Regulatory Analysis Form

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INDEPENDENT REGULATORY REVIEW COMMISSION

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Independent Regulatory Review Commission

July 2, 2024

IRRC Number: 3409

(1) Agency:

Department of Environmental Protection

(2) Agency Number: 7

Identification Number: 575

(3) PA Code Cite:

25 Pa. Code Chapter 250

(4) Short Title:

Administration of the Land Recycling Program

(5) Agency Contacts (List Telephone Number and Email Address):

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(6) Type of Rulemaking (check applicable box):

- ☒ Proposed Regulation
- ☐ Final Regulation
- ☐ Final Omitted Regulation
- ☐ Emergency Certification Regulation;
  - ☐ Certification by the Governor
  - ☐ Certification by the Attorney General

(7) Briefly explain the regulation in clear and nontechnical language. (100 words or less)

The Department of Environmental Protection's (Department) Land Recycling Program implements standards for the cleanup of soil and groundwater contamination from releases of various toxic and carcinogenic chemicals. Every three years, the Department is required by regulation to evaluate new scientific information and, as necessary, propose changes to the medium-specific concentrations (MSC) that are a part of the statewide health standard.

This regulation proposes to: add Per- and Polyfluoroalkyl substances (PFAS) compounds; update the models, values, and attainment methods for the statewide health standard for lead in soil; revise the methods for attaining toxicity values for polycyclic aromatic hydrocarbon (PAH) compounds; update the interpretation of toxicity values from the Health Effects Summary Tables (HEAST) database; and adopt more stringent toxicity values for nineteen compounds based on United States Environmental Protection Agency (EPA) guidance.

Finally, the regulation would clarify that drinking water maximum contaminant levels (MCL) and health advisory levels (HAL) become effective as MSCs upon publication of the final MCL or HAL by the EPA or the Department.

(8) State the statutory authority for the regulation. Include specific statutory citation.

This rulemaking is authorized under sections 104(a) and 303(a) of the Land Recycling and Remediation Standards Act (the Land Recycling Act or Act 2) (35 P.S. §§ 6026.104(a)), and 6026.303(a)), and section 1920-A of The Administrative Code of 1929 (71 P.S. § 510-20). Section 104(a) of the Land Recycling Act authorizes the Environmental Quality Board (Board) to adopt statewide health standards, appropriate mathematically valid statistical tests to define compliance with the Land Recycling Act and other regulations that may be needed to implement the provisions of the Land Recycling Act. Section 303(a) of the Land Recycling Act authorizes the Board to promulgate statewide health standards for regulated substances for each environmental medium and methods used to calculate the standards. Section 1920-A authorizes the Board to formulate, adopt and promulgate rules and regulations that are necessary for the proper work of the Department.

(9) Is the regulation mandated by any federal or state law or court order, or federal regulation? Are there any relevant state or federal court decisions? If yes, cite the specific law, case or regulation as well as, any deadlines for action.

This proposed rulemaking is not mandated under Federal law. Federal law, however, encourages states to develop programs for voluntary clean-up of contaminated sites. See 42 U.S.C. § 9628 (relating to State response programs). On April 21, 2004, the EPA and the Department signed the One Cleanup Program Memorandum of Understanding (One Cleanup Program) under the agencies' authority under the Federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. § 9601—9675) and Act 2 (35 P.S. 6026.101—6026.908), respectively, that requires the Department to ensure, among other things, that voluntary responses conducted under Act 2 are protective of human health and the environment and that the Department review every report relating to the investigation, assessment and clean-up of a site submitted by a remediator. The One Cleanup Program encourages the Department regularly to review the efficacy of the Land Recycling Program's regulations codified at 25 Pa. Code Chapter 250.

State law requires the promulgation of this rulemaking. Section 303(a) of the Land Recycling Act (35 P.S. § 6026.303(a)) mandates that "[t]he Environmental Quality Board shall promulgate Statewide health standards for regulated substances for each environmental medium," and that "[t]he standards shall include any existing numerical residential and nonresidential health-based standards adopted by the Department and by the Federal Government by regulation or statute, and health advisory levels." The term "HAL" is defined in section 103 of Act 2 (35 P.S. § 6026.103) as "[t]he health advisory levels published by the United States Environmental Protection Agency for particular substances." When section 303(a) and this definition of HALs are read in context, they require that the Board adopt a HAL as an MSC once it has been published by EPA. Since the last rulemaking to update the land Recycling Program's regulations, the Department has established new MCLs for PFAS compounds perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) and the EPA has published new HALs for PFAS compounds hexafluoropropylene oxide (HFPO) dimer acid, HFPO dimer acid ammonium salt (Gen-X), perfluorobutane sulfonate (PFBS), and the potassium salt of PFBS. These new MCLs and HALs must be incorporated into the regulations.

The Department's regulations at 25 Pa. Code § 250.11 (relating to periodic review of MSCs) require the Department to regularly review new scientific information that relates to the basis of the MSCs and to propose appropriate regulations to the Board whenever necessary, but not later than 36 months from the

effective date of the most recently promulgated regulations. The most recent of these rulemakings took effect upon publication in the *Pennsylvania Bulletin* on November 20, 2021. See 51 Pa.B. 7173.

(10) State why the regulation is needed. Explain the compelling public interest that justifies the regulation. Describe who will benefit from the regulation. Quantify the benefits as completely as possible and approximate the number of people who will benefit.

The proposed rulemaking is needed to comply with the Department's obligation under 25 Pa. Code § 250.11 to review scientific information that serves as the basis for Act 2 MSCs and to propose appropriate changes to the Board, when necessary. The proposed rulemaking is also necessary to incorporate several State MCLs and federal HALs published for PFAS compounds, as well as to adopt updated EPA models and the EPA's default variables for calculating soil values for lead. Finally, this proposed rulemaking is necessary to update and improve the methods for identifying the most current and scientifically valid toxicity values, particularly the selection of HEAST values.

There are several public interests that justify the need for this proposed rulemaking.

The elimination of public health and environmental hazards on existing commercial and industrial land across the Commonwealth is vital to their use and reuse as sources of employment, housing, recreation and open-space areas. The reuse of industrial land is an important component of a sound land-use policy that will help prevent the needless development of prime farmland, open-space areas and natural areas and reduce public costs for installing new water, sewer and highway infrastructure.

The Administration of the Land Recycling Program regulations provide standards used during the cleanup of contaminated sites in Pennsylvania. These standards apply to all releases of regulated substances that are addressed under the Land Recycling Act, the Hazardous Sites Cleanup Act (35 P.S. §§ 6020.101—6020.1305), the Solid Waste Management Act (35 P.S. §§ 6018.101—6018.1003), the Storage Tank and Spill Prevention Act (35 P.S. §§ 6021.101—6021.2104), and the Clean Streams Law (35 P.S. §§ 691.1—691.1001). Releases of regulated substances not only pose a threat to the environment, but also could affect the health of the general public if they are inhaled or ingested. With new research being conducted every day, it is necessary that the residents of Pennsylvania be adequately protected with site cleanup requirements based on the most up-to-date information.

Chemical substances that can have toxic or carcinogenic effects, as defined under Act 2 and the regulations promulgated thereunder, are widespread in use and potential contamination of soil and groundwater from accidental spills and unlawful disposal can impact almost any resident of the Commonwealth. Examples of substances that contain toxic or carcinogenic properties include gasoline and petroleum products, solvents, elements used in manufacture of metals and alloys, pesticides, herbicides, and some dielectric fluids previously contained in transformers and capacitors.

The Land Recycling Act requires the Board to establish by regulation a uniform statewide health standard that can be used to eliminate any substantial present or probable future risk to human health and the environment. The original standard was promulgated in 1997 and codified in Chapter 250. Section 104(a) of the Land Recycling Act explicitly recognizes that this standard would need to be updated over time as better science became available and as the need for clarification or enhancement of the program became apparent. Updating the standard serves the public, as the Department is able to use the most up-to-date health and scientific information to establish the cleanup standard for exposure to substances that cause cancer or have other toxic effects on human health. The statewide health standard is expressed as

a list of MSCs, which apply to either soil or groundwater contamination and to residential and non-residential exposure scenarios as authorized under the Land Recycling Act.

The proposed changes in the MSCs in these amendments to Chapter 250 serve both the public and the regulated community as they provide clear information on what is required at contaminated sites. Having access to that information allows the public to know the acceptable level of contamination at a site based on the intended use of the property, and it provides remediators with a uniform endpoint to the remediation process. Because each site and situation is unique, it is necessary to provide different MSCs for: 1) specific constituents in groundwater at points of compliance, 2) specific constituents in soil, where there may be direct contact through ingestion or inhalation, and 3) specific constituents in soil that may leech into groundwater. Each of these MSCs is based on the physical and toxicological properties of a specific regulated substance, which are based on scientific sources of information.

The benefits of this proposed rulemaking are difficult to quantify because, unlike other statutory or permitting schemes, Act 2 does not prevent contamination but instead provides remediators with a variety of options to address sites that have existing contamination. In that sense, this proposed rulemaking, consistent with Act 2, benefits the public because it allows for more efficient and more expedient remediation and reuse of contaminated areas while still protecting public health and safety.

(11) Are there any provisions that are more stringent than federal standards? If yes, identify the specific provisions and the compelling Pennsylvania interest that demands stronger regulations.

No provisions are more stringent than federal cleanup standards. In fact, Act 2 prohibits any standards that are more stringent than Federal standards. Act 2 states that "[t]he department shall not establish procedures for determining attainment of remediation standards where maximum contaminant levels and health advisory levels have already been established for regulated substances." See 35 P.S. § 6026.301(c) (related to determining attainment). Act 2 further states that "standards adopted under this section [Section 303 Statewide health standard] shall be no more stringent than those standards adopted by the Federal Government." See 35 P.S. § 6026.303(a) (relating to Statewide Health Standard).

(12) How does this regulation compare with those of the other states? How will this affect Pennsylvania's ability to compete with other states?

The proposed updates to Chapter 250 will not affect Pennsylvania's ability to compete with other states.

The Chapter 250 regulations provide a uniform Statewide health standard that is not available in many other states. In comparison, the Federal government and many states do not have similar generic cleanup values and instead require a site-specific risk analysis at every site to establish a numeric value that is used to determine the completion of soil and groundwater cleanup. The Land Recycling Act provides for a generic statewide health standard that can be used as an efficient way to clean up sites, particularly where small spills and releases contaminate soil. However, the ability to conduct a risk analysis to establish a cleanup value on an individual site basis is also available through the site-specific cleanup standard under Land Recycling Act, providing an additional option.

The existing regulations and this proposed rulemaking promote and facilitate the remediation and redevelopment of idle and underutilized commercial and industrial sites while protecting the public health and the environment.

(13) Will the regulation affect any other regulations of the promulgating agency or other state agencies? If yes, explain and provide specific citations.

The proposed rulemaking would not directly affect any of the Department's existing regulations or any regulations promulgated by other state agencies. While some Department regulations incorporate elements of Chapter 250 by reference, this proposed rulemaking would not require the Department to update any other regulations separate from Chapter 250.

(14) Describe the communications with and solicitation of input from the public, any advisory council/group, small businesses, and groups representing small businesses in the development and drafting of the regulation. List the specific persons and/or groups who were involved. ("Small business" is defined in Section 3 of the Regulatory Review Act, Act 76 of 2012.)

The Department worked with the Cleanup Standards Scientific Advisory Board (CSSAB) during the development of this proposed rulemaking. The purpose of the CSSAB is to assist the Department and the Board in developing statewide health standards, determining the appropriate statistically and scientifically valid procedures and risk factors to be used, and providing other technical advice as needed to implement Act 2. Members of the Cleanup Standards Scientific Advisory Board (CSSAB) typically have a background in engineering, biology, hydrogeology, statistics, medicine, chemistry, toxicology, or other related scientific education or experience. Some members of the CSSAB represent small businesses and other members work as environmental consultants and attorneys and represent small business clients.

During the public comment period on the previous Chapter 250 rulemaking, the Board received many comments regarding the values proposed for lead. Most of the commentators expressed concern with the proposed increase in the non-residential direct contact numeric value for lead in surface soil in Table 4A. The primary reason for this concern was the use of 10 µg/dL as a target blood lead level (TBLL). Due to the large number of comments and concerns, the Department published an Advanced Notice of Proposed Rulemaking (ANPR) in the October 30, 2021 issue of the *Pennsylvania Bulletin* to solicit information necessary to prepare this proposed rulemaking. Specifically, the Department requested information which could be used to evaluate the proposed updates to the lead models used to calculate the soil lead MSCs, potential changes to model input parameters, and potential changes to the statistical tests used to demonstrate attainment of the Statewide health standard for lead in soil at Act 2 remediation sites. During the submission period for the ANPR, the Department received comments from three individuals that were considered during the development of this proposed rulemaking.

The Department presented initial concepts for this proposed rulemaking to the CSSAB at its August 11, 2021 meeting. At this meeting, the CSSAB and the Department agreed that the CSSAB should form two workgroups: one to work through the various issues on lead and another to work through the concerns regarding PAH toxicity values.

The CSSAB Lead workgroup reviewed the various issues raised during the previous rulemaking comment period as well as the ANPR. These issues included the target blood lead level, the various inputs to be used in the new models, and the use of averaging for attainment of the direct contact values. The CSSAB PAH workgroup addressed questions regarding the relative potency factors (RPFs) in comparison to the various other toxicity value sources. Both workgroups developed whitepapers which were presented at CSSAB meetings on June 30 and August 11, 2022, and are attached to this document.

During CSSAB meetings on October 10, 2022, January 23 and May 31, 2023, CSSAB members had the opportunity to review and provide feedback on draft proposed regulatory amendments to Chapter 250. The Department worked with the CSSAB to resolve their concerns. Following these presentations and discussions, the CSSAB voted on January 23, 2023, to concur with the Department's recommendation to move the proposed regulation forward to the Board for consideration. After making additional updates to the draft regulation to address changes to the HEAST values and to add the PFAS compound PFHxA, the CSSAB reviewed and affirmed their decision to support the Department on May 31, 2023.

All of the documents and discussions from the CSSAB meetings are available on the CSSAB website: https://www.dep.pa.gov/PublicParticipation/AdvisoryCommittees/Cleanup%20and%20Brownfields%20Advisory%20Committees/CSSABoard/Pages/default.aspx. These can be found either under "Archived meetings" or "Agendas and Handouts."

(15) Identify the types and number of persons, businesses, small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012) and organizations which will be affected by the regulation. How are they affected?

The proposed amendments to the Land Recycling Program regulations would affect property owners of contaminated sites, operators of commercial and industrial facilities where hazardous substances are spilled onto soil or are released into groundwater, and purchasers of historically contaminated brownfield sites that are intended for redevelopment. A brownfield site is a property that's current or future use is impaired by a real or perceived contamination. This proposed rulemaking would also protect public health by minimizing exposure to substances released into the shared environment.

Overall, no particular category of person, business or organization is expected to be substantially adversely affected by the proposed updates to Chapter 250. The types of businesses affected could include gasoline service stations, fuel distribution facilities, commercial facilities that use toxic or carcinogenic chemicals, manufacturing operations, and redevelopers of brownfield sites. There are approximately 12,000 facilities in the Commonwealth that contain regulated underground and above ground storage tanks, including gasoline stations and fuel distribution and storage facilities. Some of these facilities include small gasoline station owners. Small businesses also make up some of the commercial facilities that use toxic or carcinogenic substances. Because of the broad potential reach of this regulation, it is difficult for the Department to identify further specifics on the types and numbers of small businesses that would potentially be affected by releases of regulated substances.

The number of completed remediations vary each year. On average, remediators apply the Act 2 remediation standard to just under 300 contaminated properties across the Commonwealth per year. Generally, any cost related to a given site remediation depends in large part on which regulated substances are being remediated and what the specific soil and groundwater conditions are at the site.

The proposed changes to the Chapter 250 regulations are not expected to increase costs or provide any significant savings for the regulated community. Language changes made to numerous sections of the regulation provide clarity in the regulatory requirements and ensure references in the regulation are appropriate and consistent. MSCs have been promulgated for 400 regulated substances and are divided into two environmental mediums: soil and groundwater. The same regulated substance may have standards in both mediums. The soils MSCs provide standards for direct contact and ingestion of soil. The groundwater MSCs provide standards related to human consumption of groundwater or use of groundwater for agricultural purposes. Under this proposal, the MSC values for many regulated substances are being changed due to a variety of reasons. The most common reason for changes is due

to changes in toxicity values. Approximately 45% of the changes to the MSC tables for soils lower the current values and the other 55% increase those values. Approximately half of the changes to the groundwater table for organic substances lower the current values while the other half increase those values. Lowering the values may indicate a more stringent cleanup is required at a site and increasing the values may indicate a less stringent cleanup is required at a site.

The financial impact on a given site remediation would depend on the specific regulated substances being remediated and the specific soil and groundwater conditions at the site. For example, a site with a tight clay soil profile may not allow contaminants to spread horizontally or vertically. Therefore, the amount of soil to be excavated in this situation will not significantly change to meet a lower or higher MSC value. However, it is important to note that the site remediator always has the option of using a site-specific cleanup standard.

Most small businesses that the Department can identify as possibly being affected by this regulation are owners of small gasoline stations. In addition, many of these businesses are required to participate in the Underground Storage Tank Indemnification Fund, which provides insurance coverage for the costs to clean up releases from their tanks, regardless of the MSC value used at the site.

Developers or remediators planning to build for new residential developments may be impacted by this change. It is unlikely to impact individual residents. Overall, no type of person or business is expected to be adversely affected by the updates to Chapter 250.

Accordingly, the Department believes that there will be little if any adverse impact to small businesses.

(16) List the persons, groups or entities, including small businesses, that will be required to comply with the regulation. Approximate the number that will be required to comply.

These proposed amendments to the land recycling regulations would impact any person addressing a release of a regulated substance at a property, whether voluntarily or as a result of an order by the Department, but would not impact any particular category of person with additional or new regulatory obligations. Under Act 2, a remediator may voluntarily select the standard to which to remediate. To complete a remediation, a person must then comply with all relevant remediation standards and administrative requirements. This proposed rulemaking would not affect the voluntary nature of Act 2.

The types of businesses that may need to comply with the regulations include gasoline service stations, fuel distribution facilities, commercial facilities that use toxic or carcinogenic chemicals, manufacturing operations, and redevelopers of brownfield sites. There are approximately 12,000 facilities in the Commonwealth that contain regulated underground and aboveground storage tanks, including gasoline stations and fuel distribution and storage facilities. Some of these facilities would include small gasoline station owners. Small businesses would also make up some of the commercial facilities that use toxic or carcinogenic substances. Not all of these facilities have releases or accidental spills that result in a cleanup obligation.

The number of remediations completed can vary from year to year. On average, remediators apply the Act 2 remediation standard to just under 300 contaminated properties across the Commonwealth per year. The Department does not expect that the proposed amendments would impact the number of remediations voluntarily completed or those that must be completed as a result of Department enforcement actions.

As noted above in the response to Question 15, while these proposed amendments would not likely impact a specific category of person or company, the amendments would still affect many types of responsible parties who need to address contamination under Chapter 250. The Department expects the impact of the proposed updates to Chapter 250 to be insignificant on persons and businesses that are attempting to complete the remediation process under Chapter 250. Please also see the response to item (15) above.

(17) Identify the financial, economic and social impact of the regulation on individuals, small businesses, businesses and labor communities and other public and private organizations. Evaluate the benefits expected as a result of the regulation.

The proposed amendments to the statewide health MSCs reflect the latest toxicological data on human health effects when exposed to hazardous and toxic chemicals. This assures potentially affected residents of the Commonwealth and persons interested in buying and redeveloping contaminated sites that the MSCs are protective of human health.

The proposed amendments to the Chapter 250 regulations are not expected to increase costs or provide any significant savings for the regulated community. Under this proposal, the MSC values for many regulated substances are being changed due to a variety of reasons. The most common reason is due to changes in toxicity values. Approximately 45% of the changes to the MSC tables for soils (Tables 3a, 3b, and 4a) lower the current values and the other 55% increase those values. Approximately half of the changes to groundwater table for organic substances (Table 1) lower the current values while the other half increase those values. Lowering the values may indicate a more stringent cleanup is required at a site and increasing the values may indicate a less stringent cleanup is required at a site. On average, remediators apply the Act 2 remediation standard to just under 300 contaminated properties across the Commonwealth per year. The Department does not expect that the proposed amendments would impact the number of remediations voluntarily completed or the number that must be completed because of Department enforcement actions.

Under the Land Recycling Act, remediators can choose from three different cleanup standards: background, statewide health or site-specific. Updating statewide health standard MSCs will not affect cleanup options available to remediators under other cleanup standards.

The Department believes that there will be little if any adverse financial, economic, or social impact to small businesses.

The proposed amendments to the Statewide health MSCs would reflect the latest toxicological data on human health effects that can occur when humans are exposed to hazardous and toxic chemicals. Updating the MSCs based on the latest toxicological data helps to assure potentially affected residents of this Commonwealth and persons, including businesses, small businesses and other organizations, interested in buying and redeveloping contaminated sites, that the MSCs are protective of human health.

This proposed rulemaking would benefit the public by reducing public exposure to several PFAS. PFAS are potentially linked to a number of adverse health effects, including high cholesterol, developmental effects including low birth weight, liver toxicity, decreased immune response, thyroid disease, kidney disease, ulcerative colitis and certain cancers, including testicular cancer and kidney cancer. This proposed rulemaking would add or update groundwater standards for some PFAS (adding Gen-X chemicals, PFBS potassium salt, PFBA, and PFHxA, updating PFOA (MCL), PFOS (MCL), and PFBS (HAL)) utilizing the HALs the EPA published, the MCLs the Department established, and newly

published toxicity data. Soil standards for those same PFAS would be added or updated using the underlying data from the EPA HALs, Department MCLs, as well as the newly published IRIS data. Having these new and updated MSCs would allow remediators to address PFAS groundwater and soil contamination. This would also benefit remediators wishing to remediate contaminated sites, who tend to be owners, operators or purchasers, or their contractors, of properties and facilities at or near, military bases, municipalities, and other locations that used or stored fire-fighting foam or other PFAS-containing materials.

This proposal would update various aspects of how the direct contact values for lead are calculated. As described in the whitepaper on lead developed by the CSSAB, and adopted by the department, the models would be updated, the target blood lead level (TBLL) would be decreased to 5 µg/dl, and attainment of the direct contact value would be adjusted. This proposal includes updating the models to EPA's most up-to-date Integrated Exposure Uptake Biokinetic (IEUBK) model and their Adult Lead Model (ALM) from the outdated and obsolete Uptake Biokinetic (UBK) and Society for Environmental Geochemistry and Health (SEGH) models, currently in use by the Department.

In addition to model updates, this proposed rulemaking includes updating the TBLL for lead. The previous models both proposed a higher TBLL, the UBK model included a target of 10 µg/dl in children while the SEGH model target was 20 µg/dl in adults. This proposed rulemaking utilizes 5 µg/dl as the default TBLL because it is the default value used in the IEUBK and ALM models that were developed by the EPA Superfund Program. This proposed rulemaking's use of the default values associated with the EPA Superfund Program's most current soil lead models, including the TBLL, ensures that the most up to date science is being applied to environmental cleanup sites in Pennsylvania. The Department's Land Recycling Program is closely aligned with the EPA's Superfund Program regarding the use of toxicity information, cleanup processes, and risk-based analyses. The receptor in both models is children, with the IEUBK model receptor being children from zero to 84 months of age while the ALM receptor is a fetus in the womb of an exposed adult.

The addition of averaging of attainment samples in order to attain the lead direct contact value under the Statewide health standard is also being proposed. This attainment test is limited to those sites that are attaining only the direct contact lead value and conforms to the methods utilized by both the IEUBK and ALM. These changes would benefit the public by improving the assessment of lead in soil.

This proposed rulemaking would update the process for choosing toxicity values for PAH (polycyclic aromatic hydrocarbon) chemicals. As outlined in the whitepaper provided by the CSSAB PAH Workgroup and adopted by the Department, when EPA updated the toxicity value for Benzo[a]pyrene (BaP) in IRIS in January 2017, the supporting documents specifically referred to the EPA's 1993 guidance document on use of relative potency factors for determining the toxicity of six other PAH compounds. These compounds include Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, and Indeno[1,2,3-c,d]pyrene. The whitepaper and the guidance document indicate that the toxicity of these six PAHs should be calculated as a factor of the toxicity of BaP. The whitepaper notes that the current toxicity values for PAHs in Chapter 250 are values calculated by California and others using these RPFs in relation to the previously published (replaced in 2017) BaP toxicity value. Using the RPFs in relation to the current BaP toxicity value brings the most current science to Chapter 250. This would benefit the public by bringing these MSC values into the range of detectable concentrations which will allow more remediators to address releases of these compounds and reduce public contact with these compounds. PAHs are typically located in areas where fossil fuels have been burned and are often found in asphalt.

Finally, this proposed rulemaking will update the method for determining MSCs for 19 compounds by choosing subchronic toxicity values over chronic toxicity values. The EPA has provided guidance over the last few years to update some of the toxicity values that should be used to more accurately represent the risk from certain compounds. The EPA's Office of Land and Emergency Management (OLEM) issued a memo in May of 2021 based on recommendations from OLEM's Human Health Regional Risk Assessment Forum's (OHHRRAF) Toxicity Workgroup. This memo recommends using subchronic toxicity values in place of chronic toxicity values (which are typically used for calculating MSC values) for 19 compounds. The proposed rulemaking would adopt those recommendations to adopt more conservative toxicity values for those compounds.

The EPA also provided guidance to the Department regarding the use of certain values from the EPA's Health Effect Assessment Summary Tables (HEAST) database. The HEAST database has not been updated in over 25 years (last updated in 1997) and as IRIS and PPRTV published values, any values for those same compounds are considered to be rescinded by default. The EPA clarified that any compounds evaluated within IRIS and PPRTV that specifically state that a value could not be calculated are also considered to be rescinded. Therefore, several HEAST toxicity values are proposed to be removed from Tables 5A and 5B. These changes benefit the public by more accurately evaluating the toxicity of these compounds and using more conservative values which are more protective of exposure.

Remediators would benefit from the amendments that clarify the administrative elements of Act 2, making for more efficient and streamlined Act 2 remediations.

(18) Explain how the benefits of the regulation outweigh any cost and adverse effects.

As described in the responses to Questions 10 and 17, there are important benefits to this proposed rulemaking. They include protecting the public with updated MSCs reflecting the latest toxicological data, adding new MSCs for 5 chemical compounds (HFPO Dimer acid and its ammonium salt, PFBA, PFHxA, and Potassium salts of PFBS), exposure to which, according to EPA, could cause adverse effects in humans, including developmental effects to a fetus during pregnancy or to infants during breastfeeding, cancer (such as testicular, kidney), liver effects (such as tissue damage), immune effects (such as antibody production), thyroid effects, and others such as cholesterol. The proposed amendments would also streamline Act 2 remediations.

These benefits outweigh any costs and adverse effects of the proposed rulemaking, which the Department expects to be insignificant.

The proposed amendments to the Statewide health MSCs reflect the latest toxicological data on human health effects that can occur when humans are exposed to hazardous and toxic chemicals. Updating the MSCs in this manner helps to ensure potentially affected residents of this Commonwealth and persons, including businesses, small businesses and other organizations, interested in buying and redeveloping contaminated sites that the MSCs are protective of human health. In particular, the proposed rulemaking would allow remediators to address more PFAS compound groundwater and soil contamination.

The Department anticipates little if any cost or adverse effects from this proposal. The soil numeric values represent a decrease for approximately 45% of the values and an increase for 55% of the values. For groundwater, the proposed changes reflect a decrease for approximately 50% of the values and an increase in approximately 50% of the values. Lowering the values may indicate a more stringent cleanup is required at a site and increasing the values may indicate a less stringent cleanup is required at a site.

The number of completed remediations vary each year. On average, remediators apply the Act 2 remediation standard to just under 300 contaminated properties across the Commonwealth per year. The cost impact on a given site remediation would depend on the regulated substances being remediated and the soil and groundwater conditions at the site. For example, a site with a tight clay soil profile might not allow contaminants to spread horizontally or vertically, in which case the amount of soil to be excavated would not significantly change to meet a lower or higher MSC value.

Please also see the responses to Questions 10 and 17.

(19) Provide a specific estimate of the costs and/or savings to the regulated community associated with compliance, including any legal, accounting or consulting procedures which may be required. Explain how the dollar estimates were derived.

The proposed amendments to the Chapter 250 regulations are not expected to increase costs or provide any significant savings for the regulated community associated with compliance, or any legal, accounting or consulting procedures. The soil numeric values represent a decrease for approximately 45% of the values that would change and an increase for 55% of the values that would change. For groundwater, the proposed changes reflect a decrease for approximately 50% of the values that would change and an increase in approximately 50% of the values that would change. Lowering the values may indicate a more stringent cleanup is required at a site and increasing the values may indicate a less stringent cleanup is required at a site. The number of completed remediations vary each year. On average, remediators apply the Act 2 remediation standard to just under 300 contaminated properties across the Commonwealth per year. The cost impact on a given site remediation would depend on the regulated substances being remediated and the soil and groundwater conditions at the site. For example, a site with a tight clay soil profile might not allow contaminants to spread horizontally or vertically, in which case the amount of soil to be excavated would not significantly change to meet a lower or higher MSC value.

The proposed rulemaking would not require any new legal, accounting or consulting procedures.

(20) Provide a specific estimate of the costs and/or savings to the local governments associated with compliance, including any legal, accounting or consulting procedures which may be required. Explain how the dollar estimates were derived.

The proposed amendments are not expected to impact costs or savings for local governments. In some cases, local governments are remediators; however, as with all other types of remediators, the proposed regulation is not expected to increase costs or result in significant savings.

Please also see the response to Question 19 above.

(21) Provide a specific estimate of the costs and/or savings to the state government associated with the implementation of the regulation, including any legal, accounting, or consulting procedures which may be required. Explain how the dollar estimates were derived.

The proposed amendments are not expected to impact costs or savings for state government agencies. In some cases, state government agencies are remediators; however, as with all other types of remediators, the proposed regulation is not expected to increase costs or result in significant savings.

Please also see the response to Question 19 above.

(22) For each of the groups and entities identified in items (19)-(21) above, submit a statement of legal, accounting or consulting procedures and additional reporting, recordkeeping or other paperwork, including copies of forms or reports, which will be required for implementation of the regulation and an explanation of measures which have been taken to minimize these requirements.

The proposed amendments to the Chapter 250 regulations would not require any additional recordkeeping or paperwork. No new or revised forms or reports are required.

(22a) Are forms required for implementation of the regulation?

No new or revised forms or reports are required.

(**22b) If forms are required for implementation of the regulation, attach copies of the forms here. If your agency uses electronic forms, provide links to each form or a detailed description of the information required to be reported. Failure to attach forms, provide links, or provide a detailed description of the information to be reported will constitute a faulty delivery of the regulation.**

No new or revised forms or reports are required.

(23) In the table below, provide an estimate of the fiscal savings and costs associated with implementation and compliance for the regulated community, local government, and state government for the current year and five subsequent years.

This amendment is not expected to impact costs or savings.

	Current FY 2023-24	**FY +1 2024-25**	**FY +2 2025-26**	**FY +3 2026-27**	**FY +4 2027-28**	**FY +5 2028-29**
SAVINGS:						
Regulated Community	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0
Total Savings	$0	$0	$0	$0	$0	$0
COSTS:						
Regulated Community	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0
Total Costs	$0	$0	$0	$0	$0	$0
REVENUE LOSSES:						
Regulated Community	$0	$0	$0	$0	$0	$0
Local Government	$0	$0	$0	$0	$0	$0
State Government	$0	$0	$0	$0	$0	$0
Total Revenue Losses	$0	$0	$0	$0	$0	$0

(23a) Provide the past three-year expenditure history for programs affected by the regulation.

Program	FY -3 (2020-21)	FY -2 (2021-22)	FY -1 (2022-23)	Current FY (2023-24)
Environmental Protection Operations 160-10381	$94,202,000	$98,036,000	$97,927,000	$116,450,000
Environmental Program Management 161-10382	$32,041,000	$34,160,000	$33,719,000	$39,714,000
Industrial Land Recycling Fund 689-60080	$282,000	$282,000	$362,000	$526,000
Hazardous Sites Cleanup Fund 202-20070	$24,000,000	$24,000,000	$4,928,000	$9,000,000
Storage Tank Fund 201-20073	$4,300,000	$4,300,000	$414,000	$4,788,000

(24) For any regulation that may have an adverse impact on small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012), provide an economic impact statement that includes the following:

(a) An identification and estimate of the number of small businesses subject to the regulation.

A majority of the small businesses that the Department can identify as potentially being affected by this proposal are owners of small gasoline stations. In addition to gasoline stations, the types of businesses affected could include fuel distribution facilities, commercial facilities that use toxic or carcinogenic chemicals, manufacturing operations and redevelopers of brownfield sites. There are approximately 12,000 facilities in the Commonwealth that contain regulated underground and aboveground storage tanks, including gasoline stations and fuel distribution and storage facilities. Some of these facilities would include small gasoline station owners. Small businesses would also make up some of the commercial facilities that use toxic or carcinogenic substances. Due to the broad potential reach of this regulation, it is difficult for the Department to identify further specifics on the types and numbers of small businesses that would potentially be affected by releases of regulated substances.

(b) The projected reporting, recordkeeping and other administrative costs required for compliance with the proposed regulation, including the type of professional skills necessary for preparation of the report or record.

These amendments to the Chapter 250 regulations do not add any new procedures, recordkeeping, or compliance efforts.

(c) A statement of probable effect on impacted small businesses.

The amendments to the Chapter 250 regulations are not expected to increase costs or provide any significant savings for small businesses. The cost impact on a given site remediation would depend on the specific regulated substances being remediated and the specific soil and groundwater conditions at the site.

As noted above in response to Question 15, many of the small businesses that may be impacted by this proposed rulemaking are gasoline stations, and for many of these businesses, the costs would be covered by insurance because many of these businesses are required by 35 P.S. § 6021.704(a)(1) of the Storage Tanks and Spill Prevention Act to participate in the Underground Storage Tank Indemnification Fund.

This fund provides insurance coverage for the costs to clean up releases from underground storage tanks, regardless of the MSC value used at the site.

Small businesses that handle hazardous substances can use pollution prevention techniques available through various assistance programs to prevent spills that would result in contamination of soil and groundwater. In addition, background and site-specific cleanup standards are available and not affected by the proposed updates to the Statewide health MSCs.

In addition to the Underground Storage Tank Indemnification Fund coverage, the Pennsylvania Department of Community and Economic Development (DCED), primarily through its Industrial Sites Reuse Program, offers many entities that are eligible for brownfield financial assistance, which includes small business, potential grants or loans for the assessment and remediation of soil and groundwater contamination at eligible properties.

(d) A description of any less intrusive or less costly alternative methods of achieving the purpose of the proposed regulation.

The Department is unaware of any less intrusive or less costly alternative methods of achieving the purpose of the proposed regulation, which is to update various MSCs based on current scientific information. Background and site-specific cleanup standards are available and are not affected by the proposed updates to the Statewide health MSCs. As discussed above in the responses to Questions 9 and 10, Act 2 requires that the Board and the Department evaluate data related to current MSCs and promulgate new standards, where necessary. Further, Act 2 requires the Department to incorporate applicable Federal standards and the EPA's HALs.

(25) List any special provisions which have been developed to meet the particular needs of affected groups or persons including, but not limited to, minorities, the elderly, small businesses, and farmers.

The proposed amendments to Chapter 250 do not include special provisions developed to meet the needs of any groups listed because the proposed amendments are not expected to adversely affect any listed group. Please see the responses to Questions 15, 17, and 24 regarding expected impacts of this proposed rulemaking.

(26) Include a description of any alternative regulatory provisions which have been considered and rejected and a statement that the least burdensome acceptable alternative has been selected.

No alternative regulatory provisions were considered and rejected. The least burdensome acceptable alternatives – which is required by statute and regulation – have been selected. The amendments in this proposed rulemaking are required under Act 2 and the existing Chapter 250 regulations, which require the periodic update of the Statewide health standard. Alternatives to meeting MSCs in Act 2 remediations already exist. They are the background and site-specific cleanup standards in Chapter 250, and would not be affected by the updates to the Statewide health MSCs in this rulemaking.

(27) In conducting a regulatory flexibility analysis, explain whether regulatory methods were considered that will minimize any adverse impact on small businesses (as defined in Section 3 of the Regulatory Review Act, Act 76 of 2012), including:

- **a) The establishment of less stringent compliance or reporting requirements for small businesses;**
- **b) The establishment of less stringent schedules or deadlines for compliance or reporting requirements for small businesses;**
- **c) The consolidation or simplification of compliance or reporting requirements for small businesses;**
- **d) The establishment of performance standards for small businesses to replace design or operational standards required in the regulation; and**
- **e) The exemption of small businesses from all or any part of the requirements contained in the regulation.**

The amendments are not expected to have any adverse impact on small businesses; therefore, no regulatory methods were considered to minimize any adverse impact on small businesses. Background and site-specific cleanup standards are available and not affected by the proposed updates to the statewide health MSCs.

(a) This proposed rulemaking does not affect any Act 2 compliance requirements. Under Act 2, a remediator may voluntarily select the standard to which to remediate. To complete a remediation, a person must then comply with all relevant technical and administrative requirements. Act 2 establishes the schedules related to reports necessary to comply with those remediation standards. See, for example, the notice and review provisions in sections 302(e), 303(h) and 304(n) of Act 2 (relating to background standard; Statewide health standard; and sight-specific standard). See 35 P.S. §§ 6026.302(e), 6026.303(h), and 6026.304(n). As a result, the Department and the Board have limited ability to alter schedules, deadlines and reporting requirements. In addition, reporting obligations under Act 2 generally apply only to the Department (in other words, the Department must review and approve a submitted report within a particular timeframe), and not to other parties.

(b) Please see the response to Question 27(a).

(c) Please see the response to Question 27(a).

(d) The Land Recycling Program's regulations do not have design or operation standards. Act 2 does not authorize relaxing MSC values for specific categories of remediators.

(e) Small businesses, small organizations and small governmental jurisdictions are not exempt from any provisions of the regulations. The Land Recycling Program's regulations do not take into account the size or nature of a particular entity that may own a contaminated site and the need to address it under Act 2.

(28) If data is the basis for this regulation, please provide a description of the data, explain in detail how the data was obtained, and how it meets the acceptability standard for empirical, replicable and testable data that is supported by documentation, statistics, reports, studies or research. Please submit data or supporting materials with the regulatory package. If the material exceeds 50 pages, please provide it in a searchable electronic format or provide a list of citations and internet links that, where possible, can be accessed in a searchable format in lieu of the actual material. If other data was considered but not used, please explain why that data was determined not to be acceptable.

The Land Recycling Act and the Chapter 250 regulations require the periodic update of the statewide health standard to be based on nationally recognized, peer-reviewed toxicological data, including cancer slope and unit risk factors, reference dose values, and reference concentrations published under the Integrated Risk Information System (IRIS), the National Center for Environmental Assessment, Provisional Peer-Reviewed Toxicity Values (PPRTV), the Health Effects Assessment Summary Tables, Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles, and California EPA Cancer Potency Factors and Chronic Reference Exposure Levels.

This information is extensively published by the EPA (IRIS - https://iris.epa.gov/AtoZ/?list_type=alpha) and (PPRTV - https://www.epa.gov/pprtv/provisional-peer-reviewed-toxicity-values-pprtvs-assessments), the United States Centers for Disease Control (minimum risk levels (MRLs) for hazardous substances - https://wwwn.cdc.gov/TSP/MRLS/mrlsListing.aspx), and the California Office of Environmental Health Hazard Assessment (https://oehha.ca.gov/chemicals) and is used by all state environmental and health departments in the country for conducting risk assessments for potential exposure to contaminants in soil and groundwater.

This proposed rulemaking would add or update groundwater standards for some PFAS (adding Gen-X chemicals, PFBS potassium salt, PFBA, and PFHxA, updating PFOA (MCL), PFOS (MCL), and PFBS (HAL)) utilizing the HALs EPA published, the MCLs the Department established, and newly published toxicity data. Soil standards for those same PFAS would be added or updated using the underlying data from the EPA HALs, Department MCLs, and the newly published IRIS data. These new and updated MSCs would allow remediators to address PFAS groundwater and soil contamination.

This regulation proposes to update various aspects for how the direct contact values for lead are calculated. As described in the attached whitepaper on lead developed by the CSSAB, the models would be updated, the TBLL would be decreased to 5 µg/dl, and attainment of the direct contact value would be adjusted. This proposal would update the models to use the EPA's most up-to-date IEUBK model and their ALM from the outdated and obsolete UBK and SEGH models currently in use by the Department. In addition to model updates, this regulation proposes to update the TBLL. The previous models both proposed a higher TBLL; the UBK model included a target of 10 µg/dl in children, while the SEGH model target was 20 µg/dl in adults. This proposed rulemaking uses 5 µg/dl as the default TBLL because it is the default value used in the IEUBK and ALM models that were developed by the EPA's Superfund Program. The receptor in both models is children: the IEUBK model receptor is children from zero to 84 months of age while the ALM receptor is a fetus in the womb of an exposed adult. This proposed rulemaking's use of the default values associated with the EPA Superfund Program's most current soil lead models, including the TBLL, ensures that the most up to date science is being applied to environmental cleanup sites in Pennsylvania. The Department's Land Recycling Program is closely aligned with the EPA's Superfund Program regarding the use of toxicity information, cleanup processes, and risk-based analyses. This regulation also proposes the use of averaging of attainment samples to attain the lead direct contact value under the Statewide health standard. This attainment test is limited to

those sites that are attaining only the direct contact lead value and conforms to the methods utilized by both the IEUBK and ALM. These changes would benefit the public by improving the assessment of lead in soil.

This proposed rulemaking would update the process for choosing toxicity values for PAH chemicals. As outlined in the attached whitepaper provided by the CSSAB PAH Workgroup, when the EPA updated the toxicity value for BaP in IRIS in January 2017, the supporting documents specifically referred to the EPA's 1993 guidance document on the use of relative potency factors for determining the toxicity of six other PAH compounds. These compounds include Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, and Indeno[1,2,3-c,d]pyrene. The whitepaper and the guidance document indicate that the toxicity of these six PAHs should be calculated as a factor of the toxicity of BaP. The whitepaper notes that the current toxicity values for PAHs in Chapter 250 are values calculated by California and others using these RPFs in relation to the previously published (replaced in 2017) BaP toxicity value. Using the RPFs in relation to the current BaP toxicity value ensures the Land Recycling Program's regulations in Chapter 250 use the most current science.

Finally, this proposed rulemaking will update the method for determining MSCs for 19 compounds by choosing subchronic toxicity values over chronic toxicity values. The EPA has provided guidance over the last few years to update some of the toxicity values that should be used to most conservatively evaluate the risk from certain compounds. The EPA's OLEM issued a memo in May of 2021 based on recommendations from the OHHRRAF Toxicity Workgroup that recommends using subchronic toxicity values in place of chronic toxicity values (which are typically used for calculating MSC values) for 19 compounds. The proposed rulemaking would follow those recommendations to adopt more conservative toxicity values for those compounds.

The EPA also provided guidance to the Department regarding the use of some Health Effect Assessment Summary Tables (HEAST) values. The HEAST database has not been updated since 1997. As values are published in IRIS and the PPRTV database, any values in HEAST for those same compounds were considered to be rescinded from HEAST by default. It has been clarified through conversations with the EPA that any compounds evaluated within IRIS and PPRTV that specifically state that a value could not be calculated should also be considered rescinded by the EPA. Consequently, several HEAST toxicity values are proposed to be deleted from Tables 5a and 5b. See the attached document titled "Explanation for Removal of HEAST Toxicity Values" for additional detail.

Additional information can be accessed at the following:

- Pennsylvania's PFAS MCL Rule (For PFOA and PFOS toxicity values), https://www.dep.pa.gov/Business/Water/BureauSafeDrinkingWater/DrinkingWaterMgmt/Regulations/Pages/PFAS-MCL-Rule.aspx

- EPA's Drinking Water Health Advisories (for Gen-X and PFBS chemicals), https://www.epa.gov/sdwa/drinking-water-health-advisories-has

- EPA's Recommendations on the Use of Chronic or Subchronic Noncancer Values for Superfund Human Health Risk Assessments, https://semspub.epa.gov/src/document/HQ/100002839

(29) Include a schedule for review of the regulation including:

A. The length of the public comment period:	60 days
B. The date or dates on which any public meetings or hearings will be held:	August 19, August 27 and September 4, 2024
C. The expected date of delivery of the final-form regulation:	Quarter 3, 2025
D. The expected effective date of the final-form regulation:	Upon publication in the *Pennsylvania Bulletin*
E. The expected date by which compliance with the final-form regulation will be required:	Upon publication in the *Pennsylvania Bulletin*
F. The expected date by which required permits, licenses or other approvals must be obtained:	Not applicable

(30) Describe the plan developed for evaluating the continuing effectiveness of the regulations after its implementation.

The Department evaluates the continuing effectiveness of the Land Recycling Program and the Chapter 250 regulations on an ongoing basis. Section 250.11 requires the Department to regularly review new scientific information that relates to the basis of the MSCs and to propose appropriate regulations to the Board whenever necessary, but not later than 36 months from the effective date of the most recently promulgated regulations. These efforts include ongoing tracking of remediations completed under the program and an annual program report.

Report of the Lead Workgroup to the Cleanup Standards Scientific Advisory Board

July 27, 2022

1. INTRODUCTION

The Cleanup Standards Scientific Advisory Board ("CSSAB", or "Board") to the Pennsylvania Department of Environmental Protection ("PADEP", or "Department") unanimously submitted a memo entitled, "*Memorandum - Consideration for the Application of the IEUBK Model and ALM for the Development of Soil Direct Contact Values for Lead within the Act 2 Program"* to the Department on September 17, 2020 ("Memo").

The Memo expressed the CSSAB's support for the Department's decision to replace the two models currently being used to calculate direct contact soil numeric values ("NVs") for lead for residential and nonresidential land use with the Integrated Exposure Uptake Biokinetic ("IEUBK") Model (version 1.1) (residential) and the Adult Lead Model ("ALM") (nonresidential), both developed and supported by the United States Environmental Protection Agency ("EPA").

The Memo also indicated that the Department should consider the use of the average as an additional attainment demonstration option for lead in soil under the Statewide health standard ("SHS") of the Land Recycling and Environmental Remediation Standards Act ("Act 2"). Specifically, the final paragraph of the Memo states:

> *"Based on this analysis of attainment demonstration alternatives, use of the average lead concentration should be considered as an additional option for the attainment demonstration so that the attainment "toolbox" includes a mechanism that meshes with the input criteria in the IEUBK model and ALM. By the same token, persons wishing to use the two existing attainment tests could do so consistent with what is currently provided for in the regulations implementing Act 2."*

In the August 11, 2021 meeting of the CSSAB, the Department requested that a lead workgroup be assembled to evaluate the use of the average as an attainment test for lead in soil. Subsequently, the Lead Workgroup ("Workgroup") was assembled in September 2021.

The Workgroup subsequently developed two interim work products, a draft white paper that provided extensive background information on the scientific factors associated with lead in soil in Pennsylvania and its regulation by PADEP (Attachment A) and an analysis of datasets from actual soil lead remediation sites in the Commonwealth (Attachment B). The white paper was developed to support deliberations of the Workgroup. As such, its purpose was to present the science and other facts underlying the development of Act 2 NVs and medium-specific concentrations ("MSCs") for lead in soil, without expressing opinions or providing conclusions and recommendations. Portions of the white paper are included in this report. The purpose of the dataset evaluation was to examine the relationship of the proposed average attainment test to the two existing tests (the 75%/10X ad hoc rule and the 95% Upper Confidence Limit on the Mean ("95% UCL")).

This *Report* presents two additional results of the Workgroup's deliberations:

- The recommendations of the Workgroup regarding the addition of an average attainment test based on the average soil lead concentration from site-specific sampling results, and
- Suggested draft regulatory language to incorporate the average soil lead concentration based on site-specific attainment sampling results as an additional attainment test in 25 Pa. Code Chapter 250. Administration of the Land Recycling Program.

2. UNIQUE TREATMENT OF LEAD FOR THE DIRECT CONTACT SOIL EXPOSURE PATHWAY

Beginning with the language of Act 2 of 1995 (Act 2) and continuing with the development of draft regulations in 1996 and the final regulations in 1997, it was understood that soil direct contact numeric values ("NVs") for lead would be calculated differently from NVs for other regulated substances. It is acknowledged that lead effects on developing children is an important consideration and that alternate mechanisms to address this issue would be needed.

2.1. Statutory Language

Section 303 of Act 2, which addresses factors used in calculating direct contact NVs to be applied in developing MSCs in soil, states:

> ***Section 303. Statewide health standard.***
>
> *(c) Additional factors. -- When establishing a medium-specific concentration, …. the medium-specific concentration for the ingestion of groundwater, inhalation of soils, ingestion and inhalation of volatiles and particulates shall be calculated by the department using valid scientific methods,* ***reasonable exposure pathway assumptions and exposure factors for residential and nonresidential land use which are no more stringent than the standard default exposure factors established by EPA based on the following levels of risk:***
>
> *(1) For a regulated substance which is a carcinogen, the medium-specific concentration is the concentration which represents an excess upper bound lifetime cancer target risk of between 1 in 10,000 and 1 in 1,000,000.*
>
> ***(2) For a regulated substance which is a systemic toxicant, the medium-specific concentration is the concentration to which human populations could be exposed by direct ingestion or inhalation on a daily basis without appreciable risk of deleterious effects for the exposed population.*** **(**Emphasis added)

2.2. Development of Numeric Values for Lead Compared to Other Systemic Toxicants

The text of the current Chapter 250 regulations governing the calculation of NVs for direct contact to lead in soil as a systemic toxicant describe the approach taken, unchanged from those published in 1997, and currently enumerated in § 250.306(e), as follows:

> *(e) The residential ingestion numeric value for lead in soil was developed using the Uptake Biokinetic (UBK) Model for Lead (version 0.4) developed by the EPA (U.S. Environmental Protection Agency. (1990). Uptake Biokinetic (UBK) Model for Lead (version 0.4). U.S. EPA/ECAO. August 1990, in lieu of the algorithms presented in subsections (a) and (b). Default input values are identified in Appendix A, Table 7. Because the UBK model is applicable only to children, the nonresidential ingestion numeric value was calculated according to the method developed by the Society for Environmental Geochemistry and Health (Wixson, B. G. (1991)).*

The Society for Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil. Trace Substances in Environmental Health. (11-20)

There are two essential differences between the approach in these regulations for developing lead NVs and the approach taken for developing NVs for other systemic toxicants regulated under Act 2. These differences are identified and explained below.

2.2.1. Toxicity Values versus Public Health Policy Goals

The first step in implementing Act 2 Section 303(c) during the promulgation of the original Chapter 250 regulations was to identify toxicity values available from authoritative sources for each regulated substance relative to carcinogenicity and systemic effects. Under Act 2 Section 303(c)(1) those values could include an Oral Cancer Slope Factor ("CSF_O") for the ingestion exposure route and an Inhalation Unit Risk ("IUR") for the inhalation exposure route. Similarly, under Act 2 Section 303(c)(2) the toxicity values could include an Oral Reference Dose ("RfD_O") for the ingestion exposure route and an Inhalation Reference Concentration ("RfCi") for the inhalation exposure route. For each regulated substance, any number, or none of these values might have been available.

When the final Chapter 250 regulations were published in 1997, none of these toxicity values existed for lead and lead compounds from an authoritative source.

In the absence of toxicity values for lead, other methods were needed to calculate NVs for direct contact to lead in soil, which led to the adoption of the two methods in § 250.306(e). As shown in Chapter 250, Appendix A, Table 7, both methods specify a Target Blood Lead Level ("TBLL") as the goal limiting the value of the corresponding NV. The UBK model assumes a default TBLL for children of 10 micrograms per deciliter ("ug/dL"), derived by EPA in the early 1990s from the Centers for Disease Control and Prevention's ("CDC") 1991 level of concern for lead poisoning prevention in children. The SEGH algorithm assumes a TBLL for adult receptors of 20 ug/dL. Both models are characterized as generating ingestion NVs and no inhalation NVs are calculated.

This unique approach to calculating NVs for direct contact to lead in soil will persist when the UBK Model is replaced by the IEUBK Model and the SEGH algorithm is replaced by the ALM. However, the TBLLs will change and no longer be referenced to the CDC's 10 ug/dL level of concern and the SEGH TBLL of 20 ug/dL.

The 10 ug/dL Level of Concern from 1991 applied by EPA as the TBLL in the UBK Model (version 0.4) was replaced as a CDC policy goal by a value of 5 ug/dL and renamed a Blood Lead Reference Value ("BLRV") in 2012, as described in a CDC Morbidity and Mortality Weekly Report dated October 28, 2021[1], as follows:

> *In 2012, CDC introduced the population-based blood lead reference value (BLRV) to identify children exposed to more lead than most other children in the United States…. The BLRV is based on the 97.5th percentile of the blood lead distribution in U.S. children aged 1–5 years from National Health and Nutrition Examination Survey (NHANES)[2]*

[1] https://www.cdc.gov/mmwr/volumes/70/wr/mm7043a4.htm

[2] NHANES - About the National Health and Nutrition Examination Survey (cdc.gov)

> *data… The initial BLRV of 5 µg/dL, established in 2012, was based on data from the 2007–2008 and 2009–2010 NHANES cycles. In 2012, CDC's former Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP) recommended the establishment of the BLRV and proposed it be set at 5 µg/dL (5). This recommendation was based on the weight of evidence indicating that the adverse health effects of BLLs <10 µg/dL in children included neurologic, cardiovascular, immunologic, and endocrine effects. ACCLPP further recommended that the BLRV be updated every 4 years based on the 97.5th percentile of BLLs for children aged 1–5 years across the two most recent combined NHANES cycles for which data are available.*

In October 2021, a Workgroup member contacted Jill Ryer-Powder, Ph.D., MNSP, DABT, Chair of CDC's BLRV Workgroup, and a member of its Lead Exposure and Prevention Advisory Council ("LEPAC") regarding the status of her workgroup's efforts to update the CDC's BLRV. In her email response to that inquiry on October 5, 2021, Dr. Ryer-Powder stated the following:

> *Please note that the BLRV is not a health-based number – rather it represents a value based on the 97.5th percentile of blood lead level (BLL) concentrations for US children aged 1 to 5 years. The BLRV is neither a clinical reference level defining an acceptable range of blood lead levels in children nor is it a health-based toxicity threshold; rather it is a policy tool that helps identify the children in the upper end of the population blood lead distribution in order to target prevention efforts and evaluate their effectiveness.* ***This is important to understand when setting a standard for "acceptable" concentrations of lead in soil.*** (Emphasis added)

It is notable that, in publishing the IEUBK Model version 2.0 and its User's Guide in May 2021, nine years after the CDC adopted the BLRV of 5 ug/dL, the EPA's TBLL of 5 ug/dL was adopted as the default value with no apparent reference to the actions taken by the CDC in 2012 and no mention of the ACCLPP's January 2012 report recommending those actions.

Since the original promulgation of the Chapter 250 regulations, the California EPA ("CA EPA") has developed CSF_O and IUR values for lead. As CA EPA is an acceptable source for toxicity values under Chapter 250, these two values are currently listed for lead in Chapter 250, Appendix A, Table 5B. However, the residential, direct contact NV calculated using these toxicity values is reportedly greater than 2000 mg/kg. This NV for carcinogenic effects is therefore at least four times greater than the current 500 mg/kg systemic toxicant NV listed in Chapter 250, Appendix A, Table 4, and could not be selected as the residential, direct contact NV. This calculated NV for carcinogenic effects is also at least ten times higher than the Department's proposed residential, direct contact NV of 200 mg/kg, which was derived in accordance with the procedure discussed below in Section 3.

The reference doses and concentrations used to develop the NVs for substances other than lead are health-based toxicity values and the TBLLs used to develop the direct contact NVs for lead in soil are intrinsically related to a level of concern or BLRV adopted by CDC as public health policy tools. This lack of equivalence and the absence of a valid reference dose or concentration for lead prevent a determination of which of these factors would provide a more protective basis for calculating direct contact soil NVs, and by extension MSCs.

