption fraction

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der} = \frac{THQ\ x\ AT\ x\ ED\ x\ BW}{(EF\ x\ ED)\ x\ \left(\frac{10^{-6}\ kg}{mg}\right) x \left(\left(\frac{1}{RfD_O}\ x\ IR\right) + \left(\frac{1}{RfD_D}\ x\ SA\ x\ AF\ x\ ABS_d\right)\right)}$$

Note that the USEPA term $SL_{ow\text{-}soil\text{-}nc\text{-}ing\text{-}der}$ is the equivalent if the Department term $ID_{nc.}$ In addition, there is no Department RBA parameter because the value is usually 1. Consequently, an RBA parameter does not appear in the translated equation. The equation presented immediately above is equivalent to the Department equation presented at N.J.A.C. 7:26D Appendix 2 as Equation 4 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 2, Equation 4 is:

$$ID_{nc} = \frac{THQ * AT * ED * BW}{(EF * ED * 10^{-6} kg / mg) * [(\frac{1}{RfD_O} * IR) + (\frac{1}{RfD_D} * SA * AF * ABS_d)]}$$

N.J.A.C. 7:26D Appendix 3, Equation 1--Carcinogenic Inhalation Human Health-Based Criteria

The Department addresses both residential and nonresidential land uses in calculating the carcinogenic-based inhalation exposure pathway soil criteria by applying the appropriate exposure assumptions. The equivalency demonstration made here uses the residential land use scenario equation and terminology as the specific example. The same equivalency logic also applies to the nonresidential land use scenario.

The origin of the Department residential soil remediation standard for the inhalation exposure pathway for a carcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}soil\text{-}ca\text{-}tot}\,(mg/kg) = \frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}ing}} + \frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}der}} + \frac{1}{SL_{res\text{-}soil\text{-}ca\text{-}inh}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by isolating the inhalation related screening level term:

$$\frac{1}{SL_{res-soil-ca-inh-a}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the inhalation aspect, which is designated:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a} = \frac{1}{\left(\frac{1}{SL_{res-soil-nc-inh-a}}\right)} = SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}$$

The RSLE states that:

$$SL_{res\text{-}soil\text{-}ca\text{-}inh}\,(mg/kg) = \frac{TR \times AT_{res}\left(\frac{365\ days}{year} \times LT\,(70\ years)\right)}{IUR\left(\mu g/_{m^3}\right)^{-1} \times \left(\frac{1000\ \mu g}{mg}\right) \times EF_{res}\left(\frac{350\ days}{year}\right) \times \left(\frac{1}{VF_{ulim}\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right) \times ED_{res}\,(26\ years) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right)}$$

The above equation includes the units for the listed input parameters. Deleting the units simplifies the equation to:

$$SL_{res\text{-}soil\text{-}ca\ \text{-}inh} = \frac{TR\ x\ AT_{res}\ x\ LT}{IUR\ x\ \left(\frac{1000\ ug}{mg}\right)\ x\ EF_{res}\ x\ \left|\frac{1}{VF_{ulim}} + \frac{1}{PEF}\right|\ x\ ED_{res}\ x\ ET_{res}\ x\ \left(\frac{1\ day}{24\ hours}\right)}$$

This USEPA terminology, which is for a residential land use scenario involving a carcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
TR	*TR*	Target cancer risk
AT_{res}	*AT*	Averaging time - residential

LT	*LT*	Lifetime
IUR	*IUR*	Inhalation unit risk factor
EF_{res}	*EF*	Exposure frequency - residential
VF_{ulim}	*VF*	Soil-to-air volatilization factor
PEF	*PEF*	Particulate emission factor
EDres	*ED*	Exposure duration - residential
ETres	*ET*	Exposure time - residential
$\frac{1000\ ug}{mg}$	$\frac{1000\ ug}{mg}$	Unit conversion factor
$\frac{1\ day}{24\ hours}$	$\frac{1\ day}{24\ hours}$	Unit conversion factor