2.2.2. Single Medium Pathway Versus Multimedia Pathways

When direct contact NVs for ingestion of soil are calculated for a regulated substance other than lead, the toxicity values used in those calculations are related solely to the intake of soil containing that substance. As the following excerpt from the IEUBK Model version 2.0 User's Guide states, that is not the case for lead when using the IEUBK Model:

> *Exposure can be thought of as the contact with a chemical or other agent, which may result in the absorption or exchange across boundaries of an organism, such as the gut, lungs, and skin. The results from the exposure component of the IEUBK model are estimated intake rates for the quantities of Pb* [lead]*inhaled or ingested from environmental media. The media addressed by the IEUBK model include soil, house dust, drinking water, air, and food. Paint is usually addressed in terms of its contribution to the measured concentration of Pb in soil or house dust.*[3] (Pages 16-17)

It should be noted, however, that the model defaults do not include a contribution from lead-based paint to lead in soil or house dust, but it can be added as an alternate source. The media addressed do include maternal blood.

Section 7, Table 5 and Figure 6 from Attachment A provide a discussion of the effect of running the IEUBK Model with all media included as their default values and alternative runs for "soil and dust only" and "soil only". The "soil only" model run, otherwise at the same default settings used by the Department to generate the proposed 200 mg/kg NV, results in an alternate calculated NV of 686 mg/kg. This value is more than three times higher than the proposed NV and approximately one-third of the calculated carcinogenic effects NV of >2000 mg/kg.

Although the absence of a valid reference dose or concentration for lead and the lack of equivalence between the toxicity values used to set NVs for other regulated substances and the public health policy tools used for lead still make it uncertain which methodology provides the absolute greater protection, the use of the multimedia pathway approach in the IEUBK Model instead of focusing only on lead in soil unquestionably shifts the resultant NV in a more conservative direction.

3. CURRENT NV AND MSC VALUES AND PADEP PROPOSED REVISIONS

3.1. Soil Numeric Values and Medium-Specific Concentrations for Lead: 1997 - Present

Based on the output from the UBK Model and SEGH algorithm, the residential NV for direct contact to lead in soil is 500 mg/kg and the NV for nonresidential land use is 1000 mg/kg. However, in accordance with Section 250.308, the soil-to-groundwater NV for lead was calculated to be 450 mg/kg. Section 250.305 requires, in effect, that the lowest of these three numbers, i.e., 450 mg/kg, becomes the MSC for both the residential and nonresidential land use scenarios. Exceptions to this rule occur when either equivalency or buffer distance is used to attain the soil-to-groundwater NV, or the NV derived from using the Synthetic Precipitation Leaching Procedure ("SPLP") test to attain the soil-to-groundwater NV

[3] User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Version 2 (epa.gov)

is greater than the applicable residential or nonresidential direct contact NV, leading to the direct contact NV being the MSC.

3.2. Proposed Revisions

In the August 2021 CSSAB meeting, the Department proposed updating the models used to calculate NVs for direct contact to lead in soil for both residential and nonresidential land use. As shown in Table 1, the Department proposes to replace the UBK Model with the IEUBK Model (version 2.0) for residential land use and the SEGH algorithm with the ALM for nonresidential land use.

Table 1: Proposed Changes in Models, NVs for Direct Contact to Lead in Soil and MSCs

Land Use	Current Model	Proposed Model	Current TBLL (ug/dL)	Proposed TBLL (ug/dL)	Current DC* NV (mg/kg)	Proposed DC* NV (mg/kg)	Soil-to-GW NV** (mg/kg)	Current MSC*** (mg/kg)	Proposed MSC (mg/kg)
Residential	UBK	IEUBK	10	5	500	200	450	450	200
Nonresidential	SEGH	ALM	20	5	1,000	1050	450	450	450***

*DC: Direct contact **No change will occur in this NV ***In the absence of exceptions noted above

Table 1 also shows the Department's proposal would lower the TBLL from 10 ug/dL and 20 ug/dL for residential and nonresidential land use, respectively, to a consistent 5 ug/dL. The selection of this TBLL is based on the default value included in the IEUBK Model version 2.0 released by EPA in May 2021. The Department's proposal also assumes a 5% probability of exceedance cutoff for both models. As the table shows, adoption of the IEUBK Model v. 2.0 will lower the residential NV from 500 mg/kg to 200 mg/kg. However, the use of the ALM together with the 5 ug/dL TBLL will result in a small increase in the nonresidential NV from 1000 mg/kg to 1050 mg/kg.

Importantly, the table shows the soil-to-groundwater NV of 450 mg/kg will not change. As noted above, because this NV is currently lower than either of the direct contact NVs, the soil-to-groundwater NV is currently the MSC for both land uses. In the absence of any of the infrequent exceptions noted above, this will still be the case for the nonresidential land use scenario. However, with the adoption of 200 mg/kg for the residential scenario NV, that value will then be lower than the soil-to-groundwater NV, making it the applicable MSC for residential sites. For this reason, the focus of the remainder of this analysis is on the IEUBK Model v. 2.0.

4. IEUBK MODEL V. 2.0

This discussion of the IEUBK Model (version 2.0) relies in part on excerpts from the User's Guide[4] with page numbers referenced for each one.

The IEUBK Model is used in two principal ways: Preliminary Remediation Goal ("PRG")[5] Mode and Risk Assessment Mode. The principal model inputs and calculations are the same for both modes of using

[4] User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Version 2 (epa.gov)

[5] *The PRG is the average concentration of a chemical in an exposure area that will yield the specified target risk in an individual who is exposed at random within the exposure area.* Calculating Preliminary Remediation Goals (PRGs) | US EPA

the model, i.e., a TBLL and a probability of exceedance cutoff. The difference between these two modes is the variable for which a value is being sought.

4.1. Selection of TBLL and Probability of Exceedance Cutoff

The first decisions to be made in applying the IEUBK Model are to select the TBLL (or, Blood Lead Level of Concern, or cutoff) and the probability of exceedance cutoff. As noted above, the Department's current proposal is to select 5% as the probability of exceedance cutoff and to lower the TBLL from the current 10 ug/dL to 5 ug/dL. Selection of the 5 ug/dL TBLL is based on EPA's adoption of the latter as the default in the IEUBK Model v. 2.0 in May 2021, as shown in the following excerpt from the IEUBK Model v.2.0 User's Guide:

TABLE 2-2. Default Values for the IEUBK Model Parameters

Parameter	***Default Value***	***Units***
Blood Pb level of concern, or cutoff	*5*	*µg/dL*

(Page 31)

4.2. Preliminary Remediation Goal Mode

The model is run in PRG Mode (or Find Mode) to calculate the soil concentration that would result in a user-specified probability of exceedance cutoff not being exceeded for a user-specified TBLL. Running the model in Find Mode using the same default input parameters, a "Change Cutoff" of 5 ug/dL, and a "Probability of Exceeding Cutoff" of 5%, the model generates a "Soil and/or Dust Concentration" of 200 ppm or mg/kg. This is the mode in which the Department would have run the model to generate a PRG of 200 mg/kg that is the basis for the proposed NV/MSC for residential direct contact to lead in soil of 200 mg/kg.

4.3. Risk Assessment Mode

The model is run in Risk Assessment Mode (or Run Mode) to calculate a geometric mean ("GM") blood lead ("PbB") concentration and the associated probability of exceedance of a user-specified TBLL, as summarized in the following excerpt from the User's Guide:

> *The IEUBK model is used to assess risk and support environmental cleanup decisions at residential sites. The model is not intended to predict the geometric mean (GM) PbB* [blood lead] *for a given child. Instead, IEUBK allows the user to estimate, for a hypothetical child or population of similarly exposed children, a plausible distribution of PbB concentrations centered on a GM PbB concentration (see Hogan et al., 1998 for additional discussion). The GM PbB is predicted from available information about the child's or children's exposure to Pb. From this distribution, the model estimates the probability that a child's or a population of children's PbB concentration will exceed a* ***target PbB level****.* [i.e., Target Blood Lead Level (TBLL)] *(*Page 13) (Emphasis added)

The default values listed in the User's Guide include the following entries for soil and dust:

TABLE 2-2. Default Values for the IEUBK Model Parameters

DATA ENTRY FOR SOIL/DUST (constant over time)		
Concentration (starting values to be modified using appropriate site data):		
soil	*200*	*µg/g*
dust	*150*	*µg/g*

(Page 29) (Emphasis added)

The entry for soil of 200 ug/g reflects the PRG calculated above based on no change in the standard model defaults or inputs. Therefore, using the model defaults for all input parameters (including an "outdoor soil lead concentration" of 200 ug/g or mg/kg), in Run Mode, the model generates a probability distribution graph showing a 4.979% probability (effectively 5%) of exceeding a PbB concentration of 5 ug/dL. This is the mode in which the model is run to demonstrate an input concentration is predicted to satisfy the 5% probability of exceedance cutoff for the selected TBLL of 5 ug/dL.

The bold text in this excerpt indicates that these starting values can be modified "using appropriate site data". This is what is done in Risk Assessment Mode. Absent any other changes in the defaults or inputs, it is clear only values entered that are equal to or less than 200 ug/g (200 mg/kg) will generate an acceptable probability of exceedance value of 5% or less. Thus, the question is, what value representing "appropriate site data" is meant to be entered to perform this test? That question is answered in the following excerpts from the User's Guide:

> *2.0 Loading and Starting the Model*
>
> *2.3 Detailed Descriptions of Input Options*
>
> *2.3.4 Soil/Dust Data*
>
> *2.3.4.2 Lead in Soil*
>
> *The TRW[6] recommends replacing the default constant soil value (200 µg/g) (or variable values)* ***with site-specific data representative of the average soil Pb concentration for the exposure scenario.*** (Page 36) (Emphasis added)
>
> *2.3.4.2.1 Developing a Soil Lead Concentration (PbS)*
>
> ***The PbS should be the arithmetic mean of the concentration of Pb in the soil that a child is likely to be exposed to.*** *Unless there is site-specific information to the contrary, the child is usually assumed to have an equal chance of contacting soil throughout the decision unit (DU); therefore, in most cases, the PbS would be the arithmetic mean concentration of Pb in soil of the DU. The method for estimating the arithmetic mean depends on how the soil samples were collected. Typically, the simple average of the concentrations measured in each of the samples is appropriate (the sum of the sample concentrations divided by the number of samples).* ***The arithmetic average is appropriate when samples were collected using incremental composite sampling, when samples were collected using simple random sampling, and systematic sampling approaches that result in sample locations that were evenly spaced within the DU.*** (pages 36 and 37) (Emphasis added)

[6] EPA's Technical Review Workgroup for Metals and Asbestos Lead Committee

The Workgroup has considered the use of the 95% UCL as an alternative soil concentration instead of the average value in Risk Assessment Mode. The use of a UCL is addressed in the IEUBK Model v.2.0 User's Guide section 2.3.4.2.1 as follows:

> *There will be some uncertainty in the estimate of the PbS due to the variability of Pb concentration in the DU soil. Theoretically, the distribution of PbB concentration that is predicted by the IEUBK model accounts for the uncertainty in the PbS (Section 2.3.8). In some cases, a risk assessor may choose to use an upper confidence limit (UCL) on the arithmetic mean PbS to account for the uncertainty in the estimate (EPA, 2007); however, this is less common for site lead risk assessment.* (Page 38)

On balance, the excerpts referenced above for running the model in this mode clearly favor using the average concentration of site data as the soil input concentration. They also establish that the model accounts for uncertainty in soil lead concentrations without the need to use a UCL to address this source of uncertainty.

5. USE OF THE IEUBK MODEL AT LRP SITES

Under the SHS, when the direct contact soil NV determined by the IEUBK Model run in PRG mode is the MSC, this concentration is first applied to the results of site characterization sampling to construct, by interpolation, a surface that circumscribes the volume of soil that exceeds the MSC. That volume of soil then becomes the soil that must be remediated. For lead, that typically means excavation and removal from the property, although other in situ approaches may be used, after which attainment sampling is performed on the walls and bottom of the excavation. Presently, only the ad hoc 75%/10X test and the 95% UCL test found in § 250.707. Statistical tests. (b)(1)(i) and (ii), respectively, may be applied to demonstrating attainment.

The use of the average of site-specific data for concentrations of lead in soil has been accepted by PADEP as the IEUBK Model input in Risk Assessment Mode under the SSS to demonstrate an acceptable risk level for direct contact to lead in soil by children ages 1-5 years. In this mode, the model output is the calculated probability of exceeding a user-specified TBLL (i.e., 5 ug/dL) to be compared to a user-specified probability of exceedance cutoff (i.e., 5%).

In essence this approach is identical to the model calculations used to generate the SHS MSC. The permitted use of the model in this manner under the SSS is on its own an acknowledgment by the Department that the average is an appropriate attainment test for direct contact to lead in soil. Any concern over allowing the use of the average attainment test under the SHS must, therefore, stem from a sense that the application of the average attainment test under the SHS would somehow generate a less conservative outcome than its use under the SSS.

However, there is an essential difference between the potential outcomes generated using the IEUBK Model under the SHS versus the SSS that could weigh against such concerns. As noted above, under the SHS, the volume of soil exceeding the MSC based on characterization sampling must be identified, remediated and post-remediation attainment samples collected. The results of attainment sampling could still include some concentrations exceeding the MSC and yet pass one of the existing attainment tests or the proposed average test. Nonetheless, there will have been an effort made to remediate all soil identified by site characterization as contaminated above the MSC.

By contrast, under the SSS, a baseline risk assessment can be performed prior to any remediation to determine if an unacceptable risk exists at the site. Based on Workgroup discussions, that risk assessment can be based on characterization data. If the average of those soil concentrations is less than 200 mg/kg, then the model will indicate an acceptable probability of exceedance and any soil exhibiting concentrations greater than 200 mg/kg can remain in place. Only if this risk calculation results in an unacceptable outcome would the remediation of soil with concentrations greater than 200 mg/kg be necessary, but then only to the extent required to achieve an acceptable probability of exceedance.

While there are additional protections provided under the SSS, they are either not available under the SHS or not necessary. These additional protections are primarily engineering and institutional controls, or consideration of cumulative effects in risk calculations, either across exposure pathways or regulated substances having the same impact as lead in children ages 1-5 years old. However, cumulative effects across regulated substances do not come into consideration because lead is unique among all regulated substances in terms of how risks are assessed with respect to an affected organ. On the other hand, there would seem to be not only an advantage under the SHS in terms of permanence and reduction in toxicity, mobility, or volume, but also the same consideration of cumulative effects across exposure pathways in that the same multimedia modeling methodology is applied under both the SHS and the SSS.

Therefore, to the extent that attainment of the SHS based on the average of attainment sampling results would more consistently remediate soil identified during characterization as exceeding 200 mg/kg, and the same multimedia modeling applies under both standards, cleanups under the SHS cannot rightfully be considered less conservative than those done under the SSS. It follows that allowing the use of an average attainment test under the SHS would not produce a less conservative or protective outcome than the current use of that test under the SSS.

6. COMPARATIVE EVALUATION OF ATTAINMENT TESTS

As part of the Workgroup's evaluation of the appropriateness of adding the average as an attainment test for direct contact to lead in soil, datasets were solicited from the PADEP and any Workgroup members who would provide them. In all, data were received for six Act 2 sites that have received relief from liability for releases of lead to soil. After reviewing the data, it was determined that data from four sites could be used in the evaluation. However, one of those four provided sufficient data to permit the evaluation of datasets from six separate units and one additional dataset created by combining attainment data from all six units. Therefore, a total of ten datasets were examined for the relationship of the three attainment tests to each other. An eleventh dataset was created by combining the full attainment dataset with the characterization data from that same site. The purpose of examining this large dataset is discussed later in this section.

6.1. Description of the Datasets and Graphs

Table 2 presents a summary of dataset and site characteristics and attainment test values for each site. The data were provided to the Workgroup as report tables in pdf format and were entered into Excel manually. Only two of the datasets included non-detect ("ND") values, 5 of 33 results at <0.25 mg/kg for Site 2 and 2 of 14 results at <0.5 mg/kg for Site 4, Unit HE-3. These latter two would also become 2 of 74 results in the Site 4, All Attainment dataset. Since the assumed value for any of the seven ND results

would have little effect on the determination of any of the three attainment test values, they were entered at the limit included in the pdf tables.

The 95% UCL values were determined by entering the datasets (including ND values) into the EPA's ProUCL software. The 95% UCL statistics suggested by the software program were selected. The listing of 95% UCL values in Table 2 includes a key that identifies which UCL statistic was suggested by ProUCL for each dataset. Output from the ProUCL software is included in Attachment B.

Attachment B also presents graphs of all datasets listed in Table 2. These graphs plot lead concentration on the y-axis versus the rank percentile of each sampling result in ascending order from 0% to 100% on the x-axis. Each graph also shows three color-coded horizontal lines - each one corresponding to one of the attainment test values listed in Table 2. As listed in Table 2, the datasets are from sites with a variety of land uses and geology. The number of samples in each dataset ranges from 8 to 74. Except for Site 5, the data were generated from post-excavation attainment sampling. The Site 5 dataset is comprised of 16 characterization samples collected to demonstrate attainment of the SSS by entering the average of these data in the IEUBK Model and running it in Risk Assessment Mode to show an acceptable risk based on a <5% probability of exceedance of the selected TBLL. This example was retained to show that simply comparing this same average concentration to the SHS MSC would have demonstrated the same outcome.

These 10 datasets also exhibit a variety of data distributions, including normal (3), lognormal (1) and gamma (6). Despite the variability of characteristics associated with these sites and datasets, this is nonetheless a limited sampling of the full range of conditions that might exist at sites with lead contamination in soils subject to the requirements of the LRP.

Table 2: Dataset Characteristics and Attainment Test Value Comparisons										
Dataset	**Site Use**	**Geology**	**Sample Type**	**Nbr (n)**	**MSC (mg/kg)**	**Data Distribution[1]**	**Maximum (mg/kg)**	**Average Value (mg/kg)**	**75%/10X Value[1] (mg/kg)**	**95%UCL Value[2] (mg/kg)**
Site 2	Wire Burn	Shale Fill	Attnmt.	33	450	Gamma	1024	**203**	280	AG **330**
Site 3	Scrap Yard	Alluvial Sediments	Attnmt.	53	1000	Lognormal	5897	**836**	961	H**2099** LN**1129** HN**2609**
Site 5	Orchard	Mixed Fill	Charac.[3]	16	500	Gamma	1050	**324**	471	AG**547**
Site 4, HE-1	Leaded Glass Manufacturing	Limestone Residuum	Attnmt.	8	450 NE[4]	Gamma	275	61.9	**38.4**	AG**180**
Site 4, HE-2			Attnmt.	16	450 NE[4]	Normal	392	**152**	**207**	ST203
Site 4, HE-3			Attnmt.	14	450 NE[4]	Gamma	279	67.1	**56.4**	AG**173**
Site 4, HE-4			Attnmt.	12	450 NE[4]	Normal	327	**137**	195	ST**196**
Site 4, HE-5			Attnmt.	12	450 NE[4]	Gamma	356	**101**	135	AG**255**
Site 4, HE-6			Attnmt.	12	450 NE[4]	Normal	353	**82.3**	99.4	ST**133**
Site 4, All. Attnmt.			Attnmt.	74	450 NE[4]	Gamma	392	**104**	**149**	AG132

Abbreviations: Nbr: Number; MSC: Medium Specific Concentration; mg/kg: milligrams per kilogram; Attnmt.: Attainment; Charac.: Characterization

Color coding: **292** Highest attainment test value; **203** Lowest attainment test value

Footnotes:

[1] Actual result in the dataset that is closest to, without exceeding, the 75th percentile

[2] From USEPA's ProUCL (See Attachment B)

[3] Although the data from this site is from characterization, it has been included in this analysis because the average of these data was used with the IEUBK Model to demonstrate attainment of the SSS.

[4] NE: No Exceedances, i.e., remediation proceeded until none of the results exceeded the MSC

Key to ProUCL 95% UCL Values:

AG: 95% Adjusted Gamma UCL (use when n<50)

H: 95% H-UCL; Disclaimer- *ProUCL computes and outputs H-statistic based UCLs for historical reasons only. H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide. It is therefore recommended to avoid the use of H-statistic based 95% UCLs. Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.*

LN: Lowest ProUCL nonparametric 95% UCL – ProUCL did not suggest this value

HN: Highest ProUCL nonparametric 95% UCL – ProUCL did not suggest this value

ST: 95% Student's-t UCL

6.2. Comparison of Attainment Test Results

The purpose of analyzing these datasets has been to examine the relative concentrations of the average, 75%/10X and 95% UCL tests for each of them. The expectation has been that the average concentration would be the lowest of the three and the 75%/10x and 95% UCL would be consistently higher and reasonably close to each other.

Concentrations for each of these attainment values have been color coded in Table 2 to show which of them is the lowest and highest for each of the ten datasets. For eight of the datasets, the average concentration is, as expected, the lowest of the three. For the other two, the 75%/10X concentration is the lowest. However, the difference between 75%/10X value and the average value in each case is not so great (38.4 mg/kg vs 61.9 mg/kg and 56.4 mg/kg vs 67.1 mg/kg).

Table 2 also shows the 95% UCL concentration to be the highest of the three concentrations for eight of the ten datasets. For one of these, Site 3, there are three 95% UCL values listed. The first one is the suggested statistic, but the key to ProUCL values indicates that a nonparametric 95% UCL should be used. ProUCL lists many nonparametric options, none of which is identified as preferred. For this reason, the lowest and highest nonparametric values are also listed for Site 3. The lowest of these is 1129 mg/kg, which is not nearly so much higher than the 961 mg/kg 75%/10X value as the suggested value of 2099 mg/kg.

For the other two sites, the 75%/10X concentration is the highest. For one of these, Site 4, HE-2, the difference is insignificant (207 mg/kg vs 203 mg/kg) and for the other, Site 4, All Attainment, the difference is only slightly more significant (149 mg/kg vs 132 mg/kg).

These relationships can also be viewed on the graphs in Attachment B, along with the ProUCL printouts.

Finally, an eleventh dataset was created by combining the seventy-four attainment samples from Site 4 with the eighty-eight characterization samples from that site. The resultant dataset has 162 samples ranging from <0.5 mg/kg to 24, 900 mg/kg. The average was 998 mg/kg, which, as will be shown, is why it was examined. Although it is obviously not a true attainment sample dataset, nonetheless, all the results exist on one property. It was therefore used to address one of the Department's concerns that the average of a large dataset might be used to successfully demonstrate attainment with many of the samples exceeding the MSC by more than ten times. In the case of this dataset, if the MSC were the current nonresidential direct contact NV of 1000 mg/kg, the average of 998 mg/kg would demonstrate attainment and the maximum value of 24,900 mg/kg would be nearly twenty-five times the MSC. Only two other results in this dataset exceed ten times the MSC. Discussion of this example focused on the need to examine possible limitations that could accompany the regulatory provisions of the average attainment test. Such a solution is identified in the recommendations at the end of this report.

7. SUMMARY

This section provides a summary of the key points made in the report that are supportive of the Workgroup rationale supporting the appropriateness of the average attainment test.

Summary Point #1: Lead is unique among regulated substances that are systemic toxicants for two reasons:

- There are no systemic toxicity values available for lead to calculate NVs, therefore, lead NVs are calculated using models based on a public health policy tool (the TBLL). Were there an acceptable systemic toxicity value for lead, it would be possible to compare the lead MSC using the standard methodology applied to all other systemic toxicants to the model-generated MSC to assess which methodology provides the more conservative results. That is not possible since there is no reference dose or concentration available for lead and the methodology for calculating lead NVs/MSCs is unique among all other systemic toxicants.
- The models used to calculate lead NVs are multimedia models that include inputs of lead not just from contaminated soil, but also from air, drinking water, house dust, food and maternal blood. This is not the case with other regulated substances for which only inputs from soil are considered. The use of this multimedia pathway approach instead of focusing only on lead in soil unquestionably shifts the resultant NVs in a more conservative direction. Were that modeling to be done with only the soil input, the model-calculated residential direct contact MSC would be 686 mg/kg, not 200 mg/kg. (There is no suggestion in this report that the multimedia approach in these models be changed.)

Given this unique methodology for calculating NVs for direct contact to lead in soil, it is appropriate to consider attainment criteria recommended for use with these models. (see Section 2)

Summary Point #2: While allowing for the use of an Upper Confidence Limit (UCL) EPA provides a recommendation and instructions to use the average concentration of lead in soil with the IEUBK Model as the soil lead concentration (PbS) input. This recommendation and instructions are documented in the following excerpts from the IEUBK Model User's Guide[7] (See Section 4):

- *2.3.4.2 Lead in Soil*
  The TRW[8] recommends replacing the default constant soil value (200 µg/g) (or variable values) with site-specific data representative of the average soil Pb concentration for the exposure scenario. (Page 36)

- *2.3.4.2.1 Developing a Soil Lead Concentration (PbS)*
  The PbS should be the arithmetic mean of the concentration of Pb in the soil that a child is likely to be exposed to. ….in most cases, the PbS would be the arithmetic mean concentration of Pb in soil of the DU. ….Typically, the simple average of the concentrations measured in each of the samples is appropriate…. The arithmetic average is appropriate when samples were collected using incremental composite sampling, when samples were collected using simple random sampling, and systematic sampling approaches that result in sample locations that were evenly spaced within the DU. (pages 36 and 37)

Summary Point #3: This use of the average of site-specific data for concentrations of lead in soil has been accepted by PADEP as the IEUBK Model input in Risk Assessment Mode under the SSS to demonstrate an acceptable risk level for direct contact to lead in soil by children ages 1-5 years. In this

[7] User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Version 2 (epa.gov)
[8] EPA's Technical Review Workgroup Lead Committee

mode, the model output is the calculated probability of exceeding a user-specified TBLL (i.e., 5 ug/dL) to be compared to a user-specified probability of exceedance cutoff (i.e., 5%).

Summary Point #4: Use of the average attainment test if permitted under the SHS would be no less conservative or protective than its use under the SSS, as currently permitted by the Department. This is due primarily to a preference for remediation remedies under the SHS and the inclusion of cumulative effects across the same multimedia exposure pathways addressed under the SSS. The latter is unique to lead among regulated substances. (see Section 5)

- Based on the collection of characterization data with values above and below the MSC, the SHS would require the remediation of all soil exceeding the MSC before any attainment testing is performed.
- The SHS therefore includes a preference for permanent remedial actions that results in a reduction of toxicity, mobility and volume.
- By applying multimedia models to the calculation of NVs for lead, the MSC under the SHS includes cumulative effects across exposure pathways not otherwise included for other systemic toxicants making it uniquely equivalent to the SSS for lead in that respect.

Summary Point # 5: The evaluation of three attainment tests applied across ten datasets shows a relationship among them that is predominantly what was anticipated, i.e., the preponderance of the results showed the ascending order of these test values to be the average, the 75%/10X ad hoc rule and the 95% UCL of the mean.

- The results for eight of the ten datasets showed the lowest value to be the average; for the other two, the lowest value was for the 75%/10X test.
- Evaluation of an eleventh dataset created to examine the potential need for limitations on high concentrations led to the identification of an existing provision of Chapter 250 that has been considered to address this issue and is referenced in the following recommendations. (see Section 6 and Attachment B).
- As the 95% UCL test value will always be higher than the average test value, adoption of the average as a third attainment test will largely eliminate the use of the 95% UCL test. However, there is no suggestion made in this report that either the 95% UCL test or the 75%/10X test be eliminated for lead.

8. Recommendations

Based on the conclusions enumerated above, the Workgroup recommends that the PADEP adopt an average attainment test, solely for direct contact to lead in soil, at § 250.707(b)(1) as follows:

> *(iv) For sites with a release of lead or lead compounds that has been remediated to attain an MSC for lead based on an ingestion numeric value calculated in accordance with the requirements of § 250.306(e) and Appendix A, Table 7, the arithmetic average of all attainment samples, which shall be randomly collected in a single event from the site, shall be equal to or less than the applicable MSC.*

This recommendation is made with the understanding that the average attainment test will be exempt from the requirements of § 250.707(d) (see Attachment C), and subject to the existing sampling requirements of § 250.703(d), and the existing limitations on high concentrations of § 250.703(c), which read as follows:

> *§ 250.703*
> *(c) Sampling points for demonstration of attainment of soils shall be selected to be random and representative both horizontally and vertically based on a systematic random sampling as set forth in a Department approved reference. If exceedances of a standard occur in a localized area, the Department may require additional characterization and remediation if three or more adjacent samples exceed the standard by more than ten times.*
>
> *(d) For statistical methods under § 250.707(b)(1)(i) and (iv) (relating to statistical tests), the number of sample points required for each distinct area of contamination to demonstrate attainment shall be determined in the following way:*
>
> *(1) For soil volumes equal to or less than 125 cubic yards, at least eight samples.*
> *(2) For soil volumes up to 3,000 cubic yards, at least 12 sample points.*
> *(3) For each additional soil volume of up to 3,000 cubic yards, an additional 12 sample points.*
> *(4) Additional sampling points may be required based on site-specific conditions*

Attachment A: Lead Attainment Subgroup White Paper

1. INTRODUCTION

The Cleanup Standards Scientific Advisory Board (CSSAB, or Board) to the Land Recycling Program (LRP) of the Pennsylvania Department of Environmental Protection (PADEP, or Department) unanimously submitted a memo entitled, "*Memorandum - Consideration for the Application of the IEUBK Model and ALM for the Development of Soil Direct Contact Values for Lead within the Act 2 Program"* to the LRP on September 17, 2020 (Memo).

The Memo expressed the CSSAB's support for the Department's decision to replace the two models currently being used to calculate direct contact soil numeric values (NVs) for residential and nonresidential land use with the Integrated Exposure Uptake Biokinetic (IEUBK) Model (version 1.1) (residential) and the Adult Lead Model (ALM) (nonresidential), both developed and supported by the United States Environmental Protection Agency (EPA).

The Memo also included a recommendation that the Department consider the use of the average as an additional attainment demonstration option for lead in soil under the Statewide health standard. Specifically, the final paragraph of the CSSAB 2020 Memo states:

> *"Based on this analysis of attainment demonstration alternatives, use of the average lead concentration should be considered as an additional option for the attainment demonstration so that the attainment "toolbox" includes a mechanism that meshes with the input criteria in the IEUBK model and ALM. By the same token, persons wishing to use the two existing attainment tests could do so consistent with what is currently provided for in the regulations implementing Act 2."*

In the August 11, 2021 meeting of the CSSAB, the Department requested that a new lead workgroup be assembled to address concerns from members of the LRP staff regarding the use of the average as an attainment test for lead. Subsequently, the 2021 Lead Workgroup was assembled in September 2021. During the first meeting of the workgroup, two subgroups were formed, one to address attainment criteria including use of the average, and one to address follow-on characterization issues as necessary. **In its current form, this white paper has been developed to support deliberations of the Lead Attainment Subgroup. As such, its principal purpose is to present the science and other facts underlying the development of Act 2 NVs and medium-specific concentrations (MSCs) for lead in soil, without expressing opinions or conclusions regarding the appropriateness of using the average as an attainment test. The goal has been to facilitate the subgroup's efforts to accommodate all opinions and arrive at conclusions as a group, not preempt that process. Eventually, some parts of this white paper may be incorporated into a report prepared by the full 2021 Lead Workgroup regarding the use of the average concentration of attainment sampling results as an attainment test, in addition to the two currently available attainment tests.**

In the text that follows, frequent reliance is made on language from published sources. Where this is the case, the borrowed language is shown in italics and a reference or link to the source is provided.

2. UNIQUE TREATMENT OF LEAD FOR THE DIRECT CONTACT SOIL EXPOSURE PATHWAY

Beginning with the language of Act 2 of 1995 and continuing with the development of draft regulations in 1996 and the final regulations in 1997, the stage was set for numeric values (NVs) associated with direct contact with soil containing lead to be calculated differently from NVs for other regulated substances.

2.1. Applicable Statutory Language

The applicable language of Act 2 of 1995 is contained in Section 303, the full text of which is provided in Attachment A. The following excerpt applies to the factors to be used in establishing the direct contact NVs to be applied in the development of Medium-Specific Concentrations (MSCs) for lead in soil:

> ***Act 2 of 1995, Section 303. Statewide health standard.***
>
> *(c) Additional factors. -- When establishing a medium-specific concentration, …. the medium-specific concentration for the ingestion of groundwater, inhalation of soils, ingestion and inhalation of volatiles and particulates shall be calculated by the department using valid scientific methods, reasonable exposure pathway assumptions and exposure factors for residential and nonresidential land use which are no more stringent than the standard default exposure factors established by EPA based on the following levels of risk:*
>
> *(1) For a regulated substance which is a carcinogen, the medium-specific concentration is the concentration which represents an excess upper bound lifetime cancer target risk of between 1 in 10,000 and 1 in 1,000,000.*
>
> *(2) For a regulated substance which is a systemic toxicant, the medium-specific concentration is the concentration to which human populations could be exposed by direct ingestion or inhalation on a daily basis without appreciable risk of deleterious effects for the exposed population.*

2.2. Development of Numeric Values for Lead Compared to Other Systemic Toxicants

The first step in implementing this statutory language in developing the original Chapter 250 regulations was to identify toxicity values available from authoritative sources for each regulated substance relative to carcinogenicity and systemic effects. Under Section 250.303(c)(1) those values could include an Oral Cancer Slope Factor (CSF_O) for the ingestion exposure route and an Inhalation Unit Risk (IUR) for the inhalation exposure route. Similarly, under Section 250.303(c)(2) the toxicity values could include an Oral Reference Dose (RfD_O) for the ingestion exposure route and an Inhalation Reference Concentration (RfCi) for the inhalation exposure route. For each regulated substance, any number, or none of these values might have been available.

When the final Chapter 250 regulations were published in 1997, none of these toxicity values existed for lead and lead compounds from an authoritative source. Since then, the California EPA (CA EPA) has developed CSF_O and IUR values for lead. As CA EPA is an acceptable source for toxicity values under Chapter 250, these two values are listed for lead in Chapter 250, Appendix A, Table 5B. However, NVs calculated using these toxicity values for comparison to the NVs listed in Appendix A, Table 4 are substantially higher than the current NVs in that table, as well as the Department's proposed changes to those NVs.

To provide an understanding of the scientific rationale for the absence of toxicity values for lead, Attachment B provides a detailed accounting of the scientific reasoning associated with the decisions made in 2006 by the New York State Department of Environmental Conservation (NYSDEC) and the New York State Department of Health (NYSDOH) not to adopt toxicity values for lead and lead compounds. In that excerpt, NYSDEC and NYSDOH make the following concluding statements regarding non-cancer and cancer toxicity values:

Text from https://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf

> ***Non-Cancer***
> *Many environmental guidelines or standards for lead are based on children as the sensitive population (e.g., CA EPA, 1997; Health Canada, 1992; RIVM, 2001; US EPA, 2000a, 2001; WHO, 1996). The derivations of these guidelines, however, are different from the derivation of guidelines for most contaminants. The guidelines are not based directly on a daily intake of lead from one route of exposure (for example, a reference dose for oral intake or a reference concentration for air intake) but are based on a blood lead level. The blood lead level is typically 10 mcg/dL (micrograms of lead per deciliter of blood), which is the Centers for Disease Control and Prevention (CDC) level of concern for blood lead in young children (ATSDR, 1999; CDC, 1991). In most cases, the guidelines are derived so that the blood levels of almost all children exposed at the guideline would be below 10 mcg/dL. This is the approach taken in the derivation of the SCOs for lead (see Section 5.3.4 Chronic Lead SCOs).* ***Thus, toxicity values (reference dose or reference concentration) for the non-cancer effects of lead are not proposed.*** **[emphasis added]**
> ***Cancer***
> *Only one of the authoritative bodies reviewed, the CA EPA, has derived oral cancer potency factors and inhalation unit risks for inorganic lead compounds (CA EPA, 1992, 1997, 2002, 2004). Most recently, the oral potency factor for lead was restricted to lead acetate, one of the two lead compounds shown to cause cancer via the oral route (CA EPA, 2005). In contrast, the US EPA (2005c) lead database for risk assessment in the Integrated Risk Assessment System, which is the peer-reviewed source for US EPA toxicity values for chemicals, contains the following statement:*
>
> > *Quantifying lead's cancer risk involves many uncertainties, some of which may be unique to lead. Age, health, nutritional state, body burden, and exposure duration influence the absorption, release, and excretion of lead. In addition, current knowledge of lead pharmacokinetics indicates that an estimate derived by standard procedures would not truly describe the potential risk.* ***Thus, the Carcinogen Assessment Group recommends that a numerical estimate not be used.***
> >
> > ***Given the problems associated with extrapolating animal data on lead to humans, animal-based oral cancer potency factors and inhalation unit risks for lead are not proposed.*** **[emphasis added]**

In the absence of toxicity values for lead, other methods were needed to calculate NVs for direct contact to lead in soil. Detailed accounts of the decisions made to identify and apply these methods are provided in relevant excerpts from the preambles to the 1996 draft Chapter 250 regulations and the 1997 final regulations reproduced herein in Attachment C. The following excerpt from the 1996 Preamble presents the basis for selecting the UBK model:

The direct contact soil MSC for lead for residential exposures has been estimated on the basis of protection of 95% of a population of children in the age range of 0 to 84 months. The Uptake Biokinetic (UBK) Model for Lead (version 0.4) was used to make this estimate. Although this model has been updated at least twice since version 0.4, this version was used because it was the version in use at the time the EPA developed its recommended residential lead-in-soil level of 500 mg/kg. Appendix A, Table 6 contains the input values that have been used in the model. The soil lead level from Appendix A, Table 6 (495 ug/g) has been rounded to 500 mg/kg which is the direct contact soil MSC for lead for residential exposures.

Note: A careful reading by Lead Attainment Subgroup members of the three excerpts in Attachments B and C is recommended.

The text of the current Chapter 250 regulations governing the calculation of NVs for direct contact to lead in soil as a systemic toxicant are unchanged from those published in 1997 in § 250.306(e), as follows:

(e) The residential ingestion numeric value for lead in soil was developed using the Uptake Biokinetic (UBK) Model for Lead (version 0.4) developed by the EPA (U.S. Environmental Protection Agency. (1990). Uptake Biokinetic (UBK) Model for Lead (version 0.4). U.S. EPA/ECAO. August 1990, in lieu of the algorithms presented in subsections (a) and (b). Default input values are identified in Appendix A, Table 7. Because the UBK model is applicable only to children, the nonresidential ingestion numeric value was calculated according to the method developed by the Society for Environmental Geochemistry and Health (Wixson, B. G. (1991)). The Society for Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil. Trace Sub- stances in Environmental Health. (11-20)

As shown in Appendix A, Table 7 (Attachment D) the UBK model assumes a Target Blood Lead Level (TBLL) for children of 10 micrograms per deciliter (ug/dL), derived from the Centers for Disease Control and Prevention's (CDC) 1991 level of concern for lead poisoning prevention in children. However, the SEGH algorithm assumes a TBLL for adult receptors of 20 ug/dL. Both models are characterized as generating ingestion NVs and no inhalation NVs are calculated.

By contrast, the approach for other systemic toxicants regulated under the LRP is first to calculate the NV for substances with an RfD_O using the equations in subsection (a) and the exposure assumptions in subsection (d) of *§ 250.306. Ingestion numeric values* and the NV for substances with an RfCi using the equations in subsection (a) and the exposure assumptions in subsection (d) of *§ 250.307. Inhalation numeric values*. The exposure assumptions used in these calculations include either a substance-specific reference dose or reference concentration, or both. If both toxicity values are available, subsections (c) of both *§ 250.306 and § 250.307* require that NVs for each exposure route are calculated for residential and nonresidential land use. For each substance and land use the NV for direct contact with soil is the lower of the two NVs for ingestion and inhalation from 0-15 ft. below ground surface (BGS) for residential land use and 0-2 ft. BGS for nonresidential land use.

2.3. Soil Numeric Values and Medium-Specific Concentrations for Lead: 1997 - Present

Based on the output from the UBK Model and SEGH algorithm, the residential NV for direct contact to lead in soil is 500 milligrams per kilogram (mg/kg) and the NV for nonresidential land use is 1000 mg/kg. However, in accordance with Section 250.308, the soil-to-groundwater NV for lead was calculated to be 450 mg/kg. Section 250.305 requires, in effect, that the lowest of these three numbers, i.e., 450 mg/kg, becomes the Medium-Specific Concentration (MSC) for both the residential and nonresidential land use scenarios. (Exceptions to this rule occur when either equivalency or buffer distance is used to attain the soil-to-groundwater MSC, or the NV derived from using the Synthetic Precipitation Leaching Procedure (SPLP) test to attain the soil-to-groundwater MSC is greater than the applicable (i.e., residential or nonresidential) direct contact NV, leading to the direct contact NV being the MSC.

3. PROPOSED PADEP NUMERIC VALUE AND MEDIUM-SPECIFIC CONCENTRATION REVISIONS

In the August 2021 CSSAB meeting, the Department proposed updating the models used to calculate NVs for direct contact to lead in soil for both residential and nonresidential land use. As shown in Table 1, the Department proposes to replace the UBK Model with the IEUBK Model (version 2.0) for residential land use and the SEGH algorithm with the Adult Lead Model (ALM) for nonresidential land use.

Table 1: Proposed Changes in Models, NVs for Direct Contact to Lead in Soil and MSCs

Land Use	Current Model	New Model	Current TBLL (ug/dL)	New TBLL (ug/dL)	Current DC* NV (mg/kg)	New DC* NV (mg/kg)	Soil-to-GW NV** (mg/kg)	Current MSC*** (mg/kg)	New MSC (mg/kg)
Residential	UBK	IEUBK	10	5	500	200	450	450	200
Nonresidential	SEGH	ALM	20	5	1,000	1050	450	450	450***

*DC: Direct contact **No change will occur in this NV ***In the absence of exceptions noted above

Table 1 also shows the Department's proposal would lower the TBLL from 10 ug/dL and 20 ug/dL for residential and nonresidential land use, respectively, to a consistent 5 ug/dL. The selection of this TBLL is based on the default value included in the IEUBK Model version 2.0 released by EPA in May 2021. The Department's proposal also assumes a 5% probability of exceedance cutoff for both models. As the table shows, adoption of the IEUBK Model v. 2.0 will lower the residential NV from 500 mg/kg to 200 mg/kg. However, the use of the ALM together with the 5 ug/dL TBLL will result in a small increase in the nonresidential NV from 1000 mg/kg to 1050 mg/kg.

Importantly, the table shows the soil-to-groundwater NV of 450 mg/kg will not change. As noted above, because this NV is currently lower than either of the direct contact NVs, the soil-to-groundwater NV is currently the MSC for both land uses. In the absence of any of the infrequent exceptions noted above, this will still be the case for the nonresidential land use scenario. However, with the adoption of 200 mg/kg for the residential scenario NV, that value will then be lower than the soil-to-groundwater NV, making it the applicable MSC for residential sites.

For this reason and, as a consequence of the proposed residential MSC of 200 mg/kg representing the lowest value for lead in soil proposed to date, the focus of the remainder of this white paper will be on the conservatism of using the IEUBK Model to derive residential direct contact NVs relative to the process used for other substances, the derivation of the TBLL and related CDC Blood Lead Reference Levels (BLRVs), and the significance of naturally occurring background levels of lead in surficial soils of Pennsylvania.

4. CDC GUIDANCE ON BLOOD LEAD LEVELS IN CHILDREN

4.1. History of CDC Criteria for Blood Lead Levels in Children, 1960 - 1991

The italicized text and table in this subsection are excerpted from the Morbidity and Mortality Weekly Report dated October 29, 2021 (the MMWR).

https://www.cdc.gov/mmwr/volumes/70/wr/mm7043a4.htm

See also CDC Updates Blood Lead Reference Value for Children | CDC Online Newsroom | CDC

CDC has been involved in defining the criteria for interpreting BLLs in children since 1971 (Table 1). The criteria for interpreting BLLs in children was revised over time based on new clinical and scientific evidence and improved laboratory technologies.

TABLE 1. Definitions for interpreting children's blood lead levels — United States, 1960–2021

Year	Blood lead level (µg/dL)	Interpretation*
1960	60	NA
1970	40	Undue or increased lead absorption
1975	30	Undue or increased lead absorption
1978	30	Elevated blood lead level
1985	25	Elevated blood lead level
1991	10	Level of concern
2012	5	Reference value
2021	3.5	Reference value

Abbreviation: NA = not available.
* https://stacks.cdc.gov/view/cdc/61820

The 10 ug/dL Level of Concern from 1991 was applied by EPA as the TBLL in the UBK Model (version 0.4) used to calculate the current residential direct contact NV for lead in soil.

4.2. Introduction of the Population-Based Blood Lead Reference Value (BLRV) in 2012

In 2012, CDC introduced the population-based blood lead reference value (BLRV) to identify children exposed to more lead than most other children in the United States…. The BLRV is based on the 97.5th percentile of the blood lead distribution in U.S. children aged 1–5 years from National Health and Nutrition Examination Survey (NHANES) data… [see NHANES - About the National Health and Nutrition Examination Survey (cdc.gov)] *The initial BLRV of 5 µg/dL, established in 2012, was based on data from the 2007–2008 and 2009–2010 NHANES cycles. In 2012, CDC's former Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP) recommended the establishment of the BLRV and proposed it be set at 5 µg/dL (5). This recommendation was based on the weight of evidence indicating that the adverse health effects of BLLs <10 µg/dL in children included neurologic, cardiovascular, immunologic, and endocrine effects. ACCLPP further*

recommended that the BLRV be updated every 4 years based on the 97.5th percentile of BLLs for children aged 1–5 years across the two most recent combined NHANES cycles for which data are available.

4.3. Update to the BLRV in 2021

The Lead Exposure and Prevention Advisory Committee (LEPAC) was established under the Water Infrastructure Improvements for the Nation Act of 2016. The LEPAC is charged with providing advice and guidance to the Secretary of U.S. Department of Health and Human Services (HHS), Director of CDC, and Administrator of Agency for Toxic Substances and Disease Registry on matters related to lead poisoning prevention and surveillance. In 2020, LEPAC charged a BLRV workgroup with providing advice and guidance regarding new scientific knowledge and technological developments to guide the BLRV. During a May 2021 meeting of the LEPAC, the workgroup recommended that the BLRV be updated from 5 µg/dL to 3.5 µg/dL using data derived from the two most recent NHANES cycles (2015–2016 and 2017–2018), and the LEPAC voted unanimously to accept this recommendation (6). Subsequently, the committee submitted a formal recommendation to the HHS Secretary to update the BLRV from 5 µg/dL to 3.5 µg/dL… The HHS Secretary and CDC concur with the recommendation and have developed communication and implementation plans to announce and promote the BLRV update, including to those at greatest risk.

The BLRV is a population-based measurement which indicates that 2.5% of U.S. children aged 1–5 years have BLLs ≥3.5 µg/dL. It is not a health-based standard or a toxicity threshold. The BLRV should be used as a guide to 1) help determine whether medical or environmental follow-up actions should be initiated for an individual child and 2) prioritize communities with the most need for primary prevention of exposure and evaluate the effectiveness of prevention efforts.

The most common sources of lead exposure in the United States are lead-based paint and dust, lead-contaminated soil, and lead in water from lead pipes and plumbing fixtures (1).

Attachment E presents a table of NHANES statistics for the years in question that were reportedly used by LEPAC's BLRV Workgroup to support the update of the BLRV from 5 ug/dL to 3.5 ug/dL. This table shows 97.5th percentile values of BLL of 3.48 ug/dL for two cycles from 2011 – 2014 and 3.44 ug/dL for two cycles from 2015 to 2018.

(**Personal communication**, December 4, 2021, Jill Ryer-Powder, Ph.D., MNSP, DABT, Chair CDC BLRV Workgroup, Member LEPAC)

See also May 2021 presentation to LEPAC by Jill Ryer-Powder, Ph.D., MNSP, DABT, Chair CDC BLRV Workgroup, Member LEPAC: Blood Lead Reference Value: Recommendation to LEPAC (cdc.gov)

A full copy of the BLRV Workgroup's August 10, 2021 report can be found at: https://www.cdc.gov/nceh/lead/docs/lepac/BLRV-recommendation-report-508.pdf

The NHANES datasets are available at: NHANES Questionnaires, Datasets, and Related Documentation (cdc.gov), but they require SAS software to download.

4.4. How does a BLRV Differ from a Reference Dose or Reference Concentration?

In a personal email communication on October 5, 2021, Dr. Ryer-Powder stated the following (emphasis added):

> *Please note that the BLRV is not a health-based number – rather it represents a value based on the 97.5th percentile of blood lead level (BLL) concentrations for US children aged 1 to 5 years. The BLRV is neither a clinical reference level defining an acceptable range of blood lead levels in children nor is it a health-based toxicity threshold; rather it is a policy tool that helps identify the children in the upper end of the population blood lead distribution in order to target prevention efforts and evaluate their effectiveness.* ***This is important to understand when setting a standard for "acceptable" concentrations of lead in soil.*** **[emphasis added]**

For this and other reasons, it's appropriate to examine how the BLRV differs from reference doses and reference concentrations.

4.4.1. Threshold Dose-Response RfD_O and RfCi vs Non-threshold Public Health Policy BLRV

The oral reference dose (RfD_O) and inhalation reference concentration (RfCi), which are toxicity values used to evaluate potential systemic health effects, are estimates (with uncertainty spanning perhaps one or more orders of magnitude) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Thus, the RfD_O and RfCi represent thresholds below which deleterious health effects are unlikely to occur.

RfD_Os and RfCis are derived from laboratory or human studies in which the administered concentration corresponding to the no observed adverse effect level (NOAEL) or lowest observed adverse effect level (LOAEL) for a critical toxic effect is divided by various uncertainty factors (UFs) and a modifying factor (MF). The uncertainty factors generally consist of multiples of 10 (although values less than 10 are sometimes used), with each factor representing a specific area of uncertainty inherent in the extrapolation from the available data. A UF of 10 is used to account for variation in the general population and is intended to protect sensitive subpopulations (e.g., elderly, children). A UF of 10 is used when extrapolating from animals to humans. A UF of 10 is used when a NOAEL derived from a sub-chronic instead of a chronic study is used as the basis for a chronic RfD. A UF of 10 is used when a LOAEL is used instead of a NOAEL. The MF is a value that typically ranges from 0 to 10 to reflect a qualitative professional assessment of additional uncertainties in the critical study and in the entire data base for the chemical not explicitly addressed by the preceding uncertainty factors. Depending on the chemical and available data, the combination of UFs and the MF can impart a margin of safety of several orders of magnitude (e.g., 1,000-fold or more) to the NOAEL or LOAEL. As such, RfD_Os and RfCis are based on dose-response relationships from human or animal studies with potentially high levels of uncertainty.

By contrast, the following excerpt is from the first paragraph of the Executive Summary in the BLRV Workgroup's August 10, 2021 report recommending the change to 3.5 ug/dL (emphasis added):

> ***No safe level of lead exposure has been identified for children.*** *Protecting children from childhood lead poisoning requires the collective work of many partners, including but not limited to a range of federal, state, territorial, and local agencies, as well as homeowners,*

> *landlords, and clinical providers.* ***The CDC blood lead reference value (BLRV), defined as the 97.5th percentile of blood lead level (BLL) concentrations for U.S. children aged 1 to 5 years****, is an important tool guiding the efforts of these stakeholders, but* ***is not a clinical reference level defining an acceptable range of blood lead levels in children, nor is it a health-based toxicity threshold, and it cannot be used to predict the health outcome for any particular child.***
> https://www.cdc.gov/nceh/lead/docs/lepac/BLRV-recommendation-report-508.pdf

Therefore, unlike reference doses and concentrations, the BLRV does not represent a threshold below which deleterious health effects are unlikely. In fact, if there is no safe level of exposure for the sensitive population represented by children ages 1-5, then, in this context, for certain toxicological effects lead is a systemic non-threshold substance. The BLRV is not based on dose-response studies, but rather on population-based statistics without quantitative equivalence to a toxicity threshold.

Lead also has been identified by EPA in IRIS as a B2 – probable carcinogen based on sufficient evidence of carcinogenicity in animals; however, the EPA has not established quantitative estimates (i.e., oral slope factors or inhalation unit risk factors) to define its potency.

4.4.2. Basis for Revising and Updating Values

The progression of BLRVs from 5 ug/dL in 2012 to 3.5 ug/dL in 2021 follows the recommendation made in 2012 by the ACCLPP that the BLRV be updated every four years based on the most recent NHANES data. In fact, that update to 3.5 ug/dL was first recommended in 2017 but was not successfully implemented. As NHANES data are collected and analyzed in future cycles, the following recommendation from the BLRV Workgroup in its August 10, 2021 report ensures that the BLRV will either remain the same or continue to be revised downward following positive progress in controlling children's exposure to lead, but will never be revised upward based on less encouraging results (emphasis added):

> *The Blood Lead Reference Value Workgroup recommends that the LEPAC adopt a revised BLRV of 3.5 µg/dL (based upon most recent NHANES cycles 2015-2018) [8]. The workgroup also recommends that that* [sic] *the LEPAC reaffirm CDC's commitment to regularly analyzing NHANES data to identify the 97.5th percentile and* ***adopt a policy that this analysis may be used to either maintain or lower, but never increase, the reference value in the future.***
>
> ***These recommendations are consistent with the use of a reference value that is not a threshold for toxicity, nor a fine line for determining when actionable steps should/ should not occur.***
> https://www.cdc.gov/nceh/lead/docs/lepac/BLRV-recommendation-report-508.pdf

This is a completely understandable approach for an agency committed to reducing lead exposures in children. However, this is unlike the basis for revising a reference dose or reference concentration upward or downward, which would only occur if additional authoritative dose-response studies showed the need for a higher or lower value due to higher or lower demonstrated toxicity.

5. IEUBK MODEL V. 2.0

This discussion of the IEUBK Model (version 2.0) will rely mostly on excerpts from the user's guide to be found at: User's Guide for the Integrated Exposure Uptake Biokinetic Model for Lead in Children (IEUBK) Version 2 (epa.gov). (See also Tuesday_1400a-Partridge.PDF (clu-in.org) for a helpful EPA presentation on the IEUBK Model.)

The following subsections describe the components of the model, the modes in which it can be run, with related inputs and outputs and identification of examples. Figure 1 of this white paper is after Figure 1-1 of the User's Guide. It depicts the biological structure of the model.

5.1. Exposure Component

Exposure can be thought of as the contact with a chemical or other agent, which may result in the absorption or exchange across boundaries of an organism, such as the gut, lungs, and skin. The results from the exposure component of the IEUBK model are estimated intake rates for the quantities of Pb inhaled or ingested from environmental media. The media addressed by the IEUBK model include soil, house dust, drinking water, air, and food. Paint is usually addressed in terms of its contribution to the measured concentration of Pb in soil or house dust.

It should be noted, however, that the model defaults do not include a contribution from lead-based paint to Pb in soil or house dust, but it can be added as an alternate source. The media addressed do also include maternal blood.

Quantitation of a child's exposure to Pb (µg/day) requires estimation of the concentration of Pb in the environmental media that the child contacts (usually µg/g, µg/m^3, or µg/L), multiplied by a term to describe the child's daily intake of the medium (usually g/day, m^3/day, or L/day). The Exposure Module estimates how much Pb enters a child's body by calculating media-specific Pb intake rates using the following general equation:

*Pb Intake Rate = Media Pb Concentration * Media Intake Rate*

The values used for media Pb concentrations and media intake rates are either derived from site-specific data or standard default values established by the U.S. Environmental Protection Agency (EPA)... The media intake rates are age-specific... The Exposure Module calculates the intake of Pb from each medium for use in the Uptake Module.

5.2. Uptake Component

The uptake component models the processes by which Pb intake (Pb that has entered the child's body through ingestion or inhalation) is transferred to the blood plasma. Uptake (µg/day) is the quantity of Pb absorbed per unit time from portals of entry (gut, lung) into the systemic circulation of blood. Only a fraction of the Pb entering the body through the respiratory or gastrointestinal (GI) tracts is absorbed into the systemic circulation. This absorption fraction (AF) is, by convention, termed bioavailability and integrates uptake processes which involves bioaccessibility and absorption. The IEUBK model allows for different bioavailabilities of Pb from different environmental media and includes for a partial saturation of GI absorption at high levels of Pb intake.

The Uptake Module calculates media-specific Pb uptake rates using the following equation:

*Pb Uptake Rate = Pb Intake Rate * Absorption Factor*

The Pb intake rates are calculated by the Exposure Module, and the absorption factors are typically standard default values established by EPA. The Pb intake rates and absorption factors are both age- and media-specific. Absorption factors reflect the percentage of Pb that enters the bloodstream after intake from a specific environmental medium. The overall Pb uptake value can be obtained by summing the media-specific Pb uptake values.

5.3. Biokinetics Component

The biokinetic module addresses the transfer of absorbed Pb between blood and other body tissues; the elimination of Pb from the body via urine, feces, skin, hair, and nails; and the storage and/or disposition of Pb in the extra-cellular fluid, red blood cells, liver, kidney, spongy bone, compact bone (e.g., femur), and other soft tissue. The total amount of Pb in each body compartment is age dependent and calculated using total Pb uptake derived by the Uptake Module.

The biokinetic component of the IEUBK model is, therefore, a mathematic expression of the movement of absorbed Pb throughout the body over time by physiologic or biochemical processes. This module converts the total Pb uptake rate from the uptake component into an input to the central plasma-extracellular fluid (ECF) compartment. A variety of complex equations are used to calculate compartmental Pb transfer times. Transfer coefficients are used to model movement of Pb between the internal compartments and to the excretion pathways. The quantities are combined with the total Pb uptake rate to continuously recalculate the Pb masses in each of the body compartments and especially the changing concentration of Pb in blood. Thus, based on site-specific environmental exposures input by the user or default values, a [geometric mean] *GM PbB concentration is predicted.*

5.4. Variability: Probability Distribution Module & Probability Density Curve

An important goal of the IEUBK model is to address variability in PbB concentrations among exposed children. Children having contact with the same concentrations of environmental Pb can develop very different PbB concentrations due to differences in behavior, household characteristics, and individual patterns of Pb uptake and biokinetics. The IEUBK model uses a log-normal probability distribution to characterize variability. The biokinetic component output provides a central estimate of PbB concentration, which is taken to be the GM of a lognormal distribution. The geometric standard deviation (GSD) determines the shape (spread) of the lognormal distribution. The recommended default value for this parameter (1.6) was derived from empirical studies with young children where both blood and environmental Pb concentrations were measured (White et al., 1998).

The Probability Distribution Module estimates a plausible distribution of PbB concentrations that is centered on the GM PbB concentration calculated by the Biokinetic Module. From this distribution, the model calculates the probability or risk that a child's PbB concentration will exceed a user-selected PbB level of concern (e.g. 5 µg/dL). In running this portion of the model, the user specifies a PbB level of concern and a GSD. For

most sites, EPA recommends use of the default values for both the GSD and PbB level of concern.

The results generated by the biokinetics component can be displayed by the model in a Probability Density Curve as shown on Figure 2 for the inputs assumed in calculating the proposed NV of 200 mg/kg (i.e., TBLL = 5 ug/dL and probability of exceedance cutoff = 5%).

5.5. Model Inputs and Defaults

2.1 Inputs
IEUBK contains more than 100 input parameters that are initially set to default values. Of these, many may be changed by the user; the remaining internal model parameters are set to fixed default values. The default values represent national averages or plausible central values that were developed based on peer reviewed literature and research. (page 25)

2.3.4.2 Lead in Soil
The TRW recommends replacing the default constant soil value (200 µg/g) [NV calculated by PADEP] *(or variable values) with site-specific data representative of the average soil Pb concentration for the exposure scenario.* (page 36)

2.3.4.2.1 Developing a Soil Lead Concentration (PbS)
The soil lead concentration term (PbS) is the only input parameter of the Model for which a site-specific value is necessary…. A site PbS may reflect the current exposure scenario (i.e., to predict current risk) or (potential) future exposure scenarios; ***for example, a PbS for future exposure scenarios may reflect a preliminary remediation goal.***

The PbS should be the arithmetic mean of the concentration of Pb in the soil that a child is likely to be exposed to. *Unless there is site-specific information to the contrary, the child is usually assumed to have an equal chance of contacting soil throughout the decision unit (DU); therefore, in most cases, the PbS would be the arithmetic mean concentration of Pb in soil of the DU. The method for estimating the arithmetic mean depends on how the soil samples were collected. Typically, the simple average of the concentrations measured in each of the samples is appropriate (the sum of the sample concentrations divided by the number of samples).* ***The arithmetic average is appropriate when samples were collected using incremental composite sampling, when samples were collected using simple random sampling, and systematic sampling approaches that result in sample locations that were evenly spaced within the DU.*** (pages 36 and 37).

Attachment F lists the default values for the IEUBK version 2.0 model parameters. As stated in Section 3, the Department has generated the proposed direct contact soil NV using the default model parameters.

5.5.1. Running the Model

The model is used in two principal ways:

1. to calculate a geometric mean PbB and the associated probability of exceedance of a user-specified PbB (Run Mode or Risk Assessment Mode) or
2. to calculate the soil concentration that would result in a user-specified probability of exceedance of a user-specified PbB (Find Mode or PRG mode).

The model inputs and calculations are the same for both methods of using the model. The difference between these two modes is essentially what variable is being sought. For example, using the model defaults for all input parameters (including an "outdoor soil lead concentration" of 200 ug/g or mg/kg), in Run Mode, the model generates a probability distribution graph showing a 4.979% probability (effectively 5%) of exceeding a PbB of 5ug/dL. This is the mode in which the model is run to demonstrate an input concentration is predicted to satisfy the 5% probability of exceedance cutoff for a selected BLL goal. The following is excerpted from footnote #11 in the CSSAB's 2020 Memo:

> *From the IEUBK User's Guide* [v.1.1] *(section 2.2.4): "The TRW recommends that the soil contribution to dust lead be evaluated by comparing the average or arithmetic mean of soil lead concentrations from a representative area in the child's yard.*
>
> *The IEUBK model can use an upper confidence limit (UCL); however, the interpretation for the model results is somewhat different if a UCL is used. If an arithmetic mean (or average) is used, the model provides a central point estimate for risk of an elevated blood lead level. If a UCL is used, the model result could be interpreted as a more conservative estimate of the risk of an elevated blood lead level."*
> Link no longer available.

The use of a UCL is further addressed in the user's guide for IEUBK model version 2.0 section 2.3.4.2.1 as follows:

> *There will be some uncertainty in the estimate of the PbS due to the variability of Pb concentration in the DU soil. Theoretically, the distribution of PbB concentration that is predicted by the IEUBK model accounts for the uncertainty in the PbS (Section 2.3.8). In some cases, a risk assessor may choose to use an upper confidence limit (UCL) on the arithmetic mean PbS to account for the uncertainty in the estimate (EPA, 2007); however, this is less common for site lead risk assessment. The performance or acceptance criteria should be established in Step 6 of the DQO process (EPA, 2006). These criteria should be used* [to] *determine the required sample size.* (page 38)
> https://semspub.epa.gov/src/document/HQ/400700

Running the model in Find Mode using the same default input parameters, a "Change Cutoff" of 5 ug/dL, and a "Probability of Exceeding Cutoff" of 5%, the model generates a "Soil and/or Dust Concentration" of 200 ppm or mg/kg. This is the manner in which the model was run by the Department to generate a PRG of 200 mg/kg that is the proposed NV/MSC for direct contact to lead in soil.

> *The PRG is the average concentration of a chemical in an exposure area that will yield the specified target risk in an individual who is exposed at random within the exposure area.*
> Calculating Preliminary Remediation Goals (PRGs) | US EPA

5.5.2. Selection of Target Blood Lead Level (TBLL) and Probability of Exceedance Cutoff

The first decision to be made in applying the IEUBK Model is to select the TBLL and the probability of exceedance cutoff. As noted above, the Department's current proposal is to select 5% as the probability of exceedance cutoff and to lower the TBLL from 10 ug/dL to 5 ug/dL based on EPA's adoption of the latter as the default in the IEUBK Model v. 2.0 in May 2021.

6. NATURALLY OCCURRING LEAD IN SURFICIAL SOILS IN PA

With the reduction proposed in the residential direct contact numeric value for lead in soil from 500 mg/kg to 200 mg/kg, it was apparent that the new MSC for lead in soil would fall much closer to the

range of background concentrations for lead in Pennsylvania soils. Geologists on the subgroup identified data available from the United States Geological Survey (USGS) that could provide a basis for examining the relationship between the proposed MSC and background concentrations in surficial soil in PA.

6.1. USGS Background data for lead in surface soils

In 2007, the U.S. Geological Survey initiated a low-density (1 site per 1,600 square kilometers, 4,857 sites) geochemical and mineralogical survey of soils of the conterminous United States as part of the North American Soil Geochemical Landscapes Project. Sampling and analytical protocols were developed at a workshop in 2003, and pilot studies were conducted from 2004 to 2007 to test and refine these recommended protocols. The final sampling protocol for the national-scale survey included, at each site, a sample from a depth of 0 to 5 centimeters, a composite of the soil A horizon, and a deeper sample from the soil C horizon or, if the top of the C horizon was at a depth greater than 1 meter, from a depth of approximately 80–100 centimeters. The <2-millimeter fraction of each sample was analyzed for a suite of 45 major and trace elements by methods that yield the total or near-total elemental content.

USGS Data Series 801: Geochemical and Mineralogical Data for Soils of the Conterminous United States

Attachment G presents a table that contains a full listing of these 75 samples for the 0-5 cm sampling depth. As shown in this table, each sample is characterized by two Land Cover categories that describe its provenance (e.g., Forested Upland / Mixed Forest). The locations of all 75 sampling sites are shown on Figure 3.

6.2. USGS Background Lead in Soil Concentration Statistics from EPA Website

Based on the data listed in Attachment G, the EPA published statistics for the full data listing and the data listing with two outliers excluded (based solely on an outlier screen), both as shown in Table 2. The provenance of the two highest values that EPA excluded was reviewed and both were found to be from upland forest and examination of the sample site location map showed they were not adjacent to highways or industrial areas. Therefore, the decision was made to use the statistics in Table 2 from the full data set for further analysis.

Table 2: Statistics for Naturally-Occurring Concentrations of Lead in Surficial Soils in PA

Geogenic Soil Lead Concentrations (mg/kg): 2007-2010 (All Data)

Number of Samples	Mean	Std Error	95 UCL	Std Dev	Coeff of Variation	Min	Q1	Median	Q3	90th	95th	99th	Max
75	60.2	5.3	68.9	45.6	0.758	14.7	31.8	46.4	69.3	118	153	261	261

Geogenic Soil Lead Concentrations (mg/kg): 2007-2010 (Outliers Excluded)

Number of Samples	Mean	Std Error	95 UCL	Std Dev	Coeff of Variation	Min	Q1	Median	Q3	90th	95th	99th	Max
73	55.0	3.9	61.4	33.2	0.605	14.7	31.8	46.1	66.5	105	132	161	161

About These Tables:

These tables show the overall occurrence of lead in surface samples as described by USGS.

Sources of These Data:

The U.S. Geological Survey provided the soil sampling data. The data display was prepared by U.S. Environmental Protection Agency. USGS Background Soil-Lead Survey: State Data | US EPA

6.3. Potential Effect of Natural Background Lead in Soil on BLLs in Children

Given the frequent cautions that no blood lead level (BLL) is safe, it seemed that lead concentrations in the range of those shown in Attachment G, with the statistics listed in Table 2 might warrant examination for the potential effect of natural background soil concentrations on BLLs. The statistics in Table 2 (All Data) for the mean, 95% UCL of the mean and the 95th percentile were run through the model with all media inputs set at defaults and probability of exceedance cutoff set at 5% to calculate the corresponding BLLs. The results of these calculations are shown in Table 3.

Table 3: Calculated Effect of Natural Background Lead in PA Surface Soils on BLLs in Children

	USGS Background Lead in PA Surface Soils (Top 5 cm) (mg/kg)	IEUBK Model Calculated* BLLs in Children Based on USGS Background Soil Concentration Statistics (ug/dL)
Average	60.2	3.16
95 % Upper Confidence Limit	68.9	3.27
95th Percentile	153	4.38

Notes:
PA – Pennsylvania
BLL - Blood lead level
cm – centimeters
mg/kg - milligrams per kilogram
UCL - upper confidence limit of the mean
IEUBK - Integrated Exposure Uptake Biokinetic model for lead (USEPA, 2021)
ug/dL - micrograms per deciliter
* - BLLs calculated using the "Find" function by varying the "Change Cutoff" value until the calculated "Soil and/or Dust Concentration" was equal to the background soil concentration using a probability of exceedance of 5% and a geometric standard deviation of 1.6 (both defaults).

6.4. Does Act 2 Allow for Setting a Floor on NVs Based on Natural Background?

There has been some discussion within each of the subgroups of setting a floor on the NV for residential direct contact to lead in soil based on sampling programs to establish regional background values. This subsection of Act 2 would appear to preclude that approach independent of the background standard.

> *§ 250.303(d) Relationship to background. -- The concentration of a regulated substance in an environmental medium of concern on a site where the Statewide health standard has been selected shall not be required to meet the Statewide health standard if the Statewide health standard is numerically less than the background standard. In such cases, the background standard shall apply.*

7. ANALYSIS OF EXAMPLES

Four examples have been identified to show a range of values for TBLL or blood lead concentration (BLC) and PRG and the associated GM BLL with all media included at default values (see Table 4). While all four of these examples were calculated by entering the selected BLC and a probability of exceedance cutoff of 5%, the example listed as having a basis of “PRG = EPA RSL” was not designated as such until

the resulting PRG of 400 mg/kg, which is the current RSL, was generated by the model from entering 7.5 ug/dL as the BLC. The basis "PRG = EPA RSL" was then made due to the significance of this PRG as a federal guidance value.

Table 4: Examples of IEUBK Model v.2.0 Results at 5% Probability of Exceedance Cutoff (All Media)			
Basis	**Blood Lead Concentration (ug/dL)**	**Geometric Mean Blood Lead Concentration**	**PRG Soil Concentration (mg/kg)**
PRG if TBLL not changed from 10 ug/dL to 5 ug/dL	10	4.6	611
PRG = EPA RSL*	7.5*	3.5*	400*
PADEP Proposal	5	2.3	200
New CDC BLRV 10/28/21	3.5	1.6	85

*The EPA RSL of 400 mg/kg is not determined using the IEUBK Model v. 2.0. The BLC and GM values shown for this example are those that would be associated with use of the IEUBK Model v. 2.0 to generate a PRG at that same concentration.

Figure 4 shows the progressive change in shape of the four probability density curves corresponding to each of these examples as the BLCs decline.

A second set of values was calculated for these four examples using defaults for soil and dust only and soil only. Table 5 shows the results of those calculations for PRG under each scenario.

Table 5: Examples of IEUBK Model v.2.0 Results at 5% Probability of Exceedance Cutoff (Ltd. Media)			
Basis	**Blood Lead Concentration (ug/dL)**	**PRG Soil Concentration (mg/kg) Soil & Dust Only**	**PRG Soil Concentration (mg/kg) Soil Only**
PRG if TBLL not changed from 10 ug/dL to 5 ug/dL	10	783	1453
PRG Extended from RSL	7.5	571	1059
PADEP Proposal	5	370	686
New CDC BLRV 10/28/21	3.5	254	472

7.1. Based on all model defaults for all media

The all-media results for BLC and PRG in Table 4 have been plotted on Figure 5 together with the all-media values for the background statistics as shown in Table 3. The purpose of this figure is to show the relationship of the proposed 200 mg/kg MSC to the other examples in Table 4 and to naturally-occurring background for lead in surface soils. This figure also shows that the relationship of BLC to PRG is very close to linear.

It's apparent that the new NV of 200 mg/kg will fall much closer to the natural background range and will be lower than the two highest values (269 mg/kg and 239 mg/kg) listed in Attachment G. However, the PRG corresponding to the new BLRV of 3.5 ug/dL (85 mg/kg) would be imbedded within the natural background range, closest to the value of 68.9 mg/kg in Table 3 for the 95% UCL of the mean of the data in Attachment G. It should also be noted that the BLLs in Table 3 of 3.16 to 4.38 ug/dL essentially bracket the new BLRV.

Finally, this figure shows the extension of the relationship of BLL to PRG to an x-axis intercept of 2.35 ug/dL. At that point the model is predicting that at zero contribution from soil, the remaining media at

their default values would account for a BLL of 2.35 ug/dL. Out of a total TBLL of 5 ug/dL that leaves 2.65 ug/dL for the soil contribution.

7.2. Based on model defaults for soil only and soil/dust only

The examples presented in Table 5 have been plotted on Figure 6 for the relationship of BLLs to PRGs together with the examples of this relationship from Table 4 and Figure 5. The purpose of this figure is to show graphically the effects of accounting for other media inputs when calculating a PRG for soil remediation. It's clear from this figure and Table 5 that eliminating these other media and running the model for soil and dust only and soil only has a substantial effect on the resulting PRG. **This is important to the consideration of how the method of calculating the NV for lead compares to the method used to calculate NVs for all other systemic toxicants for which other media inputs are not incorporated.**

It should be noted that Excel trendlines (not shown) for soil and dust only and soil only both intercept the x-axis at the origin, so that the PRG for soil is associated with the entire 5 ug/dL TBLL. This is contrasted with the all-media intercept of 2.35 ug/dL, which leaves only 2.65 ug/dL of the 5 ug/dL TBLL for soil.

8. OTHER SCREENING VALUES AND CLEANUP GOALS

Attachment H presents other screening values and cleanup goals including the EPA's RSL and state criteria for adjacent states Maryland, New York, New Jersey, and Ohio. Maryland is the only one of these states with soil screening values that match the proposed 200 mg/kg and 1050 mg/kg NVs in the current PADEP proposal. It is unknown whether other states are in the process of reviewing and updating their values.

Figure 1: Biological Structure of the IEUBK Model
(After Figure 1-1 of the IEUBK Model, v.2.0 User's Manual)

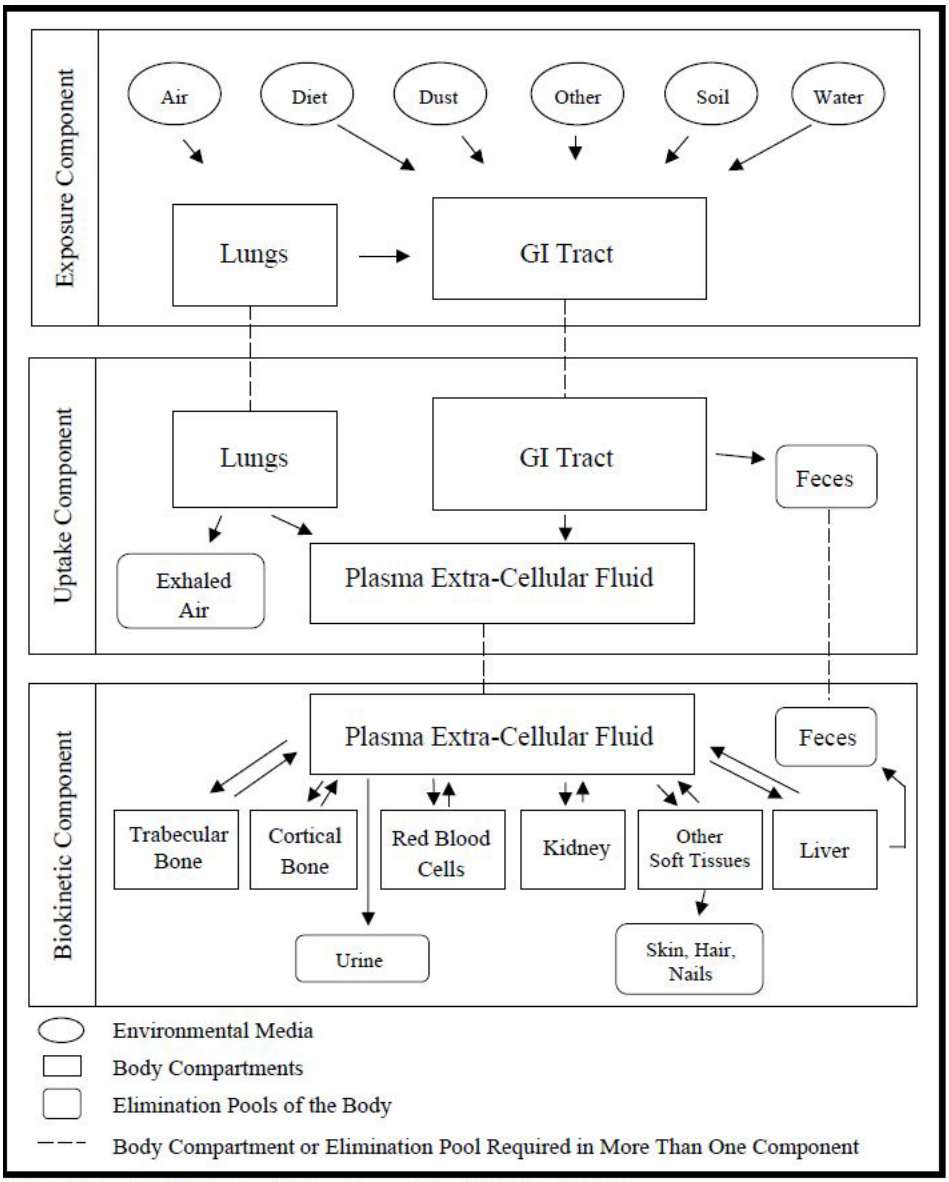
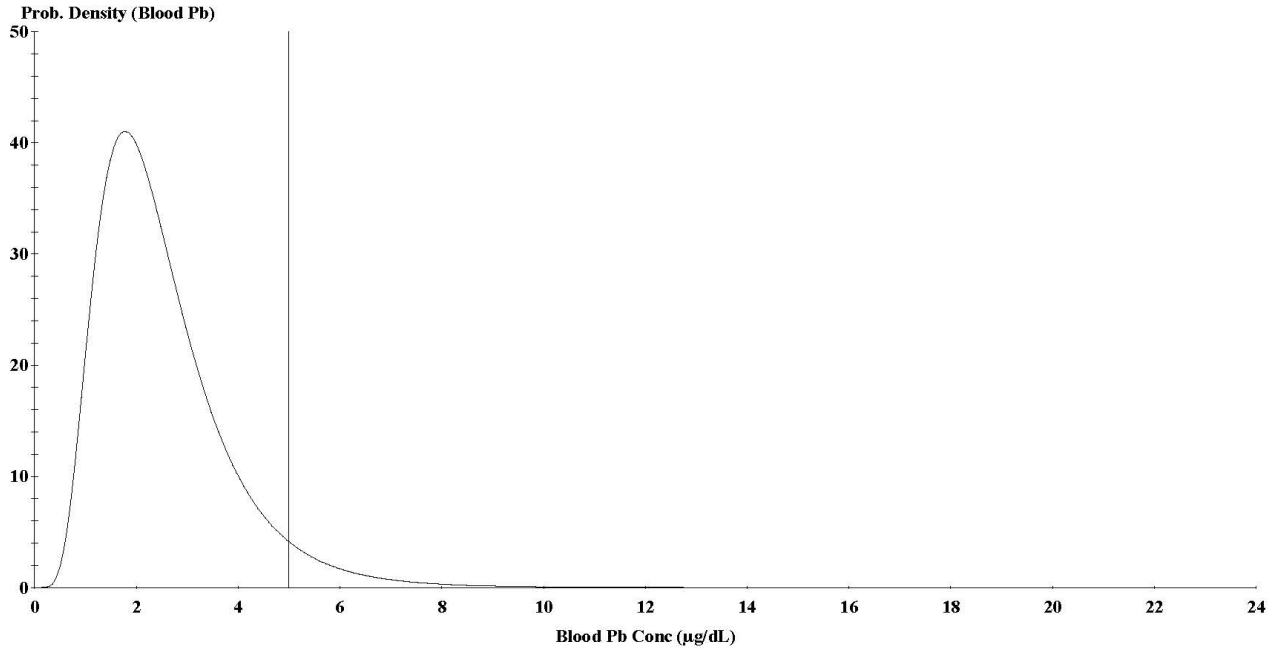


FIGURE 1-1. Biological Structure of the IEUBK Model.

Figure 2: Probability Density Curve, TBLL = 5 ug/dL, Probability of Exceedance Cutoff = 5%



Cutoff = 5.000 µg/dl
Geo Mean = 2.306
GSD = 1.600
% Above = 4.979
% Below = 95.021

Age Range = 12 to 72 months

Run Mode = Research

These IEUBK Model results are valid as long as they were produced with an official, unmodified version of the IEUBK Model with a software certificate.
While IEUBK Model output is generally written with three digits to the right of the decimal point, the true precision of the output is strongly influenced by least precise input values.

Figure 3: USGS Naturally-Occurring Background Lead in Surface Soil in Pennsylvania Sampling Site Location Map

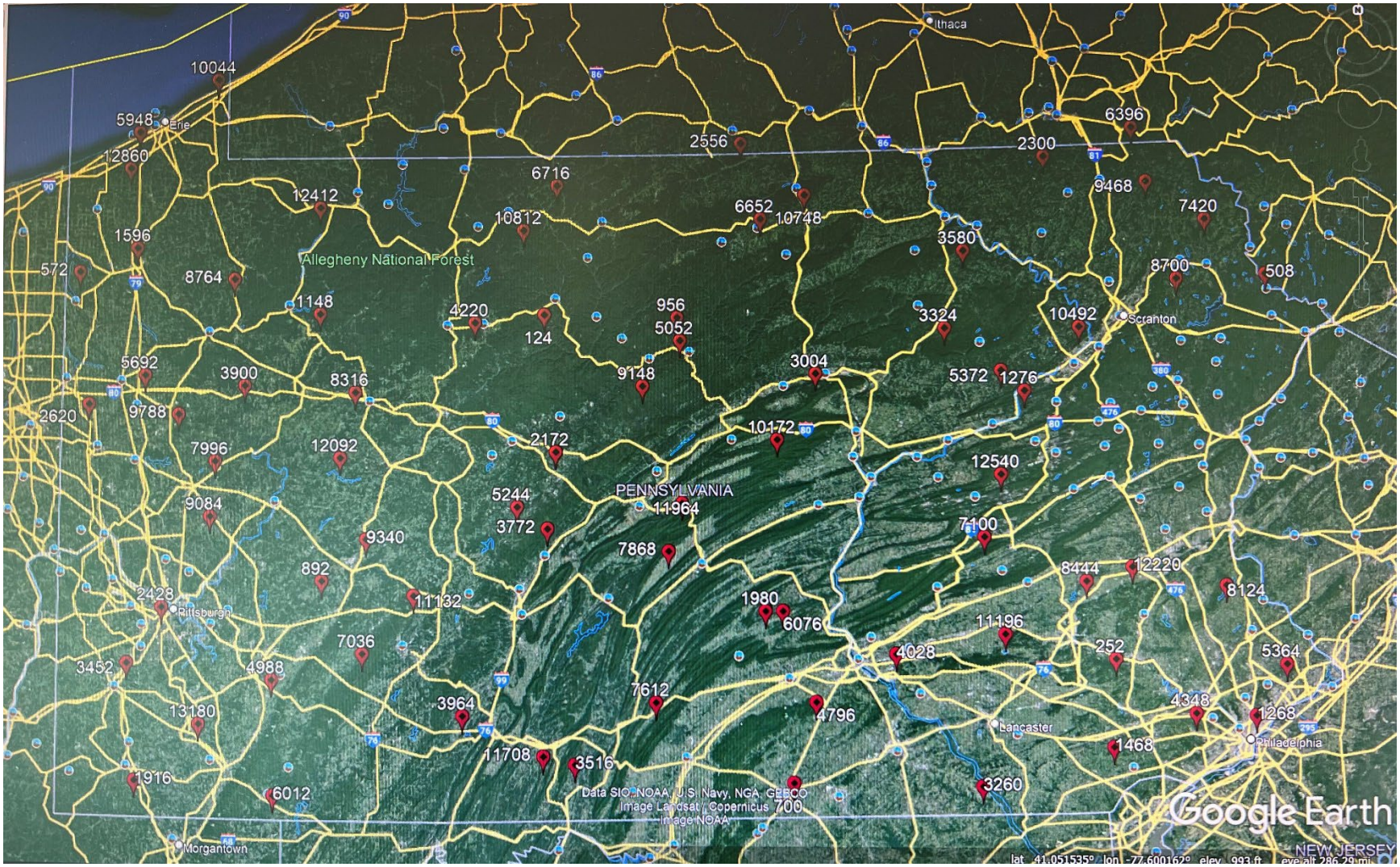


Figure 4: IEUBK v.2.0 Calculated Probability Density Curves

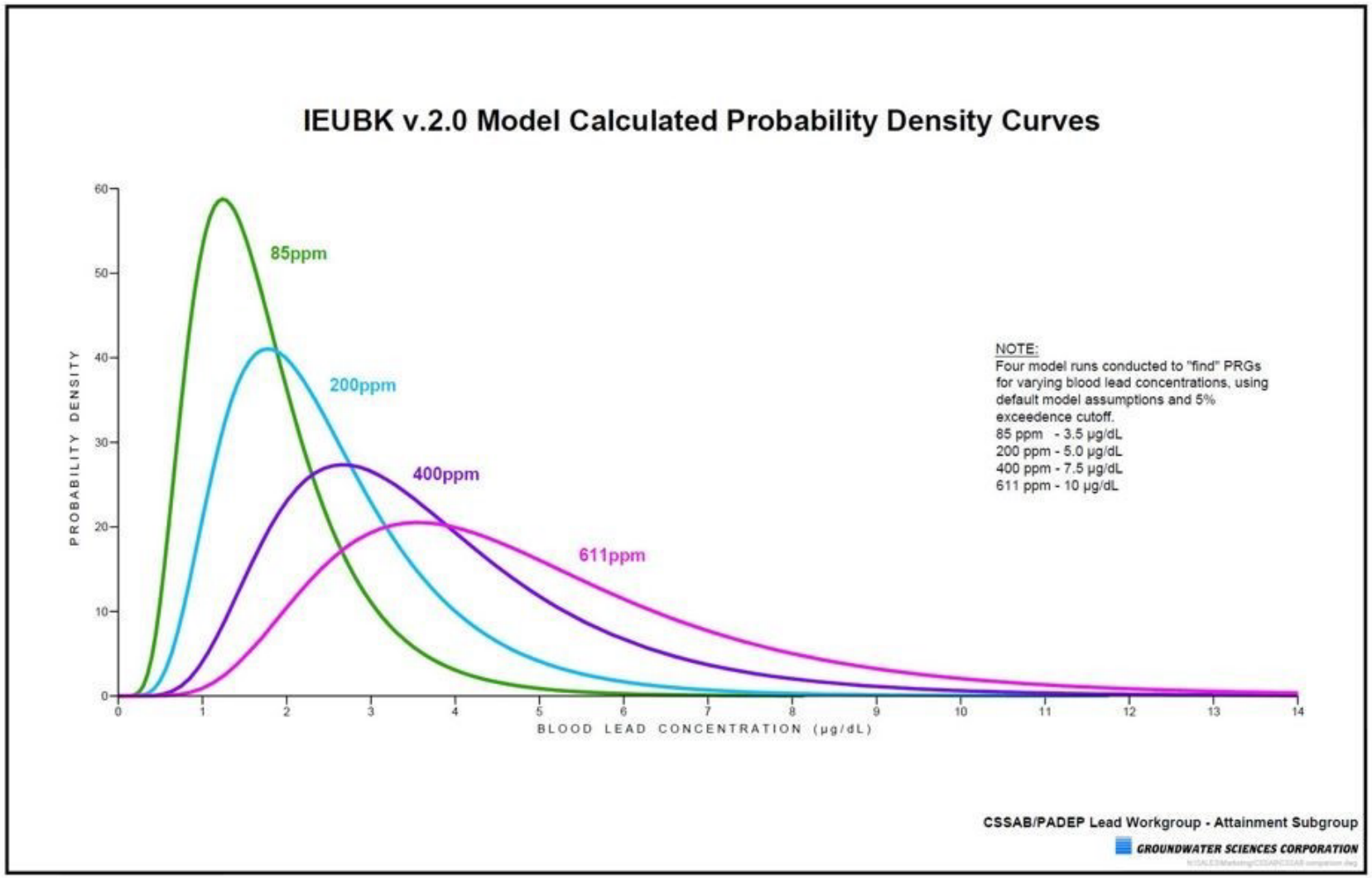


Figure 5: Examples of IEUBK 2.0 PRG Calculations (Default Assumptions) for All Media with Various TBLLs

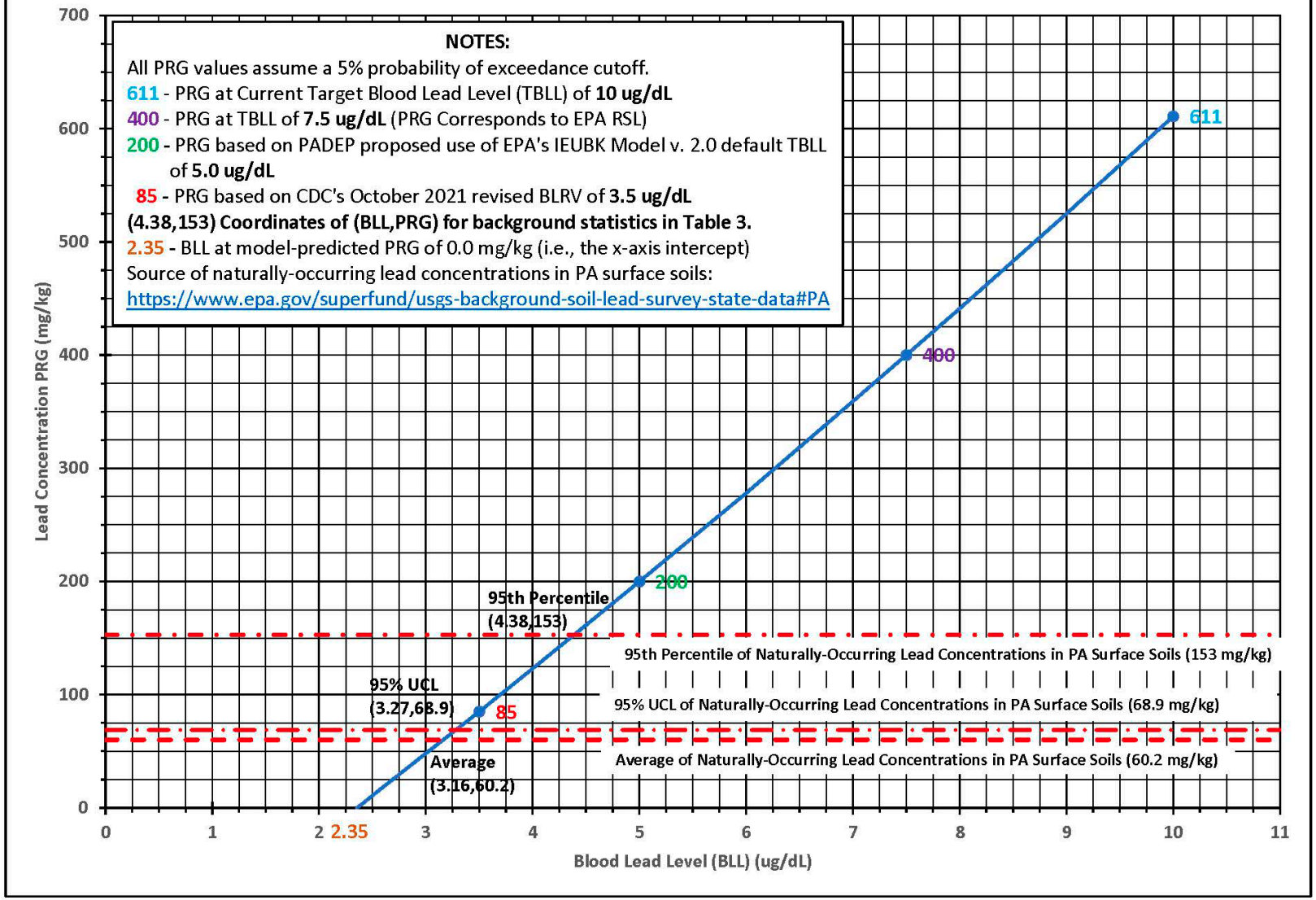
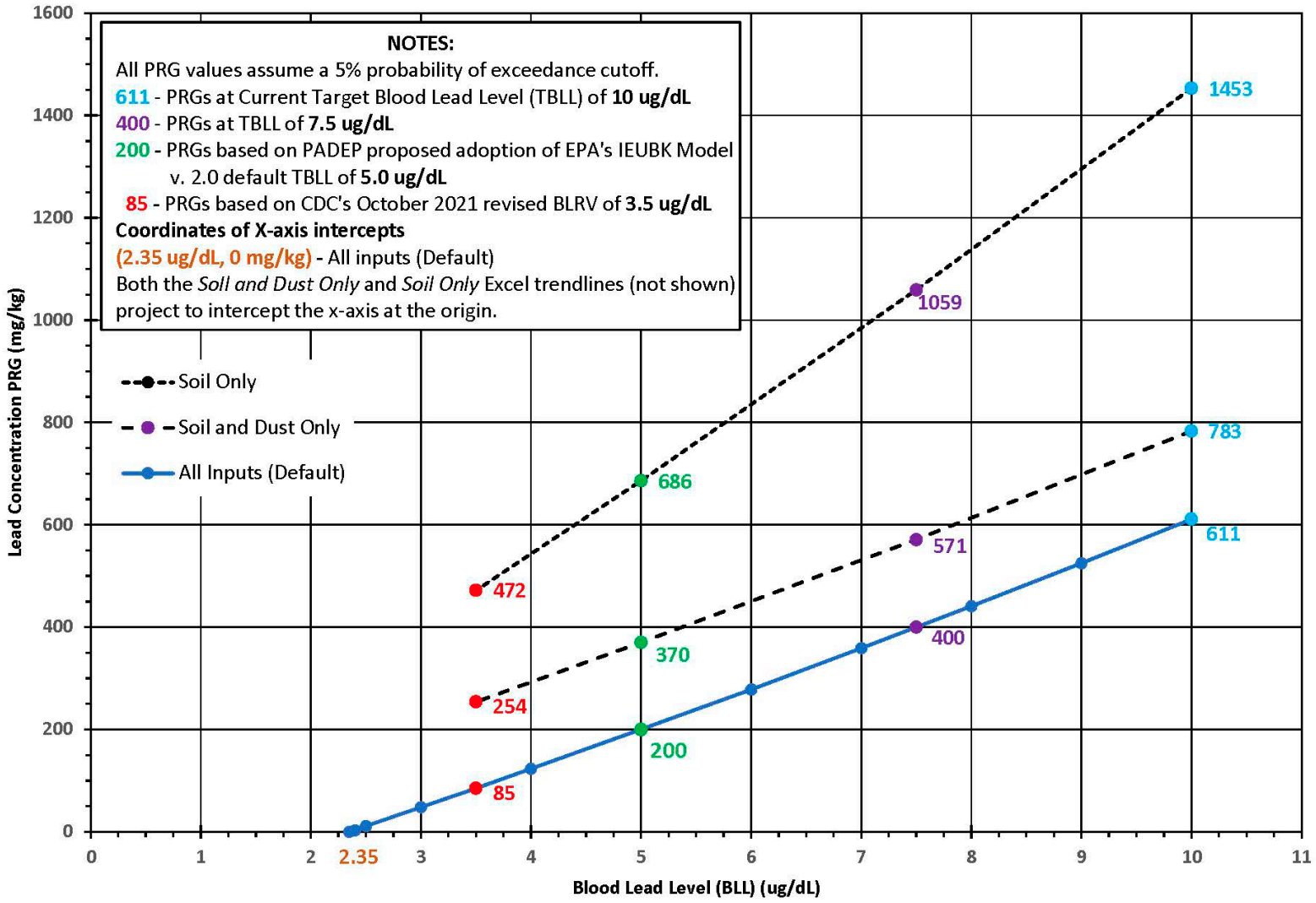


Figure 6: Examples of IEUBK 2.0 PRG Calculations for Selected Combinations of TBLL and Media Inputs



Attachment A: Act 2 of 1995, Section 303 Statewide health standard.

LAND RECYCLING AND ENVIRONMENTAL REMEDIATION STANDARDS ACT Act of May. 19, 1995, P.L. 4, No. 2 ***(Bold text indicates language that may be referenced in the text of this report.)***

Section 303. Statewide health standard.

(a) Standard. -- The Environmental Quality Board shall promulgate Statewide health standards for regulated substances for each environmental medium. The standards shall include any existing numerical residential and nonresidential health-based standards adopted by the department and by the Federal Government by regulation or statute, and health advisory levels. For those health-based standards not already established by regulation or statute, the Environmental Quality Board shall by regulation propose residential and nonresidential standards as medium-specific concentrations within 12 months of the effective date of this act. The Environmental Quality Board shall also promulgate along with the standards the methods used to calculate the standards. Standards adopted under this section shall be no more stringent than those standards adopted by the Federal Government.

(b) Medium-specific concentrations. -- The following requirements shall be used to establish a medium-specific concentration:

(1) Any regulated discharge into surface water occurring during or after attainment of the Statewide health standard shall comply with applicable laws and regulations relating to surface water discharges.

(2) Any regulated emissions to the outdoor air occurring during or after attainment of the Statewide health standard shall comply with applicable laws and regulations relating to emissions into the outdoor air.

(3) The concentration of a regulated substance in groundwater in aquifers used or currently planned to be used for drinking water or for agricultural purposes shall comply with the maximum contaminant level or health advisory level established for drinking water. If the groundwater at the site has naturally occurring background total dissolved solids concentrations greater than 2,500 milligrams per liter, the remediation standard for a regulated substance dissolved in the groundwater may be adjusted by multiplying the medium-specific concentration for groundwater in aquifers by 100. The resulting value becomes the maximum contaminant level for groundwater.

(4) For the residential standard, the concentration of a regulated substance in soil shall not exceed either the direct contact soil medium-specific concentration based on residential exposure factors within a depth of up to 15 feet from the existing ground surface or the soil-to-groundwater pathway numeric value throughout the soil column, the latter to be determined by any one of the following methods:

(i) A value which is 100 times the medium-specific concentration for groundwater.

(ii) A concentration in soil at the site that does not produce a leachate in excess of the medium-specific concentrations for groundwater in the aquifer when subjected to the Synthetic Precipitation Leaching Procedures, Method 1312 of SW 846, Test Methods for Evaluating Solid Waste, promulgated by the United States Environmental Protection Agency.

(iii) A generic value determined not to produce a concentration in groundwater in the aquifer in excess of the medium-specific concentration for groundwater based on a valid, peer-reviewed scientific method which properly accounts for factors affecting the fate, transport and attenuation of the regulated substance throughout the soil column.

(5) For the nonresidential standard, the concentration of a regulated substance in soil shall not exceed either the direct contact soil medium-specific concentration based on nonresidential exposure factors within a depth of up to 15 feet from the existing ground surface using valid scientific methods

reflecting worker exposure or the soil-to-groundwater pathway numeric value determined in accordance with paragraph (4).

(6) Exposure scenarios for medium-specific concentrations for nonresidential conditions shall be established using valid scientific methods reflecting worker exposure.

(c) Additional factors. -- When establishing a medium-specific concentration, other than those established under subsection (b)(1), (2) or (3), the medium-specific concentration for the ingestion of groundwater, inhalation of soils, ingestion and inhalation of volatiles and particulates shall be calculated by the department using valid scientific methods, reasonable exposure pathway assumptions and exposure factors for residential and nonresidential land use which are no more stringent than the standard default exposure factors established by EPA based on the following levels of risk:

(1) For a regulated substance which is a carcinogen, the medium-specific concentration is the concentration which represents an excess upper bound lifetime cancer target risk of between 1 in 10,000 and 1 in 1,000,000.

(2) For a regulated substance which is a systemic toxicant, the medium-specific concentration is the concentration to which human populations could be exposed by direct ingestion or inhalation on a daily basis without appreciable risk of deleterious effects for the exposed population.

(d) Relationship to background. -- The concentration of a regulated substance in an environmental medium of concern on a site where the Statewide health standard has been selected shall not be required to meet the Statewide health standard if the Statewide health standard is numerically less than the background standard. In such cases, the background standard shall apply.

(e) Attainment. -- Final certification that a site or portion of a site meets the Statewide health standard shall be documented in the following manner:

(1) Attainment of cleanup levels shall be demonstrated by collection and analysis of representative samples from the environmental medium of concern, including soils, and groundwater in aquifers at the point of compliance through the application of statistical tests set forth in regulation or, if no regulations have been adopted, in a demonstration of a mathematically valid application of statistical tests. The Department of Environmental Resources shall also recognize those methods of attainment demonstration generally recognized as appropriate for that particular remediation.

(2) A final report that documents attainment of the Statewide health standard shall be submitted to the department which includes the descriptions of procedures and conclusions of the site investigation to characterize the nature, extent, direction, rate of movement of the site and cumulative effects, if any, volume, composition and concentration of contaminants in environmental media, the basis for selecting environmental media of concern, documentation supporting the selection of residential or nonresidential exposure factors, descriptions of removal or treatment procedures performed in remediation, summaries of sampling methodology and analytical results which demonstrate that contaminants have been removed or treated to applicable levels and documentation of compliance with postremediation care requirements if they are needed to maintain the Statewide health standard.

(3) Institutional controls such as fencing and future land use restrictions on a site may not be used to attain the Statewide health standard. Institutional controls may be used to maintain the Statewide health standard after remediation occurs.

(f) Authority reserved. -- If a person fails to demonstrate attainment of the Statewide health standard, the department may require that additional remediation measures be taken in order to meet the health standard, or the person may select to meet the requirements of section 302 or 304.

(g) Deed notice. -- Persons attaining and demonstrating compliance with the Statewide health standard considering residential exposure factors for a regulated substance shall not be subject to the deed acknowledgment requirements of the act of July 7, 1980 (P.L.380, No.97), known as the Solid Waste Management Act, or the act of October 18, 1988 (P.L.756, No.108), known as the Hazardous Sites Cleanup Act. An existing acknowledgment contained in a deed prior to demonstrating compliance with the residential Statewide health standard may be removed. The deed acknowledgment requirements shall apply where nonresidential exposure factors were used to comply with the Statewide health standard.

(h) Notice and review provisions. -- Persons utilizing the Statewide health standard shall comply with the following requirements for notifying the public and the department of planned remediation activities:

(1) Notice of intent to initiate remediation activities shall be made in the following manner:

(i) A notice of intent to remediate a site shall be submitted to the department which provides, to the extent known, a brief description of the location of the site, a listing of the contaminant or contaminants involved, a description of the intended future use of the property for employment opportunities, housing, open space, recreation or other uses and the proposed remediation measures. The department shall publish an acknowledgment noting receipt of the notice of intent in the Pennsylvania Bulletin.

(ii) At the same time a notice of intent to remediate a site is submitted to the department, a copy of the notice shall be provided to the municipality in which the site is located and a summary of the notice of intent shall be published in a newspaper of general circulation serving the area in which the site is located.

(2) Notice of the submission of the final report demonstrating attainment of the Statewide health standard shall be given to the municipality in which the remediation site is located and published in a newspaper of general circulation serving the area and in the Pennsylvania Bulletin.

(3) The department shall review the final report demonstrating attainment of the Statewide health standard within 60 days of its receipt or notify the person submitting the report of substantive deficiencies. If the department does not respond with deficiencies within 60 days, the final report shall be deemed approved.

(4) The notices provided for in paragraphs (1) and (2) are not required to be made or published if the person conducting the remediation submits the final report demonstrating attainment of the Statewide health standard as required by this section within 90 days of the release. If the final report demonstrating attainment is not submitted to the department within 90 days of the release, all notices and procedures required by this section shall apply. This paragraph is only applicable to releases occurring after the effective date of this act.

Attachment B: Excerpts from the Preambles to the 1996 Draft Chapter 250 Regulations and the 1997 Final Chapter 250 Regulations

Excerpt from the 1996 Preamble to Draft Chapter 250 Regs

PENNSYLVANIA BULLETIN, VOL. 26, NO. 33 AUGUST 17, 1996 (Page 3990)

Section 250.305(f) explains the methodology for developing the ingestion numeric value for lead. The types of toxicological data which have been used to develop direct contact soil MSCs for all of the other regulated substances listed in Appendix A, Table 2 do not exist for lead. For example, although lead is classified as a carcinogen, it possesses no cancer slope factor so that a concentration in soil which represents an excess upper bound lifetime cancer target risk of one in 100,000 cannot be estimated. Similarly, even though lead is a systemic toxicant, there are no available oral reference doses from which to develop a threshold effect level for lead. This lack of data makes it necessary to develop direct contact soil MSCs for lead in an alternate manner.

The toxicological endpoints of concern for lead differ between children and adults. Because of this, two separate methods have been used to estimate direct contact soil MSCs for lead—one for residential exposures (based on effects on children) and one for nonresidential exposures (based on effects on adults). The following text describes the methodologies employed in developing both concentrations.

The direct contact soil MSC for lead for residential exposures has been estimated on the basis of protection of 95% of a population of children in the age range of 0 to 84 months. The Uptake Biokinetic (UBK) Model for Lead (version 0.4) was used to make this estimate. Although this model has been updated at least twice since version 0.4, this version was used because it was the version in use at the time the EPA developed its recommended residential lead-in-soil level of 500 mg/kg. Appendix A, Table 6 contains the input values that have been used in the model. The soil lead level from Appendix A, Table 6 (495 ug/g) has been rounded to 500 mg/kg which is the direct contact soil MSC for lead for residential exposures.

Because the UBK Model for Lead applies only to children, it could not be used for the nonresidential exposure scenario. Alternatively, a modeling equation applicable to adult exposures developed by the Society for Environmental Geochemistry and Health (SEGH) was obtained from Wixson (1991).

Excerpt from the Preamble to 1997 Final Chapter 250 Regulations

PENNSYLVANIA BULLETIN, VOL. 27, NO. 33, AUGUST 16, 1997 (Page 4190-4191)

A commentator stated that the Department used invalid models to derive the soil MSC for lead since EPA's IEUBK model has been updated several times and the Department has not used the most updated model. In addition, the Department should adopt a preliminarily promulgated standard by EPA under the Toxic Substances Control Act (TSCA) or adopt a standard not less than 5,000 mg/kg. The final-form regulations are based on two state-of-the-art models for estimation of MSCs for lead in residential and nonresidential soils. Although more recent versions of EPA's IEUBK model have been developed, the use of the most recent version would result in a residential MSC for lead that is lower than the 500 mg/kg level. The TSCA notice in the Federal Register, September 11, 1995, recommends a range of lead concentrations in soil of 400 mg/kg to 5,000 mg/kg. The notice also includes recommendations for interim controls to reduce exposure of children to contaminated soil within that range. Under the final-form regulations, the Statewide health standards fall within the range identified in the EPA notice.

In addition, exceedance of the 500 mg/kg residential soil MSC is not precluded under the site-specific standard. The interim controls identified in the EPA notice could be used under the site-specific standard in conjunction with a lead concentration in soil that is higher than 500 mg/kg.

Attachment C
Excerpt from New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives, Technical Support Document
Prepared By:
New York State Department of Environmental Conservation and New York State Department of Health, September 2006

Toxicity Values for Inorganic Lead

Non-Cancer

Lead and inorganic lead compounds cause a variety of health effects in humans, and can damage the nervous, cardiovascular, gastrointestinal, hematopoietic, and reproductive systems. The database on lead toxicity is unusual because it contains a large amount of data on dose-response relationships in humans (ATSDR, 1999). Consequently, the degree of uncertainty about the noncancer human health effects of lead is relatively low compared to almost all other contaminants (US EPA, 2005c). In most studies, however, the measure of dose is an internal one (most commonly, blood lead level or PbB). In addition, most studies cannot attribute blood lead levels to one single route, pathway, or source of exposures or exposures during a limited, defined time. This is because lead can accumulate in the human body, and blood lead at any given time is dependent on current and past exposures to lead. Current exposures (e.g., food, water, air, and soil) are important because absorbed lead goes into the blood before distributing to other parts of the body. Past exposures are important because the body stores absorbed accumulated lead in bones. The lead in bones can be released into the blood under certain circumstances. Thus, blood lead is considered the most reliable measure of a person's risk of non-cancer health effects from lead.

Experimental studies of the toxicity of lead in animals provide support for observations in humans. Current knowledge of lead pharmacokinetics indicates that toxicity values derived by the application of default risk assessment procedures (e.g., using administered, ingested, or inhaled dose) to animal dose-response data might not accurately estimate the potential risk (US EPA, 2005c). This stems from concerns that an adequate animal model for lead toxicity in humans is not available and because of the difficulty in accounting for pre-existing body burdens of lead (US EPA, 2005c). Moreover, an animal-based analysis would overlook the significant body of toxicological literature on human toxicity and blood lead levels (ATSDR, 1999). Thus, animal data on lead toxicity have not been used by the ATSDR (1999), US EPA (2001, 2005c), or other public health agencies to evaluate the potential human non-cancer health effects of lead exposures. Neither ATSDR (1999), nor the US EPA (2005c), nor other authoritative bodies have proposed or developed a lead reference dose or reference concentration based on animal data.

Public health agencies recognize that the primary population, dose measure, and health concern associated with environmental exposures to lead are children, blood lead levels, and neurotoxicity, respectively (e.g., ATSDR, 1999; FL DEP, 2004; NJ DEP, 2004; MN PCA, 1999; US EPA, 2001; WHO, 1996). Young children are especially vulnerable to the toxic effects of lead for at least two reasons:

(1) Increased Exposures Relative to Adults. Children are likely to be exposed to environmental lead in many more ways than are adults (e.g., more hand-to-mouth activity, more contact with dirt, more mouthing/ingestion of non-food items). Children also have greater food, water, and inhalation rates per unit body weights than do adults. In addition, young children absorb a greater percentage of ingested lead than do adults, and might absorb a greater percentage of inhaled lead than do adults (ATSDR, 1999).

(2) Increased Sensitivity Relative to Adults. For many effects, the lead blood levels that cause toxicity in children are lower than the levels that cause effects in adults, and the effects may be more severe than those in adults (ATSDR, 1999). This suggests that children are more sensitive to the toxic effects of absorbed lead than adults. The toxicological data on the effects of lead on young children support concern for the increased sensitivity of fetuses, neonates, and infants to the toxicological effects of elevated blood lead levels (ATSDR, 1999). Much of the concern over lead exposure in women of child-bearing age stems from concerns that the exposures could lead to elevated blood lead levels in the fetus (US EPA, 2003).

Many environmental guidelines or standards for lead are based on children as the sensitive population (e.g., CA EPA, 1997; Health Canada, 1992; RIVM, 2001; US EPA, 2000a, 2001; WHO, 1996). The derivations of these guidelines, however, are different from the derivation of guidelines for most contaminants. The guidelines are not based directly on a daily intake of lead from one route of exposure (for example, a reference dose for oral intake or a reference concentration for air intake) but are based on a blood lead level. The blood lead level is typically 10 mcg/dL (micrograms of lead per deciliter of blood), which is the Centers for Disease Control and Prevention (CDC) level of concern for blood lead in young children (ATSDR, 1999; CDC, 1991). In most cases, the guidelines are derived so that the blood levels of almost all children exposed at the guideline would be below 10 mcg/dL. This is the approach taken in the derivation of the SCOs for lead (see Section 5.3.4 Chronic Lead SCOs). ***Thus, toxicity values (reference dose or reference concentration) for the non-cancer effects of lead are not proposed.*** **[emphasis added]**

Cancer

The National Toxicology Program (NTP, 2005) classifies lead and lead compounds as "reasonably anticipated to be human carcinogens" based on limited evidence from studies in humans and sufficient evidence from studies in experimental animals. Similarly, the International Agency for Research on Cancer (IARC, 2004) classifies inorganic lead compounds as "probably carcinogenic to humans (Group 2A)" based on limited evidence for the carcinogenicity to humans and sufficient evidence for the carcinogenicity to experimental animals.

According to the NTP (2003, 2005) reviews, lead exposure has been associated with increased risks of lung, stomach, and bladder cancer in human populations. The epidemiological evidence is strongest for lung and stomach cancer. The evidence is not conclusive because most of the studies have limitations. These include poor exposure assessment and failure to control for confounders (other factors that could increase the risk of cancer, including lifestyle factors and concurrent occupational exposure to other carcinogens). In addition, they did not demonstrate relationships between the amount of exposure (e.g., concentration or duration) and the magnitude of cancer risk. Thus, the epidemiological data on lead are inadequate to develop cancer toxicity values (i.e., oral cancer potency factor or inhalation unit risk) for lead.

Long-term exposures to soluble (lead acetate and lead subacetate) or insoluble (lead phosphate, lead chromate) inorganic lead compounds have caused cancer in laboratory animals (NTP, 2003, 2005). Kidney tumors were most frequently associated with lead exposure, but tumors of the brain, hematopoietic system, and lung were reported in some studies. However, only two lead compounds (lead acetate and lead subacetate) have caused cancer in animals after oral exposures. Other lead compounds have caused cancer in animals after subcutaneous injection (lead phosphate or lead chromate), subcutaneous injection followed by intraperitoneal injection (lead phosphate), or intramuscular injection (lead chromate). The possibility that the carcinogenicity of lead chromate is caused by exposure to hexavalent chromium (chromate), which is an animal carcinogen, cannot be excluded. Lead naphthenate

(dermal exposures), lead carbonate (diet), lead arsenate (diet), lead nitrate (drinking water), and metallic lead, as lead powder) (intramuscular or gavage) did not significantly increase tumor incidences in experimental animals. Studies of the carcinogenicity of inhaled lead were not found.