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{res\text{-}soil\text{-}ca\text{ -}inh} = \frac{TR\ x\ AT\ x\ LT}{IUR\ x\ \left(\frac{1000\ ug}{mg}\right)\ x\ EF\ x\ \left[\frac{1}{VF}+\frac{1}{PEF}\right]\ x\ ED\ x\ ET\ x\ \left(\frac{1\ day}{24\ hours}\right)}$$

As the USEPA term $SL_{res\text{-}soil\text{-}ca\text{-}inh}$ is the equivalent of the Department term Inh_c, the equation presented above is equivalent to the Department equation presented at N.J.A.C. 7:26D Appendix 3 as Equation 1 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 3, Equation 1 is:

$$Inh_c = \frac{TR * AT * LT}{IUR * 1000\,{}^{\mu g}/_{mg} * EF * \left(\frac{1}{VF}+\frac{1}{PEF}\right) * ED * ET * \frac{1 day}{24 hours}}$$

N.J.A.C. 7:26D Appendix 3, Equation 2--Noncarcinogenic Inhalation Human Health-Based Criteria

The Department addresses both residential and nonresidential land uses in calculating the noncarcinogenic-based inhalation exposure pathway soil criteria by applying the appropriate exposure assumptions. The equivalency demonstration made here uses the residential land use scenario equation and terminology as the specific example. The same equivalency logic also applies to the nonresidential land use scenario.

The origin of the Department residential soil remediation standard for the inhalation exposure pathway for a noncarcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}soil\text{-}nc\text{-}tot\text{-}a}\left(mg/kg\right) = \frac{1}{\frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}ing\text{-}a}} + \frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}der\text{-}a}} + \frac{1}{SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}}}$$

This is the equation used by the USEPA to develop soil contaminant screening levels where the human health risks from the ingestion exposure pathway, the dermal exposure pathway, and the inhalation exposure pathway are combined. However, the soil remediation standards the Department developed only combine the ingestion and dermal exposure pathways and address the inhalation exposure pathway separately. Consequently, the Department modified the USEPA equation listed above by isolating the inhalation related screening level term:

$$\frac{1}{SL_{res-soil-nc-inh-a}}$$

The resulting modified equation represents not the total of the ingestion, dermal, and inhalation exposure components, but just the inhalation aspect, which is designated:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a} = \frac{1}{\left(\frac{1}{SL_{res-soil-nc-inh-a}}\right)} = SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}$$

The RSLE states that:

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$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a}\left(mg/kg\right) = \frac{THQ \times AT_{res\text{-}a}\left(\frac{365\ days}{year} \times ED_{res}\left(26\ years\right)\right)}{EF_{res\text{-}a}\left(\frac{350\ days}{year}\right) \times ED_{res}\left(26\ years\right) \times ET_{res\text{-}a}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times \frac{1}{RfC\left({}^{mg}\!/\!_{m^3}\right)} \times \left(\frac{1}{VF_{ulim}\left(\frac{m^3}{kg}\right)} + \frac{1}{PEF\left(\frac{m^3}{kg}\right)}\right)}$$

The above equation includes the units for the listed input parameters. Deleting the units simplifies the equation to:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a} = \frac{THQ \text{ x } AT_{res-a} \text{ x } ED_{res}}{EF_{res-a} \text{ x } ED_{res} \text{ x } ET_{res-a} \text{ x } \frac{1\text{ day}}{24\text{ hours}} \text{ x } \frac{1}{RfC} \text{ x } \left(\frac{1}{VF_{ulim}} + \frac{1}{PEF}\right)}$$

This USEPA terminology, which is for a residential land use scenario involving a noncarcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
THQ	*THQ*	Target hazard quotient
AT_{res-a}	*AT*	Averaging time-residential adult
EF_{res-a}	*EF*	Exposure frequency-residential adult
ED_{res-a}	*ED*	Exposure duration-residential adult
ET_{res-a}	*ET*	Exposure time - residential adult
RfC	*RfC*	Reference concentration
VF_{ulim}	*VF*	Soil-to-air volatilization factor
PEF	*PEF*	Particulate emission factor
$\frac{1\text{ day}}{24\text{ hours}}$	$\frac{1\ day}{24\ hours}$	Unit conversion factor