Only one of the authoritative bodies reviewed, the CA EPA, has derived oral cancer potency factors and inhalation unit risks for inorganic lead compounds (CA EPA, 1992, 1997, 2002, 2004). Most recently, the oral potency factor for lead was restricted to lead acetate, one of the two lead compounds shown to cause cancer via the oral route (CA EPA, 2005). In contrast, the US EPA (2005c) lead database for risk assessment in the Integrated Risk Assessment System, which is the peer-reviewed source for US EPA toxicity values for chemicals, contains the following statement:

> *Quantifying lead's cancer risk involves many uncertainties, some of which may be unique to lead. Age, health, nutritional state, body burden, and exposure duration influence the absorption, release, and excretion of lead. In addition, current knowledge of lead pharmacokinetics indicates that an estimate derived by standard procedures would not truly describe the potential risk. Thus, the Carcinogen Assessment Group recommends that a numerical estimate not be used.*

Given the problems associated with extrapolating animal data on lead to humans, animal-based oral cancer potency factors and inhalation unit risks for lead are not proposed. **[emphasis added]**

Attachment D: Chapter 250, Appendix A, Table 7

Table 7
DEFAULT VALUES FOR CALCULATING MEDIUM-SPECIFIC CONCENTRATIONS FOR LEAD

Input Values Used in UBK Model for Lead (for residential exposure scenario)

Geometric Standard Deviation (GSD)	1.42 (default)	Drinking water intake	Model default
Outdoor air lead concentration	0.2 µg/m^3 (default)	Soil lead level	495 µg/g
Indoor air lead concentration (% of outdoor)	30	Indoor dust lead level	495 µg/g
Time spent outdoors	Model default	Soil/dust ingestion weighting factor (%)	45
Ventilation rate	Model default	Paint lead intake	Model default
Lung absorption	Model default	Maternal contribution method	Infant model
Dietary lead intake	Model default	Mother's blood lead at birth	7.5 µg/dL blood (model default)
GI method/bioavailability	Non-linear	Target blood lead level	10 µg/dL blood
Lead concentration in drinking water	4.00 µg/L (default)		

Input Values Used in SEGH Equation (for nonresidential exposure scenario)

Concentration of lead in soil (S)	987 µg/g
Target blood lead level in adults (T)	20 µg/dL blood
Geometric standard deviation of blood lead distribution (G)	1.4
Baseline blood lead level in target population (B)	4 µg/dL blood
Number of standard deviations corresponding to degree of protection required for the target population (n)	1.645 (for 95% of population)
Slope of blood lead to soil lead relationship (δ)	7.5 µg/dL blood per µg/g soil

Attachment E: NHANES Statistics in Support of the BLRV Update from 5 ug/dL to 3.5 ug/dL

Table 1. Sample weighted geometric mean and selected percentiles of blood lead concentrations (in µg/dL) for U.S. children age 1-5 years (NHANES 2011-2018)

NHANES	Sample size	Geometric mean	50th	75th	90th	95th	97.5th
2011-2014 (2 cycles)	1531	0.86 (0.80-0.93)	0.82 (0.75-0.89)	1.21 (1.09-1.32)	1.90 (1.64-2.24)	2.57 (2.26-3.05)	3.48 (2.65-4.29)*
2015-2018 (2 cycles)	1419	0.71 (0.66-0.77)	0.65(0.6-0.71)	1.04(0.94-1.16)	1.66(1.49-1.86)	2.41(1.9-3.01)	3.44(2.68-4.22)†

*n=46 for the sample size in this percentile in NHANES 2011-2014.

†n=42 for the sample size in this percentile in NHANES 2015-2018.

Personal communication December 4, 2021:
Jill Ryer-Powder, Ph.D., MNSP, DABT, Chair CDC BLRV Workgroup, Member LEPAC

Attachment F: Default Values for the IEUBK Model v. 2.0 Parameters

TABLE 2-2. Default Values for the IEUBK Model Parameters

Parameter	Default Value	Units
Indoor air Pb concentration (% of outdoor)	30	%
AIR (by year)		
Air concentration:		
Age =		
0-1 year (0-11 months)	0.10	µg/m^3
1-2 years (12-23 months)	0.10	µg/m^3
2-3 years (24-35 months)	0.10	µg/m^3
3-4 years (36-47 months)	0.10	µg/m^3
4-5 years (48-59 months)	0.10	µg/m^3
5-6 years (60-71 months)	0.10	µg/m^3
6-7 years (72-84 months)	0.10	µg/m^3
Time outdoors:		
Age =		
0-1 year (0-11 months)	1	hours/day
1-2 years (12-23 months)	2	hours/day
2-3 years (24-35 months)	3	hours/day
3-7 years (36-84 months)	4	hours/day
Lung absorption	32	%
DATA ENTRY FOR DIET (by year)		
Dietary Pb intake:		
Age =		
0-1 year (0-11 months)	2.66	µg Pb/day
1-2 years (12-23 months)	5.03	µg Pb/day
2-3 years (24-35 months)	5.21	µg Pb/day
3-4 years (36-47 months)	5.38	µg Pb/day
4-5 years (48-59 months)	5.64	µg Pb/day
5-6 years (60-71 months)	6.04	µg Pb/day
6-7 years (72-84 months)	5.95	µg Pb/day
DATA ENTRY FOR ALTERNATE DIET SOURCES (by food class)		
Concentration:		
home-grown fruits	0	µg Pb/g
home-grown vegetables	0	µg Pb/g
fish from fishing	0	µg Pb/g
game animals from hunting	0	µg Pb/g

TABLE 2-2. Default Values for the IEUBK Model Parameters

Parameter	Default Value	Units
Percent of food class:		
home-grown fruits	0	%
home-grown vegetables	0	%
fish from fishing game	0	%
animals from hunting	0	%
DATA ENTRY FOR DRINKING WATER		
Lead concentration in drinking water	0.9	µg/L
Ingestion rate:		
Age =		
0-1 year (0-11 months)	0.40	L/day
1-2 years (12-23 months)	0.43	L/day
2-3 years (24-35 months)	0.51	L/day
3-4 years (36-47 months)	0.54	L/day
4-5 years (48-59 months)	0.57	L/day
5-6 years (60-71 months)	0.60	L/day
6-7 years (72-84 months)	0.63	L/day
DATA ENTRY FOR ALTERNATE DRINKING WATER SOURCES		
Concentration:		
first-draw water	0.9	µg/L
flushed water	0.9	µg/L
fountain water	0.9	µg/L
Percentage of total intake:		
first-draw water	50	%
flushed water	100 minus first draw and fountain	
fountain water	15	%
DATA ENTRY FOR SOIL/DUST (constant over time)		
Concentration (starting values to be modified using appropriate site data):		
soil	200	µg/g
dust	150	µg/g
Soil/dust ingestion weighting factor (percent soil)	45	%
DATA ENTRY FOR TOTAL SOIL/DUST INGESTION (by year)		
Soil/dust ingestion:		
Age =		
0-1 year (0-11 months)	0.086	g/day
1-2 years (12-23 months)	0.094	g/day
2-3 years (24-35 months)	0.067	g/day
3-4 years (36-47 months)	0.063	g/day
4-5 years (48-59 months)	0.067	g/day
5-6 years (60-71 months)	0.052	g/day
6-7 years (72-84 months)	0.055	g/day
DATA ENTRY FOR SOIL/DUST MULTIPLE SOURCE ANALYSIS (constant over time)		

TABLE 2-2. Default Values for the IEUBK Model Parameters

Parameter	Default Value	Units
Fraction of indoor dust Pb attributable to soil (M_{SD})	0.70	Unitless
Ratio of dust Pb concentration to outdoor air Pb concentration	100	µg Pb/g dust per µg Pb/m^3 air
DATA ENTRY FOR SOIL/DUST MULTIPLE SOURCE ANALYSIS WITH ALTERNATIVE HOUSEHOLD DUST LEAD SOURCES (constant over time)		
Concentration (starting values to be modified using appropriate site data):		
household dust (calculated value)	150	µg/g
secondary occupational dust	1,200	µg/g
school dust	200	µg/g
daycare center dust	200	µg/g
second home	200	µg/g
Percentage:		
household dust (calculated value)	100 minus all other	%
secondary occupational dust	0	%
school dust	0	%
daycare center dust	0	%
second home	0	%
BIOAVAILABILITY DATA ENTRY FOR ALL GUT ABSORPTION PATHWAYS		
Total Pb absorption (at low intake):		
diet	50	%
drinking water	50	%
soil	30	%
dust	30	%
alternate source	0	%
Fraction of total net absorption at low intake rate that is attributable to non-saturable (passive) processes	0.2	unitless
DATA ENTRY FOR ALTERNATE SOURCES (by year)		
Total Pb intake:		
Age =		
0-1 (0-11 months)	0	µg/day
1-2 years (12-23 months)	0	µg/day
2-3 years (24-35 months)	0	µg/day
3-4 years (36-47 months)	0	µg/day
4-5 years (48-59 months)	0	µg/day
5-6 years (60-71 months)	0	µg/day
6-7 years (72-84 months)	0	µg/day
DATA ENTRY MENU FOR MATERNAL-TO-NEWBORN LEAD EXPOSURE		
Mothers blood Pb concentration at childbirth	0.6	µg/dL
DATA ENTRY MENU FOR PLOTTING AND RISK ESTIMATION		
GSD for PbB	1.6	unitless

TABLE 2-2. Default Values for the IEUBK Model Parameters

Parameter	Default Value	Units
Blood Pb level of concern, or cutoff	5	µg/dL

Attachment G: Lead data for samples of surface soils collected from a depth of 0 to 5 centimeters in Pennsylvania USGS Data Series 801: Geochemical and Mineralogical Data for Soils of the Conterminous United States

[LabID, unique identifier assigned by the analytical laboratories; cm, centimeters; mg/kg, milligrams per kilogram]

LabID	SiteID	StateID	Latitude	Longitude	CollDate	LandCover1	LandCover2	Depth cm	Pb mg/kg
C-341158	124	PA	41.3983	-78.2875	06/22/09	Forested Upland	Deciduous Forest	0.5	40.6
C-364423	252	PA	40.1828	-75.7392	09/14/10	Forested Upland	Deciduous Forest	0-5	239
C-341159	508	PA	41.4739	-74.9908	07/16/08	Forested Upland	Mixed Forest	0-5	82.3
C-341160	572	PA	41.542	-80.4467	05/13/09	Forested Upland	Deciduous Forest	0-5	83.6
C-341161	700	PA	39.7893	-77.1831	06/23/09	Planted/Cultivated	Urban/Recreational Grasses	0-5	25.8
C-341163	892	PA	40.4839	-79.2966	06/24/09	Planted/Cultivated	Fallow	0-5	35.6
C-364424	956	PA	41.3857	-77.6786	09/28/10	Forested Upland	Deciduous Forest	0-5	47.5
C-364425	1148	PA	41.4006	-79.3129	09/10/10	Forested Upland	Deciduous Forest	0-5	58.1
C-341164	1268	PA	39.9703	-75.1194	07/30/09	Developed	Commercial/Industrial/Transportation	0-5	142
C-341165	1276	PA	41.1058	-76.1081	07/21/08	Forested Upland	Deciduous Forest	0-5	48.7
C-341166	1468	PA	39.8829	-75.7595	07/29/09	Planted/Cultivated	Pasture/Hay	0-5	37.1
C-364426	1596	PA	41.627	-80.1763	10/20/10	Forested Upland	Deciduous Forest	0-5	78.8
C-364506	1916	PA	39.7878	-80.1488	09/25/10	Forested Upland	Deciduous Forest	0-5	31.2
C-341167	1980	PA	40.3719	-77.2952	06/12/08	Planted/Cultivated	Pasture/Hay	0-5	14.7
C-341168	2172	PA	40.9259	-78.2396	05/29/09	Developed	Commercial/Industrial/Transportation	0-5	42.1
C-341169	2300	PA	41.9029	-75.9864	07/15/08	Forested Upland	Deciduous Forest	0-5	31.7
C-364427	2428	PA	40.3873	-80.0337	11/18/10	Planted/Cultivated	Urban/Recreational Grasses	0-5	37.6
C-364428	2556	PA	41.9762	-77.3733	07/26/10	Planted/Cultivated	Row Crops	0-5	18.3
C-341170	2620	PA	41.0839	-80.3889	05/15/09	Planted/Cultivated	Pasture/Hay	0-5	22.6
C-341172	3004	PA	41.1842	-77.0475	07/21/09	Forested Upland	Deciduous Forest	0-5	24.8
C-341173	3260	PA	39.7638	-76.3469	06/23/09	Forested Upland	Deciduous Forest	0-5	36.8
C-364430	3324	PA	41.3275	-76.4601	07/23/10	Forested Upland	Deciduous Forest	0-5	147
C-364507	3452	PA	40.1927	-80.1908	09/24/09	Forested Upland	Deciduous Forest	0-5	50.0
C-341174	3516	PA	39.8593	-78.1557	05/06/08	Forested Upland	Deciduous Forest	0-5	46.4
C-364431	3580	PA	41.5895	-76.3672	07/23/10	Forested Upland	Deciduous Forest	0-5	66.5
C-341175	3772	PA	40.6618	-78.278	05/22/09	Planted/Cultivated	Fallow	0-5	31.8
C-364432	3900	PA	41.1536	-79.6596	09/08/10	Forested Upland	Deciduous Forest	0-5	69.3
C-341176	3964	PA	40.026	-78.6582	05/06/08	Herbaceous Upland	Grasslands/Herbaceous	0-5	49.3

C-341177	4028	PA	40.2195	-76.7159	05/23/08	Planted/Cultivated	Pasture/Hay	0-5	19.8
C-364433	4220	PA	41.3711	-78.6028	09/07/10	Forested Upland	Deciduous Forest	0-5	98.0
C-341180	4348	PA	39.9869	-75.3877	07/29/09	Planted/Cultivated	Urban/Recreational Grasses	0-5	46.1
C-341181	4796	PA	40.0618	-77.0769	06/23/09	Forested Upland	Deciduous Forest	0-5	25.6
C-341182	4988	PA	40.1427	-79.5235	06/24/09	Planted/Cultivated	Urban/Recreational Grasses	0-5	29.5
C-364434	5052	PA	41.3062	-77.6669	09/29/10	Forested Upland	Deciduous Forest	0-5	85.3
C-341183	5244	PA	40.7378	-78.415	05/29/09	Forested Upland	Deciduous Forest	0-5	75.6
C-341184	5364	PA	40.141	-74.9731	07/28/09	Planted/Cultivated	Urban/Recreational Grasses	0-5	58.2
C-341186	5372	PA	41.1772	-76.2105	07/21/08	Planted/Cultivated	Fallow	0-5	47.3
C-364435	5692	PA	41.1868	-80.1268	10/19/10	Forested Upland	Deciduous Forest	0-5	48.2
C-364436	5948	PA	42.0307	-80.1793	10/20/10	Forested Upland	Deciduous Forest	0-5	46.7
C-341187	6012	PA	39.7459	-79.5134	07/21/09	Forested Upland	Deciduous Forest	0-5	31.3
C-341188	6076	PA	40.3709	-77.217	06/12/08	Forested Upland	Mixed Forest	0-5	126
C-341189	6396	PA	41.9941	-75.5742	07/15/08	Forested Upland	Mixed Forest	0-5	132
C-341190	6652	PA	41.717	-77.2885	07/30/09	Forested Upland	Deciduous Forest	0-5	34.9
C-341191	6716	PA	41.8396	-78.2228	06/23/09	Forested Upland	Deciduous Forest	0-5	38.8
C-341192	7036	PA	40.2364	-79.1097	06/23/09	Forested Upland	Deciduous Forest	0-5	161
C-341193	7100	PA	40.6114	-76.308	04/14/08	Forested Upland	Mixed Forest	0-5	59.1
C-341195	7420	PA	41.67	-75.257	08/12/08	Planted/Cultivated	Pasture/Hay	0-5	30.6
C-341196	7612	PA	40.0674	-77.7925	05/06/08	Forested Upland	Deciduous Forest	0-5	53.0
C-341197	7868	PA	40.5805	-77.7301	06/03/08	Planted/Cultivated	Pasture/Hay	0-5	51.6
C-364508	7996	PA	40.8923	-79.7934	08/20/10	Planted/Cultivated	Pasture/Hay	0-5	26.1
C-341198	8124	PA	40.4182	-75.2308	10/29/09	Planted/Cultivated	Row Crops	0-5	36.4
C-364509	8316	PA	41.1315	-79.1485	08/19/10	Forested Upland	Mixed Forest	0-5	27.2
C-364437	8444	PA	40.4513	-75.8598	09/14/10	Planted/Cultivated	Row Crops	0-5	29.7
C-341201	8700	PA	41.4697	-75.3999	08/12/08	Herbaceous Upland	Grasslands/Herbaceous	0-5	58.0
C-364439	8764	PA	41.5203	-79.715	09/09/10	Forested Upland	Deciduous Forest	0-5	60.7
C-364440	9084	PA	40.7021	-79.8145	10/21/10	Forested Upland	Deciduous Forest	0-5	45.6
C-364441	9148	PA	41.1507	-77.8415	09/29/10	Forested Upland	Deciduous Forest	0-5	40.0
C-341202	9340	PA	40.628	-79.0956	05/05/08	Planted/Cultivated	Urban/Recreational Grasses	0-5	108
C-341203	9468	PA	41.8063	-75.5197	08/12/08	Forested Upland	Deciduous Forest	0-5	33.3
C-364442	9788	PA	41.0529	-79.967	10/19/10	Forested Upland	Deciduous Forest	0-5	84.4
C-364443	10044	PA	42.2138	-79.8115	10/20/10	Forested Upland	Deciduous Forest	0-5	45.3

C-341204	10172	PA	40.9592	-77.228	04/30/08	Forested Upland	Mixed Forest	0-5	261
C-341205	10492	PA	41.317	-75.8531	07/21/08	Developed	Low Intensity Residential	0-5	153
C-341206	10748	PA	41.7954	-77.0847	07/28/09	Planted/Cultivated	Pasture/Hay	0-5	22.1
C-341208	10812	PA	41.6871	-78.3779	06/24/09	Planted/Cultivated	Pasture/Hay	0-5	30.6
C-341209	11132	PA	40.4351	-78.8793	06/25/09	Forested Upland	Deciduous Forest	0-5	105
C-341210	11196	PA	40.2796	-76.2288	07/24/09	Planted/Cultivated	Pasture/Hay	0-5	16.9
C-341211	11708	PA	39.8873	-78.2969	05/06/08	Forested Upland	Deciduous Forest	0-5	33.4
C-341212	11964	PA	40.745	-77.6666	06/03/08	Forested Upland	Deciduous Forest	0-5	58.6
C-364444	12092	PA	40.9064	-79.2162	09/08/10	Planted/Cultivated	Pasture/Hay	0-5	36.9
C-341213	12220	PA	40.4941	-75.6521	10/29/09	Planted/Cultivated	Row Crops	0-5	39.5
C-364445	12412	PA	41.7673	-79.3178	09/09/10	Forested Upland	Deciduous Forest	0-5	80.9
C-341214	12540	PA	40.8231	-76.2252	04/14/08	Forested Upland	Deciduous Forest	0-5	118
C-364446	12860	PA	41.9039	-80.2187	10/27/11	Planted/Cultivated	Pasture/Hay	0-5	37.8
C-364447	13180	PA	39.9869	-79.8567	11/19/10	Planted/Cultivated	Pasture/Hay	0-5	54.0

Attachment H: Other Screening Values and Cleanup Goals

US Environmental Protection Agency
Regional Screening Levels (November 2021)

Resident	Industrial	Protection of Ground Water MCL-based SSL
400	800	14

FAQ #43 - Where did the inorganic lead SL value in the Table come from?

EPA has no consensus RfD or SFO for inorganic lead, so it is not possible to calculate SLs as we have done for other chemicals. EPA considers lead to be a special case because of the difficulty in identifying the classic "threshold" needed to develop an RfD.

EPA therefore evaluates lead exposure by using blood-lead modeling, such as the Integrated Exposure-Uptake Biokinetic Model (IEUBK). The EPA Office of Solid Waste has also released a detailed directive on risk assessment and cleanup of residential soil lead. The directive recommends that soil lead levels less than 400 mg/kg are generally safe for residential use. Above that level, the document suggests collecting data and modeling blood-lead levels with the IEUBK model. For the purposes of screening, therefore, 400 mg/kg is recommended for residential soils. For water, we suggest 15 µg/L (the EPA Action Level in water), and for air, the National Ambient Air Quality Standard of 0.15 µg/m3.

However, caution should be used when both water and soil are being assessed. The IEUBK model shows that if the average soil concentration is 400 mg/kg, an average tap water concentration above 5 µg/L would yield more than a 5% probability of exceeding a 10 µg/L/dL blood-lead level for a typical child. If the average tap water concentration is 15 µg/L, an average soil concentration greater than 250 mg/kg would yield more than a 5% probability of exceeding a 10 µg/L/dL blood-lead level for a typical child.

For more information see Addressing Lead At Superfund Sites.

New York
6 NYCRR Part 375-6.8 Soil Cleanup Objectives (Effective December 14, 2006)

Unrestricted Use Soil Cleanup Objective	Restricted Use Soil Cleanup Objective					
	Protection of Public Health				Protection of Ecological Resources	Protection of Groundwater
	Residential	Restricted-Residential	Commercial	Industrial		
63 [c]	400	400	1,000	3,900	63 [f]	450

c - For constituents where the calculated SCO was lower than the rural soil background concentration, as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 1 SCO value for this use of the site.

f - For constituents where the calculated SCO was lower than the rural soil background concentrations as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 2 SCO value for this use of the site.

New Jersey
NJAC 7:26D - Appendix 1 (Last Amended May 17, 2021)

Soil Remediation Standard Ingestion-Dermal Residential	Soil Remediation Standard Inhalation Residential	Soil Remediation Standard Ingestion-Dermal Nonresidential	Soil Remediation Standard Inhalation Nonresidential	Soil Remediation Standard Migration to Groundwater
400 *	NA +	800 **	NA +	90

* - Standard based on the Integrated Exposure Uptake Biokinetic (IEUBK) model [1994] for lead in children

** - Standard based on the Adult Lead Model (ALM) [1996]

+ - Not applicable because appropriate toxicological information is not available

Note from Appendix 11 - No inhalation-based toxicity factors are available [17]

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.

Note that NJAC 7:26D-7.2 states that the Department shall update a remediation standard for soil or indoor air at J.J.A.C. 7:26D Appendix 1 when:

4. The USEPA revises or replaces its Integrated Environmental Uptake Biokinetic (IEUBK) Model and Adult Lead Model (ALM) and input parameters for lead.

Maryland

Department of the Environment Lead (Pb) Soil Screening Update Fact Sheet (Effective July 1, 2020)

Residential Soil Screening Concentration	Commercial Soil Screening Concentration	Industrial Soil Screening Concentration
200	550	1,050

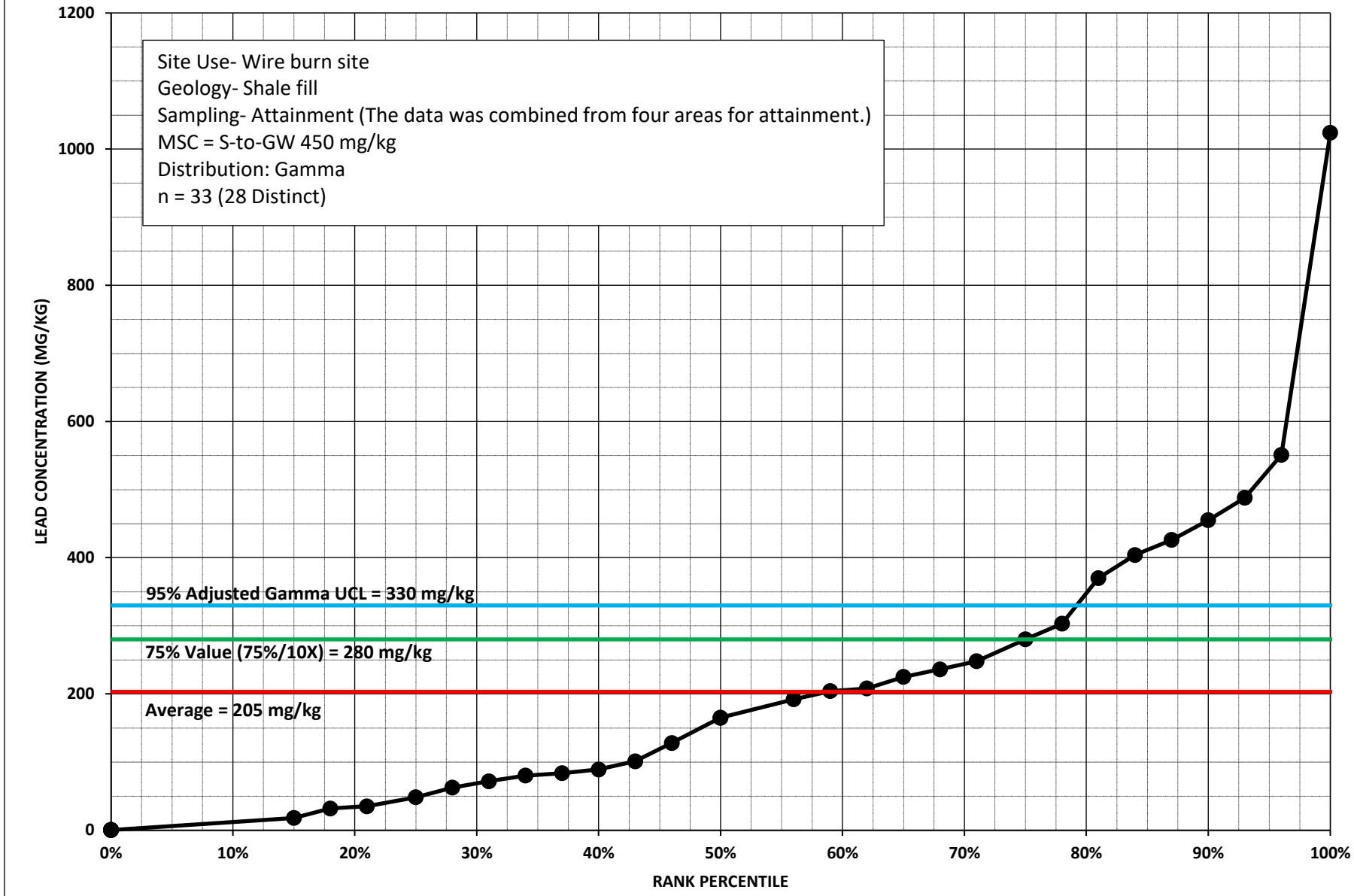
Ohio

Environmental Protection Agency 3745-300-08 Appendix A (Enacted October 7, 2019)

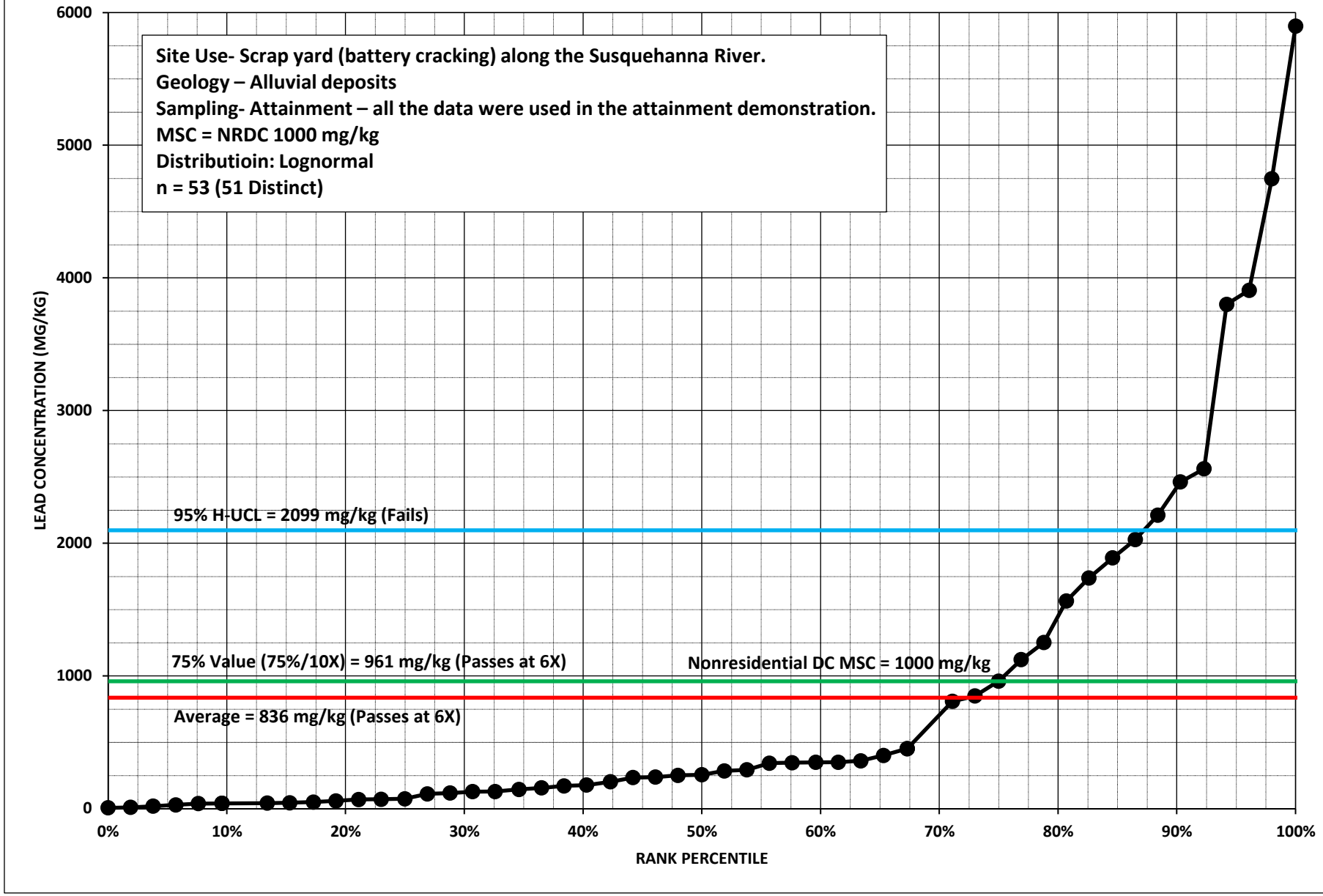
Generic Direct Contact Soil Standard for a Single Chemical			
Residential Land Use Category	Commercial Land Use with High Frequency Child Exposure	Commercial or Industrial Land Use Category	Construction Activities Category
400 *	400 *	800 *	400 *

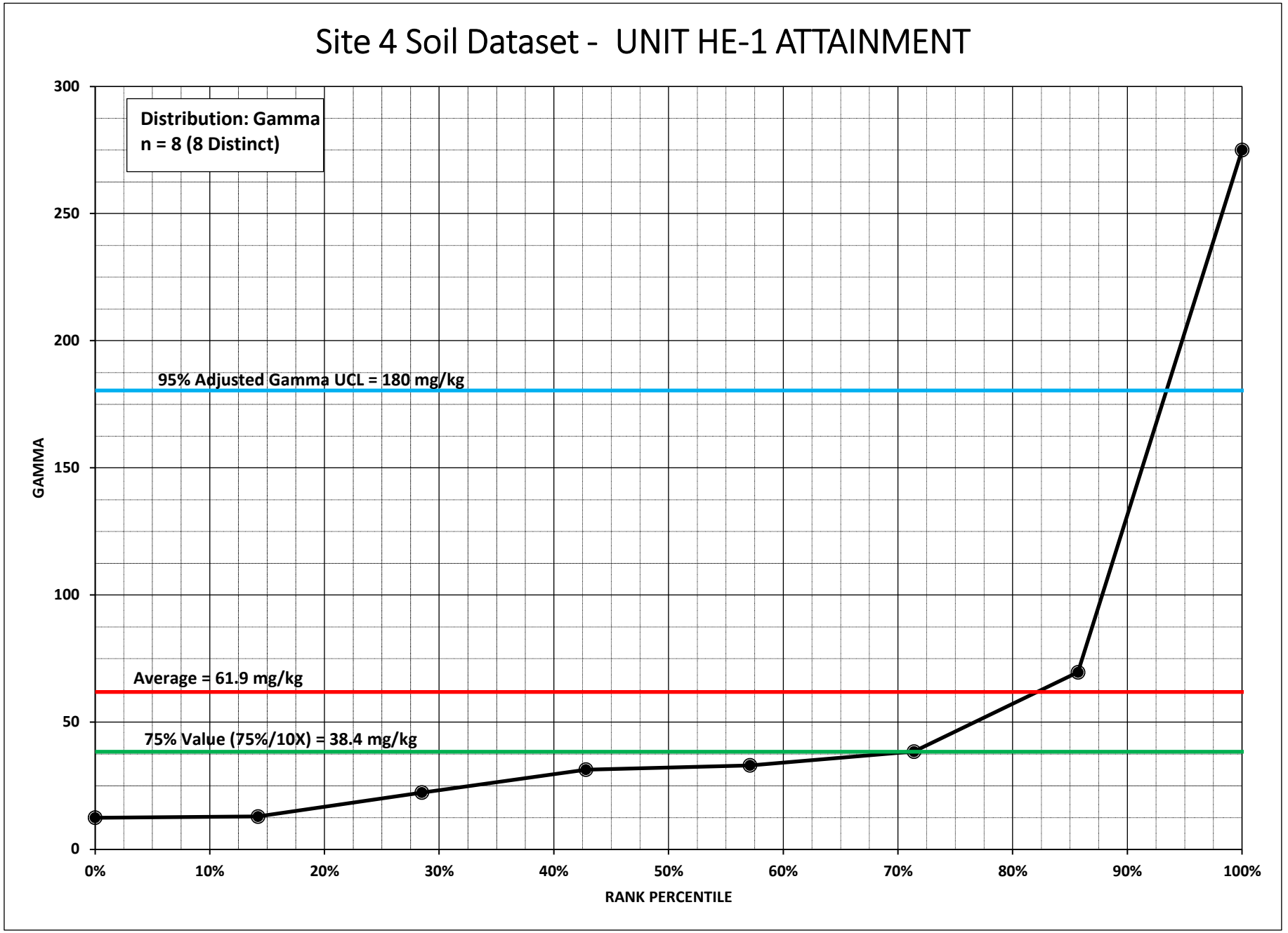
* - The lead standards in Appendix A account for other factors and assumptions in addition to the carcinogenic or non-carcinogenic risk of lead. Therefore, the cumulative risk considerations in this rule are not appropriate and need not be performed for lead.

Site 2 Soil Dataset - ATTAINMENT

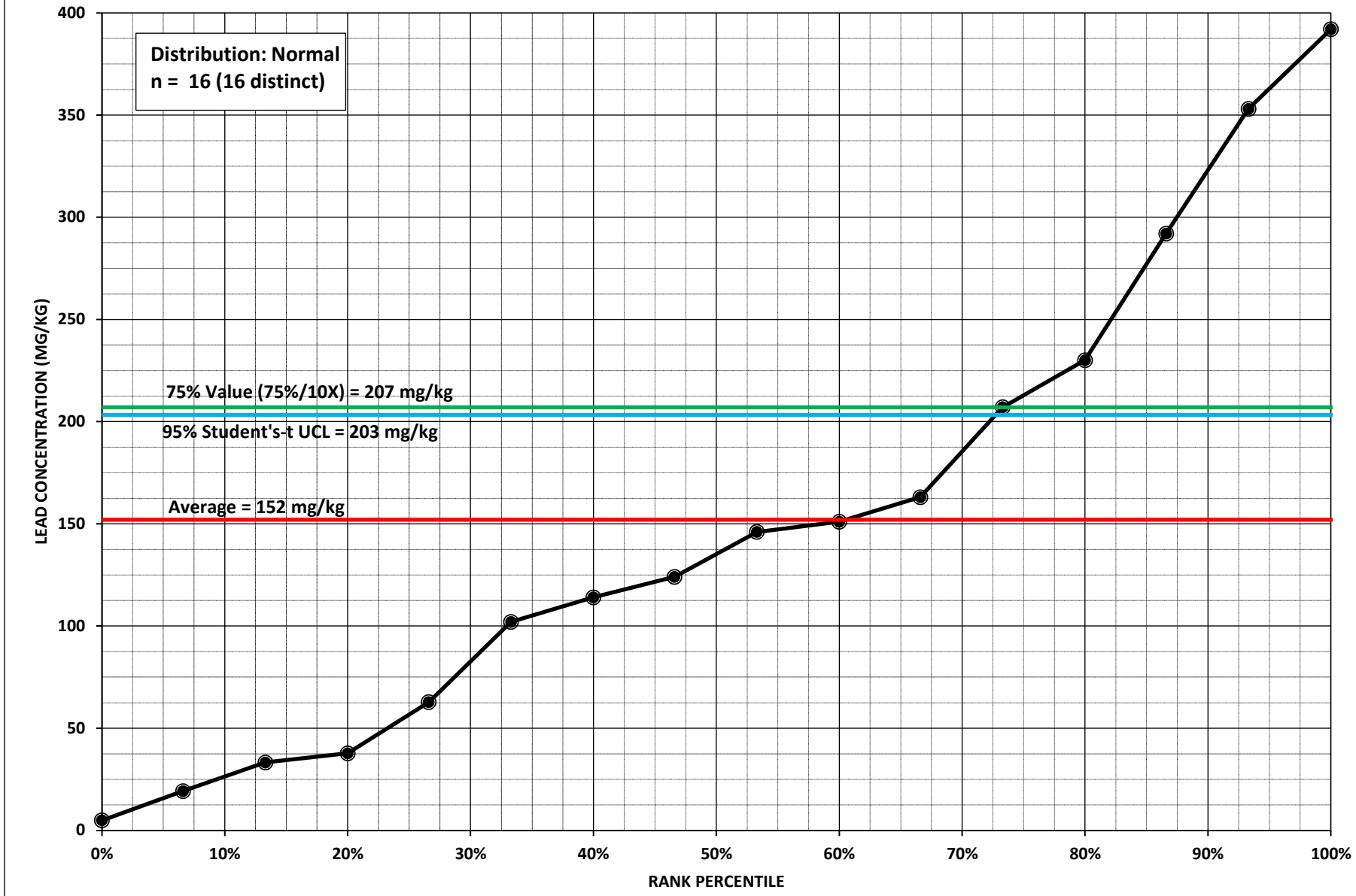


Site 3 Soil Dataset

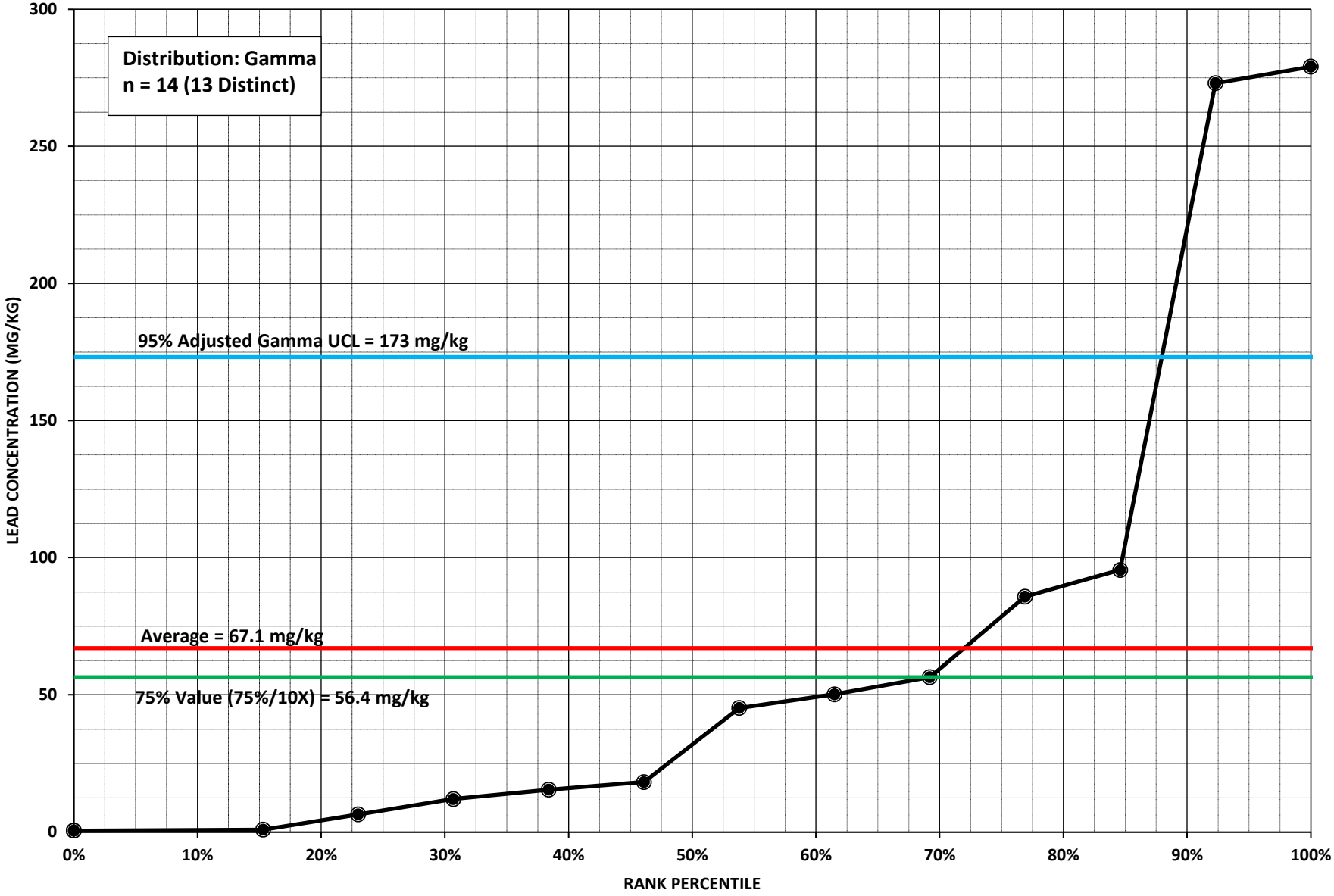



Site 4 Soil Dataset - UNIT HE-1 ATTAINMENT
Distribution: Gamma
n = 8 (8 Distinct)
95% Adjusted Gamma UCL = 180 mg/kg
Average = 61.9 mg/kg
75% Value (75%/10X) = 38.4 mg/kg
GAMMA
RANK PERCENTILE
0
50
100
150
200
250
300
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

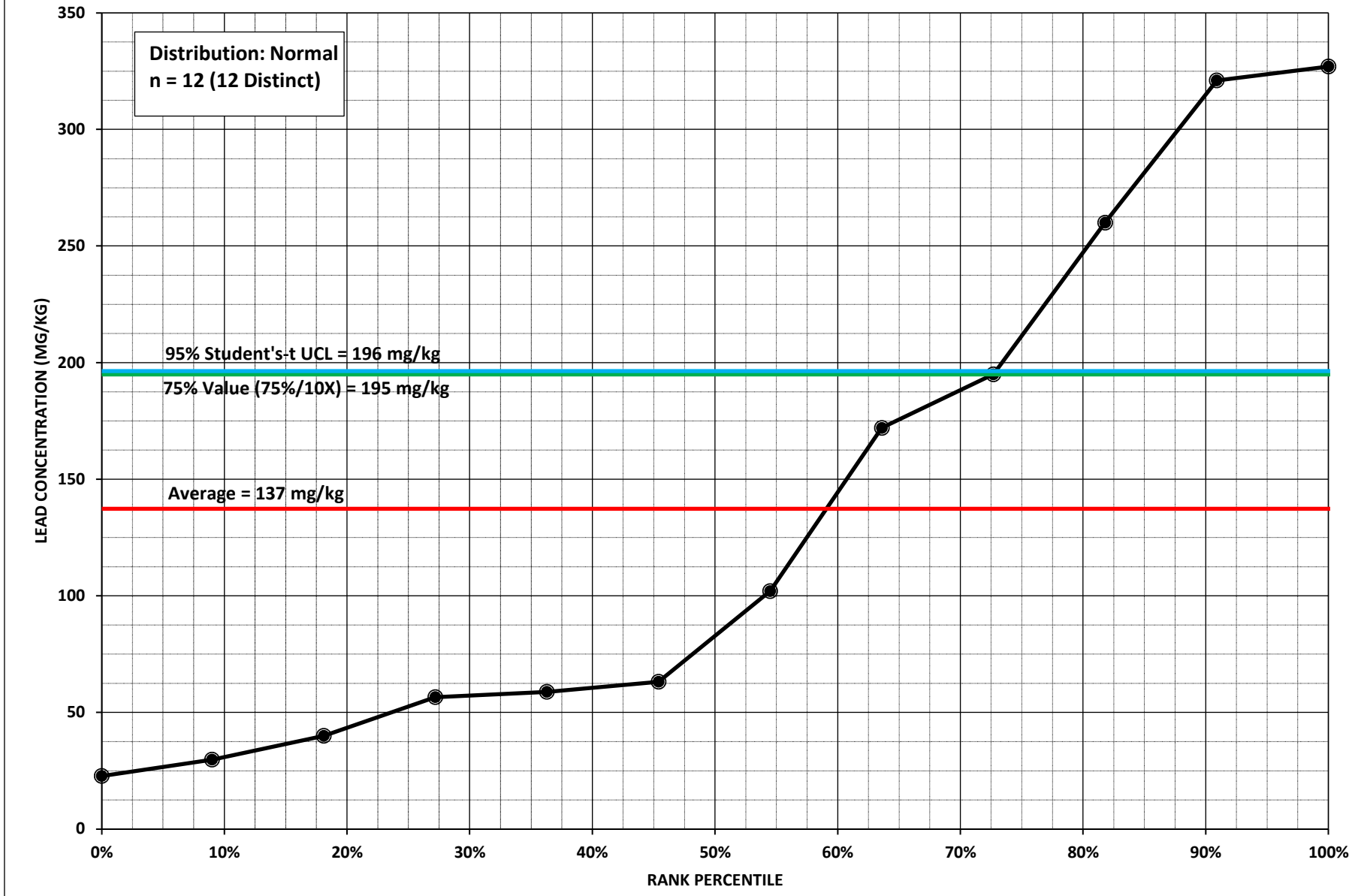
Site 4 Soil Dataset - UNIT HE-2 ATTAINMENT



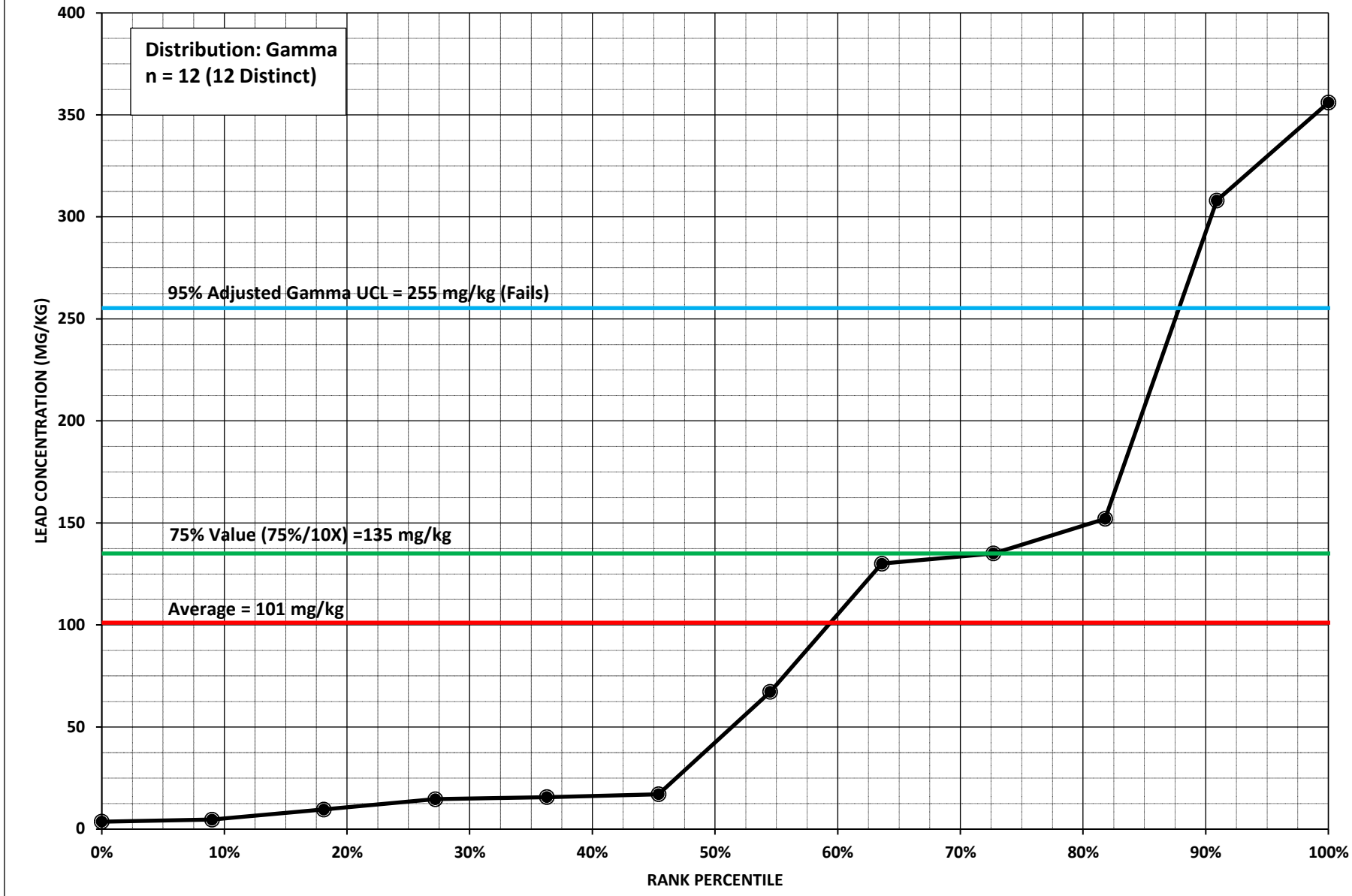
Site 4 Soil Dataset - UNIT HE-3 ATTAINMENT



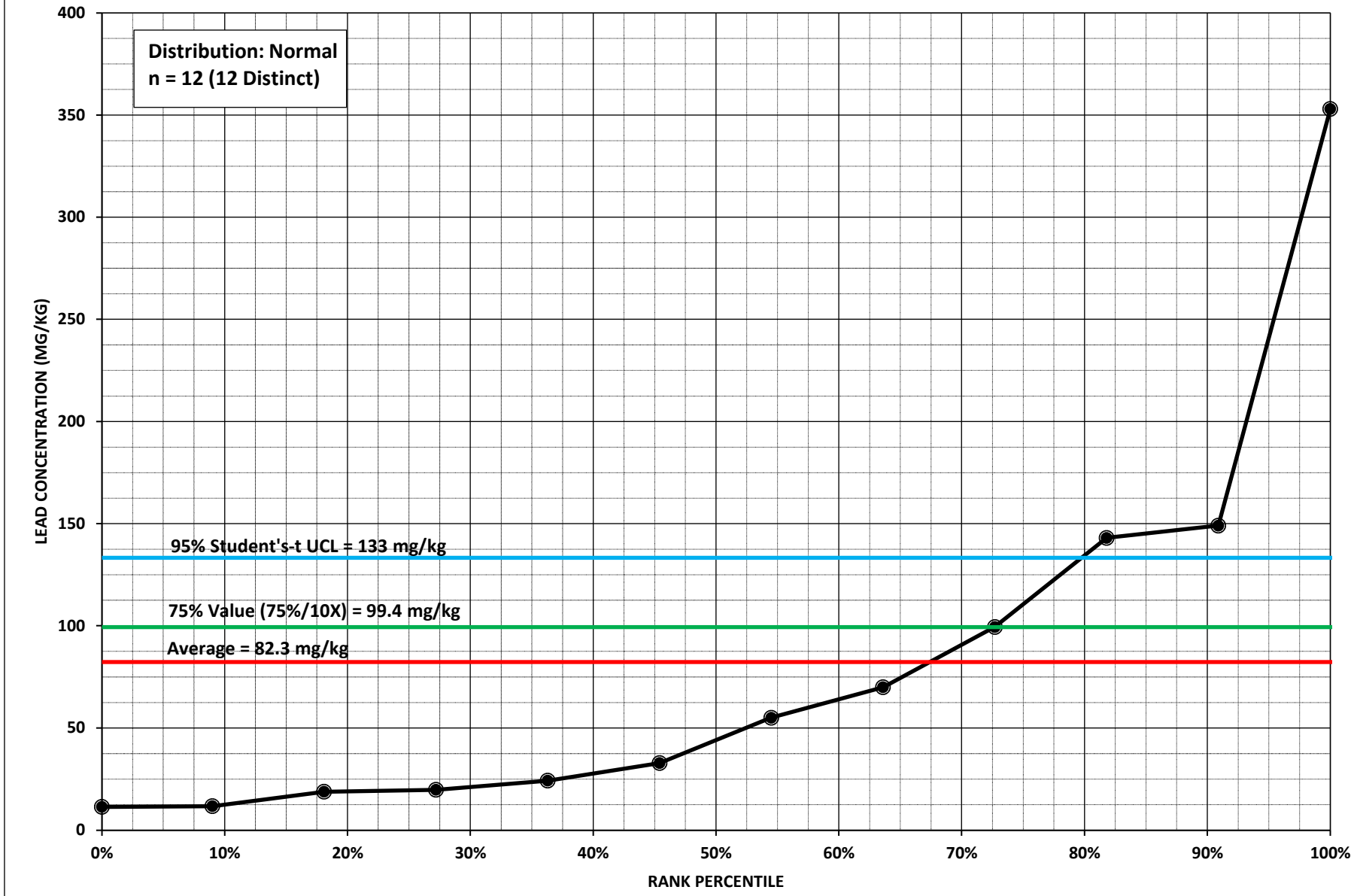
Site 4 Soil Dataset - UNIT HE-4 ATTAINMENT



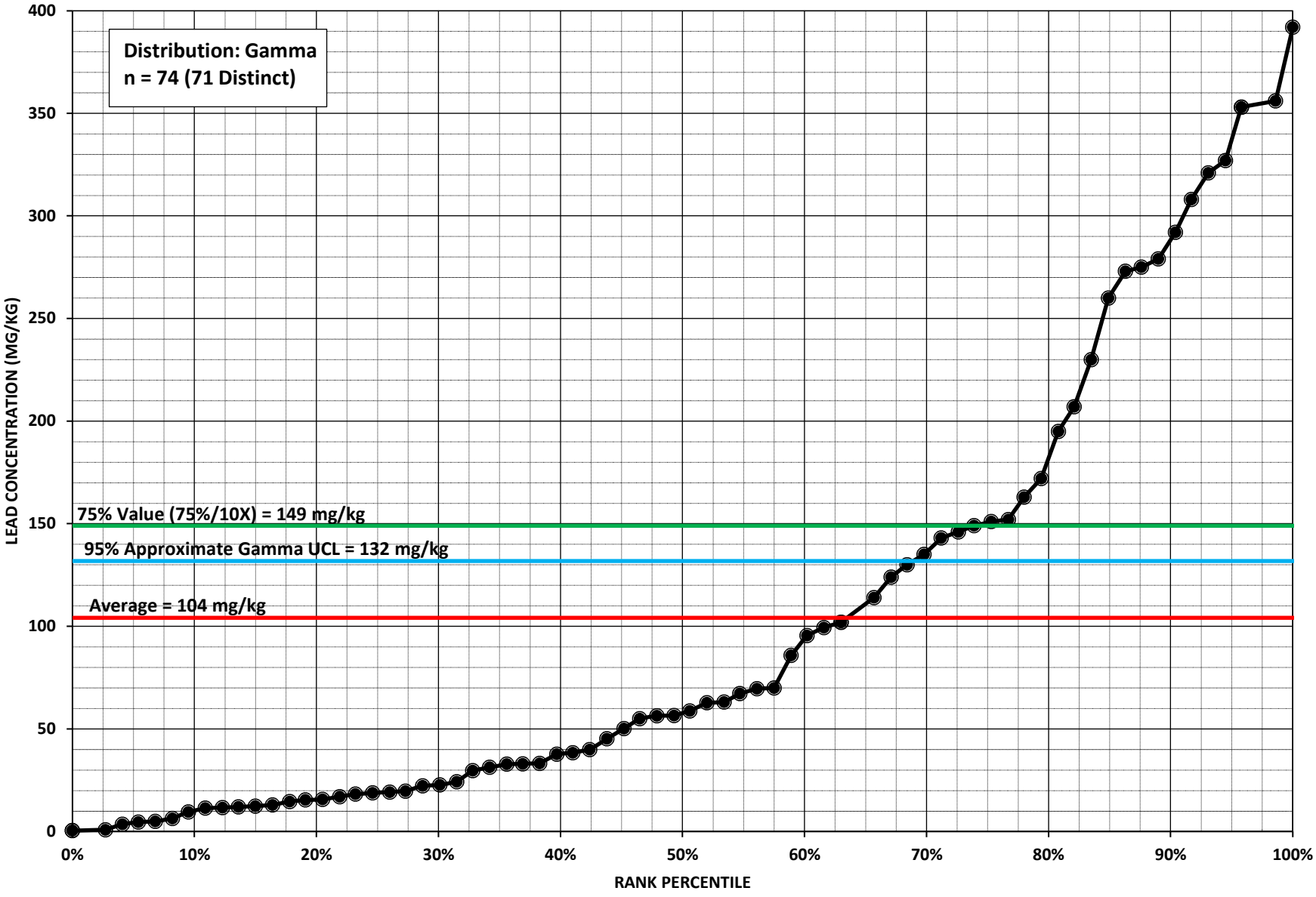
Site 4 Soil Dataset - UNIT HE-5 ATTAINMENT



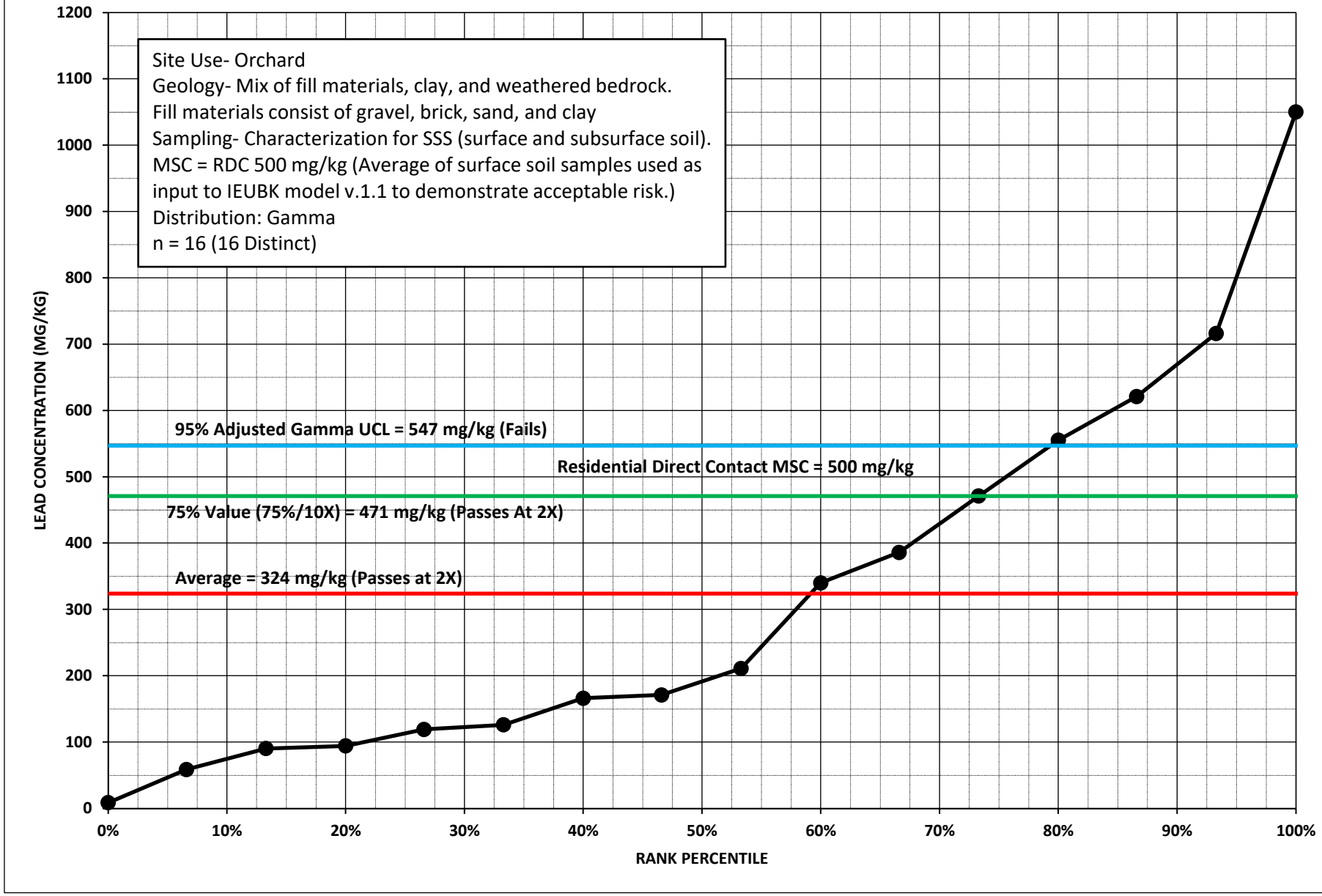
Site 4 Soil Dataset - UNIT HE-6 ATTAINMENT



Site 4 Soil Dataset - ALL ATTAINMENT DATA



Site 5 Soil Dataset - SURFACE SOIL DATA



	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Uncensored Full Data Sets											
2												
3	User Selected Options											
4	Date/Time of Computation	ProUCL 5.12/3/2022 12:51:55 PM										
5	From File	Dataset Statistics.xls										
6	Full Precision	OFF										
7	Confidence Coefficient	95%										
8	Number of Bootstrap Operations	2000										
9												
10												
11	Site 2											
12												
13	General Statistics											
14	Total Number of Observations					33			Number of Distinct Observations			28
15									Number of Missing Observations			0
16	Minimum					0.25			Mean			202.8
17	Maximum					1024			Median			165
18	SD					216.3			Std. Error of Mean			37.65
19	Coefficient of Variation					1.066			Skewness			1.932
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.822			Shapiro Wilk GOF Test			
23	5% Shapiro Wilk Critical Value					0.931			Data Not Normal at 5% Significance Level			
24	Lilliefors Test Statistic					0.174			Lilliefors GOF Test			
25	5% Lilliefors Critical Value					0.152			Data Not Normal at 5% Significance Level			
26	Data Not Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL								95% UCLs (Adjusted for Skewness)			
30	95% Student's-t UCL					266.6			95% Adjusted-CLT UCL (Chen-1995)			278.3
31									95% Modified-t UCL (Johnson-1978)			268.7
32												
33	Gamma GOF Test											
34	A-D Test Statistic					1.291			Anderson-Darling Gamma GOF Test			
35	5% A-D Critical Value					0.809			Data Not Gamma Distributed at 5% Significance Level			
36	K-S Test Statistic					0.143			Kolmogorov-Smirnov Gamma GOF Test			
37	5% K-S Critical Value					0.162			Detected data appear Gamma Distributed at 5% Significance Level			
38	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					0.522			k star (bias corrected MLE)			0.495
42	Theta hat (MLE)					388.8			Theta star (bias corrected MLE)			410.2
43	nu hat (MLE)					34.43			nu star (bias corrected)			32.64
44	MLE Mean (bias corrected)					202.8			MLE Sd (bias corrected)			288.4
45									Approximate Chi Square Value (0.05)			20.58
46	Adjusted Level of Significance					0.0419			Adjusted Chi Square Value			20.08
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50)					321.7			95% Adjusted Gamma UCL (use when n<50)			329.6
50												
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.743			Shapiro Wilk Lognormal GOF Test			
53	5% Shapiro Wilk Critical Value					0.931			Data Not Lognormal at 5% Significance Level			

54					Lilliefors Test Statistic	0.232	Lilliefors Lognormal GOF Test					
55					5% Lilliefors Critical Value	0.152	Data Not Lognormal at 5% Significance Level					
56					Data Not Lognormal at 5% Significance Level							
57												
58					Lognormal Statistics							
59					Minimum of Logged Data	-1.386			Mean of logged Data	4.103		
60					Maximum of Logged Data	6.931			SD of logged Data	2.518		
61												
62					Assuming Lognormal Distribution							
63					95% H-UCL	11523			90% Chebyshev (MVUE) UCL	2975		
64					95% Chebyshev (MVUE) UCL	3851			97.5% Chebyshev (MVUE) UCL	5066		
65					99% Chebyshev (MVUE) UCL	7454						
66												
67					Nonparametric Distribution Free UCL Statistics							
68					Data appear to follow a Discernible Distribution at 5% Significance Level							
69												
70					Nonparametric Distribution Free UCLs							
71					95% CLT UCL	264.8			95% Jackknife UCL	266.6		
72					95% Standard Bootstrap UCL	262.4			95% Bootstrap-t UCL	289.9		
73					95% Hall's Bootstrap UCL	305.1			95% Percentile Bootstrap UCL	265.4		
74					95% BCA Bootstrap UCL	278.9						
75					90% Chebyshev(Mean, Sd) UCL	315.8			95% Chebyshev(Mean, Sd) UCL	367		
76					97.5% Chebyshev(Mean, Sd) UCL	438			99% Chebyshev(Mean, Sd) UCL	577.5		
77												
78					Suggested UCL to Use							
79					95% Adjusted Gamma UCL	329.6						
80												
81					When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test							
82					When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL							
83												
84					Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
85					Recommendations are based upon data size, data distribution, and skewness.							
86					These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
87					However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
88												
89												
90	Site 3											
91												
92					General Statistics							
93					Total Number of Observations	53			Number of Distinct Observations	51		
94									Number of Missing Observations	0		
95					Minimum	7			Mean	836.3		
96					Maximum	5897			Median	255		
97					SD	1297			Std. Error of Mean	178.2		
98					Coefficient of Variation	1.551			Skewness	2.274		
99												
100					Normal GOF Test							
101					Shapiro Wilk Test Statistic	0.663	Shapiro Wilk GOF Test					
102					5% Shapiro Wilk P Value	6.883E-15	Data Not Normal at 5% Significance Level					
103					Lilliefors Test Statistic	0.315	Lilliefors GOF Test					
104					5% Lilliefors Critical Value	0.121	Data Not Normal at 5% Significance Level					
105					Data Not Normal at 5% Significance Level							
106												

	A	B	C	D	E	F	G	H	I	J	K	L
107	Assuming Normal Distribution											
108	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
109	95% Student's-t UCL				1135		95% Adjusted-CLT UCL (Chen-1995)				1189	
110							95% Modified-t UCL (Johnson-1978)				1144	
111												
112	Gamma GOF Test											
113	A-D Test Statistic				1.401		Anderson-Darling Gamma GOF Test					
114	5% A-D Critical Value				0.81		Data Not Gamma Distributed at 5% Significance Level					
115	K-S Test Statistic				0.178		Kolmogorov-Smirnov Gamma GOF Test					
116	5% K-S Critical Value				0.129		Data Not Gamma Distributed at 5% Significance Level					
117	Data Not Gamma Distributed at 5% Significance Level											
118												
119	Gamma Statistics											
120	k hat (MLE)				0.554		k star (bias corrected MLE)				0.535	
121	Theta hat (MLE)				1509		Theta star (bias corrected MLE)				1562	
122	nu hat (MLE)				58.73		nu star (bias corrected)				56.74	
123	MLE Mean (bias corrected)				836.3		MLE Sd (bias corrected)				1143	
124							Approximate Chi Square Value (0.05)				40.43	
125	Adjusted Level of Significance				0.0455		Adjusted Chi Square Value				40.04	
126												
127	Assuming Gamma Distribution											
128	95% Approximate Gamma UCL (use when n>=50))				1174		95% Adjusted Gamma UCL (use when n<50)				1185	
129												
130	Lognormal GOF Test											
131	Shapiro Wilk Test Statistic				0.971		Shapiro Wilk Lognormal GOF Test					
132	5% Shapiro Wilk P Value				0.39		Data appear Lognormal at 5% Significance Level					
133	Lilliefors Test Statistic				0.075		Lilliefors Lognormal GOF Test					
134	5% Lilliefors Critical Value				0.121		Data appear Lognormal at 5% Significance Level					
135	Data appear Lognormal at 5% Significance Level											
136												
137	Lognormal Statistics											
138	Minimum of Logged Data				1.946		Mean of logged Data				5.6	
139	Maximum of Logged Data				8.682		SD of logged Data				1.637	
140												
141	Assuming Lognormal Distribution											
142	95% H-UCL				2099		90% Chebyshev (MVUE) UCL				1883	
143	95% Chebyshev (MVUE) UCL				2293		97.5% Chebyshev (MVUE) UCL				2862	
144	99% Chebyshev (MVUE) UCL				3981							
145												
146	Nonparametric Distribution Free UCL Statistics											
147	Data appear to follow a Discernible Distribution at 5% Significance Level											
148												
149	Nonparametric Distribution Free UCLs											
150	95% CLT UCL				1129		95% Jackknife UCL				1135	
151	95% Standard Bootstrap UCL				1130		95% Bootstrap-t UCL				1226	
152	95% Hall's Bootstrap UCL				1218		95% Percentile Bootstrap UCL				1153	
153	95% BCA Bootstrap UCL				1191							
154	90% Chebyshev(Mean, Sd) UCL				1371		95% Chebyshev(Mean, Sd) UCL				1613	
155	97.5% Chebyshev(Mean, Sd) UCL				1949		99% Chebyshev(Mean, Sd) UCL				2609	
156												
157	Suggested UCL to Use											
158	95% H-UCL				2099							
159												

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Site 4_Attain

General Statistics

Total Number of Observations	74	Number of Distinct Observations	71
		Number of Missing Observations	0
Minimum	0.5	Mean	104.2
Maximum	392	Median	57.65
SD	109.5	Std. Error of Mean	12.73
Coefficient of Variation	1.051	Skewness	1.156

Normal GOF Test

Shapiro Wilk Test Statistic	0.812	Shapiro Wilk GOF Test
5% Shapiro Wilk P Value	5.004E-13	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.204	Lilliefors GOF Test
5% Lilliefors Critical Value	0.103	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	125.5	95% Adjusted-CLT UCL (Chen-1995)	127
		95% Modified-t UCL (Johnson-1978)	125.7

Gamma GOF Test

A-D Test Statistic	0.505	Anderson-Darling Gamma GOF Test
5% A-D Critical Value	0.792	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0659	Kolmogorov-Smirnov Gamma GOF Test
5% K-S Critical Value	0.108	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.777	k star (bias corrected MLE)	0.755
Theta hat (MLE)	134.1	Theta star (bias corrected MLE)	138.1
nu hat (MLE)	115.1	nu star (bias corrected)	111.7
MLE Mean (bias corrected)	104.2	MLE Sd (bias corrected)	120
		Approximate Chi Square Value (0.05)	88.33
Adjusted Level of Significance	0.0468	Adjusted Chi Square Value	87.92

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	131.9	95% Adjusted Gamma UCL (use when n<50)	132.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.921	Shapiro Wilk Lognormal GOF Test

213				5% Shapiro Wilk P Value	9.9070E-5	Data Not Lognormal at 5% Significance Level					
214				Lilliefors Test Statistic	0.0841	Lilliefors Lognormal GOF Test					
215				5% Lilliefors Critical Value	0.103	Data appear Lognormal at 5% Significance Level					
216	Data appear Approximate Lognormal at 5% Significance Level										
217											
218	Lognormal Statistics										
219				Minimum of Logged Data	-0.693	Mean of logged Data	3.88				
220				Maximum of Logged Data	5.971	SD of logged Data	1.517				
221											
222	Assuming Lognormal Distribution										
223				95% H-UCL	252.6	90% Chebyshev (MVUE) UCL	255.8				
224				95% Chebyshev (MVUE) UCL	304.5	97.5% Chebyshev (MVUE) UCL	372.1				
225				99% Chebyshev (MVUE) UCL	504.9						
226											
227	Nonparametric Distribution Free UCL Statistics										
228	Data appear to follow a Discernible Distribution at 5% Significance Level										
229											
230	Nonparametric Distribution Free UCLs										
231				95% CLT UCL	125.2	95% Jackknife UCL	125.5				
232				95% Standard Bootstrap UCL	125.5	95% Bootstrap-t UCL	126.8				
233				95% Hall's Bootstrap UCL	127.4	95% Percentile Bootstrap UCL	125.4				
234				95% BCA Bootstrap UCL	128.5						
235				90% Chebyshev(Mean, Sd) UCL	142.4	95% Chebyshev(Mean, Sd) UCL	159.7				
236				97.5% Chebyshev(Mean, Sd) UCL	183.8	99% Chebyshev(Mean, Sd) UCL	230.9				
237											
238	Suggested UCL to Use										
239				95% Approximate Gamma UCL	131.9						
240											
241	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
242	Recommendations are based upon data size, data distribution, and skewness.										
243	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
244	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
245											
246											
247	Site 4 HE1										
248											
249	General Statistics										
250				Total Number of Observations	8	Number of Distinct Observations	8				
251						Number of Missing Observations	0				
252				Minimum	12.4	Mean	61.86				
253				Maximum	275	Median	32.15				
254				SD	88	Std. Error of Mean	31.11				
255				Coefficient of Variation	1.423	Skewness	2.604				
256											
257	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use										
258	guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.										
259	For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).										
260	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1										
261											
262	Normal GOF Test										
263				Shapiro Wilk Test Statistic	0.596	Shapiro Wilk GOF Test					
264				5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level					
265				Lilliefors Test Statistic	0.355	Lilliefors GOF Test					

266				5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level					
267	Data Not Normal at 5% Significance Level										
268											
269	Assuming Normal Distribution										
270	95% Normal UCL					95% UCLs (Adjusted for Skewness)					
271				95% Student's-t UCL	120.8				95% Adjusted-CLT UCL (Chen-1995)	143.6	
272									95% Modified-t UCL (Johnson-1978)	125.6	
273											
274	Gamma GOF Test										
275				A-D Test Statistic	0.749	Anderson-Darling Gamma GOF Test					
276				5% A-D Critical Value	0.735	Data Not Gamma Distributed at 5% Significance Level					
277				K-S Test Statistic	0.295	Kolmogorov-Smirnov Gamma GOF Test					
278				5% K-S Critical Value	0.301	Detected data appear Gamma Distributed at 5% Significance Level					
279	Detected data follow Appr. Gamma Distribution at 5% Significance Level										
280											
281	Gamma Statistics										
282				k hat (MLE)	1.05				k star (bias corrected MLE)	0.74	
283				Theta hat (MLE)	58.9				Theta star (bias corrected MLE)	83.63	
284				nu hat (MLE)	16.8				nu star (bias corrected)	11.84	
285				MLE Mean (bias corrected)	61.86				MLE Sd (bias corrected)	71.93	
286									Approximate Chi Square Value (0.05)	5.119	
287				Adjusted Level of Significance	0.0195				Adjusted Chi Square Value	4.059	
288											
289	Assuming Gamma Distribution										
290	95% Approximate Gamma UCL (use when n>=50)				143				95% Adjusted Gamma UCL (use when n<50)	180.4	
291											
292	Lognormal GOF Test										
293				Shapiro Wilk Test Statistic	0.895	Shapiro Wilk Lognormal GOF Test					
294				5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level					
295				Lilliefors Test Statistic	0.222	Lilliefors Lognormal GOF Test					
296				5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level					
297	Data appear Lognormal at 5% Significance Level										
298											
299	Lognormal Statistics										
300				Minimum of Logged Data	2.518				Mean of logged Data	3.578	
301				Maximum of Logged Data	5.617				SD of logged Data	1.001	
302											
303	Assuming Lognormal Distribution										
304				95% H-UCL	216.5				90% Chebyshev (MVUE) UCL	113.5	
305				95% Chebyshev (MVUE) UCL	140.3				97.5% Chebyshev (MVUE) UCL	177.4	
306				99% Chebyshev (MVUE) UCL	250.4						
307											
308	Nonparametric Distribution Free UCL Statistics										
309	Data appear to follow a Discernible Distribution at 5% Significance Level										
310											
311	Nonparametric Distribution Free UCLs										
312				95% CLT UCL	113				95% Jackknife UCL	120.8	
313				95% Standard Bootstrap UCL	110.3				95% Bootstrap-t UCL	391.6	
314				95% Hall's Bootstrap UCL	389.2				95% Percentile Bootstrap UCL	119.6	
315				95% BCA Bootstrap UCL	151.9						
316				90% Chebyshev(Mean, Sd) UCL	155.2				95% Chebyshev(Mean, Sd) UCL	197.5	
317				97.5% Chebyshev(Mean, Sd) UCL	256.2				99% Chebyshev(Mean, Sd) UCL	371.4	
318											

319	Suggested UCL to Use										
320				95% Adjusted Gamma UCL	180.4						
321											
322	When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test										
323	When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL										
324											
325	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
326	Recommendations are based upon data size, data distribution, and skewness.										
327	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
328	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
329											
330											
331	Site 4 HE2										
332											
333	General Statistics										
334				Total Number of Observations	16			Number of Distinct Observations	16		
335								Number of Missing Observations	0		
336				Minimum	4.9			Mean	152		
337				Maximum	392			Median	135		
338				SD	117.2			Std. Error of Mean	29.3		
339				Coefficient of Variation	0.771			Skewness	0.745		
340											
341	Normal GOF Test										
342				Shapiro Wilk Test Statistic	0.93			Shapiro Wilk GOF Test			
343				5% Shapiro Wilk Critical Value	0.887			Data appear Normal at 5% Significance Level			
344				Lilliefors Test Statistic	0.15			Lilliefors GOF Test			
345				5% Lilliefors Critical Value	0.213			Data appear Normal at 5% Significance Level			
346	Data appear Normal at 5% Significance Level										
347											
348	Assuming Normal Distribution										
349				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
350				95% Student's-t UCL	203.3			95% Adjusted-CLT UCL (Chen-1995)	206		
351								95% Modified-t UCL (Johnson-1978)	204.3		
352											
353	Gamma GOF Test										
354				A-D Test Statistic	0.239			Anderson-Darling Gamma GOF Test			
355				5% A-D Critical Value	0.758			Detected data appear Gamma Distributed at 5% Significance Level			
356				K-S Test Statistic	0.141			Kolmogorov-Smirnov Gamma GOF Test			
357				5% K-S Critical Value	0.22			Detected data appear Gamma Distributed at 5% Significance Level			
358	Detected data appear Gamma Distributed at 5% Significance Level										
359											
360	Gamma Statistics										
361				k hat (MLE)	1.283			k star (bias corrected MLE)	1.084		
362				Theta hat (MLE)	118.4			Theta star (bias corrected MLE)	140.2		
363				nu hat (MLE)	41.06			nu star (bias corrected)	34.7		
364				MLE Mean (bias corrected)	152			MLE Sd (bias corrected)	146		
365								Approximate Chi Square Value (0.05)	22.22		
366				Adjusted Level of Significance	0.0335			Adjusted Chi Square Value	21.09		
367											
368	Assuming Gamma Distribution										
369				95% Approximate Gamma UCL (use when n>=50))	237.3			95% Adjusted Gamma UCL (use when n<50)	250		
370											
371	Lognormal GOF Test										

372				Shapiro Wilk Test Statistic	0.901	Shapiro Wilk Lognormal GOF Test					
373				5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level					
374				Lilliefors Test Statistic	0.201	Lilliefors Lognormal GOF Test					
375				5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level					
376				Data appear Lognormal at 5% Significance Level							
377											
378				Lognormal Statistics							
379				Minimum of Logged Data	1.589	Mean of logged Data	4.586				
380				Maximum of Logged Data	5.971	SD of logged Data	1.173				
381											
382				Assuming Lognormal Distribution							
383				95% H-UCL	481.4	90% Chebyshev (MVUE) UCL	363.2				
384				95% Chebyshev (MVUE) UCL	444.9	97.5% Chebyshev (MVUE) UCL	558.3				
385				99% Chebyshev (MVUE) UCL	781.1						
386											
387				Nonparametric Distribution Free UCL Statistics							
388				Data appear to follow a Discernible Distribution at 5% Significance Level							
389											
390				Nonparametric Distribution Free UCLs							
391				95% CLT UCL	200.2	95% Jackknife UCL	203.3				
392				95% Standard Bootstrap UCL	197.9	95% Bootstrap-t UCL	212.6				
393				95% Hall's Bootstrap UCL	209.7	95% Percentile Bootstrap UCL	200.3				
394				95% BCA Bootstrap UCL	204						
395				90% Chebyshev(Mean, Sd) UCL	239.9	95% Chebyshev(Mean, Sd) UCL	279.7				
396				97.5% Chebyshev(Mean, Sd) UCL	335	99% Chebyshev(Mean, Sd) UCL	443.5				
397											
398				Suggested UCL to Use							
399				95% Student's-t UCL	203.3						
400											
401				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
402				Recommendations are based upon data size, data distribution, and skewness.							
403				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
404				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
405											
406											
407	Site 4 HE3										
408											
409				General Statistics							
410				Total Number of Observations	14	Number of Distinct Observations	13				
411						Number of Missing Observations	0				
412				Minimum	0.5	Mean	67.07				
413				Maximum	279	Median	31.7				
414				SD	93.8	Std. Error of Mean	25.07				
415				Coefficient of Variation	1.399	Skewness	1.82				
416											
417				Normal GOF Test							
418				Shapiro Wilk Test Statistic	0.7	Shapiro Wilk GOF Test					
419				5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level					
420				Lilliefors Test Statistic	0.26	Lilliefors GOF Test					
421				5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level					
422				Data Not Normal at 5% Significance Level							
423											
424				Assuming Normal Distribution							

425	95% Normal UCL					95% UCLs (Adjusted for Skewness)					
426				95% Student's-t UCL	111.5				95% Adjusted-CLT UCL (Chen-1995)	121.3	
427									95% Modified-t UCL (Johnson-1978)	113.5	
428											
429	Gamma GOF Test										
430				A-D Test Statistic	0.284	Anderson-Darling Gamma GOF Test					
431				5% A-D Critical Value	0.796	Detected data appear Gamma Distributed at 5% Significance Level					
432				K-S Test Statistic	0.119	Kolmogorov-Smirnov Gamma GOF Test					
433				5% K-S Critical Value	0.242	Detected data appear Gamma Distributed at 5% Significance Level					
434	Detected data appear Gamma Distributed at 5% Significance Level										
435											
436	Gamma Statistics										
437				k hat (MLE)	0.485	k star (bias corrected MLE)	0.428				
438				Theta hat (MLE)	138.4	Theta star (bias corrected MLE)	156.6				
439				nu hat (MLE)	13.57	nu star (bias corrected)	11.99				
440				MLE Mean (bias corrected)	67.07	MLE Sd (bias corrected)	102.5				
441						Approximate Chi Square Value (0.05)	5.223				
442				Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	4.644				
443											
444	Assuming Gamma Distribution										
445				95% Approximate Gamma UCL (use when n>=50)	154	95% Adjusted Gamma UCL (use when n<50)	173.2				
446											
447	Lognormal GOF Test										
448				Shapiro Wilk Test Statistic	0.904	Shapiro Wilk Lognormal GOF Test					
449				5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level					
450				Lilliefors Test Statistic	0.167	Lilliefors Lognormal GOF Test					
451				5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level					
452	Data appear Lognormal at 5% Significance Level										
453											
454	Lognormal Statistics										
455				Minimum of Logged Data	-0.693	Mean of logged Data	2.889				
456				Maximum of Logged Data	5.631	SD of logged Data	2.141				
457											
458	Assuming Lognormal Distribution										
459				95% H-UCL	3382	90% Chebyshev (MVUE) UCL	350.8				
460				95% Chebyshev (MVUE) UCL	455.4	97.5% Chebyshev (MVUE) UCL	600.7				
461				99% Chebyshev (MVUE) UCL	885.9						
462											
463	Nonparametric Distribution Free UCL Statistics										
464	Data appear to follow a Discernible Distribution at 5% Significance Level										
465											
466	Nonparametric Distribution Free UCLs										
467				95% CLT UCL	108.3	95% Jackknife UCL	111.5				
468				95% Standard Bootstrap UCL	107.2	95% Bootstrap-t UCL	172.1				
469				95% Hall's Bootstrap UCL	334.5	95% Percentile Bootstrap UCL	111.1				
470				95% BCA Bootstrap UCL	127.3						
471				90% Chebyshev(Mean, Sd) UCL	142.3	95% Chebyshev(Mean, Sd) UCL	176.3				
472				97.5% Chebyshev(Mean, Sd) UCL	223.6	99% Chebyshev(Mean, Sd) UCL	316.5				
473											
474	Suggested UCL to Use										
475				95% Adjusted Gamma UCL	173.2						
476											
477	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										

478	Recommendations are based upon data size, data distribution, and skewness.										
479	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
480	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
481											
482											
483	Site 4 HE4										
484											
485	General Statistics										
486				Total Number of Observations	12			Number of Distinct Observations	12		
487								Number of Missing Observations	0		
488				Minimum	22.7			Mean	137.3		
489				Maximum	327			Median	82.55		
490				SD	114			Std. Error of Mean	32.91		
491				Coefficient of Variation	0.83			Skewness	0.734		
492											
493	Normal GOF Test										
494				Shapiro Wilk Test Statistic	0.851			Shapiro Wilk GOF Test			
495				5% Shapiro Wilk Critical Value	0.859			Data Not Normal at 5% Significance Level			
496				Lilliefors Test Statistic	0.242			Lilliefors GOF Test			
497				5% Lilliefors Critical Value	0.243			Data appear Normal at 5% Significance Level			
498	Data appear Approximate Normal at 5% Significance Level										
499											
500	Assuming Normal Distribution										
501				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
502				95% Student's-t UCL	196.4			95% Adjusted-CLT UCL (Chen-1995)	198.9		
503								95% Modified-t UCL (Johnson-1978)	197.6		
504											
505	Gamma GOF Test										
506				A-D Test Statistic	0.456			Anderson-Darling Gamma GOF Test			
507				5% A-D Critical Value	0.746			Detected data appear Gamma Distributed at 5% Significance Level			
508				K-S Test Statistic	0.21			Kolmogorov-Smirnov Gamma GOF Test			
509				5% K-S Critical Value	0.25			Detected data appear Gamma Distributed at 5% Significance Level			
510	Detected data appear Gamma Distributed at 5% Significance Level										
511											
512	Gamma Statistics										
513				k hat (MLE)	1.494			k star (bias corrected MLE)	1.176		
514				Theta hat (MLE)	91.89			Theta star (bias corrected MLE)	116.7		
515				nu hat (MLE)	35.86			nu star (bias corrected)	28.23		
516				MLE Mean (bias corrected)	137.3			MLE Sd (bias corrected)	126.6		
517								Approximate Chi Square Value (0.05)	17.11		
518				Adjusted Level of Significance	0.029			Adjusted Chi Square Value	15.8		
519											
520	Assuming Gamma Distribution										
521				95% Approximate Gamma UCL (use when n>=50))	226.6			95% Adjusted Gamma UCL (use when n<50)	245.4		
522											
523	Lognormal GOF Test										
524				Shapiro Wilk Test Statistic	0.927			Shapiro Wilk Lognormal GOF Test			
525				5% Shapiro Wilk Critical Value	0.859			Data appear Lognormal at 5% Significance Level			
526				Lilliefors Test Statistic	0.167			Lilliefors Lognormal GOF Test			
527				5% Lilliefors Critical Value	0.243			Data appear Lognormal at 5% Significance Level			
528	Data appear Lognormal at 5% Significance Level										
529											
530	Lognormal Statistics										

531				Minimum of Logged Data	3.122				Mean of logged Data		4.552
532				Maximum of Logged Data	5.79				SD of logged Data		0.94
533											
534				Assuming Lognormal Distribution							
535				95% H-UCL	326.8				90% Chebyshev (MVUE) UCL		262.2
536				95% Chebyshev (MVUE) UCL	317.3				97.5% Chebyshev (MVUE) UCL		393.8
537				99% Chebyshev (MVUE) UCL	544.1						
538											
539				Nonparametric Distribution Free UCL Statistics							
540				Data appear to follow a Discernible Distribution at 5% Significance Level							
541											
542				Nonparametric Distribution Free UCLs							
543				95% CLT UCL	191.4				95% Jackknife UCL		196.4
544				95% Standard Bootstrap UCL	188.5				95% Bootstrap-t UCL		215.3
545				95% Hall's Bootstrap UCL	191.2				95% Percentile Bootstrap UCL		192.5
546				95% BCA Bootstrap UCL	195.8						
547				90% Chebyshev(Mean, Sd) UCL	236				95% Chebyshev(Mean, Sd) UCL		280.8
548				97.5% Chebyshev(Mean, Sd) UCL	342.8				99% Chebyshev(Mean, Sd) UCL		464.8
549											
550				Suggested UCL to Use							
551				95% Student's-t UCL	196.4						
552											
553				When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test							
554				When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL							
555											
556				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
557				Recommendations are based upon data size, data distribution, and skewness.							
558				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
559				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
560											
561											
562	Site 4 HE5										
563											
564				General Statistics							
565				Total Number of Observations	12				Number of Distinct Observations		12
566									Number of Missing Observations		0
567				Minimum	3.55				Mean		101.1
568				Maximum	356				Median		42.1
569				SD	121.6				Std. Error of Mean		35.1
570				Coefficient of Variation	1.203				Skewness		1.282
571											
572				Normal GOF Test							
573				Shapiro Wilk Test Statistic	0.79				Shapiro Wilk GOF Test		
574				5% Shapiro Wilk Critical Value	0.859				Data Not Normal at 5% Significance Level		
575				Lilliefors Test Statistic	0.255				Lilliefors GOF Test		
576				5% Lilliefors Critical Value	0.243				Data Not Normal at 5% Significance Level		
577				Data Not Normal at 5% Significance Level							
578											
579				Assuming Normal Distribution							
580				95% Normal UCL					95% UCLs (Adjusted for Skewness)		
581				95% Student's-t UCL	164.1				95% Adjusted-CLT UCL (Chen-1995)		172.7
582									95% Modified-t UCL (Johnson-1978)		166.3
583											

	A	B	C	D	E	F	G	H	I	J	K	L
584	Gamma GOF Test											
585	A-D Test Statistic					0.513	Anderson-Darling Gamma GOF Test					
586	5% A-D Critical Value					0.774	Detected data appear Gamma Distributed at 5% Significance Level					
587	K-S Test Statistic					0.244	Kolmogorov-Smirnov Gamma GOF Test					
588	5% K-S Critical Value					0.257	Detected data appear Gamma Distributed at 5% Significance Level					
589	Detected data appear Gamma Distributed at 5% Significance Level											
590												
591	Gamma Statistics											
592	k hat (MLE)					0.64	k star (bias corrected MLE)					0.536
593	Theta hat (MLE)					157.9	Theta star (bias corrected MLE)					188.7
594	nu hat (MLE)					15.37	nu star (bias corrected)					12.86
595	MLE Mean (bias corrected)					101.1	MLE Sd (bias corrected)					138.1
596							Approximate Chi Square Value (0.05)					5.797
597	Adjusted Level of Significance					0.029	Adjusted Chi Square Value					5.091
598												
599	Assuming Gamma Distribution											
600	95% Approximate Gamma UCL (use when n>=50)					224.2	95% Adjusted Gamma UCL (use when n<50)					255.3
601												
602	Lognormal GOF Test											
603	Shapiro Wilk Test Statistic					0.915	Shapiro Wilk Lognormal GOF Test					
604	5% Shapiro Wilk Critical Value					0.859	Data appear Lognormal at 5% Significance Level					
605	Lilliefors Test Statistic					0.194	Lilliefors Lognormal GOF Test					
606	5% Lilliefors Critical Value					0.243	Data appear Lognormal at 5% Significance Level					
607	Data appear Lognormal at 5% Significance Level											
608												
609	Lognormal Statistics											
610	Minimum of Logged Data					1.267	Mean of logged Data					3.66
611	Maximum of Logged Data					5.875	SD of logged Data					1.626
612												
613	Assuming Lognormal Distribution											
614	95% H-UCL					1120	90% Chebyshev (MVUE) UCL					302.4
615	95% Chebyshev (MVUE) UCL					385.5	97.5% Chebyshev (MVUE) UCL					500.8
616	99% Chebyshev (MVUE) UCL					727.4						
617												
618	Nonparametric Distribution Free UCL Statistics											
619	Data appear to follow a Discernible Distribution at 5% Significance Level											
620												
621	Nonparametric Distribution Free UCLs											
622	95% CLT UCL					158.8	95% Jackknife UCL					164.1
623	95% Standard Bootstrap UCL					155.9	95% Bootstrap-t UCL					203.1
624	95% Hall's Bootstrap UCL					209.7	95% Percentile Bootstrap UCL					158.3
625	95% BCA Bootstrap UCL					169.9						
626	90% Chebyshev(Mean, Sd) UCL					206.4	95% Chebyshev(Mean, Sd) UCL					254.1
627	97.5% Chebyshev(Mean, Sd) UCL					320.3	99% Chebyshev(Mean, Sd) UCL					450.3
628												
629	Suggested UCL to Use											
630	95% Adjusted Gamma UCL					255.3						
631												
632	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
633	Recommendations are based upon data size, data distribution, and skewness.											
634	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
635	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
636												

	A	B	C	D	E	F	G	H	I	J	K	L
637												
638	Site 4 HE6											
639												
640						General Statistics						
641					Total Number of Observations	12			Number of Distinct Observations			12
642									Number of Missing Observations			0
643					Minimum	11.4			Mean			82.33
644					Maximum	353			Median			43.9
645					SD	98.35			Std. Error of Mean			28.39
646					Coefficient of Variation	1.195			Skewness			2.157
647												
648						Normal GOF Test						
649					Shapiro Wilk Test Statistic	0.734			Shapiro Wilk GOF Test			
650					5% Shapiro Wilk Critical Value	0.859			Data Not Normal at 5% Significance Level			
651					Lilliefors Test Statistic	0.235			Lilliefors GOF Test			
652					5% Lilliefors Critical Value	0.243			Data appear Normal at 5% Significance Level			
653						Data appear Approximate Normal at 5% Significance Level						
654												
655						Assuming Normal Distribution						
656					95% Normal UCL				95% UCLs (Adjusted for Skewness)			
657					95% Student's-t UCL	133.3			95% Adjusted-CLT UCL (Chen-1995)			147.9
658									95% Modified-t UCL (Johnson-1978)			136.3
659												
660						Gamma GOF Test						
661					A-D Test Statistic	0.428			Anderson-Darling Gamma GOF Test			
662					5% A-D Critical Value	0.756			Detected data appear Gamma Distributed at 5% Significance Level			
663					K-S Test Statistic	0.176			Kolmogorov-Smirnov Gamma GOF Test			
664					5% K-S Critical Value	0.252			Detected data appear Gamma Distributed at 5% Significance Level			
665						Detected data appear Gamma Distributed at 5% Significance Level						
666												
667						Gamma Statistics						
668					k hat (MLE)	1.022			k star (bias corrected MLE)			0.822
669					Theta hat (MLE)	80.52			Theta star (bias corrected MLE)			100.1
670					nu hat (MLE)	24.54			nu star (bias corrected)			19.74
671					MLE Mean (bias corrected)	82.33			MLE Sd (bias corrected)			90.78
672									Approximate Chi Square Value (0.05)			10.66
673					Adjusted Level of Significance	0.029			Adjusted Chi Square Value			9.654
674												
675						Assuming Gamma Distribution						
676					95% Approximate Gamma UCL (use when n>=50))	152.5			95% Adjusted Gamma UCL (use when n<50)			168.3
677												
678						Lognormal GOF Test						
679					Shapiro Wilk Test Statistic	0.946			Shapiro Wilk Lognormal GOF Test			
680					5% Shapiro Wilk Critical Value	0.859			Data appear Lognormal at 5% Significance Level			
681					Lilliefors Test Statistic	0.141			Lilliefors Lognormal GOF Test			
682					5% Lilliefors Critical Value	0.243			Data appear Lognormal at 5% Significance Level			
683						Data appear Lognormal at 5% Significance Level						
684												
685						Lognormal Statistics						
686					Minimum of Logged Data	2.434			Mean of logged Data			3.848
687					Maximum of Logged Data	5.866			SD of logged Data			1.107
688												
689						Assuming Lognormal Distribution						

690				95% H-UCL	244.6			90% Chebyshev (MVUE) UCL		163.5	
691				95% Chebyshev (MVUE) UCL	201.2			97.5% Chebyshev (MVUE) UCL		253.4	
692				99% Chebyshev (MVUE) UCL	356						
693											
694				Nonparametric Distribution Free UCL Statistics							
695				Data appear to follow a Discernible Distribution at 5% Significance Level							
696											
697				Nonparametric Distribution Free UCLs							
698				95% CLT UCL	129			95% Jackknife UCL		133.3	
699				95% Standard Bootstrap UCL	125.6			95% Bootstrap-t UCL		177.2	
700				95% Hall's Bootstrap UCL	297.3			95% Percentile Bootstrap UCL		132.8	
701				95% BCA Bootstrap UCL	147.7						
702				90% Chebyshev(Mean, Sd) UCL	167.5			95% Chebyshev(Mean, Sd) UCL		206.1	
703				97.5% Chebyshev(Mean, Sd) UCL	259.6			99% Chebyshev(Mean, Sd) UCL		364.8	
704											
705				Suggested UCL to Use							
706				95% Student's-t UCL	133.3						
707											
708				When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test							
709				When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL							
710											
711				Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.							
712				Recommendations are based upon data size, data distribution, and skewness.							
713				These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).							
714				However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.							
715											
716											
717	Site 5 SUR										
718											
719				General Statistics							
720				Total Number of Observations	16			Number of Distinct Observations		16	
721								Number of Missing Observations		0	
722				Minimum	8.7			Mean		324	
723				Maximum	1050			Median		191	
724				SD	290.7			Std. Error of Mean		72.68	
725				Coefficient of Variation	0.897			Skewness		1.193	
726											
727				Normal GOF Test							
728				Shapiro Wilk Test Statistic	0.876			Shapiro Wilk GOF Test			
729				5% Shapiro Wilk Critical Value	0.887			Data Not Normal at 5% Significance Level			
730				Lilliefors Test Statistic	0.214			Lilliefors GOF Test			
731				5% Lilliefors Critical Value	0.213			Data Not Normal at 5% Significance Level			
732				Data Not Normal at 5% Significance Level							
733											
734				Assuming Normal Distribution							
735				95% Normal UCL				95% UCLs (Adjusted for Skewness)			
736				95% Student's-t UCL	451.4			95% Adjusted-CLT UCL (Chen-1995)		466.7	
737								95% Modified-t UCL (Johnson-1978)		455	
738											
739				Gamma GOF Test							
740				A-D Test Statistic	0.217			Anderson-Darling Gamma GOF Test			
741				5% A-D Critical Value	0.76			Detected data appear Gamma Distributed at 5% Significance Level			
742				K-S Test Statistic	0.118			Kolmogorov-Smirnov Gamma GOF Test			

743				5% K-S Critical Value	0.22	Detected data appear Gamma Distributed at 5% Significance Level					
744	Detected data appear Gamma Distributed at 5% Significance Level										
745											
746	Gamma Statistics										
747				k hat (MLE)	1.168	k star (bias corrected MLE)				0.991	
748				Theta hat (MLE)	277.3	Theta star (bias corrected MLE)				326.9	
749				nu hat (MLE)	37.39	nu star (bias corrected)				31.71	
750				MLE Mean (bias corrected)	324	MLE Sd (bias corrected)				325.5	
751						Approximate Chi Square Value (0.05)				19.84	
752				Adjusted Level of Significance	0.0335	Adjusted Chi Square Value				18.78	
753											
754	Assuming Gamma Distribution										
755			95% Approximate Gamma UCL (use when n>=50)		517.8	95% Adjusted Gamma UCL (use when n<50)				547.1	
756											
757	Lognormal GOF Test										
758				Shapiro Wilk Test Statistic	0.927	Shapiro Wilk Lognormal GOF Test					
759				5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level					
760				Lilliefors Test Statistic	0.127	Lilliefors Lognormal GOF Test					
761				5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level					
762	Data appear Lognormal at 5% Significance Level										
763											
764	Lognormal Statistics										
765				Minimum of Logged Data	2.163	Mean of logged Data				5.295	
766				Maximum of Logged Data	6.957	SD of logged Data				1.19	
767											
768	Assuming Lognormal Distribution										
769				95% H-UCL	1019	90% Chebyshev (MVUE) UCL				756.8	
770				95% Chebyshev (MVUE) UCL	928.4	97.5% Chebyshev (MVUE) UCL				1167	
771				99% Chebyshev (MVUE) UCL	1634						
772											
773	Nonparametric Distribution Free UCL Statistics										
774	Data appear to follow a Discernible Distribution at 5% Significance Level										
775											
776	Nonparametric Distribution Free UCLs										
777				95% CLT UCL	443.5	95% Jackknife UCL				451.4	
778				95% Standard Bootstrap UCL	442.4	95% Bootstrap-t UCL				493.8	
779				95% Hall's Bootstrap UCL	480.2	95% Percentile Bootstrap UCL				446.7	
780				95% BCA Bootstrap UCL	470						
781				90% Chebyshev(Mean, Sd) UCL	542	95% Chebyshev(Mean, Sd) UCL				640.8	
782				97.5% Chebyshev(Mean, Sd) UCL	777.9	99% Chebyshev(Mean, Sd) UCL				1047	
783											
784	Suggested UCL to Use										
785				95% Adjusted Gamma UCL	547.1						
786											
787	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.										
788	Recommendations are based upon data size, data distribution, and skewness.										
789	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).										
790	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.										
791											

(d) Except for the statistical methods identified in subsections (a)(1)(i) and (b)(1)(i) and (2)(i), a demonstration of attainment of one or a combination of remediation standards shall comply with the following:

(1) When statistical methods are to be used for demonstration of attainment of Statewide health or site-specific standards, the null hypotheses (Ho) shall be that the true site arithmetic average concentration is at or above the cleanup standard, and the alternative hypothesis (Ha) shall be that the true site arithmetic average concentration is below the cleanup standard. When statistical methods are to be used to determine that the background standard is exceeded, the null hypothesis (Ho) shall be that the background standard is achieved and the alternative hypothesis (Ha) shall be that the background standard is not achieved.

(2) A statistical method chosen shall comply with the following performance standards:

(i) The underlying assumptions of the statistical method shall be met, such as data distribution.

(ii) The statistical method shall be recommended for this use in Department-approved guidance or regulation and shall be generally recognized as appropriate for the particular remediation implemented at the site.

(iii) Compositing cannot be used with nonparametric methods or for volatile organic compounds.

(iv) For parametric methods, the censoring level for each nondetect shall be the assigned value randomly generated that is between zero and the limit related to the PQL.

(v) Tests shall account for seasonal and spatial variability as well as temporal correlation of data, unless otherwise approved by the Department.

(vi) Tests used to determine that the background standard is exceeded shall maintain adequate power to detect contamination in accordance with current EPA guidances, regulations or protocols.

(vii) For the limits relating to the PQLs, Statewide health and site-specific standards, the false-positive rate for a statistical test may not be greater than 0.20 for nonresidential and 0.05 for residential.

(viii) Statistical testing shall be done individually for each regulated substance present at the site.

(3) The following information shall be documented in a final report when a statistical method is applied:

(i) A description of the statistical method.

(ii) A clear statement of the applicable decision rule in the form of statistical hypotheses for each spatial unit and temporal boundary including the applicable statistical parameter of interest and the specific cleanup standard.

(iii) A description of the underlying assumptions of the method.

(iv) Documentation showing that the sample data set meets the underlying assumptions of the method and demonstrating that the method is appropriate to apply to the data.

(v) Specification of false positive rates and, in addition for the background standard, specification of false negative rates.

(vi) Documentation of input and output data for the statistical test, presented in tables or figures, or both, as appropriate.

(vii) An interpretation and conclusion of the statistical test.

(e) The references identified in subsection (b)(1)(ii) and (2)(ii) are as follows:

(1) EPA, Office of Policy, Planning and Evaluation, *Methods for Evaluating the Attainment of Cleanup Standards*, Volume 1: Soils and Solid Media, EPA 230/02-89-042, Washington, D. C. 1989.

(2) EPA, Office of Solid Waste Management Division, *Test Methods for Evaluating Solid Waste*, SW-846 Volume II: Field Methods, EPA, November 1985, Third Edition.

(3) EPA, Office of Solid Waste Management Division, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities*, Interim Final Guidance, EPA, Washington, D.C., April, 1989.

(4) EPA, Office of Solid Waste Management Division, *Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities*, Addendum to Interim Final Guidance, EPA, Washington, D.C., June, 1992.

(5) 40 CFR 264 and 265 (relating to standards for owners and operators of hazardous waste treatment, storage, and disposal facilities; and interim status standards for owners and operators of hazardous waste treatment, storage, and disposal facilities).

Authority

The provisions of this § 250.707 issued under sections 104(a) and 303(a) of the Land Recycling and Environmental Remediation Standards Act (35 P. S. §§ 6026.104(a) and 6026.303(a)).

Source

The provisions of this § 250.707 amended November 23, 2001, effective November 24, 2001, 31 Pa.B. 6395; amended January 7, 2011, effective January 8, 2011, 41 Pa.B. 230. Immediately preceding text appears at serial pages (285794) to (285801).

Cross References

This section cited in 25 Pa. Code § 250.702 (relating to attainment requirements); 25 Pa. Code § 250.703 (relating to general attainment requirements for soil); 25 Pa. Code § 250.703 (relating to general attainment requirements for soil); and 25 Pa. Code § 250.704 (relating to general attainment requirements for groundwater).

§ 250.708. Postremediation care attainment.

(a) After engineering controls are in place and the groundwater concentration levels have stabilized following any effects from the remediation, a statistical test shall be used to demonstrate that regulated substances in groundwater do not

RELATIVE POTENCY FACTORS FOR CARCINOGENIC POLYCYCLIC AROMATIC HYDROCARBONS

Discussion and Recommendations for Consideration by the Cleanup Standards Scientific Advisory Board

PAH Workgroup

June 2022

Introduction

During the meeting of the workgroup evaluating cleanup standards for polycyclic aromatic hydrocarbons ("PAHs") on October 7, 2021, the Pennsylvania Department of Environmental Protection ("PADEP") asked for justification for the use of Relative Potency Factors ("RPFs") to derive toxicity values for carcinogenic polycyclic aromatic hydrocarbons ("cPAHs") for use in calculating medium-specific concentrations ("MSCs") to implement the Statewide health standard ("SHS") under the Pennsylvania Land Recycling and Environmental Remediation Standards Act ("Act 2"). PADEP expressed concern with certain statements in guidance documents suggesting that the use of RPFs may be limited to cumulative risk assessments and may not be appropriate for the derivation of statewide cleanup standards for individual chemicals. To address this concern, the workgroup agreed that further research was needed regarding various guidance documents describing the derivation and use of RPFs.

Background

Development of the RPFs currently used by the United States Environmental Protection Agency ("EPA") for cPAH risk assessment is explained in an EPA guidance document from 1993.[1] In EPA's effort to develop drinking water criteria for PAHs, they developed weight-of-evidence judgements for seven PAHs ruled as "probable human carcinogens." EPA was able to calculate an IRIS oral cancer slope factor for benzo[a]pyrene ("BaP") but data were insufficient for the calculation of cancer slope factors for the other cPAHs. Previous quantitative risk assessments had assumed that all cPAHs are equipotent to BaP. However, available literature suggested that this was not the case, and risk assessment practices were being inconsistently applied. The need for a standard set of comparative risk estimates for assessment of cPAHs relative to the cancer potency of BaP was identified. Instead of potentially overestimating risk by applying the BaP cancer slope factor equally to these other seven PAH's, EPA determined RPFs to more accurately account for the toxicity of individual PAHs in mixtures.

The 1993 guidance document recommends the application of RPFs, using BaP as the index chemical, to assess the carcinogenic hazard from oral exposure to cPAHs. Additionally, the RPFs were developed as order of magnitude rankings of risks posed by cPAHs (i.e., factors of ten) because the quality of the available toxicological data did not support any greater precision. The guidance document does not discuss the use of RPFs in deriving chemical-specific cleanup standards or screening levels.

In 1994, the California Environmental Protection Agency ("CalEPA") expanded upon the EPA approach when it developed Potency Equivalency Factors ("PEFs") for use in evaluating PAH mixtures.[2] The approach CalEPA embraced in 1994 also uses BaP as the index chemical and includes PEFs for 22 cPAHs. The CalEPA approach also included the use of PEFs to address cPAH exposure via inhalation in addition to ingestion.

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[1] USEPA 1993. Provisional Guidance of Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons. EPA/600/R-93/089. Available at https://semspub.epa.gov/src/document/HQ/100000047

[2] CalEPA 1994. Benzo[a]pyrene as a Toxic Air Contaminant. Available at https://ww2.arb.ca.gov/sites/default/files/classic/toxics/id/summary/bap.pdf

The use of RPFs is further discussed in Section 4 of EPA's 2000 Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures.[3] The document acknowledges that the preferred approach for risk characterization of mixtures is a direct toxicological evaluation of the complete mixture, or toxicological evaluation of all of a mixture's individual component chemicals, but RPFs may be applied in the absence of such information when the component chemicals are expected to be toxicologically similar. The RPF approach is explained generally in Section 4.4 of the guidance document and the following example is given:

> *For example, if compound A is judged to be one-tenth as toxic as the index compound, i.e., it requires ten times the exposure to cause the same toxicity, then the RPF for compound A is 0.1.*

This is an example of applying an RPF in two directions: to the calculation of risk (one tenth as toxic) and to the calculation of exposures at a specified risk level (ten times the exposure to cause the same toxicity). The document describes three mixtures where EPA has employed the RPF approach with varying levels of certainty: dioxins, PCBs, and PAHs.

In 2001, EPA sponsored a two-day peer consultation workshop regarding approaches to PAH health assessment. As described in a report of the workshop,[4] the experts generally agreed that the RPF approach is not the preferred approach for health assessment of PAH mixtures but may be the only available approach in the absence of toxicological information on the mixture itself. Recommendations from the workshop included the following:

(1) EPA should convene a panel to re-evaluate the validity and usefulness of the RPF approach;

(2) the oral cancer slope factor of BaP should be updated, using the data from a recent chronic feeding study;

(3) EPA should develop an inhalation unit risk estimate for BaP;

(4) EPA should commission a new inhalation study, preferably with two species and two sexes per species, conducted by the National Toxicology Program;

(5) the validity of using BaP as the indicator compound should be re-evaluated;

(6) additional carcinogenic PAHs should be added to the current set of PAHs for which relative potency factors are derived (suggestions ranged from including all EPA "target" PAHs to adding only PAHs known to be potent and removing those known to be of low potency); and

(7) existing dermal carcinogenicity studies should be evaluated to obtain information on the absorption and distribution of PAHs and PAH-containing mixtures, and data on the systemic tumorigenicity of exposure via this route.

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[3] USEPA 2000. Supplementary Guidance for Conducting Health Risk Assessment of Chemical Mixtures. EPA/630/R-00/002. Available at https://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=4486

[4] USEPA 2001. Peer Consultation Workshop on Approaches to PAH Health Assessment. Available at https://ofmpub.epa.gov/eims/eimscomm.getfile?p_download_id=36313

The use of RPFs is further discussed in EPA's 2005 Guidelines for Carcinogen Risk Assessment[5] as a dose-response assessment tool for well-defined classes of chemicals that operate through a common mode of action for the same toxic endpoint. Other members of the class are tied to the index chemical by RPFs that are based on characteristics such as relative toxicological outcomes, relative metabolic rates, relative absorption rates, quantitative structure/activity relationships, or receptor binding characteristics. The document lists dioxin-like compounds and cPAHs as examples of where EPA has employed this approach.