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{res\text{-}soil\text{-}nc\text{-}inh\text{-}a} = \frac{THQ\ x\ AT\ x\ ED}{EF\ x\ ED\ x\ ET\ x\ \frac{1\ day}{24\ hours}\ x\ \frac{1}{RfC}\ x\ \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

As the USEPA term $SL_{res\text{-}soil\text{-}nc\text{-}inh}$ is the equivalent of the Department term Inh_{nc}, the equation presented above is equivalent to the Department equation presented at N.J.A.C. 7:26D Appendix 3 as Equation 2 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 3, Equation 2 is:

$$Inh_{nc} = \frac{THQ * AT * ED}{EF * ED * ET * \frac{1day}{24hours} * \frac{1}{RfC} * \left(\frac{1}{VF} + \frac{1}{PEF}\right)}$$

N.J.A.C. 7:26D Appendix 5, Equation 1--Carcinogenic Indoor Air Human Health-Based Criteria

The Department addresses both residential and nonresidential land uses in calculating the carcinogenic indoor air human health-based criteria by applying the appropriate exposure assumptions. The equivalency demonstration made here uses the residential land use scenario equation and terminology as the specific example. The same equivalency logic also applies to the nonresidential land use scenario.

The origin of the Department residential indoor air remediation standard for the vapor intrusion exposure pathway for a carcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}air\text{-}ca}\left(\mu g/m^3\right) = \frac{TR \times AT_{res}\left(\frac{365\text{ days}}{\text{year}} \times LT\left(70\text{ years}\right)\right)}{EF_{res}\left(\frac{350\text{ days}}{\text{year}}\right) \times ED_{res}\left(26\text{ years}\right) \times ET_{res}\left(\frac{24\text{ hours}}{\text{day}}\right) \times \left(\frac{1\text{ day}}{24\text{ hours}}\right) \times IUR\left(\frac{\mu g}{m^3}\right)^{-1}}$$

The above equation includes the units for the listed input parameters. Deleting the units simplifies the equation to:

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$$SL_{res\text{-}air\text{-}ca} = \frac{TR \text{ x } AT_{res} \text{ x } LT}{EF_{res} \text{ x } ED_{res} \text{ x } ET_{res} \text{ x } \left(\frac{1\text{ day}}{24\text{ hours}}\right) \text{ x } IUR}$$

This USEPA terminology, which is for a residential land use scenario involving a carcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
TR	*TR*	Target cancer risk
AT_{res}	*AT*	Averaging time - residential
LT	*LT*	Lifetime
IUR	*IUR*	Inhalation unit risk factor

EF_{res}	*EF*	Exposure frequency - residential
EDres	*ED*	Exposure duration - residential
ETres	*ET*	Exposure time - residential
$\frac{1\ day}{24\ hours}$	$\frac{1\ day}{24\ hours}$	Unit conversion factor

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{res\text{-}air\text{-}ca} = \frac{TR\ x\ AT\ x\ LT}{EF\ x\ ED\ x\ ET\ x\ \left(\frac{1\ day}{24\ hours}\right)\ x\ IUR}$$

As the USEPA term $SL_{res\text{-}air\text{-}ca}$ is the equivalent of the Department term IA_c, the equation presented above is equivalent to the Department equation presented at N.J.A.C. 7:26D Appendix 5 as Equation 1 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 5, Equation 1 is:

$$IA_c = \frac{TR * AT * LT}{EF * ED * ET * \frac{1}{24}\frac{day}{hours} * IUR}$$

N.J.A.C. 7:26D Appendix 5, Equation 2--Noncarcinogenic Indoor Air Human Health-Based Criteria

The Department addresses both residential and nonresidential land uses in calculating the noncarcinogenic indoor air human health-based criteria by applying the appropriate exposure assumptions. The equivalency demonstration made here uses the residential land use scenario equation and terminology as the specific example. The same equivalency logic also applies to the nonresidential land use scenario.