Also in 2005, CalEPA completed a review of its 1994 PEF values. The approach used by CalEPA in 2005 continues to use BaP as the index chemical and includes PEFs for 25 cPAHs, for both oral and inhalation risks. With the exception of a slight reduction in the PEF for dibenz(a,h)anthracene, none of the previous PEFs were modified following this review.[6]

The 2005 CalEPA technical support document was updated in 2009, and Appendix B to the technical support document containing chemical-specific information was updated in 2011.[7] The derivation of PEFs for cPAHs is discussed in the BaP section of Appendix B. Actual cancer potencies (not relative to BaP) were specified for five individual cPAHs and derivatives. The previous PEFs for the remaining 20 cPAHs were not adjusted.

In 2010, EPA released a draft document titled *Development of a Relative Potency Factor (RPF) Approach for Polycyclic Aromatic Hydrocarbon (PAH) Mixtures*[8] and sought external peer review[9] as well as public comment. The document acknowledges that the preferred "whole mixture" approach to PAH risk assessment may not be practicable for several reasons: (1) there are very few toxicity data available for whole PAH mixtures, (2) chemical analysis of the composition of mixtures is limited, (3) PAH-containing mixtures tend to be very complex, and (4) the composition of these mixtures tends to vary across sources and the various environmental media in which they are encountered. The document explains that there are two key assumptions underpinning the RPF approach: (1) a similar toxicological action of PAH components in the mixture, and (2) the absence of interactions among PAH mixture components at low levels of exposure typically encountered in the environment. The document concluded that these assumptions are reasonable and supported by the experimental data for PAHs.

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[5] USEPA 2005. Guidelines for Carcinogen Risk Assessment. EPA/630/P-03/001F. Available at https://www.epa.gov/sites/default/files/2013-09/documents/cancer_guidelines_final_3-25-05.pdf

[6] CalEPA 2005. Air Toxics Hot Spots Program Risk Assessment Guidelines Part II: Technical Support Document for Describing Available Cancer Potency Factors. Available at https://oehha.ca.gov/air/crnr/adopted-air-toxics-hot-spots-program-risk-assessment-guidelines-part-ii-2005

[7] CalEPA 2009. Technical Support Document for Cancer Potency Factors. See also Appendix B. Available at https://oehha.ca.gov/media/downloads/crnr/tsdcancerpotency.pdf

[8] USEPA 2010. Development of a Relative Potency Factor (RPF) Approach for Polycyclic Aromatic Hydrocarbon (PAH) Mixtures (External Review Draft). Available at https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=494851&Lab=NCEA

[9] USEPA 2010. Draft Charge to External Reviewers. Available at https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=494850&Lab=NCEA

The bulk of the document is devoted to a review of available toxicological literature and the derivation of RPFs and the document represents a significant expansion and improvement upon the previous RPFs published by EPA in 1993. A comprehensive review of scientific literature dating from the 1950s through 2008 identified over 900 individual publications for a target list of 74 PAHs. More than 600 of these papers included cancer-related endpoint data on at least one PAH and BaP tested at the same time. RPFs from individual studies were calculated from over 300 data sets representing 51 individual PAHs, and adequate data were available for a weight of evidence evaluation of 35 compounds for inclusion in the RPF approach. Of these, final RPFs were derived for 27 PAHs, significantly increasing the number of PAHs that can be addressed through this approach.

Section 8 of the document discusses uncertainties inherent to the RPF approach, including extrapolation of cancer effects across exposure routes. Section 8.6 of the document finds that cross-route extrapolation is reasonable and supported by the toxicological data and recommends the use of these RPFs across all exposure routes, including both ingestion and inhalation.

The following table shows the RPFs and PEFs currently in use by EPA and CalEPA and the draft RPFs proposed by EPA in 2010 for the seven cPAHs listed in the tables included in 25 Pa. Code Chapter 250:

cPAH	EPA 1993	CalEPA 2011	EPA 2010 (draft)
Benzo[a]anthracene	0.1	0.1	0.2
Benzo[a]pyrene	1.0 (index)	1.0 (index)	1.0 (index)
Benzo[b]fluoranthene	0.1	0.1	0.8
Benzo[k]fluoranthene	0.01	0.1	0.03
Chrysene	0.001	0.01	0.1
Dibenz[a,h]anthracene	1.0		10
Indeno[1,2,3-c,d]pyrene	0.1	0.1	0.07

The 2010 draft document and the questions in the accompanying charge to peer reviewers were reviewed by EPA's Scientific Advisory Board ("SAB"), and the SAB's findings and recommendations are detailed in a 2011 report.[10] The SAB recognized the pragmatic need for the RPF approach, and based upon the currently available data, recommended that EPA continue to use the RPF approach for assessing cancer risk for PAH mixtures. The SAB found that the choice of BaP as the index chemical is well justified but urged EPA to quickly update the outdated BaP toxicity information in the Integrated Risk Information System ("IRIS") database.

The SAB agreed with EPA's application of the proposed RPFs across all routes of exposure. The SAB generally agreed with the RPFs derived by EPA with a few reservations. First, the SAB noted that the toxicological studies for certain PAHs (benzo[c]fluorene, dibenz[a,h]anthracene, and dibenzo[a,l]pyrene) resulted in highly divergent RPFs, and the use of the geometric mean may be more appropriate to calculate average RPFs for cPAHs with such outlier studies. Second, that SAB noted that the RPFs for certain PAHs (benzo[g,h,i]perylene, benzo[j]aceanthrylene, fluoranthene, and indeno[1,2,3-e]pyrene)

[10] USEPA 2011. SAB Review of EPA's "Development of a Relative Potency Factor (RPF) Approach for Polycyclic Aromatic Hydrocarbon (PAH) Mixtures (February 2010 Draft)". Available at http://yosemite.epa.gov/sab/sabproduct.nsf/36a1ca3f683ae57a85256ce9006a32d0/260CFBD4492CA1D785257798006E854B/$File/Draft+PAH+Mixtures+Report+09-08-10.pdf

were developed with data only from studies using non-physiological routes of exposure, and recommended against deriving RPFs for these compounds on the basis of such limited data.

EPA proceeded with updating the existing 1992 IRIS assessment for the indicator compound BaP, and the final toxicological review document was published to IRIS in January 2017.[11] The updated assessment was based on a comprehensive, systematic literature search through August 2016, and approximately 700 reference studies were included in the toxicological review. As stated in the document, both the oral slope factor and inhalation unit risk were derived with the intention that they will be paired with RPFs for the assessment of the carcinogenicity of PAH mixtures. A range of oral slope factors were considered and the highest (most conservative) value of 1 per mg/kg-day was selected for the IRIS value. Of the inhalation cancer studies, only a single study of lifetime exposure was located, and an inhalation unit risk of $6x10^{-4}$ per $\mu g/m^3$ from this study was selected as the IRIS value.

According to the April 2019 IRIS Program Outlook[12], during fiscal year 2018, EPA prioritized its IRIS assessments to meet the highest needs of EPA Programs and Regions and to bring greater focus to assessments actively under development. The 2010 draft assessment of PAH mixtures that was reviewed by the SAB was not identified as a priority for fiscal year 2019 and was suspended at that time. The program outlook says the draft assessment will remain available on the IRIS website and may be restarted as EPA priorities change.

In April 2022, the Agency for Toxic Substances and Disease Registry ("ATSDR") published its *Guidance for Calculating Benzo(a)pyrene Equivalents for Cancer Evaluations of Polycyclic Aromatic Hydrocarbons*[13]. The document is consistent with previous EPA and CalEPA guidance in that it recommends the use of PEFs for quantification of cPAH cancer risks relative to BaP. The ATSDR document recommends using the PEFs published by CalEPA in 2011 and the BaP slope factor developed by OEHHA over the RPFs developed by EPA and the current BaP slope factor published in the IRIS database.

We are therefore left with recent IRIS toxicity values for BaP that were intended to be paired with RPFs to assess the potency of other cPAHs. As the 2010 RPFs developed by EPA were never released from draft status, the choice of RPFs available to PADEP seems to be between the values derived by EPA in 1993 or CalEPA in 2011. The approach of using RPFs in lieu of chemical-specific risk factors was developed by EPA because sufficient toxicological data has not been developed to accurately quantify the cancer risk of individual cPAHs. Based on the scientific consensus that these cPAHs act similarly on the body, the use of RPFs is a pragmatic approach that allows accurate risk assessment over a wide range of possible PAH mixtures. It is the approach that EPA and other agencies have consistently found to be appropriate since 1993.

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[11] USEPA 2017. Toxicological Review of Benzo[a]pyrene. Available at https://cfpub.epa.gov/ncea/iris/iris_documents/documents/toxreviews/0136tr.pdf

[12] USEPA 2019. A Message from the IRIS Program – April 2019. Available at https://www.epa.gov/sites/default/files/2019-04/documents/iris_program_outlook_apr2019.pdf

[13] ATSDR 2022. Guidance for Calculating Benzo(a)pyrene Equivalents for Cancer Evaluations of Polycyclic Aromatic Hydrocarbons. Available at https://www.atsdr.cdc.gov/pha-guidance/resources/ATSDR-PAH-Guidance-508.pdf

Use of RPFs in Calculating Cleanup Standards and Screening Levels

None of the guidance documents discussed above describe procedures for calculating risk-based cleanup standards or screening levels from RPFs. These documents either provide guidance for conducting risk assessments or provide the scientific basis for the relative potency of cPAHs – as such, these documents would not be expected to provide instructions for the calculation of risk-based standards. Those instructions are found in the Act 2 regulations, and while PADEP has some regulatory discretion in selecting appropriate toxicity values for input into the calculation of MSCs, PADEP wishes to follow a prescribed hierarchy of sources for simplicity and transparency. Because there are several other regulatory agencies which are tasked with calculating risk-based standards for PAHs in environmental media, it is helpful to review how other agencies have handled this issue.

California Department of Toxic Substances Control

The California Department of Toxic Substances Control ("DTSC") publishes screening levels (the "DTSC-SLs") for preliminary evaluation of contaminated sites for human health risks. The DTSC-SLs are calculated at the $1x10^{-6}$ cancer risk level and a hazard quotient ("HQ") of 1. The use and derivation of the current DTSC-SLs is described in the June 2020 version of HERO HHRA Note 3.[14] As explained in the guidance document, calculation of the DTSC -SLs follows the same equations and methods as EPA's Regional Screening Levels ("RSLs") but using promulgated toxicity criteria required by California's 2018 Toxicity Criteria Rule and using California-specific exposure factors. If a DTSC-SL was not calculated for a particular chemical, the user is directed to use the corresponding EPA RSL instead.

The toxicity criteria used to derive the DTSC-SLs are set forth in Table 1 of HERO HHRA Note 10,[15] last updated in February 2019. For BaP, DTSC is using the 2017 IRIS oral slope factor but is using an inhalation unit risk developed by CalEPA's Office of Environmental Health Hazard Assessment ("OEHHA") for use in a public health goal for drinking water. With the exception of dibenz[a,h]anthracene, for which OEHHA has developed specific toxicity values, the toxicities of the other five cPAHs listed in Chapter 250 are assessed relative to BaP. The RPFs published by EPA in 1993 and currently used to calculate the EPA RSLs were used to calculate the DTSC-SLs based on oral slope factors. The PEFs most recently published by CalEPA in 2011 were used to calculate the DTSC-SLs based on inhalation unit risks. It should be noted that the 1993 RPFs and 2011 PEFs for individual cPAHs are the same values with the exception of benzo[k]fluoranthene and chrysene, where the 2011 PEFs are more potent by a factor of 10.

In summary, DTSC has calculated screening levels for cPAHs in various environmental media by relating their toxicities to BaP through a combination of the 1993 EPA RPFs and the 2011 CalEPA PEFs. The RPFs are used to calculate screening levels based on oral slope factors and the PEFs are used to calculate screening levels based on inhalation unit risks. The use of PEFs in this application appears to be a statutory requirement of California's 2018 Toxicity Criteria Rule. As described above, with the exception

[14] DTSC 2020. HHRA Note 3, DTSC-modified Screening Levels. Available at https://dtsc.ca.gov/wp-content/uploads/sites/31/2019/04/HHRA-Note-3-June-2020-A.pdf

[15] DTSC 2019. HHRA Note 10, Toxicity Criteria. Available at https://dtsc.ca.gov/wp-content/uploads/sites/31/2019/02/HHRA-Note-10-2019-02-25.pdf

of the inhalation unit risk for BaP and the oral slope factor and inhalation unit risk for dibenz[a,h]anthracene, the toxicity values used to calculate the DTSC-SLs do not match those listed in the OEHHA database and currently listed in Table 5a.

New York State Department of Environmental Conservation

The New York State Department of Environmental Conservation ("NYSDEC"), in conjunction with the New York State Department of Health, calculated Soil Cleanup Objectives ("SCOs") for use in its Brownfield Cleanup Program. The development of the SCOs is described in a 2006 technical support document.[16] SCOs that are risk-based are calculated using the $1x10^{-6}$ cancer risk and HQ=1 hazard levels. The assessment of mixtures of PAHs is discussed in Section 5.1.5.1 of the document.
For the cPAHs, BaP is again used as the indicator chemical and the toxicities of the other six cPAHs listed in Chapter 250 are assessed relative to BaP using RPFs. RPFs are then used to convert the SCO for BaP into an SCO for each cPAH. In determining the appropriate RPF to use for each cPAH, NYSDEC performed a limited review of toxicological literature, including the EPA 1993 RPFs and the CalEPA 2011 PEFs among other sources. As shown in Table 5.1.5-2 of the document, NYSDEC selected the EPA 1993 RPF for all cPAHs except chrysene, for which it selected the CalEPA 2011 PEF which is more potent by a factor of 10.

New Jersey Department of Environmental Protection

The New Jersey Department of Environmental Protection ("NJDEP") recently updated its Soil Remediation Standards ("SRS") in a May 2021 rulemaking. As set forth in the rule adoption document,[17] and as required by statute, the SRS are calculated based on a cancer risk of $1x10^{-6}$ and an HQ of 1. Toxicity factors used in the development of the SRS are presented in Appendix 11 of the document. NJDEP is using the 2017 IRIS values for BaP and assessing the toxicity of the other six cPAHs relative to BaP. NJDEP is using the EPA 1993 RPFs to calculate remediation standards in various environmental media and exposure routes for the six cPAHs relative to the potency of BaP, consistent with the approach taken by EPA in calculating the RSLs.

US Environmental Protection Agency

EPA provides RSLs and a calculator to assist in screening-level decisions at CERCLA hazardous waste sites. Unlike the values published by NYSDEC and NJDEP, these are not regulatory cleanup standards, but like the DTSC-SLs, they are used in preliminary evaluations of contaminated sites. The RSLs are also used as the first step in a human health risk assessment under the Act 2 Site-Specific Standard. RSLs are calculated for a range of risk targets and hazard quotients, and across a variety of land use and exposure assumptions. The tables comprising the RSLs are updated semiannually by the RSL Workgroup as new toxicity values become available.

[16] NYSDEC and NYDOH 2006. Development of Soil Cleanup Objectives – Technical Support Document. Available at https://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf
[17] NJDEP 2021. Courtesy copy of rule adoption. Available at https://www.nj.gov/dep/rules/adoptions/adopt_20210517a.pdf

The derivation of the RSLs is explained in a User's Guide,[18] with Section 2.3.6 describing the use of RPFs in assessing the potency of cPAHs. The guide cites the EPA 1993 guidance document as the source of RPFs used to calculate toxicity values and screening levels for cPAHs relative to BaP. The guide acknowledges that this application is not in complete agreement with the direction of the EPA 1993 guidance document, but the approach was used as a means to calculate toxicity values for each cPAH. The guide also notes that computationally it makes little difference whether the RPFs are applied to the concentrations of cPAHs found in environmental samples or to the toxicity values as long as the RPFs are not applied to both, and that if the adjusted toxicity values are used in a risk assessment, the user will need to sum the risks from all cPAHs to derive a total risk. This summation of risks from multiple chemicals and exposures is standard practice in any site-specific risk assessment and is required by the Act 2 regulations.

Discussion of Cumulative Risk under the Statewide Health Standard

Section 303 of Act 2 describes the procedures for establishing the MSCs implementing the Statewide health standard, and states that "for a regulated substance which is a carcinogen, the medium-specific concentration is the concentration which represents an excess upper bound lifetime cancer target risk of between 1 in 10,000 and 1 in 1,000,000." The regulations implementing Act 2 at 25 Pa Code Chapter 250 show that the MSCs are calculated based on a 1 in 100,000 excess cancer risk level. As has been discussed by members of the Cleanup Standards Scientific Advisory Board ("CSSAB"), the ten-fold reduction in allowable carcinogenic risk from 1 in 10,000 ($1x10^{-4}$) to 1 in 100,000 ($1x10^{-5}$) is an acknowledgement that multiple regulated substances may be detected at a site at concentrations at or near their MSCs (assuming those MSCs are based on direct contact numeric values rather than soil-to-groundwater numeric values), which could result in unacceptable cumulative cancer risks if the MSCs were calculated based on a $1x10^{-4}$ target risk. The MSCs are derived at a target cancer risk level that is ten times more conservative to safeguard against this possibility of adverse cumulative risk. By setting the MSCs at a risk level lower than the acceptable level, the Statewide health standard employs cumulative risk concepts, using default exposure factors and assumptions that can be safely applied across the state, including an inherent assumption that no more than ten carcinogens will be detected at a site at their maximum allowed direct contact concentration. This is currently the case with all carcinogens with MSCs listed in Chapter 250 and there is nothing about the application of RPFs to derive toxicity values and calculate MSCs that would necessitate a different approach for cPAHs.

The guidance documents described above suggest that RPFs should be used in a cumulative risk assessment of cPAH exposures, and the derivation of MSCs is consistent with that guidance. The regulatory procedures for calculating the MSCs do not discriminate between carcinogens – the maximum allowable risk from each carcinogen under the statewide health standard is established at the $1x10^{-5}$ level with the assumption that the cumulative risk at a site is unlikely to ever exceed a cumulative cancer risk of $1x10^{-4}$. Note also that additional conservatism is provided by the fact that the most sensitive oral slope factor was selected from a range of values in the IRIS assessment of BaP, which serves as the index chemical for the other cPAHs.

[18] USEPA 2021. Regional Screening Levels (RSLs) – User's Guide. Available at https://www.epa.gov/risk/regional-screening-levels-rsls-users-guide

Some of the toxicity values currently used by PADEP to calculate MSCs for cPAHs are sourced from CalEPA and were derived through the application of PEFs relative to BaP, as discussed previously. Therefore, the concept of RPFs is used in calculating the MSCs. Moreover, in the absence of specific toxicity values for certain non-carcinogenic PAHs, PADEP has defaulted to using surrogate toxicity values to calculate MSCs. The approach of using RPFs appears to be more thoroughly studied and vetted when compared to the uncertainty involved in selecting appropriate surrogates to use.

Recommendations for Implementation

The application of RPFs to derive relative toxicity values and cleanup standards is consistent with the supporting guidance documents given the assumption of cumulative excess risk inherent in the MSC calculations, as well as the precedence established by various regulatory agencies including EPA and CalEPA, the two agencies that have derived RPFs from the toxicological literature. Understanding that the 2017 IRIS toxicity values for BaP are of the highest available quality, PADEP is now faced with the choice of which RPFs to use and how to present them in a transparent way. The most recent and comprehensive development of RPFs appears to be the 2010 draft assessment developed by EPA. However, this document was never finalized and PADEP may not be able to use it as a reference. Therefore, the choice seems to be between the EPA 1993 RPFs and the CalEPA 2011 PEFs, or some combination of the two. If PADEP wishes to cite to a single guidance document as the basis for all RPFs, or does not wish to review the intricacies of the toxicological studies and apply its judgement in selecting individual RPFs for each cPAH, it may be preferable to pick one of these sets. Of these, selection of the 1993 RPFs developed by EPA would seem to be more consistent with the established hierarchy of sources and would be entirely consistent with the EPA RSLs used under the site-specific standard.

Application of the EPA 1993 RPFs will result in changes to some of the cPAH toxicity values currently listed in Table 5a and will result in increases to the corresponding MSCs. However, this is a direct result of the fact that the cancer potency of these chemicals has only ever been assessed relative to that of BaP, which itself was recently determined to be less potent though the 2017 IRIS assessment. Toxicity values sourced from IRIS are understood to be the highest available quality, and the IRIS values for BaP were developed with the intention that they would be paired with RPFs to allow carcinogenic risk assessment for the other cPAHs. While EPA has done some work to update and expand the available RPFs, that work has not been finalized and remains in draft status. Therefore, application of the existing 1993 EPA RPFs to derive toxicity values and calculate MSCs for the other cPAHs does represent the best available state of the science and is consistent with PADEP's established hierarchy of sources. A table is provided as an attachment to this document that compares the proposed toxicity values to the values currently listed in Table 5a, as well as the toxicity values and RPFs currently in use by the agencies described above. Applications of the proposed toxicity values will result in corresponding changes to the MSCs for the six cPAHs other than BaP. Those changes are shown in a separate table attached to end of this document.

Recommendations for Transparency

The CSSAB PAH Workgroup agrees that the use of RPFs to derive toxicity values needs to be clearly explained to the public and to users of the MSC tables. This can be accomplished using a footnote in Table 5a, in the appropriate section of the Chapter 250 regulations implementing Act 2, in the appropriate section of the Act 2 Technical Guidance Manual, or some combination of the three.

Footnote in Table 5a

Table 5a contains a series of footnotes explaining the source of the toxicity values listed. For the cancer slope factors and inhalation unit risks that are derived relative to those of BaP, it seems appropriate to add an additional footnote explaining the source of the RPFs used. A suggested footnote is as follows:

> *R = EPA 1993 Relative Potency Factors (relative to benzo[a]pyrene) per 250.605(a)(1)(i)*

Regulatory Language

25 Pa. Code 250.605 explains the hierarchy of sources of toxicity information that may be used in deriving site-specific standards, and PADEP wishes to follow this hierarchy in developing the Statewide Health Standards for purposes of consistency and transparency. The CSSAB PAH workgroup agreed that the use of RPFs should therefore be described in the section of the regulations. Because the 1993 RPFs were developed by EPA and are currently used by EPA and other agencies in conjunction with the IRIS values for BaP, the CSSAB PAH workgroup agreed that the derived toxicity values would be of higher quality and certainty than the sources listed in the hierarchy, with the exception of IRIS values developed specifically for the cPAHs (which do not currently exist). The following suggested language could be inserted under 250.605(a)(1):

> *250.605(a)(1)(i): Cancer slope factors and inhalation unit risk factors for carcinogenic PAHs are derived using Relative Potency Factors contained in United States Environmental Protection Agency July 1993 Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (EPA/600/R-93/089).*

Technical Guidance Manual

Similarly, Section III.H.3.c of the Act 2 Technical Guidance Manual presents the same hierarchy of sources of toxicity information that may be used in deriving site-specific standards, and the CSSAB PAH workgroup agreed that the use of RPFs should be explained here as well. For transparency and consistency with the regulatory language proposed above, the same suggested language could be inserted under III.H.3.c.i:

> *Section III.H.3.c.i.a: Cancer slope factors and inhalation unit risk factors for carcinogenic PAHs are derived using Relative Potency Factors contained in United States Environmental Protection Agency July 1993 Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (EPA/600/R-93/089).*

Attachment 1 – Comparison of PAH Workgroup-Proposed Toxicity Values to those Currently Used by PADEP and Other Agencies

		Benzo[a]pyrene	Benzo[a]anthracene	Benzo[b]fluoranthene	Benzo[k]fluoranthene	Chrysene	Dibenz[a,h]anthracene	Indeno[1,2,3-c,d]pyrene
PADEP Table 5a (current)	**CSF_o $(mg/kg\text{-}d)^{-1}$**	1 I	0.7 X	1.2 C	1.2 C	0.12 C	4.1 C	1.2 C
	IUR $(\mu g/m^3)^{-1}$	0.0006 I	0.00011 C	0.00011 C	0.00011 C	0.000011 C	0.0012 C	0.00011 C
PADEP Table 5a (proposed by PAH Workgroup)	**CSF_o $(mg/kg\text{-}d)^{-1}$**	1 I	0.1 R*	0.1 R*	0.01 R*	0.001 R*	1 R*	0.1 R*
	IUR $(\mu g/m^3)^{-1}$	0.0006 I	0.00006 R*	0.00006 R*	0.000006 R*	0.0000006 R*	0.0006 R*	0.00006 R*
	RPF used	none (index)	0.1	0.1	0.01	0.001	1.0	0.1
CA DTSC-SLs	**CSF_o $(mg/kg\text{-}d)^{-1}$**	1	0.1	0.1	0.01	0.001	4.1	0.1
	IUR $(\mu g/m^3)^{-1}$	0.0011	0.00011	0.00011	0.00011	0.000011	0.0012	0.00011
	RPF used	none (index)	0.1	0.1	varies by route	varies by route	none (CA-developed)	0.1
NYSDEC SCOs	**CSF_o $(mg/kg\text{-}d)^{-1}$**	9.03	0.903	0.903	0.0903	0.0903	9.03	0.903
	IUR $(\mu g/m^3)^{-1}$	0.0011	0.00011	0.00011	0.000011	0.000011	0.0011	0.00011
	RPF used	none (index)	0.1	0.1	0.01	0.01	1	0.1
NJDEP SRS	**CSF_o $(mg/kg\text{-}d)^{-1}$**	1	0.1	0.1	0.01	0.001	1	0.1
	IUR $(\mu g/m^3)^{-1}$	0.0006	0.00006	0.00006	0.000006	0.0000006	0.0006	0.00006
	RPF used	none (index)	0.1	0.1	0.01	0.001	1.0	0.1
USEPA RSLs	**CSF_o $(mg/kg\text{-}d)^{-1}$**	1	0.1	0.1	0.01	0.001	1	0.1
	IUR $(\mu g/m^3)^{-1}$	0.0006	0.00006	0.00006	0.000006	0.0000006	0.0006	0.00006
	RPF used	none (index)	0.1	0.1	0.01	0.001	1	0.1

*Although the toxicity values proposed for Table 5a are sourced from IRIS, the existing IRIS footnote in Table 5a does not describe the application of RPFs to the IRIS values for BaP. PADEP and CSSAB have discussed the need to add an additional footnote to Table 5a that explains this step in more detail for the six cPAHs other than BaP.

Attachment 2 – PAH Workgroup-Proposed MSCs Calculated Using Toxicity Values Derived Using EPA 1993 RPFs

		Table 1 - Groundwater						Table 3a - Soil Direct Contact			Table 3b - Soil to Groundwater												
		Used Aquifers				Nonuse Aquifers		Surface Soil		Subsurface Soil	Used Aquifers								Nonuse Aquifers				
		TDS ≤ 2500		TDS > 2500							TDS ≤ 2500				TDS > 2500								
		R	NR	R	NR	R	NR	R	NR	NR	R		NR		R		NR		R		NR		
											100xGW MSC	Generic Value	100xGW MSC	Generic Value	100xGW MSC	Generic Value	100xGW MSC	Generic Value	100xGW MSC	Generic Value	100xGW MSC	Generic Value	
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	
Benzo[a]pyrene	**current**	0.2 M	0.2 M	3.8 S	3.8 S	3.8 S	3.8 S	4.2 G	91 G	190000 C	0.02	46 E	0.02	46 E	0.38	860 E	0.38	860 E	0.38	860 E	0.38	860 E	
	proposed*	0.2 M	0.2 M	3.8 S	3.8 S	3.8 S	3.8 S	4.2 G	91 G	190000 C	0.02	46 E	0.02	46 E	0.38	860 E	0.38	860 E	0.38	860 E	0.38	860 E	
Benzo[a]anthracene	**current**	0.3 G	3.9 G	11 S	11 S	11 S	11 S	6.1	130	190000 C	0.03	26 E	0.39	340 E	1.1	960 E	1.1	960 E	1.1	960 E	1.1	960 E	
	proposed*	2.1 G	11 S	11 S	11 S	11 S	11 S	42 G	910 G	190000 C	0.21	180 E	1.1	960 E	1.1	960 E	1.1	960 E	1.1	960 E	1.1	960 E	
Benzo[b]fluoranthene	**current**	0.18 G	1.2 S	1.2 S	1.2 S	1.2 S	1.2 S	3.5	76	190000 C	0.018	25 E	0.12	170 E	0.12	170 E	0.12	170 E	0.12	170 E	0.12	170 E	
	proposed*	1.2 S	1.2 S	1.2 S	1.2 S	1.2 S	1.2 S	42 G	910 G	190000 C	0.12	170 E	0.12	170 E	0.12	170 E	0.12	170 E	0.12	170 E	0.12	170 E	
Benzo[k]fluoranthene	**current**	0.18 G	0.55 S	0.55 S	0.55 S	0.55 S	0.55 S	3.5	76	190000 C	0.018	200 E	0.055	610 E	0.055	610 E	0.055	610 E	0.055	610 E	0.055	610 E	
	proposed*	0.55 S	0.55 S	0.55 S	0.55 S	0.55 S	0.55 S	420 G	9100 G	190000 C	0.055	610 E	0.055	610 E	0.055	610 E	0.055	610 E	0.055	610 E	0.055	610 E	
Chrysene	**current**	1.8 G	1.9 S	1.9 S	1.9 S	1.9 S	1.9 S	35	760	190000 C	0.18	220 E	0.19	230 E	0.19	230 E	0.19	230 E	0.19	230 E	0.19	230 E	
	proposed*	1.9 S	1.9 S	1.9 S	1.9 S	1.9 S	1.9 S	4200 G	91000 G	190000 C	0.19	230 E	0.19	230 E	0.19	230 E	0.19	230 E	0.19	230 E	0.19	230 E	
Dibenz[a,h]anthracene	**current**	0.052 G	0.6 S	0.6 S	0.6 S	0.6 S	0.6 S	1	22	190000 C	0.0052	23 E	0.06	270 E	0.06	270 E	0.06	270 E	0.06	270 E	0.06	270 E	
	proposed*	0.21 G	0.6 S	0.6 S	0.6 S	0.6 S	0.6 S	4.2 G	91 G	190000 C	0.021	95 E	0.06	270 E	0.06	270 E	0.06	270 E	0.06	270 E	0.06	270 E	
Indeno[1,2,3-c,d]pyrene	**current**	0.18 G	2.3 G	18 G	62 S	62 S	62 S	3.5	76	190000 C	0.018	1400 E	0.23	18000 E	1.8	140000 E	6.2	190000 C	6.2	190000 C	6.2	190000 C	
	proposed*	2.1 G	27 G	62 S	62 S	62 S	62 S	42 G	910 G	190000 C	0.21	16000 E	2.7	190000 C	6.2	190000 C	6.2	190000 C	6.2	190000 C	6.2	190000 C	

*Numeric values proposed by the PAH Workgroup

CDL-1

FACE SHEET FOR FILING DOCUMENTS WITH THE LEGISLATIVE REFERENCE BUREAU

(Pursuant to Commonwealth Documents Law)

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Independent Regulatory Review Commission

July 2, 2024

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Copy below is hereby approved as to form and legality. Attorney General

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5/6/2024

DATE OF APPROVAL

☐ Check if applicable
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Copy below is hereby certified to be true and correct copy of a document issued, prescribed or promulgated by:

DEPARTMENT OF ENVIRONMENTAL PROTECTION
ENVIRONMENTAL QUALITY BOARD

(AGENCY)

DOCUMENT/FISCAL NOTE NO. 7-575

DATE OF ADOPTION March 12, 2024

BY Jessica L Shirley

TITLE JESSICA SHIRLEY
ACTING CHAIRPERSON

EXECUTIVE OFFICER CHAIRPERSON OR SECRETARY

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BY

April 9, 2024

DATE OF APPROVAL

(Deputy General Counsel)
~~(Chief Counsel - Independent Agency)~~
(Strike inapplicable title)

☐ Check if applicable. No Attorney General Approval or objection within 30 days after submission.

NOTICE OF PROPOSED RULEMAKING

DEPARTMENT OF ENVIRONMENTAL PROTECTION
ENVIRONMENTAL QUALITY BOARD

Administration of the Land Recycling Program

25 Pa. Code Chapter 250

PROPOSED RULEMAKING
ENVIRONMENTAL QUALITY BOARD
[25 PA. CODE CH. 250]
Administration of the Land Recycling Program

The Environmental Quality Board (Board) proposes to amend Chapter 250 (relating to administration of the land recycling program). This rulemaking is proposed under § 250.11 (relating to periodic review of MSCs), which requires that the Department of Environmental Protection (Department) review new scientific information that relates to the basis of the statewide health standard medium-specific concentrations (MSC) at least 36 months after the effective date of the most recently promulgated MSCs and propose to the Board any changes to the MSCs as necessary. In addition to updating the existing MSCs, this proposed rulemaking would update the models used to calculate the soil lead MSCs and update the Department's process for calculating MSCs for carcinogenic polycyclic aromatic hydrocarbons (PAH). This proposed rulemaking would also clarify several other regulatory requirements.

This proposed rulemaking was adopted by the Board at its meeting of March 12, 2024.

A. *Effective Date*

This proposed rulemaking will be effective upon final-form publication in the *Pennsylvania Bulletin*.

B. *Contact Persons*

For further information contact Michael Maddigan, Program Manager, Land Recycling Program, P.O. Box 8471, Rachel Carson State Office Building, Harrisburg, PA 17105-8471, (717) 772-3609, or Nicholas Pistory, Assistant Counsel, Bureau of Regulatory Counsel, P.O. Box 8464, Rachel Carson State Office Building, Harrisburg, PA 17105-8464, (717) 783-9372. Information regarding submitting comments on this proposal appears in Section J of this preamble. Persons with a disability may use the Pennsylvania Hamilton Relay Service by calling 1-800-654-5984 (TDD users) or 1-800-654-5988 (voice users). This proposed rulemaking is available on the Department of Environmental Protection's (Department) web site at www.dep.pa.gov (select "Public Participation," then "Environmental Quality Board" then navigate to the Board meeting of March 12, 2024).

C. *Statutory Authority*

This proposed rulemaking is authorized under sections 104(a) and 303(a) of the Land Recycling and Environmental Remediation Standards Act (Act 2) (35 P.S. §§ 6026.104(a) and 6026.303(a)), and section 1920-A of The Administrative Code of 1929 (71 P.S. § 510-20). Section 104(a) of Act 2 authorizes the Board to adopt statewide health standards as well as appropriate mathematically valid statistical tests to define compliance with Act 2 and other regulations that may be needed to implement the provisions of Act 2. Section 303(a) of Act 2 authorizes the Board to promulgate statewide health standards for regulated substances for each environmental medium and methods used to calculate the standards. Section 1920-A authorizes the Board to formulate, adopt and promulgate rules and regulations that are necessary for the proper work of the Department.

D. *Background and Purpose*

Section 250.11 of the land recycling program's regulations requires that the Department review new scientific information that is used to calculate MSCs under the statewide health standard and propose appropriate changes at least every 36 months following the effective date of the most recently promulgated MSCs. The Board's most recently promulgated MSCs became effective upon publication in the *Pennsylvania Bulletin* at 51 Pa.B. 7173 (November 20, 2021). These proposed changes, based on new information, protect public health and the environment and provide the regulated community with clear information regarding the requirements of Act 2 and Chapter 250 related to the remediation of contaminated sites.

The proposed amendments include changes to soil numeric values for 46 regulated substances; 45% of these changes lower the current values and the other 55% increase those values. Changes to groundwater numeric values are proposed for 34 regulated substances; half of these changes lower the current values and the other half increase those values. In addition to updating the Chapter 250 MSCs, this proposed rulemaking includes changes that would add groundwater and soil MSCs for five compounds in the per- and polyfluoroalkyl substances (PFAS) family: hexafluoropropylene oxide (HFPO) dimer acid, HFPO dimer acid ammonium salt (Gen-X), perfluorobutanoic acid (PFBA), perfluorohexanoic acid (PFHxA), and perfluorobutane sulfonate (PFBS) potassium salt) and update the values for three others (PFBS), perfluorooctane sulfonate (PFOS), and perfluorooctanoic acid (PFOA). The proposed standards for these PFAS are based on data in toxicological studies published by the Department's Bureau of Safe Drinking Water or the United States Environmental Protection Agency (EPA). Under section 303(a) of Act 2, the Department has directly incorporated the EPA's Health Advisory Levels (HAL) regarding PFBS and HFPO dimer acid and their salts as groundwater MSCs and has used the data developed by the EPA for those HALs to calculate soil MSCs for both compounds. The Department has also directly incorporated the Bureau of Safe Drinking Water's published Maximum Contaminant Level (MCL) values regarding PFOA and PFOS as groundwater MSCs, and has used the toxicological data developed by Bureau of Safe Drinking Water for those MCLs to calculate soil MSCs for both compounds. With respect to PFHxA and PFBA, the Department is proposing soil and groundwater standards based on 2023 EPA Integrated Risk Information System (IRIS) evaluations.

This proposed rulemaking includes changes to the methods for calculating the direct contact soil standards for lead. The previous rulemaking finalized in 2021 that updated the MSCs also had proposed changes to the direct contact numeric values. The Board received many comments on the lead standards during that public comment period. Most of the commentators expressed concern with the proposed increase in the non-residential direct contact numeric value for lead in surface soil in Table 4A (relating to medium-specific concentrations (MSCs) for inorganic regulated substances in soil – direct contact numeric values). The main concern expressed by the public comments was the proposed use of 10 micrograms per deciliter (µg/dL) as the target blood lead level (TBLL).

The number and nature of the public comments received on this issue prompted the Department to publish an Advance Notice of Proposed Rulemaking (ANPR) in the *Pennsylvania Bulletin* at 51 Pa.B. 6776 (October 30, 2021) to solicit information necessary to prepare this proposed rulemaking. Specifically, the Department requested information which could be used to evaluate

(1) the proposed updates to the lead models used to calculate the soil lead MSCs, (2) the potential changes to model input parameters, and (3) the potential changes to the statistical tests used to demonstrate attainment of the Statewide health standard for lead in soil at Act 2 remediation sites. During the submission period for the ANPR, the Department received comments from two individuals and one organization that were considered during the development of this proposed rulemaking.

This proposed rulemaking includes the updated models published by the EPA, which are the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Children that will be used to calculate the residential values and the Adult Lead Model (ALM) that will be used to calculate the non-residential values. In addition to updating the models, the TBLL is proposed to be reduced from the current values of 10 µg/dL for residential calculations and 20 µg/dL for non-residential calculations to 5 µg/dL for both residential and non-residential calculations, which is the default value used in the EPA models.

Additionally, this proposed rulemaking includes a change in the method of determining the toxicity values for six carcinogenic polycyclic aromatic hydrocarbon (PAH) compounds (Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, and Indeno[1,2,3-c,d]pyrene). The EPA's guidance recommends the application of relative potency factors (RPF) to assess the carcinogenic hazard from oral exposure to carcinogenic PAHs. RPFs are comparative risk estimates of the relative potency of each carcinogenic PAH as compared to benzo(a)pyrene (BaP). BaP is a commonly found PAH that has a significantly higher number of documented toxicity studies than the other six PAHs. When the EPA updated the toxicity value for BaP in IRIS in January 2017, the supporting documents specifically referred to the EPA's 1993 guidance document on the use of relative potency factors for determining the toxicity of six other PAH compounds. The Board proposes to use the EPA's RPFs as toxicity values to more accurately calculate MSCs for these six carcinogenic PAHs.

Furthermore, this proposed rulemaking will update the method for determining MSCs for 19 compounds by choosing subchronic (short term exposure) toxicity values over chronic (long term exposure) toxicity values. The EPA's Office of Land and Emergency Management (OLEM) issued a memo in May of 2021 (EPA's Recommendations on the Use of Chronic or Subchronic Noncancer Values for Superfund Human Health Risk Assessments, https://semspub.epa.gov/src/document/HQ/100002839) regarding the use of certain toxicity values based on recommendations from OLEM's Human Health Regional Risk Assessment Forum's Toxicity Workgroup. The OLEM's memo recommends using subchronic toxicity values in place of chronic toxicity values to more accurately represent the risk of exposure to certain compounds. The Department typically selects chronic toxicity values for calculating numeric values used to determine the MSCs so using the process recommended in the OLEM's memo changes the Department's toxicity value selection procedure for 19 compounds.

The EPA also provided guidance to the Department regarding the use of certain values from the EPA's Health Effect Assessment Summary Tables (HEAST) database. The HEAST database has not been updated since 1997 and as IRIS and PPRTV published values, any HEAST values for those same compounds were rescinded by the EPA. It has been clarified through direct communication with the EPA that any compounds evaluated within IRIS and PPRTV that

specifically state that a value could not be calculated are also considered to be rescinded. Therefore, several HEAST toxicity values are proposed to be removed from Tables 5A and 5B (relating to physical and toxicological properties – organic regulated substances; physical and toxicological properties – inorganic regulated substances) in this proposed rulemaking.

Finally, this proposed rulemaking would clarify a procedural issue related to the administrative requirements of Act 2 by specifying that MCLs and HALs become effective as MSCs upon publication of the final MCL or HAL by the EPA or the Department.

This proposed rulemaking impacts any person addressing a release of a regulated substance at a property, whether voluntarily or as a result of an order by the Department. This proposed rulemaking would not impact any particular category of person with additional or new regulatory obligations. Under Act 2, a remediator may select the standard to which to remediate. To complete a remediation, the remediator must then comply with all relevant remediation and administrative standards.

As noted previously, this proposed rulemaking will not singularly affect one specific industry or person. This proposed rulemaking will impact the owners and operators of storage tank facilities that have had a release of a petroleum or hazardous substance. There are approximately 12,000 storage facilities in this Commonwealth. Some of these facilities are owned or operated by small businesses. Because of the broad potential reach of this proposed rulemaking, it is not possible to identify specific types and numbers of small businesses that could potentially be affected by property contamination. In addition, Act 2 and Chapter 250 are unique from other statutes and regulations because they do not create permitting or corrective action obligations. Instead, Act 2 and Chapter 250 provide remediators with options to address contamination and any associated liability that arises under other statutes. For example, adding PFBA to Chapter 250 does not create any liability or obligation related to PFBA. Instead, a person's liability arises under the Clean Streams Law, while Act 2 and Chapter 250 provide that person the means to resolve their Clean Streams Law liability and address the contamination. In this way, Act 2 and Chapter 250 do not create new obligations that will impact a particular category of person like a new permitting obligation or corrective action regulation would.

This rulemaking proposes to adjust the cleanup thresholds for demonstration of the Statewide health standard. Lowering the values may indicate a more stringent cleanup is required at a site and increasing the values may indicate a less stringent cleanup is required at a site. The soil numeric values represent a proposed decrease for approximately 45% of the values and an increase for 55% of the values. For groundwater, the proposed changes reflect a decrease for approximately 50% of the values and an increase in approximately 50% of the values. These proposed changes reflect updated information related to exposure limitations to these substances and recognize that a higher or lower standard is better representative of those substances' exposure thresholds.

The number of completed remediations varies each year. On average, remediators apply the Act 2 remediation standard to just under 300 contaminated properties across the Commonwealth per year. Generally, the cost related to a given site remediation depends in large part on which regulated substances are being remediated and what the specific soil and groundwater conditions are at the site.

The Department worked with the Cleanup Standards Scientific Advisory Board (CSSAB) during the development of this proposed rulemaking. The CSSAB was established by Section 105 of Act 2 (35 P.S. § 6026.105) and consists of persons representing a cross-section of experience, including engineering, biology, hydrogeology, statistics, medicine, chemistry, toxicology, and other related fields. The purpose of the CSSAB is to assist the Department and the Board in developing statewide health standards, determining the appropriate statistically and scientifically valid procedures and risk factors to be used, and providing other technical advice as needed to implement Act 2. During CSSAB meetings on October 10, 2022, January 23, 2023, and May 31, 2023, CSSAB members had the opportunity to review and provide feedback on draft regulatory amendments to Chapter 250. The Department worked with the CSSAB to resolve their concerns. Following these presentations and discussions, the CSSAB voted on January 23, 2023, in support of the Department's recommendation to move the regulation forward to the EQB for consideration. After making additional updates to the draft regulation to address the HEAST values changes and add the PFAS compound PFHxA, the CSSAB reviewed and affirmed their decision to support the Department on May 31, 2023.

E. *Summary of Regulatory Requirements*

§ 250.304. MSCs for groundwater.

In subsection (c), this proposed rulemaking would clarify that MCLs and HALs are effective immediately upon publication in either the *Federal Register* or *Pennsylvania Bulletin*.

In subsection (g), this proposed rulemaking would add a source of aqueous solubility information for PFAS to support the new compounds proposed to be added to the MSC tables in this rulemaking.

§ 250.305. MSCs for soil.

In subsection (b), the proposed amendments clarify the mathematical operation taking place by including multiplication symbols in the equations, update the associated variable definitions and add a missing definition.

§ 250.306. Ingestion numeric values.

In subsection (d), this proposed rulemaking would correct a typographical error for the groundwater ingestion factor.

The proposed amendments to subsection (e) would update the models used to calculate the residential and nonresidential ingestion numeric values for lead in soil. This includes changes to the target blood lead levels that are applied to the corresponding lead numeric value calculations. The models currently used by the Department are the Uptake Biokinetic (UBK) and Society for Environmental Geochemistry and Health (SEGH) models, which are outdated and need to be replaced with more current science. The Board is proposing to replace these models with the EPA's most up-to-date IEUBK model and the EPA's ALM. These model updates also include reducing the current TBLLs from 10 µg/dl in children (UBK model) and 20 µg/dl in adults (SEGH model) to 5 µg/dl for both models because 5 µg/dl is the default TBLL used in the IEUBK and ALM models. The receptor in both models is children; the IEUBK model receptor

is children from zero to 84 months of age and the ALM receptor is a fetus in the womb of an exposed adult. The IEUBK and ALM models were developed by the EPA's Superfund Program and their use, including their default values, ensures that the Commonwealth's environmental cleanup program incorporates the most up to date science associated with the EPA's environmental cleanup program. The Department's Land Recycling Program needs to be closely aligned with the EPA's Superfund Program regarding the use of toxicity information, cleanup processes and risk-based analyses.

The Board also proposes to add averaging of attainment sample data as a statistical test in § 250.707 (relating to statistical tests) to demonstrate attainment of the lead direct contact values under the Statewide health standard. This proposed use of averages will be limited to sample data being used to demonstrate attainment of the Statewide health standard for lead in soil. The use of averages conforms to the methods utilized by both the IEUBK and ALM. The new model references would also be updated in this subsection.

§ 250.404. Pathway identification and elimination.

The proposed amendment to subsection (a) would change the word "environmental" to "ecological" to clarify appropriate receptors.

§ 250.605. Sources of toxicity information.

The proposed amendment to subsection (a)(1) would add the EPA's July 1993 *Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons* to the toxicity value source hierarchy.

§ 250.606. Development of site-specific standards.

The proposed amendment to subsection (d)(3)(iii) would delete the words "below grade" to clarify that slab-on-grade buildings also must be evaluated for vapor intrusion.

§ 250.703. General attainment requirements for soil.

The proposed amendment to subsection (b) would clarify that attainment samples shall be taken from both the base and sidewalls of the excavation to ensure there is no remaining contamination.

In subsection (d), the proposed amendment adds a cross-reference to the newly proposed subparagraph of § 250.707(b)(1)(iv) to include the proposed statistical method for using the arithmetic average for lead to the section that defines the number of samples that are required for attainment.

§ 250.707. Statistical tests.

In subsection (b)(1), new subparagraph (iv) is proposed to allow for averaging of attainment soil sample results for lead when demonstrating attainment of the statewide health standard using the direct contact soil numeric values. The addition of averaging as a statistical test to demonstrate attainment of the Statewide health standard is only applicable for attainment data being

compared to the soil direct contact lead values. This is because the soil direct contact lead values were calculated using the IEUBK and ALM models, which use averages in their methodology. The ability to use the average for attainment of the lead direct contact values does not eliminate the ability to use other statistical methods, as all are protective of human health.

The proposed amendments to subsection (b)(1) and subsection (d) add a reference to the new subparagraph (iv).

Appendix A, Tables 1, 3A, 3B, 4A, 5A, 5B, and 7

The proposed amendments to the "Medium-Specific Concentrations" tables would update the MSCs for certain regulated substances. Updates to footnotes are necessary to help explain several changes to the MSCs.

The proposed updates include a correction to the groundwater numeric values for bromobenzene in Tables 1 and 3B, which were added to the regulations as part of the last Chapter 250 rulemaking. The bromobenzene value in Table 1 is based on the EPA's HAL, but was not converted from mg/L to the correct units of µg/L. Correcting this value in Table 1 also requires the corresponding bromobenzene value in Table 3B to be corrected. Other proposed changes to Tables 1, 3A, 3B, and 4A are based on updates to toxicity values in the sources that are referenced in § 250.605(a) or other sources as described as follows.

For Tables 5A and 5B, a proposed footnote would refer to the memorandum from the EPA's OLEM from May 2021, which recommends the use of certain subchronic toxicity values instead of a chronic toxicity value, as described previously in Section D. Chronic values would typically be the default toxicity values listed in Tables 5A and 5B. However, as described in previously in Section D, guidance from the EPA's OLEM recommends using subchronic toxicity values in place of chronic toxicity values for 19 compounds. This proposed rulemaking would adopt the EPA's recommendations for those compounds.

As also described in Section D, the EPA provided guidance to the Department regarding the use of certain values from EPA's HEAST database. The HEAST database has not been updated since 1997 and as values are published in IRIS and the PPRTV database, any HEAST values for those same compounds were rescinded by EPA. It has been clarified through direct communication with EPA that any compounds evaluated within IRIS and the PPRTV database that specifically state that a value could not be calculated are considered to be rescinded. This resulted in the removal of several HEAST toxicity values from Tables 5A and 5B in this proposed rulemaking.

The proposed amendments updating the calculated toxicity values in Table 5A for six PAH compounds relative to Benzo[a]pyrene result in increases in the MSCs for those compounds. As outlined in the whitepaper provided by the CSSAB PAH Workgroup that is included with this rulemaking, when the EPA updated the toxicity value for Benzo[a]pyrene (BaP) in IRIS in January 2017, the supporting documents specifically referred to the EPA's 1993 guidance document on use of relative potency factors (RPF) for determining the toxicity of six other PAH compounds. These compounds include Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Chrysene, Dibenz[a,h]anthracene, and Indeno[1,2,3-c,d]pyrene. The

whitepaper and the guidance document indicate that the toxicity of these six PAHs should be calculated as a factor of the toxicity of BaP. The whitepaper notes that the current toxicity values for PAHs in Chapter 250 are values calculated by California and others using these RPFs in relation to the BaP toxicity value published before the IRIS update in January 2017. Using the RPFs in relation to the current BaP toxicity value brings the most current science to Chapter 250. This proposal also would add a footnote to reference the EPA's 1993 Relative Potency Factors document.

Numeric values would be calculated for several new substances, including HFPO dimer acid and its ammonium salt, PFBA, PFHxA, and the potassium salt of PFBS in groundwater and soil. The proposed numeric value changes are attributed to changes in the PAH toxicity values, publication of new MCL and HAL values for PFAS compounds, and updates in toxicity values in Tables 5A and 5B.

The proposed amendments to the "Default Values for Calculating MSCs for Lead" in Table 7 would update the input parameters for use in the IEUBK Model for Lead in Children for residential exposure. Proposed amendments for non-residential exposure would update the model input parameters for the ALM. These models represent the EPA's most current science and are being proposed by the Department to replace the outdated and obsolete UBK and SEGH models currently in use by the Department. In addition to model updates, as discussed previously this proposed rulemaking includes updating the TBLL. The Department currently uses TBLLs of 10 µg/dl and 20 µg/dl with the UBK and SEGH models, respectively. This proposed rulemaking uses 5 µg/dl as the TBLL because it is the default value used in both the IEUBK and ALM models that were developed by the EPA's Superfund Program. This proposed rulemaking's use of the default values associated with the EPA Superfund Program's most current soil lead models, including the TBLL, ensures that the most up to date science is being applied to environmental cleanup sites in this Commonwealth. The Department's Land Recycling Program is closely aligned with the EPA's Superfund Program regarding the use of toxicity information, cleanup processes, and risk-based analyses. The receptor in both models is children; with the IEUBK model receptor being children from zero to 84 months of age while the ALM receptor is a fetus in the womb of an exposed adult. References for both models would also be updated. These proposed amendments would result in updates to the lead residential and nonresidential direct contact values provided in Table 4A.

F. *Benefits, Costs, and Compliance*

Benefits

In enacting Act 2, the General Assembly found and declared among its policy goals that "[p]ublic health and environmental hazards cannot be eliminated without clear, predictable environmental remediation standards and a process for developing those standards," that "[a]ny remediation standards adopted by this Commonwealth must provide for the protection of public health and the environment," and that "[c]leanup plans should be based on actual risk that contamination on the site may pose to public health and the environment, taking into account its current and future use and the degree to which contamination can spread offsite and expose the public or the environment to risk." (35 P.S. § 6026.102).

To implement this policy, the General Assembly authorized the Board and the Department to develop standards and methods to effectuate those goals (35 P.S. §§ 6026.104 and 6026.303). The Department's regulatory structure, as authorized under Act 2 and as implemented by Chapter 250, provides those important benefits articulated in the General Assembly's declaration of policy.

The amendments to the MSCs in this proposed rulemaking would serve both the public and the regulated community because they would provide MSCs based on the most up-to-date health and scientific information for substances that cause cancer or have other toxic effects on human health. The Board first published Chapter 250 regulations in 1997 at 27 Pa.B. 4181 (August 16, 1997). In section 104(a) of Act 2 (35 P.S. § 6026.104(a)), the General Assembly recognized that these standards must be updated over time as better science becomes available and as the need for clarification or enhancement of the program becomes apparent.

Potential contamination of soil and groundwater from accidental spills and unlawful disposal can impact almost any resident of this Commonwealth. Many of the chemical substances addressed in this proposed rulemaking are systemic toxicants or carcinogens as defined under Act 2 and, in some cases, are widespread in use. Examples of substances that contain toxic or carcinogenic properties include gasoline and other petroleum products, solvents, elements used in the manufacture of metals and alloys, pesticides, and some dielectric fluids previously contained in transformers and capacitors. Releases of regulated substances not only pose a threat to the environment, but also could affect the health of the general public if inhaled or ingested. New research on many of these substances is ongoing and provides the basis for protection of the residents of this Commonwealth through site cleanup requirements.

Although some of the changes to soil numeric values in this proposed rulemaking would decrease the numeric values, approximately 60% of the values would increase. Increases in values reflect updated information related to exposure limitations to the substances and acknowledge that a higher standard is better representative of those substances' exposure threshold.

An additional benefit of this proposed rulemaking would be the promulgation of soil and groundwater MSCs for five additional PFAS compounds. Establishing these MSCs would allow remediators to address groundwater and soil contamination and thereby lessen public exposure to the contaminants. This will also benefit remediators wishing to remediate contaminated sites, who tend to be owners, operators or purchasers – or their contractors – of properties and facilities including, at, or near, military bases, municipalities and other locations that used or stored fire-fighting foam. The EPA reports that contamination from these chemicals has also been associated with manufacturing textiles, food packaging, personal care products and other materials, such as cookware, that are resistant to water, grease and stains. See the EPA's Per- and Polyfluoroalkyl Substances website (updated March 14, 2023) (available at https://www.epa.gov/pfas).

The benefits of this proposed rulemaking are difficult to quantify because, unlike other statutory or permitting schemes, Act 2 does not prevent contamination but instead provides remediators with a variety of options to addresses sites that have already been contaminated. In that sense,

this proposed rulemaking, consistent with Act 2, benefits the public because it can lead to more efficient and more expedient remediation and reuse of contaminated areas.

Compliance Costs

Financially and economically, the Department believes that any potential impact to the regulated community would be insignificant. Under this proposal, the MSC values for many regulated substances are being amended for a variety of reasons. The most common reason for the amendments is due to changes in toxicity values that are used in calculating MSC made by a Federal agency (including the EPA and the United States Department of Health Agency for Toxic Substances and Disease Registry). The soil numeric values represent a decrease for approximately 40% of the values and an increase for 60% of the values. For groundwater, the proposed changes reflect a decrease for approximately 50% of the values and an increase in approximately 50% of the values. Lowering the values may indicate a more stringent cleanup is required at a site and increasing the values may indicate a less stringent cleanup is required at a site. The number of completed remediations vary each year. On average, remediators apply the Act 2 remediation standard to approximately 300 contaminated properties across the Commonwealth. The Department does not expect that the proposed amendments would impact the number of remediations voluntarily completed or the number that must be completed as a result of Department enforcement actions.

The proposed updates to statewide health standard MSCs would not affect the cleanup options available to remediators under other cleanup standards. Persons conducting remediation under Act 2 may choose from three different cleanup standards: background, statewide health or site-specific.