The origin of the Department residential indoor air remediation standard for the vapor intrusion exposure pathway for a noncarcinogen is based upon the USEPA, Regional Screening Levels, Equations (November 2018) (RSLE):

$$SL_{res\text{-}air\text{-}nc}\left(\mu g/m^3\right) = \frac{THQ \times AT_{res\text{-}a}\left(\frac{365\ days}{year} \times ED_{res}(26\ years)\right) \times \left(\frac{1000\ \mu g}{mg}\right)}{EF_{res}\left(\frac{350\ days}{year}\right) \times ED_{res}(26\ years) \times ET_{res}\left(\frac{24\ hours}{day}\right) \times \left(\frac{1\ day}{24\ hours}\right) \times \frac{1}{RfC\left(\frac{mg}{m^3}\right)}}$$

The above equation includes the units for the listed input parameters. Deleting these units simplifies the equation to:

$$SL_{res\text{-}air\text{-}nc} = \frac{THQ\ x\ AT_{res-a}\ x\ ED_{res}\ x\ \left(\frac{1000\ ug}{mg}\right)}{EF_{res}\ x\ ED_{res}\ x\ ET_{res}\ x\ \left(\frac{1\ day}{24\ hours}\right)\ x\ \left(\frac{1}{RfC}\right)}$$

This USEPA terminology, which is for a residential land use scenario involving a noncarcinogenic contaminant, converts to the Department terminology as follows:

USEPA Term	Department Term	USEPA Definition
THQ	*THQ*	Target hazard quotient
$AT_{res\text{-}a}$	*AT*	Averaging time-residential adult
EF_{res}	*EF*	Exposure frequency-residential adult
ED_{res}	*ED*	Exposure duration-residential adult
ET_{res}	*ET*	Exposure time - residential adult
RfC	*RfC*	Reference concentration
$\frac{1000\ ug}{mg}$	$\frac{1000\ ug}{mg}$	Unit conversion factor
$\frac{1\ day}{24\ hours}$	$\frac{1\ day}{24\ hours}$	Unit conversion factor

Using the above terminology to translate this equation into Departmental nomenclature, the equation becomes:

$$SL_{res\text{-}air\text{-}nc} = \frac{THQ\ x\ AT\ x\ ED\ x\ \left(\frac{1000\ ug}{mg}\right)}{EF\ x\ ED\ x\ ET\ x\ \left(\frac{1\ day}{24\ hours}\right)\ x\ \left(\frac{1}{RfC}\right)}$$

As the USEPA term $SL_{res\text{-}air\text{-}nc}$ is the equivalent of the Department term IA_{nc}, the equation presented above is equivalent to the equation presented at N.J.A.C. 7:26D Appendix 5 as Equation 2 and verifies its equivalence with equations used by the USEPA.

N.J.A.C. 7:26D Appendix 5, Equation 2 is:

$$IA_{nc} = \frac{THQ * AT * ED * \frac{1000\ \mu g}{mg}}{EF * ED * ET * \frac{1}{24}\frac{day}{hours} * \frac{1}{RfC}}$$

References

USEPA (2018) Regional Screening Levels (RSLs)--Equations (November 2018)

http://www.epa.gov/risk/regional-screening-levels-rsls-equations

CHAPTER 26E

TECHNICAL REQUIREMENTS FOR SITE REMEDIATION

SUBCHAPTER 1. GENERAL INFORMATION

7:26E-1.5 General remediation requirements

(a)-(b) (No change.)

(c) The person responsible for conducting the remediation of a site shall remediate to comply with the Remediation Standards, N.J.A.C. 7:26D.

(d)-(i) (No change.)

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