The Department does not expect that this proposed rulemaking would create any additional costs. Act 2 does not create liability for or the obligation to address contamination for these and other chemicals. Instead, that obligation comes from other environmental statutes, including the Clean Streams Law (35 P.S. §§ 691.1—691.1001) and the Solid Waste Management Act (35 P.S. §§ 6018.101—6018.1003). Act 2 provides remediators with options to remediate contamination. This would benefit the public by lessening public exposure to these contaminants.

Compliance Assistance Plan

The Land Recycling Program would disseminate information concerning these updates using the Department website and e-mails to environmental consultants involved in the program.

Paperwork Requirements

This proposed rulemaking would not result in any additional forms or reports, beyond those that are already required by Act 2 and Chapter 250.

G. *Pollution Prevention*

The Pollution Prevention Act of 1990 (42 U.S.C. §§ 13101—13109) established a National policy that promotes pollution prevention as the preferred means for achieving State environmental protection goals. The Department encourages pollution prevention, which is the

reduction or elimination of pollution at its source, through the substitution of environmentally friendly materials, more efficient use of raw materials, and the incorporation of energy efficiency strategies. Pollution prevention practices can provide greater environmental protection with greater efficiency because they can result in significant cost savings to facilities that permanently achieve or move beyond compliance.

Act 2 encourages cleanup plans that have as a goal remedies which treat, destroy or remove regulated substances whenever technically and economically feasible. This proposed rulemaking would provide the necessary statewide health standard MSCs for remediators to remove contamination or eliminate exposure, where appropriate. This proposed rulemaking reflects the most up-to-date science, especially as it relates to the characterization and removal of contamination that exceeds Act 2 MSCs. During the remediation of a contaminated site, potential sources of pollution are often removed to attain the Act 2 standards, thus eliminating or minimizing the potential for continued migration of the sources of pollution to other areas.

H. *Sunset Review*

The Board is not establishing a sunset date for these regulations since they are needed for the Department to carry out its statutory authority. The Department will continue to closely monitor these regulations for their effectiveness and recommend updates to the Board as necessary.

I. *Regulatory Review*

Under section 5(a) of the Regulatory Review Act (RRA) (71 P.S. § 745.5(a)), on July 2, 2024, the Department submitted a copy of this proposed rulemaking and a copy of a Regulatory Analysis Form to the Independent Regulatory Review Commission (IRRC) and to the Chairpersons of the House and Senate Environmental Resources and Energy Committees. A copy of this material is available to the public upon request.

Under section 5(g) of the RRA, IRRC may convey any comments, recommendations, or objections to this proposed rulemaking within 30 days of the close of the public comment period. The comments, recommendations or objections must specify the regulatory review criteria in section 5.2 of the RRA (71 P.S. § 745.5b) which have not been met. The RRA specifies detailed procedures for review, prior to final publication of the rulemaking, by the Department, the General Assembly and the Governor.

J. *Public Comments*

Interested persons are invited to submit to the Board written comments, suggestions, support or objections regarding this proposed rulemaking. Comments, suggestions, support or objections must be received by the Board by September 11, 2024.

Comments may be submitted to the Board online, by e-mail, by mail or express mail as follows.

Comments may be submitted to the Board by accessing eComment at http://www.ahs.dep.pa.gov/eComment.

Comments may be submitted to the Board by e-mail at RegComments@pa.gov. A subject heading of this proposed rulemaking and a return name and address must be included in each transmission.

If an acknowledgement of comments submitted online or by e-mail is not received by the sender within 2 working days, the comments should be retransmitted to the Board to ensure receipt. Comments submitted by facsimile will not be accepted.

Written comments should be mailed to the Environmental Quality Board, P.O. Box 8477, Harrisburg, PA 17105-8477. Express mail should be sent to the Environmental Quality Board, Rachel Carson State Office Building, 16th Floor, 400 Market Street, Harrisburg, PA 17101-2301.

K. *Public Hearings*

The Board will hold two in-person public hearings and one virtual public hearing to accept comments on this proposed rulemaking.

Persons wishing to present testimony at a hearing are requested to contact Casey Damicantonio for the Department and the Board, (717) 783-8727 or RA-EPEQB@pa.gov, at least 1 week in advance of the hearing to sign up to present testimony. Language interpretation services are available upon request. Persons in need of language interpretation services must contact Casey Damicantonio at least 1 week in advance of the hearing.

Verbal testimony at a hearing is limited to 5 minutes for each witness. Organizations are limited to designating one witness to present testimony on their behalf at one hearing.

Persons in need of accommodations as provided for in the Americans with Disabilities Act of 1990 should contact the Board at (717) 783-8727 or through the Pennsylvania Hamilton Relay Service at (800) 654-5984 (TDD) or (800) 654-5988 (voice users) to discuss how the Board may accommodate their needs.

The hearings will be held as follows:

In-Person Hearings

August 19, 2024 at 1 p.m.	Department of Environmental Protection Southwest Regional Office Waterfront Conference Rooms A and B 400 Waterfront Drive Pittsburgh, PA 15222

August 27, 2024 at 1 p.m.	Department of Environmental Protection Southeast Regional Office Delaware Conference Room 2 East Main Street Norristown, PA 19401

For in-person hearings, witnesses are requested to submit three written copies of their verbal testimony to the hearing chairperson at the hearing.

Virtual Hearing

September 4, 2024 at 6 p.m.	Microsoft Teams – Access information to be posted on the Board's webpage (Internet or telephone access)

Information on how to access the virtual hearing by Internet or telephone will be available on the Board's webpage found through the Public Participation tab on the Department's web site at www.dep.pa.gov (select "Public Participation," then "Environmental Quality Board"). Prior to the virtual hearing, individuals are encouraged to visit the Board's webpage for the most current information for accessing the hearing. Members of the public wishing to observe the virtual hearing without providing testimony are also directed to access the Board's webpage.

Witnesses attending a virtual hearing may provide testimony by means of telephone or Internet connection. Video demonstrations and screen sharing by witnesses will not be permitted.

For the virtual hearing, witnesses are requested to submit a written copy of their verbal testimony by e-mail to RegComments@pa.gov after providing testimony at a hearing.

JESSICA SHIRLEY,
Acting Chairperson

ANNEX A

TITLE 25. ENVIRONMENTAL PROTECTION
PART I. DEPARTMENT OF ENVIRONMENTAL PROTECTION
SUBPART D. ENVIRONMENTAL HEALTH AND SAFETY
ARTICLE VI. GENERAL HEALTH AND SAFETY
CHAPTER 250. ADMINISTRATION OF LAND RECYCLING PROGRAM

Subchapter C. STATEWIDE HEALTH STANDARDS

§ 250.304. MSCs for groundwater.

* * * * *

(c) The MSCs for regulated substances contained in groundwater in aquifers used or currently planned to be used for drinking water or for agricultural purposes are the MCLs as established by the Department or the EPA in § 109.202 (relating to State MCLs, MRDLs and treatment technique requirements). For regulated substances where no MCL has been established, the MSCs are the Lifetime Health Advisory Levels (HAL) set forth in Drinking Water Standards and Health Advisories (DWSHA), EPA Office of Water Publication No. EPA 822-F-18-001 March 2018 or as revised), except for substances designated in the DWSHA with cancer descriptor (L) "Likely to be carcinogenic to humans" or (L/N) "Likely to be carcinogenic above a specific dose but not likely to be carcinogenic below that dose because a key event in tumor formation does not occur below that dose." **MSCs for regulated substances with HALs designated in the DWSHA with L or L/N cancer descriptors will be calculated by the Department and become effective upon publication in the *Pennsylvania Bulletin*. [New] All other new** or revised MCLs or HALs **[promulgated by the Department or] published in the *Federal Register* by** the EPA **or in the *Pennsylvania Bulletin* by the Environmental Quality Board** shall become effective immediately **[for any demonstration of attainment completed after the date the new or revised MCLs or HALs become effective.] and shall supersede any MSCs previously promulgated for those regulated substances. For the purposes of this subsection, MCLs and HALs refer exclusively to final versions of promulgated MCLs and published versions of final HALs.**

* * * * *

(g) The references referred to in subsection (f) are:

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(25) Kim, Minhee, et al. 2015. *Selecting reliable physicochemical properties of perfluoroalkyl and polyfluoroalkyl substances (PFASs) based on molecular descriptors*. Environ. Pollution 196: 462-472.

§ 250.305. MSCs for soil.

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(b) The MSCs for regulated substances in soil are presented in Appendix A, Tables 3 and 4. The methodology for calculating MSCs in soil is detailed in subsections (c)—(e) and the MSCs are further limited to not exceed the physical capacity of the soil to contain a regulated substance. This physical limitation is based on an assumed porosity of 0.35, an assumed dry bulk density of soil of 1.8 kilograms per liter and an assumed density of a regulated substance of 1.0 kilograms per liter. This is calculated according to the equation in paragraph (1). For regulated substances which are organics and liquids at standard temperature and pressure (STP) as identified in Appendix A, Table 5 (Chemical Properties), the physical limitation is further limited based on residual saturation with the additional assumption of a residual saturation ratio of substance volume to soil volume of 0.051, as calculated in Equation (2).

(1) $[C_{PL} = \frac{\rho_{RS} n}{\rho_B}]$ $C_{PL} = \frac{\rho_{RS} \times n}{\rho_B}$

(2) $[MSC = Sr * \frac{\rho_{RS} n}{\rho_B} * \times 1{,}000{,}000\ mg/kg = 10{,}000\ mg/kg]$

$MSC = Sr \times \frac{\rho_{RS} \times n}{\rho_B} \times 1{,}000{,}000\ mg/kg = 10{,}000\ mg/kg$

where:

C_{PL} = physical capacity of the soil

ρ_{RS} = density of the regulated substance = 1.0 kg/L

[n] *n* = porosity of the soil = 0.35

ρ_B = dry bulk density of the soil = 1.8 kg/L

[Sr] *Sr* = residual saturation ratio (substance vol./soil vol.) = 0.051

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§ 250.306. Ingestion numeric values.

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(d) The default exposure assumptions used to calculate the ingestion numeric values are as follows:

Term		Residential		Nonresidential (Onsite Worker)
		Systemic[1]	*Carcinogens*[2,6]	
THQ	Target Hazard Quotient	1	N/A	1
RfD_o	Oral Reference Dose (mg/kg-day)	Chemical-specific	N/A	Chemical-specific
BW	Body Weight (kg) Soil Groundwater	 15 80	N/A	 80 80
AT_{nc}	Averaging Time for systemic toxicants (yr) Soil Groundwater	 6 30	 N/A N/A	 25 25
Abs	Absorption (unitless)[3]	1	1	1
EF	Exposure Frequency (d/yr) Soil Groundwater	 250 350	 250 350	 180 250
ED	Exposure Duration (yr) Soil Groundwater	 6 30	 N/A N/A	 25 25
IngR	Ingestion Rate Soil (mg/day) GW (L/day)	 100 2.4	 N/A N/A	 50 1.2
CF	Conversion Factor Soil (kg/mg) GW (unitless)	 1×10^{-6} 1	 1×10^{-6} 1	 1×10^{-6} 1
TR	Target Risk	N/A	1×10^{-5}	1×10^{-5}
CSF_o	Oral Cancer Slope Factor (mg/kg-day)$^{-1}$	N/A	Chemical-specific	Chemical-specific
AT_c	Averaging Time for carcinogens (yr)	N/A	70	70
IFadj[4]	Ingestion Factor Soil (mg-yr/kg-day) GW (L-yr/kg day)	N/A	 55 **[1.2] <u>1.1</u>**	 15.6 0.38
AIFadj[5]	Combined Age-Dependent Adjustment Factor and Ingestion Factor Soil (mg-yr/kg-day) GW (L-yr/kg-day)	N/A	 241 3.45	N/A
$CSFo_k$	TCE oral cancer slope factor for kidney		9.3×10^{-3}	
$CSFo_l$	TCE oral cancer slope factor for non-		3.7×10^{-2}	

Notes:

[1] Residential exposure to noncarcinogens is based on childhood (ages 1—6) exposure for soil, and adult exposure for groundwater, consistent with USEPA (1991).

[2] Residential exposure to carcinogens is based on combined childhood and adult exposure.

[3] The oral absorption factor takes into account absorption and bioavailability. In cases where the oral RfD or CSF is based on administered oral dose, the absorption factor would be limited to bioavailability. The default value is 1.

[4] The Ingestion Factor for the residential scenario is calculated using the equation If adj = ED_c x IR_c/BW_c + ED_a x IR_a/BW_a, where ED_c = 6 yr, IR_c = 100 mg/day for soils and 1 L/day for groundwater, BW_c = 15 kg, ED_a = 24 yr, IR_a = 50 mg/day for soils and 2.4 L/day for groundwater, and BW_a = 80 kg. The ingestion factor for the nonresidential scenario is calculated using the equation If adj = ED x IR/BW, where ED = 25 yr, IR = 50 mg/day for soils and 1.2 L/day for groundwater, and BW = 80 kg.

[5] The Combined Age-Dependent Adjustment Factor and Ingestion Factor (AIFadj) for the residential scenario is calculated using the equation AIFadj = [($ADAF_{<2}$ x $ED_{<2}$) + ($ADAF_{2-6}$ x ED_{2-6})] x IR_c / BW_c + [($ADAF_{>6-16}$ x $ED_{>6-16}$ + ($ADAF_{>16}$ x $ED_{>16}$)] x IR_a / BW_a, where $ADAF_{<2}$ = 10, $ED_{<2}$ = 2 yr, $ADAF_{2-6}$ = 3, ED_{2-6} = 4 yr, IR_c = 100mg/day for soils and 1 L/day for groundwater, BW_c = 15 kg, $ADAF_{>6-16}$ = 3, $ED_{>6-16}$ = 10 yr, $ADAF_{>16}$ = 1, $ED_{>16}$ = 14 yr, IR_a = 50 mg/day for soils and 2.4 L/day for groundwater, and BW_a = 80 kg.

[6] For the equation to calculate the vinyl chloride residential MSC based on the carcinogenic effect, IRc = 100 mg/day for soils and 1 L/day for groundwater, BWc = 15 kg.

(e) The residential ingestion numeric value for lead in soil was developed using the **[Uptake Biokinetic (UBK) Model for Lead (version 0.4)]** **Integrated Exposure Uptake Biokinetic Model for Lead in Children, Windows® version (IEUBKwin v1.1 build 11) 32-bit version** developed by the EPA (U.S. Environmental Protection Agency. (**[1990]** **February 2010)**) **[Uptake Biokinetic (UBK) Model for Lead (version 0.4). U.S. EPA/ECAO. August 1990,**] in lieu of the algorithms presented in subsections (a) and (b). Default input values are identified in Appendix A, Table 7. **[Because the UBK model is applicable only to children, the nonresidential ingestion numeric value was calculated according to the method developed by the Society for Environmental Geochemistry and Health (Wixson, B. G. (1991)). The Society for Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil. *Trace Substances in Environmental Health*. (11-20), using the following equations:**

$$S = \frac{1000\left[\left(\frac{T}{G^n}\right) - B\right]}{\delta}$$ **]**

Because the IEUBK model is applicable only to children, the nonresidential ingestion numeric value was calculated using the EPA's Adult Lead Methodology in accordance with the guidance, exposure factors, equations and spreadsheets provided in EPA's *Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil* (EPA-540-R-03-001, OSWER Dir #9285.7-54, January 2003), *OLEM Directive 9285.6-56 "Update to the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Geometric Standard Deviation Parameters"* (May 2017) and the associated June 14, 2017 version of the *Calculations of Preliminary Remediation Goals (PRGs) for Soil in Nonresidential Areas* *U.S. EPA Technical Review Workgroup for Lead, Adult Lead Committee* spreadsheets. Table 7 identifies each of the variables **[in this equation]** **used to calculate the nonresidential ingestion numeric value for lead**.

* * * * *

Subchapter D. SITE-SPECIFIC STANDARD

§ 250.404. Pathway identification and elimination.

(a) The person shall use Department or Department-approved EPA or ASTM guidance to identify any potential current and future exposure pathways for both human receptors and **[environmental]** **ecological** receptors identified in § 250.402 (relating to human health and environmental protection goals).

* * * * *

Subchapter F. EXPOSURE AND RISK DETERMINATIONS

§ 250.605. Sources of toxicity information.

(a) For site-specific standards, the person shall use appropriate reference doses, reference concentrations, cancer slope factors and unit risk factors identified in Subchapter C (relating to Statewide health standards), unless the person can demonstrate that published data, available from one of the following sources, provides more current reference doses, reference concentrations, cancer slope factors or unit risk factors:

(1) Integrated Risk Information System (IRIS). **Cancer slope factors and inhalation unit risk factors for carcinogenic polycyclic aromatic hydrocarbons are derived using relative potency factors contained in United States Environmental Protection Agency July 1993 Provisional Guidance for Quantitative Risk Assessment of Polycyclic Aromatic Hydrocarbons (EPA/600/R-93/089).**

(2) United States Environmental Protection Agency, National Center for Environmental Assessment (NCEA) Provisional Peer-Reviewed Toxicity Values (PPRTV).

(3) Other sources:

(i) Health Effects Assessment Summary Tables (HEAST).

(ii) Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles.

(iii) California EPA, California Cancer Potency Factors and Chronic Reference Exposure Levels.

(iv) EPA criteria documents, including drinking water criteria documents, drinking water health advisory summaries, ambient water quality criteria documents and air quality criteria documents.

(v) EPA Human Health Benchmarks for Pesticides (HHBP).

(vi) EPA PPRTV Appendix.

* * * * *

§ 250.606. Development of site-specific standards.

* * * * *

(d) The following factors shall be considered in the development of the risk assessment and in the development of site-specific standards:

* * * * *

(3) The person shall consider current and probable future exposure scenarios, such as:

(i) Human ingestion of soil when direct contact exposure to the soil may reasonably occur.

(ii) Exposure to groundwater by ingestion with respect to leaching of regulated substances from soils to groundwater.

(iii) Human inhalation of regulated substances from volatilization and migration of these substances into **[below grade]** occupied space.

(iv) Human ingestion of regulated substances in surface water or other site-specific surface water exposure pathways with respect to regulated substances migration from soil to surface water.

(v) Human inhalation of regulated substances in air or other site-specific air exposure pathways with respect to the release of regulated substances from soil to air.

* * * * *

Subchapter G. DEMONSTRATION OF ATTAINMENT

§ 250.703. General attainment requirements for soil.

* * * * *

(b) The soil to which the attainment criteria are applied shall be determined by circumscribing with an irregular surface those concentrations detected during characterization which exceed the selected standard. Where this soil is to be removed from the site, the attainment demonstration applies to the base **and sidewalls** of the excavation defined by the limit of excavation.

* * * * *

(d) For statistical methods under § 250.707(b)(1)(i) **and (iv)** (relating to statistical tests), the number of sample points required for each distinct area of contamination to demonstrate attainment shall be determined in the following way:

* * * * *

§ 250.707. Statistical tests.

* * * * *

(b) The following statistical tests may be accepted by the Department to demonstrate attainment of the Statewide health standard. The statistical test for soil shall apply to each distinct area of contamination. The statistical test for groundwater will apply to each compliance monitoring well. Testing shall be performed individually for each regulated substance identified in the final report site investigation as being present at the site for which a person wants relief from liability under the act. The application of a statistical method must meet the criteria in subsection (d).

(1) For soil attainment determination at each distinct area of contamination, subparagraph **[(i), (ii) or (iii)]** **(i), (ii), (iii) or (iv)** shall be met in addition to the attainment requirements in § § 250.702 and 250.703 (relating to attainment requirements; and general attainment requirements for soil).

* * * * *

(iii) For sites with a petroleum release where full site characterization, as defined in § 250.204(b) (relating to final report), has not been done in association with an excavation remediation, attainment of the Statewide health standard shall be demonstrated using the following procedure:

* * * * *

(D) A vapor intrusion analysis is not necessary if the requirements of § 250.707(b)(1)(iii) are met in addition to the following:

(I) At least one soil sample is collected on the sidewall nearest an inhabited building within the appropriate proximity distance to a potential vapor intrusion source and there are not substantially higher field instrument readings elsewhere.

(II) Observations of obvious contamination and the use of appropriate field screening instruments verify that contamination has not contacted or penetrated the foundation of an inhabited building.

(III) Groundwater contamination has not been identified as a potential vapor intrusion concern.

(iv) For sites with a release of lead or lead compounds that has been remediated to attain an MSC for lead based on an ingestion numeric value calculated in accordance with the requirements of § 250.306(e) and Appendix A, Table 7, the arithmetic average of all attainment samples, which shall be randomly collected in a single event from the site, shall be equal to or less than the applicable MSC.

* * * * *

(d) Except for the statistical methods identified in subsections (a)(1)(i)**, [and]** (b)(1)(i) **and (iv),** and (2)(i), a demonstration of attainment of one or a combination of remediation standards shall comply with the following:

* * * * *

Appendix A

Table 1—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater

Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
ACENAPHTHENE	83-32-9	2,100 G	3,800 S	3,800 S	3,800 S	3,800 S	3,800 S
ACENAPHTHYLENE	208-96-8	2,100 G	5,800 G	16,000 S	16,000 S	16,000 S	16,000 S
ACEPHATE	30560-19-1	42 G	120 G	4,200 G	12,000 G	42 G	120 G
ACETALDEHYDE	75-07-0	19 N	79 N	1,900 N	7,900 N	19 N	79 N
ACETONE	67-64-1	31,000 G	88,000 G	3,100,000 G	8,800,000 G	310,000 G	880,000 G
ACETONITRILE	75-05-8	130 N	530 N	13,000 N	53,000 N	1,300 N	5,300 N
ACETOPHENONE	98-86-2	3,500 G	9,700 G	350,000 G	970,000 G	3,500 G	9,700 G
ACETYLAMINOFLUORENE, 2- (2AAF)	53-96-3	0.17 G	0.72 G	17 G	72 G	170 G	720 G
ACROLEIN	107-02-8	0.042 N	0.18 N	4.2 N	18 N	0.42 N	1.8 N
ACRYLAMIDE	79-06-1	0.19 N	2.5 N	19 N	250 N	0.19 N	2.5 N
ACRYLIC ACID	79-10-7	**[2.1] 0.42** N	**[8.8] 1.8** N	**[210] 42** N	**[880] 180** N	**[210] 42** N	**[880] 180** N
ACRYLONITRILE	107-13-1	0.72 N	3.7 N	72 N	370 N	72 N	370 N
ALACHLOR	15972-60-8	2 M	2 M	200 M	200 M	2 M	2 M
ALDICARB	116-06-3	3 M	3 M	300 M	300 M	3,000 M	3,000 M
ALDICARB SULFONE	1646-88-4	2 M	2 M	200 M	200 M	2 M	2 M
ALDICARB SULFOXIDE	1646-87-3	4 M	4 M	400 M	400 M	4 M	4 M
ALDRIN	309-00-2	0.038 G	0.16 G	3.8 G	16 G	20 S	20 S
ALLYL ALCOHOL	107-18-6	0.21 N	0.88 N	21 N	88 N	21 N	88 N
AMETRYN	834-12-8	60 H	60 H	6,000 H	6,000 H	60 H	60 H
AMINOBIPHENYL, 4-	92-67-1	0.031 G	0.13 G	3.1 G	13 G	31 G	130 G
AMITROLE	61-82-5	0.69 G	2.9 G	69 G	290 G	690 G	2,900 G
AMMONIA	7664-41-7	30,000 H	30,000 H	3,000,000 H	3,000,000 H	30,000 H	30,000 H
AMMONIUM SULFAMATE	7773-06-0	2,000 H	2,000 H	200,000 H	200,000 H	2,000 H	2,000 H
ANILINE	62-53-3	2.1 N	8.8 N	210 N	880 N	2.1 N	8.8 N
ANTHRACENE	120-12-7	66 S	66 S	66 S	66 S	66 S	66 S
ATRAZINE	1912-24-9	3 M	3 M	300 M	300 M	3 M	3 M
AZINPHOS-METHYL (GUTHION)	86-50-0	52 G	150 G	5,200 G	15,000 G	52 G	150 G
BAYGON (PROPOXUR)	114-26-1	3 H	3 H	300 H	300 H	3,000 H	3,000 H
BENOMYL	17804-35-2	270 G	1,100 G	2,000 S	2,000 S	270 G	1,100 G
BENTAZON	25057-89-0	200 H	200 H	20,000 H	20,000 H	200 H	200 H
BENZENE	71-43-2	5 M	5 M	500 M	500 M	500 M	500 M
BENZIDINE	92-87-5	0.00092 G	0.012 G	0.092 G	1.2 G	0.92 G	12 G

All concentrations in µg/L
M = Maximum Contaminant Level
N = Inhalation
R = Residential
H = Lifetime health advisory level
S = Aqueous solubility cap
NR = Non-Residential
G = Ingestion

THMs—The values listed for trihalomethanes (THMs) are the total for all THMs combined.

HAAs—The values listed for haloacetic acids (HAAs) are the total for all HAAs combined.

[PFOA and PFOS values listed are for individual or total combined.]

Appendix A

Table 1—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater

Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
BENZO[A]ANTHRACENE	56-55-3	**[0.3] 2.1** G	**[3.9] 11 [G] S**	11 S	11 S	11 S	11 S
BENZO[A]PYRENE	50-32-8	0.2 M	0.2 M	3.8 S	3.8 S	3.8 S	3.8 S
BENZO[B]FLUORANTHENE	205-99-2	**[0.18] 1.2** [G] S	1.2 S	1.2 S	1.2 S	1.2 S	1.2 S
BENZO[GHI]PERYLENE	191-24-2	0.26 S	0.26 S	0.26 S	0.26 S	0.26 S	0.26 S
BENZO[K]FLUORANTHENE	207-08-9	**[0.18] 0.55** [G] S	0.55 S	0.55 S	0.55 S	0.55 S	0.55 S
BENZOIC ACID	65-85-0	140,000 G	390,000 G	2,700,000 S	2,700,000 S	140,000 G	390,000 G
BENZOTRICHLORIDE	98-07-7	0.05 G	0.21 G	5 G	21 G	5 G	21 G
BENZYL ALCOHOL	100-51-6	3,500 G	9,700 G	350,000 G	970,000 G	3,500 G	9,700 G
BENZYL CHLORIDE	100-44-7	1 N	5.1 N	100 N	510 N	100 N	510 N
BETA PROPIOLACTONE	57-57-8	0.012 N	0.063 N	1.2 N	6.3 N	0.12 N	0.63 N
BHC, ALPHA-	319-84-6	0.1 G	0.43 G	10 G	43 G	100 G	430 G
BHC, BETA-	319-85-7	0.36 G	1.5 G	36 G	100 S	100 S	100 S
BHC, GAMMA (LINDANE)	58-89-9	0.2 M	0.2 M	20 M	20 M	200 M	200 M
BIPHENYL, 1,1-	92-52-4	0.84 N	3.5 N	84 N	350 N	84 N	350 N
BIS(2-CHLOROETHOXY)METHANE	111-91-1	100 G	290 G	10,000 G	29,000 G	100 G	290 G
BIS(2-CHLOROETHYL)ETHER	111-44-4	0.15 N	0.76 N	15 N	76 N	15 N	76 N
BIS(2-CHLORO-ISOPROPYL)ETHER	108-60-1	300 H	300 H	30,000 H	30,000 H	30,000 H	30,000 H
BIS(CHLOROMETHYL)ETHER	542-88-1	0.00079 N	0.004 N	0.079 N	0.4 N	0.079 N	0.4 N
BIS[2-ETHYLHEXYL] PHTHALATE	117-81-7	6 M	6 M	290 S	290 S	290 S	290 S
BISPHENOL A	80-05-7	1,700 G	4,900 G	120,000 S	120,000 S	120,000 S	120,000 S
BROMACIL	314-40-9	70 H	70 H	7,000 H	7,000 H	70 H	70 H
BROMOBENZENE	108-86-1	**[0.06] 60** H	**[0.06] 60** H	**[6] 6,000** H	**[6] 6,000** H	**[0.06] 60** H	**[0.06] 60** H
BROMOCHLOROMETHANE	74-97-5	90 H	90 H	9,000 H	9,000 H	90 H	90 H
BROMODICHLOROMETHANE (THM)	75-27-4	80 M	80 M	8,000 M	8,000 M	80 M	80 M
BROMOMETHANE	74-83-9	10 H	10 H	1,000 H	1,000 H	1,000 H	1,000 H
BROMOXYNIL	1689-84-5	6.3 G	26 G	630 G	2,600 G	6.3 G	26 G
BROMOXYNIL OCTANOATE	1689-99-2	6.3 G	26 G	80 S	80 S	80 S	80 S

All concentrations in µg/L M = Maximum Contaminant Level N = Inhalation
R = Residential H = Lifetime health advisory level S = Aqueous solubility cap
NR = Non-Residential G = Ingestion
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Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
BUTADIENE, 1,3-	106-99-0	1.1 G	4.5 G	110 G	450 G	110 G	450 G
BUTYL ALCOHOL, N-	71-36-3	3,500 G	9,700 G	350,000 G	970,000 G	35,000 G	97,000 G
BUTYLATE	2008-41-5	400 H	400 H	40,000 H	40,000 H	400 H	400 H
BUTYLBENZENE, N-	104-51-8	1,700 G	4,900 G	15,000 S	15,000 S	1,700 G	4,900 G
BUTYLBENZENE, SEC-	135-98-8	3,500 G	9,700 G	17,000 S	17,000 S	3,500 G	9,700 G
BUTYLBENZENE, TERT-	98-06-6	3,500 G	9,700 G	30,000 S	30,000 S	3,500 G	9,700 G
BUTYLBENZYL PHTHALATE	85-68-7	340 G	1,400 G	2,700 S	2,700 S	2,700 S	2,700 S
CAPTAN	133-06-2	280 G	500 S	500 S	500 S	500 S	500 S
CARBARYL	63-25-2	3,500 G	9,700 G	120,000 S	120,000 S	120,000 S	120,000 S
[CARBAZOLE]	**[86-74-8]**	**[33] [G]**	**[140] [G]**	**[1,200] [S]**	**[1,200] [S]**	**[33] [G]**	**[140] [G]**
CARBOFURAN	1563-66-2	40 M	40 M	4,000 M	4,000 M	40 M	40 M
CARBON DISULFIDE	75-15-0	1,500 N	6,200 N	150,000 N	620,000 N	1,500 N	6,200 N
CARBON TETRACHLORIDE	56-23-5	5 M	5 M	500 M	500 M	50 M	50 M
CARBOXIN	5234-68-4	700 H	700 H	70,000 H	70,000 H	700 H	700 H
CHLORAMBEN	133-90-4	100 H	100 H	10,000 H	10,000 H	100 H	100 H
CHLORDANE	57-74-9	2 M	2 M	56 S	56 S	56 S	56 S
CHLORO-1,1-DIFLUOROETHANE, 1-	75-68-3	110,000 N	440,000 N	1,400,000 S	1,400,000 S	110,000 N	440,000 N
CHLORO-1-PROPENE, 3- (ALLYL CHLORIDE)	107-05-1	2.1 N	8.8 N	210 N	880 N	210 N	880 N
CHLOROACETALDEHYDE	107-20-0	2.4 G	10 G	240 G	1,000 G	2.4 G	10 G
CHLOROANILINE, P-	106-47-8	3.3 G	14 G	330 G	1,400 G	3.3 G	14 G
CHLOROBENZENE	108-90-7	100 M	100 M	10,000 M	10,000 M	10,000 M	10,000 M
CHLOROBENZILATE	510-15-6	5.9 G	25 G	590 G	2,500 G	5,900 G	13,000 S
CHLOROBUTANE, 1-	109-69-3	1,400 G	3,900 G	140,000 G	390,000 G	1,400 G	3,900 G
CHLORODIBROMOMETHANE (THM)	124-48-1	80 M	80 M	8,000 M	8,000 M	8,000 M	8,000 M
CHLORODIFLUOROMETHANE	75-45-6	110,000 N	440,000 N	2,900,000 S	2,900,000 S	110,000 N	440,000 N
CHLOROETHANE	75-00-3	**[21,000]** **8,400** N	**[88,000]** **35,000** N	**[2,100,000]** **840,000** N	**[5,700,000]** **3,500,000** **[S] N**	**[2,100,000]** **840,000** N	**[5,700,000]** **3,500,000** **[S] N**
CHLOROFORM (THM)	67-66-3	80 M	80 M	8,000 M	8,000 M	800 M	800 M
CHLORONAPHTHALENE, 2-	91-58-7	2,800 G	7,800 G	12,000 S	12,000 S	2,800 G	7,800 G
CHLORONITROBENZENE, P-	100-00-5	4.2 N	18 N	420 N	1,800 N	4.2 N	18 N

All concentrations in µg/L
R = Residential
NR = Non-Residential
M = Maximum Contaminant Level
H = Lifetime health advisory level
G = Ingestion
N = Inhalation
S = Aqueous solubility cap

THMs—The values listed for trihalomethanes (THMs) are the total for all THMs combined.
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		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
CHLOROPHENOL, 2-	95-57-8	40 H	40 H	4,000 H	4,000 H	40 H	40 H
CHLOROPRENE	126-99-8	0.16 N	0.83 N	16 N	83 N	16 N	83 N
[CHLOROPROPANE, 2-]	**[75-29-6]**	**[210] [N]**	**[880] [N]**	**[21,000] [N]**	**[88,000] [N]**	**[210] [N]**	**[880] [N]**
CHLOROTHALONIL	1897-45-6	38 G	160 G	600 S	600 S	38 G	160 G
CHLOROTOLUENE, O-	95-49-8	100 H	100 H	10,000 H	10,000 H	100 H	100 H
CHLOROTOLUENE, P-	106-43-4	100 H	100 H	10,000 H	10,000 H	100 H	100 H
CHLORPYRIFOS	2921-88-2	2 H	2 H	200 H	200 H	2 H	2 H
CHLORSULFURON	64902-72-3	**[690]** **1,700** G	**[1,900]** **4,900** G	**[69,000]** **170,000** G	190,000 **[G] S**	**[690]** **1,700** G	**[1,900]** **4,900** G
CHLORTHAL-DIMETHYL (DACTHAL) (DCPA)	1861-32-1	70 H	70 H	500 S	500 S	500 S	500 S
CHRYSENE	218-01-9	**[1.8]** **1.9** **[G] S**	1.9 S	1.9 S	1.9 S	1.9 S	1.9 S
CRESOL(S)	1319-77-3	1,300 N	5,300 N	130,000 N	530,000 N	130,000 N	530,000 N
CRESOL, DINITRO-O-,4,6-	534-52-1	2.8 G	7.8 G	280 G	780 G	280 G	780 G
CRESOL, O- (METHYLPHENOL, 2-)	95-48-7	1,700 G	4,900 G	170,000 G	490,000 G	170,000 G	490,000 G
CRESOL, M (METHYLPHENOL, 3-)	108-39-4	1,700 G	4,900 G	170,000 G	490,000 G	1,700,000 G	2,500,000 S
CRESOL, P (METHYLPHENOL, 4-)	106-44-5	**[170]** **690** G	**[490]** **1,900** G	**[17,000]** **69,000** G	**[49,000]** **190,000** G	**[170,000]** **690,000** G	**[490,000]** **1,900,000** G
CRESOL, P-CHLORO-M-	59-50-7	3,500 G	9,700 G	350,000 G	970,000 G	3,500 G	9,700 G
CROTONALDEHYDE	4170-30-3	**[0.34]** **35** G	**[1.4]** **97** G	**[34]** **3,500** G	**[140]** **9,700** G	**[34]** **3,500** G	**[140]** **9,700** G
CROTONALDEHYDE, TRANS-	123-73-9	**[0.34]** **35** G	**[1.4]** **97** G	**[34]** **3,500** G	**[140]** **9,700** G	**[34]** **3,500** G	**[140]** **9,700** G
CUMENE (ISOPROPYL BENZENE)	98-82-8	840 N	3,500 N	50,000 S	50,000 S	50,000 S	50,000 S
CYANAZINE	21725-46-2	1 H	1 H	100 H	100 H	1 H	1 H
CYCLOHEXANE	110-82-7	13,000 N	53,000 N	55,000 S	55,000 S	13,000 N	53,000 N
CYCLOHEXANONE	108-94-1	1,500 N	6,200 N	150,000 N	620,000 N	1,500 N	6,200 N
CYFLUTHRIN	68359-37-5	1 S	1 S	1 S	1 S	1 S	1 S
CYROMAZINE	66215-27-8	17,000 G	49,000 G	1,700,000 G	4,900,000 G	17,000 G	49,000 G
DDD, 4,4'-	72-54-8	2.7 G	11 G	160 S	160 S	160 S	160 S
DDE, 4,4'-	72-55-9	1.9 G	8 G	40 S	40 S	40 S	40 S

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[PFOA and PFOS values listed are for individual or total combined.]

Appendix A

Table 1—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater

Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
DDT, 4,4'-	50-29-3	1.9 G	5.5 S	5.5 S	5.5 S	5.5 S	5.5 S
DI(2-ETHYLHEXYL)ADIPATE	103-23-1	400 M	400 M	40,000 M	40,000 M	200,000 S	200,000 S
DIALLATE	2303-16-4	11 G	45 G	1,100 G	4,500 G	11,000 G	40,000 S
DIAMINOTOLUENE, 2,4-	95-80-7	0.16 G	0.68 G	16 G	68 G	160 G	680 G
DIAZINON	333-41-5	1 H	1 H	100 H	100 H	1 H	1 H
DIBENZO[A,H]ANTHRACENE	53-70-3	**[0.052]** G **0.21**	0.6 S	0.6 S	0.6 S	0.6 S	0.6 S
DIBENZOFURAN	132-64-9	35 G	97 G	3,500 G	4,500 S	3,500 G	4,500 S
DIBROMO-3-CHLOROPROPANE, 1,2-	96-12-8	0.2 M	0.2 M	20 M	20 M	20 M	20 M
DIBROMOBENZENE, 1,4-	106-37-6	350 G	970 G	20,000 S	20,000 S	350 G	970 G
DIBROMOETHANE, 1,2- (ETHYLENE DIBROMIDE)	106-93-4	0.05 M	0.05 M	5 M	5 M	5 M	5 M
DIBROMOMETHANE	74-95-3	8.4 N	35 N	840 N	3,500 N	840 N	3,500 N
DIBUTYL PHTHALATE, N-	84-74-2	3,500 G	9,700 G	350,000 G	400,000 S	400,000 S	400,000 S
DICAMBA	1918-00-9	4,000 H	4,000 H	400,000 H	400,000 H	4,000 H	4,000 H
DICHLOROACETIC ACID (HAA)	79-43-6	60 M	60 M	6,000 M	6,000 M	60 M	60 M
DICHLORO-2-BUTENE, 1,4-	764-41-0	0.012 N	0.06 N	1.2 N	6 N	0.012 N	0.06 N
DICHLORO-2-BUTENE, TRANS-1,4-	110-57-6	0.012 N	0.06 N	1.2 N	6 N	0.012 N	0.06 N
DICHLOROBENZENE, 1,2-	95-50-1	600 M	600 M	60,000 M	60,000 M	60,000 M	60,000 M
DICHLOROBENZENE, 1,3-	541-73-1	600 H	600 H	60,000 H	60,000 H	60,000 H	60,000 H
DICHLOROBENZENE, P-	106-46-7	75 M	75 M	7,500 M	7,500 M	7,500 M	7,500 M
DICHLOROBENZIDINE, 3,3'-	91-94-1	1.4 G	6 G	140 G	600 G	1,400 G	3,100 S
DICHLORODIFLUOROMETHANE (FREON 12)	75-71-8	1,000 H	1,000 H	100,000 H	100,000 H	100,000 H	100,000 H
DICHLOROETHANE, 1,1-	75-34-3	31 N	160 N	3,100 N	16,000 N	310 N	1,600 N
DICHLOROETHANE, 1,2-	107-06-2	5 M	5 M	500 M	500 M	50 M	50 M
DICHLOROETHYLENE, 1,1-	75-35-4	7 M	7 M	700 M	700 M	70 M	70 M
DICHLOROETHYLENE, CIS-1,2-	156-59-2	70 M	70 M	7,000 M	7,000 M	700 M	700 M
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	100 M	100 M	10,000 M	10,000 M	1,000 M	1,000 M
DICHLOROMETHANE (METHYLENE CHLORIDE)	75-09-2	5 M	5 M	500 M	500 M	500 M	500 M
DICHLOROPHENOL, 2,4-	120-83-2	20 H	20 H	2,000 H	2,000 H	20,000 H	20,000 H
DICHLOROPHENOXYACETIC ACID, 2,4- (2,4-D)	94-75-7	70 M	70 M	7,000 M	7,000 M	70,000 M	70,000 M
DICHLOROPROPANE, 1,2-	78-87-5	5 M	5 M	500 M	500 M	50 M	50 M
DICHLOROPROPENE, 1,3-	542-75-6	6.5 G	27 G	650 G	2,700 G	650 G	2,700 G
DICHLOROPROPIONIC ACID, 2,2- (DALAPON)	75-99-0	200 M	200 M	20,000 M	20,000 M	20,000 M	20,000 M

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Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
DICHLORVOS	62-73-7	2.2 G	9.4 G	220 G	940 G	2.2 G	9.4 G
DICYCLOPENTADIENE	77-73-6	0.63 N	2.6 N	63 N	260 N	0.63 N	2.6 N
DIELDRIN	60-57-1	0.041 G	0.17 G	4.1 G	17 G	41 G	170 S
DIETHYL PHTHALATE	84-66-2	28,000 G	78,000 G	1,100,000 S	1,100,000 S	1,100,000 S	1,100,000 S
DIFLUBENZURON	35367-38-5	200 S	200 S	200 S	200 S	200 S	200 S
DIISOPROPYL METHYLPHOSPHONATE	1445-75-6	600 H	600 H	60,000 H	60,000 H	600 H	600 H
DIMETHOATE	60-51-5	76 G	210 G	7,600 G	21,000 G	76,000 G	210,000 G
DIMETHOXYBENZIDINE, 3,3-	119-90-4	0.41 G	1.7 G	41 G	170 G	410 G	1,700 G
DIMETHRIN	70-38-2	36 S	36 S	36 S	36 S	36 S	36 S
DIMETHYLAMINOAZOBENZENE, P-	60-11-7	0.14 G	0.59 G	14 G	59 G	140 G	590 G
DIMETHYLANILINE, N,N-	121-69-7	24 G	100 G	2,400 G	10,000 G	2,400 G	10,000 G
DIMETHYLBENZIDINE, 3,3-	119-93-7	0.059 G	0.25 G	5.9 G	25 G	59 G	250 G
DIMETHYL METHYLPHOSPHONATE	756-79-6	100 H	100 H	10,000 H	10,000 H	100 H	100 H
DIMETHYLPHENOL, 2,4-	105-67-9	690 G	1,900 G	69,000 G	190,000 G	690,000 G	1,900,000 G
DINITROBENZENE, 1,3-	99-65-0	1 H	1 H	100 H	100 H	1,000 H	1,000 H
DINITROPHENOL, 2,4-	51-28-5	69 G	190 G	6,900 G	19,000 G	69,000 G	190,000 G
DINITROTOLUENE, 2,4-	121-14-2	2.1 G	8.8 G	210 G	880 G	2,100 G	8,800 G
DINITROTOLUENE, 2,6- (2,6-DNT)	606-20-2	0.43 G	1.8 G	43 G	180 G	430 G	1,800 G
DINOSEB	88-85-7	7 M	7 M	700 M	700 M	7,000 M	7,000 M
DIOXANE, 1,4-	123-91-1	6.5 G	27 G	650 G	2,700 G	65 G	270 G
DIPHENAMID	957-51-7	200 H	200 H	20,000 H	20,000 H	200 H	200 H
DIPHENYLAMINE	122-39-4	3,500 G	9,700 G	300,000 S	300,000 S	300,000 S	300,000 S
DIPHENYLHYDRAZINE, 1,2-	122-66-7	0.22 N	1.1 N	22 N	110 N	22 N	110 N
DIQUAT	**[85-00-7]** **2764-72-9**	20 M	20 M	2,000 M	2,000 M	20 M	20 M
DISULFOTON	298-04-4	0.7 H	0.7 H	70 H	70 H	700 H	700 H
DITHIANE, 1,4-	505-29-3	80 H	80 H	8,000 H	8,000 H	80 H	80 H
DIURON	330-54-1	69 G	190 G	6,900 G	19,000 G	69 G	190 G
ENDOSULFAN	115-29-7	210 G	480 S	480 S	480 S	480 S	480 S
ENDOSULFAN I (APLHA)	959-98-8	210 G	500 S	500 S	500 S	210 G	500 S
ENDOSULFAN II (BETA)	33213-65-9	210 G	450 S	450 S	450 S	210 G	450 S
ENDOSULFAN SULFATE	1031-07-8	120 S	120 S	120 S	120 S	120 S	120 S
ENDOTHALL	145-73-3	100 M	100 M	10,000 M	10,000 M	100 M	100 M

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Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
ENDRIN	72-20-8	2 M	2 M	200 M	200 M	2 M	2 M
EPICHLOROHYDRIN	106-89-8	2.1 N	8.8 N	210 N	880 N	210 N	880 N
ETHEPHON	16672-87-0	170 G	490 G	17,000 G	49,000 G	170 G	490 G
ETHION	563-12-2	17 G	49 G	850 S	850 S	17 G	49 G
ETHOXYETHANOL, 2- (EGEE)	110-80-5	**[420] 84** N	**[1,800] 350** N	**[42,000] 8,400** N	**[180,000] 35,000** N	**[42,000] 8,400** N	**[180,000] 35,000** N
ETHYL ACETATE	141-78-6	150 N	620 N	15,000 N	62,000 N	15,000 N	62,000 N
ETHYL ACRYLATE	140-88-5	**[14] 17 [G] N**	**[57] 70 [G] N**	**[1,400] 1,700 [G] N**	**[5,700] 7,000 [G] N**	**[1,400] 1,700 [G] N**	**[5,700] 7,000 [G] N**
ETHYL BENZENE	100-41-4	700 M	700 M	70,000 M	70,000 M	70,000 M	70,000 M
ETHYL DIPROPYLTHIOCARBAMATE, S- (EPTC)	759-94-4	1,700 G	4,900 G	170,000 G	370,000 S	1,700 G	4,900 G
ETHYL ETHER	60-29-7	6,900 G	19,000 G	690,000 G	1,900,000 G	6,900 G	19,000 G
ETHYL METHACRYLATE	97-63-2	630 N	2,600 N	63,000 N	260,000 N	630 N	2,600 N
ETHYLENE CHLORHYDRIN	107-07-3	690 G	1,900 G	69,000 G	190,000 G	690 G	1,900 G
ETHYLENE GLYCOL	107-21-1	14,000 H	14,000 H	1,400,000 H	1,400,000 H	1,400,000 H	1,400,000 H
ETHYLENE THIOUREA (ETU)	96-45-7	2.8 G	7.8 G	280 G	780 G	2,800 G	7,800 G
ETHYLP-NITROPHENYL PHENYLPHOSPHOROTHIOATE	2104-64-5	0.35 G	0.97 G	35 G	97 G	0.35 G	0.97 G
FENAMIPHOS	22224-92-6	0.7 H	0.7 H	70 H	70 H	0.7 H	0.7 H
FENVALERATE (PYDRIN)	51630-58-1	85 S	85 S	85 S	85 S	85 S	85 S
FLUOMETURON	2164-17-2	90 H	90 H	9,000 H	9,000 H	90 H	90 H
FLUORANTHENE	206-44-0	260 S	260 S	260 S	260 S	260 S	260 S
FLUORENE	86-73-7	1,400 G	1,900 S	1,900 S	1,900 S	1,900 S	1,900 S
FLUOROTRICHLOROMETHANE (FREON 11)	75-69-4	2,000 H	2,000 H	200,000 H	200,000 H	200,000 H	200,000 H
FONOFOS	944-22-9	10 H	10 H	1,000 H	1,000 H	10 H	10 H
FORMALDEHYDE	50-00-0	1,000 H	1,000 H	100,000 H	100,000 H	100,000 H	100,000 H
FORMIC ACID	64-18-6	0.63 N	2.6 N	63 N	260 N	6.3 N	26 N
FOSETYL-AL	39148-24-8	87,000 G	240,000 G	8,700,000 G	24,000,000 G	87,000 G	240,000 G
FURAN	110-00-9	35 G	97 G	3,500 G	9,700 G	3,500 G	9,700 G
FURFURAL	98-01-1	19 G	78 G	1,900 G	7,800 G	19 G	78 G
GLYPHOSATE	1071-83-6	700 M	700 M	70,000 M	70,000 M	700 M	700 M

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Table 1—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater

Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
HEPTACHLOR	76-44-8	0.4 M	0.4 M	40 M	40 M	180 S	180 S
HEPTACHLOR EPOXIDE	1024-57-3	0.2 M	0.2 M	20 M	20 M	200 M	200 M
HEXACHLOROBENZENE	118-74-1	1 M	1 M	6 S	6 S	6 S	6 S
HEXACHLOROBUTADIENE	87-68-3	8.4 G	35 G	840 G	2,900 S	2,900 S	2,900 S
HEXACHLOROCYCLOPENTADIENE	77-47-4	50 M	50 M	1,800 S	1,800 S	1,800 S	1,800 S
HEXACHLOROETHANE	67-72-1	1 H	1 H	100 H	100 H	100 H	100 H
HEXAFLUOROPROPYLENE OXIDE (HFPO) DIMER ACID (GEN-X)	**13252-13-6**	**0.01 H**	**0.01 H**	**1 H**	**1 H**	**0.01 H**	**0.01 H**
HEXAFLUOROPROPYLENE OXIDE (HFPO) DIMER ACID AMMONIUM SALT (GEN-X)	**62037-80-3**	**0.01 H**	**0.01 H**	**1 H**	**1 H**	**0.01 H**	**0.01 H**
HEXANE	110-54-3	1,500 N	5,800 G	9,500 S	9,500 S	1,500 N	5,800 G
HEXAZINONE	51235-04-2	400 H	400 H	40,000 H	40,000 H	400 H	400 H
HEXYTHIAZOX (SAVEY)	78587-05-0	500 S	500 S	500 S	500 S	500 S	500 S
HMX	2691-41-0	400 H	400 H	5,000 S	5,000 S	400 H	400 H
HYDRAZINE/HYDRAZINE SULFATE	302-01-2	0.01 N	0.051 N	1 N	5.1 N	0.1 N	0.51 N
HYDROQUINONE	123-31-9	11 G	45 G	1,100 G	4,500 G	11,000 G	45,000 G
INDENO[1,2,3-CD]PYRENE	193-39-5	**[0.18] 2.1** G	**[2.3] 27** G	**[18] 62 [G] S**	62 S	62 S	62 S
IPRODIONE	36734-19-7	15 G	62 G	1,500 G	6,200 G	15 G	62 G
ISOBUTYL ALCOHOL	78-83-1	10,000 G	29,000 G	1,000,000 G	2,900,000 G	1,000,000 G	2,900,000 G
ISOPHORONE	78-59-1	100 H	100 H	10,000 H	10,000 H	100,000 H	100,000 H
ISOPROPYL METHYLPHOSPHONATE	1832-54-8	700 H	700 H	70,000 H	70,000 H	700 H	700 H
KEPONE	143-50-0	0.065 G	0.27 G	6.5 G	27 G	65 G	270 G
MALATHION	121-75-5	500 H	500 H	50,000 H	50,000 H	140,000 S	140,000 S
MALEIC HYDRAZIDE	123-33-1	4,000 H	4,000 H	400,000 H	400,000 H	4,000 H	4,000 H
MANEB	12427-38-2	11 G	45 G	1,100 G	4,500 G	11 G	45 G
MERPHOS OXIDE	78-48-8	17 G	49 G	1,700 G	2,300 S	17 G	49 G
METHACRYLONITRILE	126-98-7	3.5 G	9.7 G	350 G	970 G	3.5 G	9.7 G
METHAMIDOPHOS	10265-92-6	1.7 G	4.9 G	170 G	490 G	1.7 G	4.9 G
METHANOL	67-56-1	42,000 N	180,000 N	4,200,000 N	18,000,000 N	4,200,000 N	18,000,000 N
METHOMYL	16752-77-5	200 H	200 H	20,000 H	20,000 H	200 H	200 H
METHOXYCHLOR	72-43-5	40 M	40 M	45 S	45 S	45 S	45 S

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		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
METHOXYETHANOL, 2-	109-86-4	**[42] 15** N	**[180] 62** N	**[4,200] 1,500** N	**[18,000] 6,200** N	**[420] 150** N	**[1,800] 620** N
METHYL ACETATE	79-20-9	35,000 G	97,000 G	3,500,000 G	9,700,000 G	35,000 G	97,000 G
METHYL ACRYLATE	96-33-3	42 N	180 N	4,200 N	18,000 N	4,200 N	18,000 N
METHYL CHLORIDE	74-87-3	30 H	30 H	3,000 H	3,000 H	3,000 H	3,000 H
METHYL ETHYL KETONE	78-93-3	4,000 H	4,000 H	400,000 H	400,000 H	400,000 H	400,000 H
METHYL HYDRAZINE	60-34-4	0.042 N	0.18 N	4.2 N	18 N	0.42 N	1.8 N
METHYL ISOBUTYL KETONE	108-10-1	**[2,800] 6,300 [G] N**	**[7,800] 26,000 [G] N**	**[280,000] 630,000 [G] N**	**[780,000] 2,600,000 [G] N**	**[280,000] 630,000 [G] N**	**[780,000] 2,600,000 [G] N**
METHYL ISOCYANATE	624-83-9	2.1 N	8.8 N	210 N	880 N	2.1 N	8.8 N
METHYL N-BUTYL KETONE	591-78-6	63 N	260 N	6,300 N	26,000 N	63 N	260 N
METHYL METHACRYLATE	80-62-6	1,500 N	6,200 N	150,000 N	620,000 N	150,000 N	620,000 N
METHYL METHANESULFONATE	66-27-3	6.6 G	27 G	660 G	2,700 G	6.6 G	27 G
METHYL PARATHION	298-00-0	1 H	1 H	100 H	100 H	1,000 H	1,000 H
METHYL STYRENE (MIXED ISOMERS)	25013-15-4	84 N	350 N	8,400 N	35,000 N	84 N	350 N
METHYL TERT-BUTYL ETHER (MTBE)	1634-04-4	20	20	2,000	2,000	200	200
METHYLCHLOROPHENOXYACETIC ACID (MCPA)	94-74-6	30 H	30 H	3,000 H	3,000 H	30,000 H	30,000 H
METHYLENE BIS(2-CHLOROANILINE), 4,4'-	101-14-4	2.1 G	27 G	210 G	2,700 G	2.1 G	27 G
METHYLNAPHTHALENE, 2-	91-57-6	6.3 N	26 N	630 N	2,600 N	6.3 N	26 N
METHYLSTYRENE, ALPHA	98-83-9	2,400 G	6,800 G	240,000 G	560,000 S	2,400 G	6,800 G
METOLACHLOR	51218-45-2	700 H	700 H	70,000 H	70,000 H	700 H	700 H
METRIBUZIN	21087-64-9	70 H	70 H	7,000 H	7,000 H	70 H	70 H
MEVINPHOS	7786-34-7	0.87 G	2.4 G	87 G	240 G	0.87 G	2.4 G
MONOCHLOROACETIC ACID (HAA)	79-11-8	60 **[H] M**	60 **[H] M**	6,000 **[H] M**	6,000 **[H] M**	60 **[H] M**	60 **[H] M**
NAPHTHALENE	91-20-3	100 H	100 H	10,000 H	10,000 H	10,000 H	10,000 H
NAPHTHYLAMINE, 1-	134-32-7	0.36 G	1.5 G	36 G	150 G	36 G	150 G
NAPHTHYLAMINE, 2-	91-59-8	0.36 G	1.5 G	36 G	150 G	360 G	1,500 G
NAPROPAMIDE	15299-99-7	4,200 G	12,000 G	70,000 S	70,000 S	4,200 G	12,000 G
NITROANILINE, O-	88-74-4	0.11 N	0.44 N	11 N	44 N	0.11 N	0.44 N

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		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
NITROANILINE, P-	100-01-6	33 G	140 G	3,300 G	14,000 G	33 G	140 G
NITROBENZENE	98-95-3	1.2 N	6.3 N	120 N	630 N	120 N	630 N
NITROGUANIDINE	556-88-7	700 H	700 H	70,000 H	70,000 H	700 H	700 H
NITROPHENOL, 2-	88-75-5	280 G	780 G	28,000 G	78,000 G	28,000 G	78,000 G
NITROPHENOL, 4-	100-02-7	60 H	60 H	6,000 H	6,000 H	6,000 H	6,000 H
NITROPROPANE, 2-	79-46-9	**[0.018] 0.084** N	**[0.093] 0.43** N	**[1.8] 8.4** N	**[9.3] 43** N	**[0.18] 0.84** N	**[0.93] 4.3** N
NITROSODIETHYLAMINE, N-	55-18-5	0.00045 N	0.0058 N	0.045 N	0.58 N	0.0045 N	0.058 N
NITROSODIMETHYLAMINE, N-	62-75-9	0.0014 N	0.018 N	0.14 N	1.8 N	0.014 N	0.18 N
NITROSO-DI-N-BUTYLAMINE, N-	924-16-3	0.031 N	0.16 N	3.1 N	16 N	3.1 N	16 N
NITROSODI-N-PROPYLAMINE, N-	621-64-7	0.025 N	0.13 N	2.5 N	13 N	0.25 N	1.3 N
NITROSODIPHENYLAMINE, N-	86-30-6	19 N	96 N	1,900 N	9,600 N	1,900 N	9,600 N
NITROSO-N-ETHYLUREA, N-	759-73-9	0.0079 G	0.1 G	0.79 G	10 G	7.9 G	100 G
OCTYL PHTHALATE, DI-N-	117-84-0	350 G	970 G	3,000 S	3,000 S	3,000 S	3,000 S
OXAMYL (VYDATE)	23135-22-0	200 M	200 M	20,000 M	20,000 M	200 M	200 M
PARAQUAT	1910-42-5	30 H	30 H	3,000 H	3,000 H	30 H	30 H
PARATHION	56-38-2	1 G	2.9 G	100 G	290 G	1 G	2.9 G
PCBS, TOTAL (POLYCHLORINATED BIPHENYLS) (AROCLORS)	1336-36-3	0.5 M	0.5 M	50 M	50 M	0.5 M	0.5 M
PCB-1016 (AROCLOR)	12674-11-2	2.4 G	6.8 G	240 G	250 S	2.4 G	6.8 G
PCB-1221 (AROCLOR)	11104-28-2	0.33 G	1.4 G	33 G	140 G	0.33 G	1.4 G
PCB-1232 (AROCLOR)	11141-16-5	0.33 G	1.4 G	33 G	140 G	0.33 G	1.4 G
PCB-1242 (AROCLOR)	53469-21-9	0.33 G	1.4 G	33 G	100 S	0.33 G	1.4 G
PCB-1248 (AROCLOR)	12672-29-6	0.33 G	1.4 G	33 G	54 S	0.33 G	1.4 G
PCB-1254 (AROCLOR)	11097-69-1	0.69 G	1.9 G	57 S	57 S	0.69 G	1.9 G
PCB-1260 (AROCLOR)	11096-82-5	0.33 G	1.4 G	33 G	80 S	0.33 G	1.4 G
PEBULATE	1114-71-2	**[1,700] 24** G	**[4,900] 68** G	**[92,000] 2,400 [S] G**	**[92,000] 6,800 [S] G**	**[1,700] 24** G	**[4,900] 68** G
PENTACHLOROBENZENE	608-93-5	28 G	78 G	740 S	740 S	740 S	740 S
PENTACHLOROETHANE	76-01-7	7.2 G	30 G	720 G	3,000 G	7.2 G	30 G
PENTACHLORONITROBENZENE	82-68-8	2.5 G	10 G	250 G	440 S	440 S	440 S
PENTACHLOROPHENOL	87-86-5	1 M	1 M	100 M	100 M	1,000 M	1,000 M

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THMs—The values listed for trihalomethanes (THMs) are the total for all THMs combined.
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Appendix A

Table 1—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater

Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
PERFLUOROBUTANE SULFONATE (PFBS)	375-73-5	**[10] 2 [G] H**	**[29] 2 [G] H**	**[1,000] 200 [G] H**	**[2,900] 200 [G] H**	**[10] 2 [G] H**	**[29] 2 [G] H**
PERFLUOROBUTANOIC ACID (PFBA)	**375-22-4**	**35 G**	**97 G**	**3,500 G**	**9,700 G**	**35 G**	**97 G**
PERFLUOROHEXANOIC ACID (PFHxA)	**307-24-4**	**17 G**	**49 G**	**1,700 G**	**4,900 G**	**17 G**	**49 G**
PERFLUOROOCTANE SULFONATE (PFOS)	1763-23-1	**[0.07] 0.018 [H] M**	**[0.07] 0.018 [H] M**	**[7] 1.8 [H] M**	**[7] 1.8 [H] M**	**[0.07] 0.018 [H] M**	**[0.07] 0.018 [H] M**
PERFLUOROOCTANOIC ACID (PFOA)	335-67-1	**[0.07] 0.014 [H] M**	**[0.07] 0.014 [H] M**	**[7] 1.4 [H] M**	**[7] 1.4 [H] M**	**[0.07] 0.014 [H] M**	**[0.07] 0.014 [H] M**
PHENACETIN	62-44-2	300 G	1,200 G	30,000 G	120,000 G	300,000 G	760,000 S
PHENANTHRENE	85-01-8	1,100 S	1,100 S	1,100 S	1,100 S	1,100 S	1,100 S
PHENOL	108-95-2	2,000 H	2,000 H	200,000 H	200,000 H	200,000 H	200,000 H
PHENYL MERCAPTAN	108-98-5	35 G	97 G	3,500 G	9,700 G	35 G	97 G
PHENYLENEDIAMINE, M-	108-45-2	210 G	580 G	21,000 G	58,000 G	210,000 G	580,000 G
PHENYLPHENOL, 2-	90-43-7	340 G	1,400 G	34,000 G	140,000 G	340,000 G	700,000 S
PHORATE	298-02-2	**[6.9] 5.9** G	**[19] 17** G	**[690] 590** G	**[1,900] 1,700** G	**[6.9] 5.9** G	**[19] 17** G
PHTHALIC ANHYDRIDE	85-44-9	42 N	180 N	4,200 N	18,000 N	4,200 N	18,000 N
PICLORAM	1918-02-1	500 M	500 M	50,000 M	50,000 M	500 M	500 M
POTASSIUM PERFLUOROBUTANE SULFONATE	**29420-49-3**	**2 H**	**2 H**	**200 H**	**200 H**	**2 H**	**2 H**
PROMETON	1610-18-0	400 H	400 H	40,000 H	40,000 H	400 H	400 H
PRONAMIDE	23950-58-5	2,600 G	7,300 G	15,000 S	15,000 S	2,600 G	7,300 G
PROPACHLOR	1918-16-7	0.1 H	0.1 H	10 H	10 H	10 H	10 H
PROPANIL	709-98-8	170 G	490 G	17,000 G	49,000 G	170 G	490 G
PROPANOL, 2- (ISOPROPYL ALCOHOL)	67-63-0	420 N	1,800 N	42,000 N	180,000 N	420 N	1,800 N
PROPAZINE	139-40-2	10 H	10 H	1,000 H	1,000 H	10 H	10 H
PROPHAM	122-42-9	100 H	100 H	10,000 H	10,000 H	100 H	100 H
PROPYLBENZENE, N-	103-65-1	2,100 N	8,800 N	52,000 S	52,000 S	2,100 N	8,800 N
PROPYLENE OXIDE	75-56-9	2.7 G	11 G	270 G	1,100 G	2.7 G	11 G
PYRENE	129-00-0	130 S	130 S	130 S	130 S	130 S	130 S
PYRETHRUM	8003-34-7	350 S	350 S	350 S	350 S	350 S	350 S
PYRIDINE	110-86-1	35 G	97 G	3,500 G	9,700 G	350 G	970 G

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Appendix A

Table 1—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Groundwater

Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
QUINOLINE	91-22-5	0.22 G	0.91 G	22 G	91 G	220 G	910 G
QUIZALOFOP (ASSURE)	76578-14-8	300 S	300 S	300 S	300 S	300 S	300 S
RDX	121-82-4	2 H	2 H	200 H	200 H	2 H	2 H
RESORCINOL	108-46-3	69,000 G	190,000 G	6,900,000 G	19,000,000 G	69,000 G	190,000 G
RONNEL	299-84-3	1,700 G	4,900 G	40,000 S	40,000 S	1,700 G	4,900 G
SIMAZINE	122-34-9	4 M	4 M	400 M	400 M	4 M	4 M
STRYCHNINE	57-24-9	10 G	29 G	1,000 G	2,900 G	10,000 G	29,000 G
STYRENE	100-42-5	100 M	100 M	10,000 M	10,000 M	10,000 M	10,000 M
TEBUTHIURON	34014-18-1	500 H	500 H	50,000 H	50,000 H	500 H	500 H
TERBACIL	5902-51-2	90 H	90 H	9,000 H	9,000 H	90 H	90 H
TERBUFOS	13071-79-9	0.4 H	0.4 H	40 H	40 H	0.4 H	0.4 H
TETRACHLOROBENZENE, 1,2,4,5-	95-94-3	**[10] 1** G	**[29] 2.9** G	**[580] 100 [S] G**	**[580] 290 [S] G**	580 S	580 S
TETRACHLORODIBENZO-P-DIOXIN, 2,3,7,8- (TCDD)	1746-01-6	0.00003 M	0.00003 M	0.003 M	0.003 M	0.019 S	0.019 S
TETRACHLOROETHANE, 1,1,1,2-	630-20-6	70 H	70 H	7,000 H	7,000 H	7,000 H	7,000 H
TETRACHLOROETHANE, 1,1,2,2-	79-34-5	0.84 N	4.3 N	84 N	430 N	84 N	430 N
TETRACHLOROETHYLENE (PCE)	127-18-4	5 M	5 M	500 M	500 M	50 M	50 M
TETRACHLOROPHENOL, 2,3,4,6-	58-90-2	1,000 G	2,900 G	100,000 G	180,000 S	180,000 S	180,000 S
TETRAETHYL LEAD	78-00-2	0.0035 G	0.0097 G	0.35 G	0.97 G	3.5 G	9.7 G
TETRAETHYLDITHIOPYROPHOSPHATE	3689-24-5	17 G	49 G	1,700 G	4,900 G	17 G	49 G
TETRAHYDROFURAN	109-99-9	25 N	130 N	2,500 N	13,000 N	25 N	130 N
THIOFANOX	39196-18-4	10 G	29 G	1,000 G	2,900 G	10 G	29 G
THIRAM	137-26-8	520 G	1,500 G	30,000 S	30,000 S	520 G	1,500 G
TOLUENE	108-88-3	1,000 M	1,000 M	100,000 M	100,000 M	100,000 M	100,000 M
TOLUIDINE, M-	108-44-1	41 G	170 G	4,100 G	17,000 G	41 G	170 G
TOLUIDINE, O	95-53-4	41 G	170 G	4,100 G	17,000 G	41,000 G	170,000 G
TOLUIDINE, P-	106-49-0	22 G	91 G	2,200 G	9,100 G	22 G	91 G
TOXAPHENE	8001-35-2	3 M	3 M	300 M	300 M	3 M	3 M
TRIALLATE	2303-17-5	**[0.91] 9.1** G	**[3.8] 38** G	**[91] 910** G	**[380] 3,800** G	**[0.91] 9.1** G	**[3.8] 38** G
TRIBROMOMETHANE (BROMOFORM) (THM)	75-25-2	80 M	80 M	8,000 M	8,000 M	8,000 M	8,000 M
TRICHLORO-1,2,2-TRIFLUOROETHANE, 1,1,2-	76-13-1	11,000 N	44,000 N	170,000 S	170,000 S	170,000 S	170,000 S

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Regulated Substance	*CASRN*	*Used Aquifers*				*Nonuse Aquifers*	
		TDS ≤ 2500 mg/L		*TDS > 2500 mg/L*			
		R	*NR*	*R*	*NR*	*R*	*NR*
TRICHLOROACETIC ACID (HAA)	76-03-9	60 M	60 M	6,000 M	6,000 M	60 M	60 M
TRICHLOROBENZENE, 1,2,4-	120-82-1	70 M	70 M	7,000 M	7,000 M	7,000 M	7,000 M
TRICHLOROBENZENE, 1,3,5-	108-70-3	40 H	40 H	4,000 H	4,000 H	40 H	40 H
TRICHLOROETHANE, 1,1,1-	71-55-6	200 M	200 M	20,000 M	20,000 M	2,000 M	2,000 M
TRICHLOROETHANE, 1,1,2-	79-00-5	5 M	5 M	500 M	500 M	50 M	50 M
TRICHLOROETHYLENE (TCE)	79-01-6	5 M	5 M	500 M	500 M	50 M	50 M
TRICHLOROPHENOL, 2,4,5-	95-95-4	3,500 G	9,700 G	350,000 G	970,000 G	1,000,000 S	1,000,000 S
TRICHLOROPHENOL, 2,4,6-	88-06-2	35 G	97 G	3,500 G	9,700 G	35,000 G	97,000 G
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	93-76-5	70 H	70 H	7,000 H	7,000 H	70,000 H	70,000 H
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)	93-72-1	50 M	50 M	5,000 M	5,000 M	50 M	50 M
TRICHLOROPROPANE, 1,1,2-	598-77-6	170 G	490 G	17,000 G	49,000 G	170 G	490 G
TRICHLOROPROPANE, 1,2,3-	96-18-4	**[40] <u>0.0071</u> [H] <u>G</u>**	**[40] <u>0.091</u> [H] <u>G</u>**	**[4,000] <u>0.71</u> [H] <u>G</u>**	**[4,000] <u>9.1</u> [H] <u>G</u>**	**[4,000] <u>0.71</u> [H] <u>G</u>**	**[4,000] <u>9.1</u> [H] <u>G</u>**
TRICHLOROPROPENE, 1,2,3-	96-19-5	0.63 N	2.6 N	63 N	260 N	0.63 N	2.6 N
TRIETHYLAMINE	121-44-8	15 N	62 N	1,500 N	6,200 N	15 N	62 N
TRIETHYLENE GLYCOL	112-27-6	69,000 G	190,000 G	6,900,000 G	19,000,000 G	69,000 G	190,000 G
TRIFLURALIN	1582-09-8	10 H	10 H	1,000 H	1,000 H	10 H	10 H
TRIMETHYLBENZENE, 1,3,4- (TRIMETHYLBENZENE, 1,2,4-)	95-63-6	130 N	530 N	13,000 N	53,000 N	13,000 N	53,000 N
TRIMETHYLBENZENE, 1,3,5-	108-67-8	130 N	530 N	13,000 N	49,000 S	130 N	530 N
TRINITROGLYCEROL (NITROGLYCERIN)	55-63-0	5 H	5 H	500 H	500 H	500 H	500 H
TRINITROTOLUENE, 2,4,6-	118-96-7	2 H	2 H	200 H	200 H	2 H	2 H
VINYL ACETATE	108-05-4	420 N	1,800 N	42,000 N	180,000 N	420 N	1,800 N
VINYL BROMIDE (BROMOETHENE)	593-60-2	**[1.5] <u>3.3</u>** N	**[7.8] <u>17</u>** N	**[150] <u>330</u>** N	**[780] <u>1,700</u>** N	**[15] <u>33</u>** N	**[78] <u>170</u>** N
VINYL CHLORIDE	75-01-4	2 M	2 M	200 M	200 M	20 M	20 M
WARFARIN	81-81-2	10 G	29 G	1,000 G	2,900 G	10,000 G	17,000 S
XYLENES (TOTAL)	1330-20-7	10,000 M	10,000 M	180,000 S	180,000 S	180,000 S	180,000 S
ZINEB	12122-67-7	1,700 G	4,900 G	10,000 S	10,000 S	1,700 G	4,900 G

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Appendix A
Table 3—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Soil
A. Direct Contact Numeric Values

REGULATED SUBSTANCE	*CASRN*	*Residential 0—15 feet*		*Nonresidential*			
				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
ACENAPHTHENE	83-32-9	13,000	G	190,000	C	190,000	C
ACENAPHTHYLENE	208-96-8	13,000	G	190,000	C	190,000	C
ACEPHATE	30560-19-1	260	G	3,800	G	190,000	C
ACETALDEHYDE	75-07-0	170	N	710	N	820	N
ACETONE	67-64-1	10,000	C	10,000	C	10,000	C
ACETONITRILE	75-05-8	1,100	N	4,700	N	5,500	N
ACETOPHENONE	98-86-2	10,000	C	10,000	C	10,000	C
ACETYLAMINOFLUORENE, 2- (2AAF)	53-96-3	4.9	G	24	G	190,000	C
ACROLEIN	107-02-8	0.38	N	1.6	N	1.8	N
ACRYLAMIDE	79-06-1	1.7	N	22	N	25	N
ACRYLIC ACID	79-10-7	**[19] 3.8**	N	**[79] 16**	N	**[91] 18**	N
ACRYLONITRILE	107-13-1	6.5	N	33	N	37	N
ALACHLOR	15972-60-8	330	G	1,600	G	190,000	C
ALDICARB	116-06-3	220	G	3,200	G	190,000	C
ALDICARB SULFONE	1646-88-4	220	G	3,200	G	190,000	C
ALDICARB SULFOXIDE	1646-87-3	220	G	3,200	G	190,000	C
ALDRIN	309-00-2	1.1	G	5.4	G	190,000	C
ALLYL ALCOHOL	107-18-6	1.9	N	7.9	N	9.1	N
AMETRYN	834-12-8	2,000	G	29,000	G	190,000	C
AMINOBIPHENYL, 4-	92-67-1	0.89	G	4.3	G	190,000	C
AMITROLE	61-82-5	20	G	97	G	190,000	C
AMMONIA	7664-41-7	9,600	N	10,000	C	10,000	C
AMMONIUM SULFAMATE	7773-06-0	44,000	G	190,000	C	190,000	C
ANILINE	62-53-3	19	N	79	N	90	N
ANTHRACENE	120-12-7	66,000	G	190,000	C	190,000	C
ATRAZINE	1912-24-9	81	G	400	G	190,000	C
AZINPHOS-METHYL (GUTHION)	86-50-0	330	G	4,800	G	190,000	C
BAYGON (PROPOXUR)	114-26-1	880	G	13,000	G	190,000	C
BENOMYL	17804-35-2	7,800	G	38,000	G	190,000	C
BENTAZON	25057-89-0	6,600	G	96,000	G	190,000	C
BENZENE	71-43-2	57	N	280	N	330	N
BENZIDINE	92-87-5	0.018	G	0.4	G	190,000	C
BENZO[A]ANTHRACENE	56-55-3	**[6.1] 42**	G	**[130] 910**	G	190,000	C
BENZO[A]PYRENE	50-32-8	4.2	G	91	G	190,000	C
BENZO[B]FLUORANTHENE	205-99-2	**[3.5] 42**	G	**[76] 910**	G	190,000	C
BENZO[GHI]PERYLENE	191-24-2	13,000	G	190,000	C	190,000	C
BENZO[K]FLUORANTHENE	207-08-9	**[3.5] 420**	G	**[76] 9,100**	G	190,000	C
BENZOIC ACID	65-85-0	190,000	C	190,000	C	190,000	C
BENZOTRICHLORIDE	98-07-7	1.4	G	7	G	10,000	C
BENZYL ALCOHOL	100-51-6	10,000	C	10,000	C	10,000	C
BENZYL CHLORIDE	100-44-7	9	N	45	N	52	N
BETA PROPIOLACTONE	57-57-8	0.11	N	0.55	N	0.63	N
BHC, ALPHA	319-84-6	3	G	14	G	190,000	C
BHC, BETA-	319-85-7	10	G	51	G	190,000	C
BHC, GAMMA (LINDANE)	58-89-9	**[17] 2.2**	G	**[83] 32**	G	190,000	C
BIPHENYL, 1,1-	92-52-4	8.2	N	34	N	40	N
BIS(2-CHLOROETHOXY)METHANE	111-91-1	660	G	9,600	G	10,000	C
BIS(2-CHLOROETHYL)ETHER	111-44-4	1.3	N	6.7	N	7.6	N
BIS(2-CHLORO-ISOPROPYL)ETHER	108-60-1	**[44] 8,800**	**[N] G**	**[220] 10,000**	**[N] C**	**[250] 10,000**	**[N] C**
BIS(CHLOROMETHYL)ETHER	542-88-1	0.0071	N	0.036	N	0.041	N

All concentrations in mg/kg
G—Ingestion
N—Inhalation
C—Cap

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				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
BIS[2-ETHYLHEXYL] PHTHALATE	117-81-7	1,300	G	6,500	G	10,000	C
BISPHENOL A	80-05-7	11,000	G	160,000	G	190,000	C
BROMACIL	314-40-9	22,000	G	190,000	C	190,000	C
BROMOBENZENE	108-86-1	1,100	N	4,700	N	5,400	N
BROMOCHLOROMETHANE	74-97-5	760	N	3,200	N	3,600	N
BROMODICHLOROMETHANE	75-27-4	12	N	60	N	69	N
BROMOMETHANE	74-83-9	95	N	400	N	460	N
BROMOXYNIL	1689-84-5	180	G	880	G	190,000	C
BROMOXYNIL OCTANOATE	1689-99-2	180	G	880	G	190,000	C
BUTADIENE, 1,3-	106-99-0	15	N	74	N	85	N
BUTYL ALCOHOL, N-	71-36-3	10,000	C	10,000	C	10,000	C
BUTYLATE	2008-41-5	10,000	C	10,000	C	10,000	C
BUTYLBENZENE, N-	104-51-8	10,000	C	10,000	C	10,000	C
BUTYLBENZENE, SEC-	135-98-8	10,000	C	10,000	C	10,000	C
BUTYLBENZENE, TERT-	98-06-6	10,000	C	10,000	C	10,000	C
BUTYLBENZYL PHTHALATE	85-68-7	9,800	G	10,000	C	10,000	C
CAPTAN	133-06-2	8,100	G	40,000	G	190,000	C
CARBARYL	63-25-2	22,000	G	190,000	C	190,000	C
[CARBAZOLE]	**[86-74-8]**	**[930]**	**[G]**	**[4,600]**	**[G]**	**[190,000]**	**[C]**
CARBOFURAN	1563-66-2	1,100	G	16,000	G	190,000	C
CARBON DISULFIDE	75-15-0	10,000	C	10,000	C	10,000	C
CARBON TETRACHLORIDE	56-23-5	75	N	370	N	430	N
CARBOXIN	5234-68-4	22,000	G	190,000	C	190,000	C
CHLORAMBEN	133-90-4	3,300	G	48,000	G	190,000	C
CHLORDANE	57-74-9	53	G	260	G	190,000	C
CHLORO-1,1-DIFLUOROETHANE, 1-	75-68-3	10,000	C	10,000	C	10,000	C
CHLORO-1-PROPENE, 3- (ALLYL CHLORIDE)	107-05-1	19	N	80	N	92	N
CHLOROACETALDEHYDE	107-20-0	69	G	340	G	10,000	C
CHLOROACETOPHENONE, 2-	532-27-4	190,000	C	190,000	C	190,000	C
CHLOROANILINE, P-	106-47-8	93	G	460	G	190,000	C
CHLOROBENZENE	108-90-7	950	N	3,900	N	4,500	N
CHLOROBENZILATE	510-15-6	170	G	830	G	190,000	C
CHLOROBUTANE, 1-	109-69-3	8,800	G	10,000	C	10,000	C
CHLORODIBROMOMETHANE	124-48-1	220	G	1,100	G	10,000	C
CHLORODIFLUOROMETHANE	75-45-6	10,000	C	10,000	C	10,000	C
CHLOROETHANE	75-00-3	10,000	C	10,000	C	10,000	C
CHLOROFORM	67-66-3	19	N	96	N	110	N
CHLORONAPHTHALENE, 2-	91-58-7	18,000	G	190,000	C	190,000	C
CHLORONITROBENZENE, P-	100-00-5	39	N	160	N	180	N
CHLOROPHENOL, 2-	95-57-8	1,100	G	10,000	C	10,000	C
CHLOROPRENE	126-99-8	1.5	N	7.4	N	8.5	N
[CHLOROPROPANE, 2-]	**[75-29-6]**	**[1,900]**	**[N]**	**[7,900]**	**[N]**	**[9,100]**	**[N]**
CHLOROTHALONIL	1897-45-6	1,100	G	5,400	G	190,000	C
CHLOROTOLUENE, O-	95-49-8	4,400	G	10,000	C	10,000	C
CHLOROTOLUENE, P-	106-43-4	4,400	C	10,000	C	10,000	C
CHLORPYRIFOS	2921-88-2	220	G	3,200	G	190,000	C
CHLORSULFURON	64902-72-3	**[4,400]** **11,000**	G	**[64,000]** **160,000**	G	190,000	C
CHLORTHAL-DIMETHYL (DACTHAL) (DCPA)	1861-32-1	2,200	G	32,000	G	190,000	C
CHRYSENE	218-01-9	**[35]** **4,200**	G	**[760]** **91,000**	G	190,000	C

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Appendix A
Table 3—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Soil
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REGULATED SUBSTANCE	*CASRN*	*Residential 0—15 feet*		*Nonresidential*			
				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
CRESOL(S)	1319-77-3	10,000	C	10,000	C	10,000	C
CRESOL, 4,6-DINITRO-O-	534-52-1	18	G	260	G	190,000	C
CRESOL, O- (2-METHYLPHENOL)	95-48-7	11,000	G	160,000	G	190,000	C
CRESOL, M- (3-METHYLPHENOL)	108-39-4	10,000	C	10,000	C	10,000	C
CRESOL, P- (4-METHYLPHENOL)	106-44-5	**[1,100] 4,400**	G	**[16,000] 64,000**	G	190,000	C
CRESOL, P-CHLORO-M-	59-50-7	22,000	G	190,000	G	190,000	C
CROTONALDEHYDE	4170-30-3	**[9.8] 220**	G	**[48] 3,200**	G	10,000	C
CROTONALDEHYDE, TRANS-	123-73-9	**[9.8] 220**	G	**[48] 3,200**	G	10,000	C
CUMENE (ISOPROPYL BENZENE)	98-82-8	7,600	N	10,000	C	10,000	C
CYANAZINE	21725-46-2	**[22] 440**	G	**[110] 6,400**	G	190,000	C
CYCLOHEXANE	110-82-7	10,000	C	10,000	C	10,000	C
CYCLOHEXANONE	108-94-1	10,000	C	10,000	C	10,000	C
CYFLUTHRIN	68359-37-5	5,500	G	80,000	G	190,000	C
CYROMAZINE	66215-27-8	110,000	G	190,000	C	190,000	C
DDD, 4,4'-	72-54-8	78	G	380	G	190,000	C
DDE, 4,4'-	72-55-9	55	G	270	G	190,000	C
DDT, 4,4'-	50-29-3	55	G	270	G	190,000	C
DI(2-ETHYLHEXYL)ADIPATE	103-23-1	10,000	C	10,000	C	10,000	C
DIALLATE	2303-16-4	300	G	1,500	G	10,000	C
DIAMINOTOLUENE, 2,4-	95-80-7	4.7	G	23	G	190,000	C
DIAZINON	333-41-5	150	G	2,200	G	10,000	C
DIBENZO[A,H]ANTHRACENE	53-70-3	**[1] 4.2**	G	**[22] 91**	G	190,000	C
DIBENZOFURAN	132-64-9	220	G	3,200	G	190,000	C
DIBROMO-3-CHLOROPROPANE, 1,2-	96-12-8	0.029	N	0.37	N	0.42	N
DIBROMOBENZENE, 1,4-	106-37-6	2,200	G	32,000	G	190,000	C
DIBROMOETHANE, 1,2- (ETHYLENE DIBROMIDE)	106-93-4	0.74	N	3.7	N	4.2	N
DIBROMOMETHANE	74-95-3	76	N	310	N	360	N
DIBUTYL PHTHALATE, N-	84-74-2	10,000	C	10,000	C	10,000	C
DICAMBA	1918-00-9	6,600	G	96,000	G	190,000	C
DICHLOROACETIC ACID	76-43-6	370	G	1,800	G	10,000	C
DICHLORO-2-BUTENE, 1,4-	764-41-0	0.11	N	0.52	N	0.6	N
DICHLORO-2-BUTENE, TRANS-1,4-	110-57-6	0.11	N	0.52	N	0.6	N
DICHLOROBENZENE, 1,2-	95-50-1	**[3,800] 10,000**	**[N] C**	10,000	C	10,000	C
DICHLOROBENZENE, 1,3-	541-73-1	10,000	C	10,000	C	10,000	C
DICHLOROBENZENE, P-	106-46-7	40	N	200	N	230	N
DICHLOROBENZIDINE, 3,3'-	91-94-1	41	G	200	G	190,000	C
DICHLORODIFLUOROMETHANE (FREON 12)	75-71-8	1,900	N	8,000	N	9,100	N
DICHLOROETHANE, 1,1-	75-34-3	280	N	1,400	N	1,600	N
DICHLOROETHANE, 1,2-	107-06-2	17	N	85	N	98	N
DICHLOROETHYLENE, 1,1-	75-35-4	3,800	N	10,000	C	10,000	C
DICHLOROETHYLENE, CIS-1,2-	156-59-2	440	G	6,400	G	10,000	C
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	**[4,400] 760**	**[G] N**	**[10,000] 3,200**	**[C] N**	**[10,000] 3,600**	**[C] N**
DICHLOROMETHANE (METHYLENE CHLORIDE)	75-09-2	1,300	G	10,000	C	10,000	C
DICHLOROPHENOL, 2,4-	120-83-2	660	G	9,600	G	190,000	C
DICHLOROPHENOXYACETIC ACID, 2,4- (2,4-D)	94-75-7	2,200	G	32,000	G	190,000	C
DICHLOROPROPANE, 1,2-	78-87-5	**[0.12] 76**	N	**[0.6] 320**	N	**[0.69] 360**	N
DICHLOROPROPENE, 1,3-	542-75-6	110	N	550	N	640	N

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REGULATED SUBSTANCE	*CASRN*	*Residential 0—15 feet*		*Nonresidential*			
				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
DICHLOROPROPIONIC ACID, 2,2- (DALAPON)	75-99-0	6,600	G	10,000	C	10,000	C
DICHLORVOS	62-73-7	64	G	310	G	10,000	C
DICYCLOPENTADIENE	77-73-6	5.7	N	24	N	27	N
DIELDRIN	60-57-1	1.2	G	5.7	G	190,000	C
DIETHANOLAMINE	111-42-2	440	G	6,400	G	10,000	C
DIETHYL PHTHALATE	84-66-2	10,000	C	10,000	C	10,000	C
DIFLUBENZURON	35367-38-5	4,400	G	64,000	G	190,000	C
DIISOPROPYL METHYLPHOSPHONATE	1445-75-6	10,000	C	10,000	C	10,000	C
DIMETHOATE	60-51-5	480	G	7,000	G	190,000	C
DIMETHOXYBENZIDINE, 3,3-	119-90-4	12	G	57	G	190,000	C
DIMETHRIN	70-38-2	66,000	G	190,000	C	190,000	C
DIMETHYLAMINOAZOBENZENE, P-	60-11-7	4	G	20	G	190,000	C
DIMETHYLANILINE, N,N-	121-69-7	440	G	3,400	G	10,000	C
DIMETHYLBENZIDINE, 3,3-	119-93-7	1.7	G	8.3	G	190,000	C
DIMETHYL METHYLPHOSPHONATE	756-79-6	10,000	C	10,000	C	10,000	C
DIMETHYLPHENOL, 2,4-	105-67-9	4,400	G	10,000	C	10,000	C
DINITROBENZENE, 1,3-	99-65-0	22	G	320	G	190,000	C
DINITROPHENOL, 2,4-	51-28-5	440	G	6,400	G	190,000	C
DINITROTOLUENE, 2,4-	121-14-2	60	G	290	G	190,000	C
DINITROTOLUENE, 2,6- (2,6-DNT)	606-20-2	12	G	61	G	190,000	C
DINOSEB	88-85-7	220	G	3,200	G	190,000	C
DIOXANE, 1,4-	123-91-1	89	N	440	N	510	N
DIPHENAMID	957-51-7	6,600	G	96,000	G	190,000	C
DIPHENYLAMINE	122-39-4	22,000	G	190,000	C	190,000	C
DIPHENYLHYDRAZINE, 1,2-	122-66-7	2.1	N	10	N	12	N
DIQUAT	**[85-00-7]** **2764-72-9**	480	G	7,000	G	190,000	C
DISULFOTON	298-04-4	8.8	G	130	G	10,000	C
DITHIANE, 1,4-	505-29-3	2,200	G	32,000	G	190,000	C
DIURON	330-54-1	440	G	6,400	G	190,000	C
ENDOSULFAN	115-29-7	1,300	G	19,000	G	190,000	C
ENDOSULFAN I (ALPHA)	959-98-8	1,300	G	19,000	G	190,000	C
ENDOSULFAN II (BETA)	33213-65-9	1,300	G	19,000	G	190,000	C
ENDOSULFAN SULFATE	1031-07-8	1,300	G	19,000	G	190,000	C
ENDOTHALL	145-73-3	4,400	G	64,000	G	190,000	C
ENDRIN	72-20-8	66	G	960	G	190,000	C
EPICHLOROHYDRIN	106-89-8	19	N	79	N	91	N
ETHEPHON	16672-87-0	1,100	G	16,000	G	190,000	C
ETHION	563-12-2	110	G	1,600	G	10,000	C
ETHOXYETHANOL, 2- (EGEE)	110-80-5	**[3,800]** **770**	N	**[10,000]** **3,200**	**[C]** **N**	**[10,000]** **3,700**	**[C]** **N**
ETHYL ACETATE	141-78-6	1,300	N	5,500	N	6,300	N
ETHYL ACRYLATE	140-88-5	150	N	630	N	720	N
ETHYL BENZENE	100-41-4	180	N	880	N	1,000	N
ETHYL DIPROPYLTHIOCARBAMATE, S- (EPTC)	759-94-4	10,000	C	10,000	C	10,000	C
ETHYL ETHER	60-29-7	10,000	C	10,000	C	10,000	C
ETHYL METHACRYLATE	97-63-2	5,700	N	10,000	C	10,000	C
ETHYLENE CHLORHYDRIN	107-07-3	4,400	G	10,000	C	10,000	C
ETHYLENE GLYCOL	107-21-1	7,600	N	10,000	C	10,000	C
ETHYLENE THIOUREA (ETU)	96-45-7	18	G	260	G	190,000	C

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REGULATED SUBSTANCE	*CASRN*	*Residential 0—15 feet*		*Nonresidential*			
				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
ETHYLP-NITROPHENYL PHENYLPHOSPHOROTHIOATE	2104-64-5	2.2	G	32	G	190,000	C
FENAMIPHOS	22224-92-6	55	G	800	G	190,000	C
FENVALERATE (PYDRIN)	51630-58-1	5,500	G	10,000	C	10,000	C
FLUOMETURON	2164-17-2	2,900	G	42,000	G	190,000	C
FLUORANTHENE	206-44-0	8,800	G	130,000	G	190,000	C
FLUORENE	86-73-7	8,800	G	130,000	G	190,000	C
FLUOROTRICHLOROMETHANE (FREON 11)	75-69-4	10,000	C	10,000	C	10,000	C
FONOFOS	944-22-9	440	G	6,400	G	10,000	C
FORMALDEHYDE	50-00-0	34	N	170	N	200	N
FORMIC ACID	64-18-6	5.7	N	24	N	27	N
FOSETYL-AL	39148-24-8	190,000	C	190,000	C	190,000	C
FURAN	110-00-9	220	G	3,200	G	10,000	C
FURFURAL	98-01-1	530	G	2,600	G	4,500	N
GLYPHOSATE	1071-83-6	22,000	G	190,000	C	190,000	C
HEPTACHLOR	76-44-8	4.1	G	20	G	190,000	C
HEPTACHLOR EPOXIDE	1024-57-3	2	G	10	G	190,000	C
HEXACHLOROBENZENE	118-74-1	**[12] 2.2**	G	**[57] 32**	G	190,000	C
HEXACHLOROBUTADIENE	87-68-3	220	G	1,200	G	10,000	C
HEXACHLOROCYCLOPENTADIENE	77-47-4	1,300	G	10,000	C	10,000	C
HEXACHLOROETHANE	67-72-1	46	N	230	N	270	N
HEXAFLUOROPROPYLENE OXIDE (HFPO) DIMER ACID	**13252-13-6**	**0.66**	**G**	**9.6**	**G**	**10,000**	**C**
HEXAFLUOROPROPYLENE OXIDE (HFPO) DIMER ACID AMMONIUM SALT	**62037-80-3**	**0.66**	**G**	**9.6**	**G**	**10,000**	**C**
HEXANE	110-54-3	10,000	C	10,000	C	10,000	C
HEXAZINONE	51235-04-2	7,300	G	110,000	G	190,000	C
HEXYTHIAZOX (SAVEY)	78587-05-0	5,500	G	80,000	G	190,000	C
HMX	2691-41-0	11,000	G	160,000	G	190,000	C
HYDRAZINE/HYDRAZINE SULFATE	302-01-2	0.091	N	0.45	N	0.52	N
HYDROQUINONE	123-31-9	310	G	1,500	G	190,000	C
INDENO[1,2,3-CD]PYRENE	193-39-5	**[3.5] 42**	G	**[76] 910**	G	190,000	C
IPRODIONE	36734-19-7	420	G	2,100	G	190,000	C
ISOBUTYL ALCOHOL	78-83-1	10,000	C	10,000	C	10,000	C
ISOPHORONE	78-59-1	10,000	C	10,000	C	10,000	C
ISOPROPYL METHYLPHOSPHONATE	1832-54-8	10,000	C	10,000	C	10,000	C
KEPONE	143-50-0	1.9	G	9.1	G	190,000	C
MALATHION	121-75-5	4,400	G	10,000	C	10,000	C
MALEIC HYDRAZIDE	123-33-1	110,000	G	190,000	C	190,000	C
MANEB	12427-38-2	310	G	1,500	G	190,000	C
MERPHOS OXIDE	78-48-8	110	G	1,600	G	10,000	C
METHACRYLONITRILE	126-98-7	22	G	320	G	2,700	N
METHAMIDOPHOS	10265-92-6	11	G	160	G	190,000	C
METHANOL	67-56-1	10,000	C	10,000	C	10,000	C
METHOMYL	16752-77-5	5,500	G	80,000	G	190,000	C
METHOXYCHLOR	72-43-5	1,100	G	16,000	G	190,000	C
METHOXYETHANOL, 2-	109-86-4	**[380] 130**	N	**[1,600] 560**	N	**[1,800] 640**	N
METHYL ACETATE	79-20-9	10,000	C	10,000	C	10,000	C
METHYL ACRYLATE	96-33-3	380	N	1,600	N	1,800	N
METHYL CHLORIDE	74-87-3	**[250] 1,700**	N	**[1,200] 7,200**	N	**[1,400] 8,200**	N

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				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
METHYL ETHYL KETONE	78-93-3	10,000	C	10,000	C	10,000	C
METHYL HYDRAZINE	60-34-4	0.38	N	1.6	N	1.8	N
METHYL ISOBUTYL KETONE	108-10-1	10,000	C	10,000	C	10,000	C
METHYL ISOCYANATE	624-83-9	19	N	79	N	91	N
METHYL N-BUTYL KETONE (2-HEXANONE)	591-78-6	570	N	2,400	N	2,700	N
METHYL METHACRYLATE	80-62-6	10,000	C	10,000	C	10,000	C
METHYL METHANESULFONATE	66-27-3	190	G	920	G	10,000	C
METHYL PARATHION	298-00-0	55	G	800	G	190,000	C
METHYL STYRENE (MIXED ISOMERS)	25013-15-4	760	N	3,100	N	3,600	N
METHYL TERT-BUTYL ETHER (MTBE)	1634-04-4	1,700	N	8,500	N	9,800	N
METHYLCHLOROPHENOXYACETIC ACD (MCPA)	94-74-6	110	G	1,600	C	190,000	C
METHYLENE BIS(2-CHLOROANILINE), 4,4'-	101-14-4	42	G	910	G	190,000	C
METHYLNAPHTHALENE, 2-	91-57-6	57	N	240	N	270	N
METHYLSTYRENE, ALPHA	98-83-9	10,000	C	10,000	C	10,000	C
METOLACHLOR	51218-45-2	10,000	C	10,000	C	10,000	C
METRIBUZIN	21087-64-9	5,500	G	80,000	G	190,000	C
MEVINPHOS	7786-34-7	5.5	G	80	G	190,000	C
MONOCHLOROACETIC ACID	79-11-8	**[440] <u>2,200</u>**	G	**[6,400] <u>32,000</u>**	G	190,000	C
NAPHTHALENE	91-20-3	13	N	66	N	77	N
NAPHTHYLAMINE, 1-	134-32-7	10	G	51	G	190,000	C
NAPHTHYLAMINE, 2-	91-59-8	10	G	51	G	190,000	C
NAPROPAMIDE	15299-99-7	26,000	G	190,000	C	190,000	C
NITROANILINE, O-	88-74-4	0.95	N	3.9	N	4.5	N
NITROANILINE, P-	100-01-6	880	G	4,600	G	190,000	C
NITROBENZENE	98-95-3	11	N	55	N	63	N
NITROGUANIDINE	556-88-7	22,000	G	190,000	C	190,000	C
NITROPHENOL, 2-	88-75-5	1,800	G	26,000	G	190,000	C
NITROPHENOL, 4-	100-02-7	1,800	G	26,000	G	190,000	C
NITROPROPANE, 2-	79-46-9	**[0.16] <u>0.76</u>**	N	**[0.82] <u>3.8</u>**	N	**[0.94] <u>4.4</u>**	N
NITROSODIETHYLAMINE, N-	55-18-5	0.0041	N	0.051	N	0.059	N
NITROSODIMETHYLAMINE, N-	62-75-9	0.012	N	0.16	N	0.18	N
NITROSO-DI-N-BUTYLAMINE, N-	924-16-3	0.28	N	1.4	N	1.6	N
NITROSODI-N-PROPYLAMINE, N-	621-64-7	0.22	N	1.1	N	1.3	N
NITROSODIPHENYLAMINE, N-	86-30-6	170	N	860	N	990	N
NITROSO-N-ETHYLUREA, N-	759-73-9	0.16	G	3.4	G	190,000	C
OCTYL PHTHALATE, DI-N-	117-84-0	2,200	G	10,000	C	10,000	C
OXAMYL (VYDATE)	23135-22-0	5,500	G	80,000	G	190,000	C
PARAQUAT	1910-42-5	990	G	14,000	G	190,000	C
PARATHION	56-38-2	6.6	G	96	G	10,000	C
PCBS, TOTAL (POLYCHLORINATED BIPHENYLS) (AROCLORS)	1336-36-3	9.3	G	46	G	190,000	C
PCB-1016 (AROCLOR)	12674-11-2	15	G	220	G	10,000	C
PCB-1221 (AROCLOR)	11104-28-2	4.7	N	23	N	27	N
PCB-1232 (AROCLOR)	11141-16-5	9.3	G	46	G	10,000	C
PCB-1242 (AROCLOR)	53469-21-9	9.3	G	46	G	10,000	C
PCB-1248 (AROCLOR)	12672-29-6	9.3	G	46	G	10,000	C
PCB-1254 (AROCLOR)	11097-69-1	4.4	G	64	G	10,000	C
PCB-1260 (AROCLOR)	11096-82-5	9.3	G	46	G	190,000	C

All concentrations in mg/kg
G—Ingestion
N—Inhalation
C—Cap

Appendix A
Table 3—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Soil
A. Direct Contact Numeric Values

REGULATED SUBSTANCE	*CASRN*	*Residential 0—15 feet*		*Nonresidential*			
				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
PEBULATE	1114-71-2	**[10,000] 150**	**[C] G**	**[10,000] 2,200**	**[C] G**	10,000	C
PENTACHLOROBENZENE	608-93-5	180	G	2,600	G	190,000	C
PENTACHLOROETHANE	76-01-7	210	G	1,000	G	10,000	C
PENTACHLORONITROBENZENE	82-68-8	72	G	350	G	190,000	C
PENTACHLOROPHENOL	87-86-5	47	G	230	G	190,000	C
PERFLUOROBUTANE SULFONATE (PFBS)	375-73-5	66	G	960	G	10,000	C
PERFLUOROBUTANOIC ACID (PFBA)	**375-22-4**	**220**	**G**	**3,200**	**G**	**190,000**	**C**
PERFLUOROHEXANOIC ACID (PFHxA)	**307-24-4**	**110**	**G**	**1,600**	**G**	**10,000**	**C**
PERFLUOROOCTANE SULFONATE (PFOS)	1763-23-1	**[4.4] 0.68**	G	**[64] 9.9**	G	190,000	C
PERFLUOROOCTANOIC ACID (PFOA)	335-67-1	**[4.4] 0.86**	G	**[64] 12**	G	190,000	C
PHENACETIN	62-44-2	8,500	G	41,000	G	190,000	C
PHENANTHRENE	85-01-8	66,000	G	190,000	C	190,000	C
PHENOL	108-95-2	3,800	N	16,000	N	18,000	N
PHENYL MERCAPTAN	108-98-5	220	G	3,200	G	10,000	C
PHENYLENEDIAMINE, M-	108-45-2	1,300	G	19,000	G	190,000	C
PHENYLPHENOL, 2-	90-43-7	9,600	G	47,000	G	190,000	C
PHORATE	298-02-2	**[44] 37**	G	**[640] 540**	G	10,000	C
PHTHALIC ANHYDRIDE	85-44-9	380	N	1,600	N	1,800	N
PICLORAM	1918-02-1	15,000	G	190,000	C	190,000	C
POTASSIUM PERFLUOROBUTANE SULFONATE	**29420-49-3**	**66**	**G**	**960**	**G**	**190,000**	**C**
PROMETON	1610-18-0	3,300	G	48,000	G	190,000	C
PRONAMIDE	23950-58-5	17,000	G	190,000	C	190,000	C
PROPACHLOR	1918-16-7	2,900	G	42,000	G	190,000	C
PROPANIL	709-98-8	1,100	G	16,000	G	190,000	C
PROPANOL, 2- (ISOPROPYL ALCOHOL)	67-63-0	3,800	N	10,000	C	10,000	C
PROPAZINE	139-40-2	4,400	G	10,000	C	10,000	C
PROPHAM	122-42-9	4,400	G	64,000	G	190,000	C
PROPYLBENZENE, N-	103-65-1	10,000	C	10,000	C	10,000	C
PROPYLENE OXIDE	75-56-9	78	G	380	G	690	N
PYRENE	129-00-0	6,600	G	96,000	G	190,000	C
PYRETHRUM	8003-34-7	220	G	3,200	G	10,000	C
PYRIDINE	110-86-1	220	G	3,200	G	10,000	C
QUINOLINE	91-22-5	6.2	G	30	G	10,000	C
QUIZALOFOP (ASSURE)	76578-14-8	2,000	G	29,000	G	190,000	C
RDX	121-82-4	230	G	1,100	G	190,000	C
RESORCINOL	108-46-3	190,000	C	190,000	C	190,000	C
RONNEL	299-84-3	11,000	G	160,000	G	190,000	C
SIMAZINE	122-34-9	160	G	760	G	190,000	C
STRYCHNINE	57-24-9	66	G	960	G	190,000	C
STYRENE	100-42-5	10,000	C	10,000	C	10,000	C
TEBUTHIURON	34014-18-1	15,000	G	190,000	C	190,000	C
TERBACIL	5902-51-2	2,900	G	42,000	G	190,000	C
TERBUFOS	13071-79-9	5.5	G	80	G	10,000	C
TETRACHLOROBENZENE, 1,2,4,5-	95-94-3	**[66] 6.6**	G	**[960] 96**	G	190,000	C
TETRACHLORODIBENZO-P-DIOXIN, 2,3,7,8- (TCDD)	1746-01-6	0.00014	G	0.0007	G	190,000	C
TETRACHLOROETHANE, 1,1,1,2-	630-20-6	60	N	300	N	340	N
TETRACHLOROETHANE, 1,1,2,2-	79-34-5	7.6	N	38	N	44	N
TETRACHLOROETHYLENE (PCE)	127-18-4	760	N	3,200	N	3,600	N
TETRACHLOROPHENOL, 2,3,4,6-	58-90-2	6,600	G	96,000	G	190,000	C
TETRAETHYL LEAD	78-00-2	0.022	G	0.32	G	10,000	C

All concentrations in mg/kg
G—Ingestion
N—Inhalation
C—Cap

Appendix A
Table 3—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Soil
A. Direct Contact Numeric Values

REGULATED SUBSTANCE	*CASRN*	*Residential 0—15 feet*		*Nonresidential*			
				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
TETRAETHYLDITHIOPYROPHOSPHATE	3689-24-5	110	G	1,600	G	10,000	C
TETRAHYDROFURAN	109-99-9	230	N	1,100	N	1,300	N
THIOFANOX	39196-18-4	66	G	960	G	190,000	C
THIRAM	137-26-8	3,300	G	48,000	G	190,000	C
TOLUENE	108-88-3	10,000	C	10,000	C	10,000	C
TOLUIDINE, M-	108-44-1	1,200	G	5,700	G	10,000	C
TOLUIDINE, O-	95-53-4	1,200	G	5,700	G	10,000	C
TOLUIDINE, P-	106-49-0	620	G	3,000	G	190,000	C
TOXAPHENE	8001-35-2	17	G	83	G	190,000	C
TRIALLATE	2303-17-5	**[26] 260**	G	**[130] 1,300**	G	10,000	C
TRIBROMOMETHANE (BROMOFORM)	75-25-2	400	N	2,000	N	2,300	N
TRICHLORO-1,2,2-TRIFLUOROETHANE, 1,1,2-	76-13-1	10,000	C	10,000	C	10,000	C
TRICHLOROACETIC ACID	76-03-9	270	G	1,300	G	190,000	C
TRICHLOROBENZENE, 1,2,4-	120-82-1	39	N	160	N	190	N
TRICHLOROBENZENE, 1,3,5-	108-70-3	46	N	190	N	230	N
TRICHLOROETHANE, 1,1,1-	71-55-6	10,000	C	10,000	C	10,000	C
TRICHLOROETHANE, 1,1,2-	79-00-5	3.8	N	16	N	18	N
TRICHLOROETHYLENE (TCE)	79-01-6	38	N	160	N	180	N
TRICHLOROPHENOL, 2,4,5-	95-95-4	22,000	G	190,000	C	190,000	C
TRICHLOROPHENOL, 2,4,6-	88-06-2	220	G	3,200	G	190,000	C
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	93-76-5	2,200	G	32,000	G	190,000	C
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)(SILVEX)	93-72-1	1,800	G	26,000	G	190,000	C
TRICHLOROPROPANE, 1,1,2-	598-77-6	1,100	G	10,000	C	10,000	C
TRICHLOROPROPANE, 1,2,3-	96-18-4	0.14	G	3.0	G	27	N
TRICHLOROPROPENE, 1,2,3-	96-19-5	5.7	N	24	N	27	N
TRIETHYLAMINE	121-44-8	130	N	550	N	630	N
TRIETHYLENE GLYCOL	112-27-6	10,000	C	10,000	C	10,000	C
TRIFLURALIN	1582-09-8	1,700	G	12,000	G	190,000	C
TRIMETHYLBENZENE, 1,3,4- (TRIMETHYLBENZENE, 1,2,4-)	95-63-6	1,100	N	4,700	N	5,400	N
TRIMETHYLBENZENE, 1,3,5-	108-67-8	1,100	N	4,700	N	5,400	N
TRINITROGLYCEROL (NITROGLYCERIN)	55-63-0	22	G	320	G	10,000	C
TRINITROTOLUENE, 2,4,6-	118-96-7	110	G	1,600	G	190,000	C
VINYL ACETATE	108-05-4	3,800	N	10,000	C	10,000	C
VINYL BROMIDE (BROMOETHENE)	593-60-2	**[14] 30**	N	**[70] 150**	N	**[80] 170**	N
VINYL CHLORIDE	75-01-4	0.93	G	61	G	290	N
WARFARIN	81-81-2	66	G	960	G	190,000	C
XYLENES (TOTAL)	1330-20-7	1,900	N	7,900	N	9,100	N
ZINEB	12122-67-7	11,000	G	160,000	G	190,000	C

All concentrations in mg/kg
G—Ingestion
N—Inhalation
C—Cap

Appendix A
Table 3—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Soil
B. Soil to Groundwater Numeric Values[1]

REGULATED SUBSTANCE	*CASRN*	*Used Aquifers*												*Nonuse Aquifers*						*Soil Buffer Distance (feet)*
		TDS ≤ 2500 mg/L						*TDS > 2500 mg/L*												
		Residential			*Nonresidential*			*Residential*			*Nonresidential*			*Residential*			*Nonresidential*			
		100 X GW MSC	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		
ACENAPHTHENE	83-32-9	210	2,600	E	380	4,700	E	380	4,700	E	380	4,700	E	380	4,700	E	380	4,700	E	15
ACENAPHTHYLENE	208-96-8	210	2,400	E	580	6,600	E	1,600	18,000	E	1,600	18,000	E	1,600	18,000	E	1,600	18,000	E	15
ACEPHATE	30560-19-1	4.2	0.5	E	12	1.4	E	420	50	E	1,200	140	E	4.2	0.5	E	12	1.4	E	NA
ACETALDEHYDE	75-07-0	1.9	0.23	E	7.9	0.96	E	190	23	E	790	96	E	1.9	0.23	E	7.9	0.96	E	NA
ACETONE	67-64-1	3,100	350	E	8,800	980	E	10,000	10,000	C	10,000	10,000	C	10,000	3,500	E	10,000	9,800	E	NA
ACETONITRILE	75-05-8	13	1.5	E	53	6	E	1,300	150	E	5,300	600	E	130	15	E	530	60	E	NA
ACETOPHENONE	98-86-2	350	190	E	970	520	E	10,000	10,000	C	10,000	10,000	C	350	190	E	970	520	E	NA
ACETYLAMINOFLUORENE, 2- (2AAF)	53-96-3	0.017	0.07	E	0.072	0.3	E	1.7	7	E	7.2	30	E	17	70	E	72	300	E	20
ACROLEIN	107-02-8	0.0042	0.00047	E	0.018	0.002	E	0.42	0.047	E	1.8	0.2	E	0.042	0.0047	E	0.18	0.02	E	NA
ACRYLAMIDE	79-06-1	0.019	0.0033	E	0.25	0.043	E	1.9	0.33	E	25	4.3	E	0.019	0.0033	E	0.25	0.043	E	NA
ACRYLIC ACID	79-10-7	**[0.21] 0.042**	**[0.039] 0.0077**	E	**[0.88] 0.18**	**[0.16] 0.033**	E	**[21] 4.2**	**[3.9] 0.77**	E	**[88] 18**	**[16] 3.3**	E	**[21] 4.2**	**[3.9] 0.77**	E	**[88] 18**	**[16] 3.3**	E	NA
ACRYLONITRILE	107-13-1	0.072	0.01	E	0.37	0.051	E	7.2	1	E	37	5.1	E	7.2	1	E	37	5.1	E	NA
ALACHLOR	15972-60-8	0.2	0.077	E	0.2	0.077	E	20	7.7	E	20	7.7	E	0.2	0.077	E	0.2	0.077	E	NA
ALDICARB	116-06-3	0.3	0.05	E	0.3	0.05	E	30	5	E	30	5	E	300	50	E	300	50	E	NA
ALDICARB SULFONE	1646-88-4	0.2	0.027	E	0.2	0.027	E	20	2.7	E	20	2.7	E	0.2	0.027	E	0.2	0.027	E	NA
ALDICARB SULFOXIDE	1646-87-3	0.4	0.045	E	0.4	0.045	E	40	4.5	E	40	4.5	E	0.4	0.045	E	0.4	0.045	E	NA
ALDRIN	309-00-2	0.0038	0.46	E	0.016	1.9	E	0.38	46	E	1.6	190	E	2	240	E	2	240	E	10
ALLYL ALCOHOL	107-18-6	0.021	0.0025	E	0.088	0.01	E	2.1	0.25	E	8.8	1	E	2.1	0.25	E	8.8	1	E	NA
AMETRYN	834-12-8	6	6.5	E	6	6.5	E	600	650	E	600	650	E	6	6.5	E	6	6.5	E	NA
AMINOBIPHENYL, 4-	92-67-1	0.0031	0.0012	E	0.013	0.005	E	0.31	0.12	E	1.3	0.5	E	3.1	1.2	E	13	5	E	NA
AMITROLE	61-82-5	0.069	0.028	E	0.29	0.12	E	6.9	2.8	E	29	12	E	69	28	E	290	120	E	NA
AMMONIA	7664-41-7	3,000	360	E	3,000	360	E	10,000	10,000	C	10,000	10,000	C	3,000	360	E	3,000	360	E	NA
AMMONIUM SULFAMATE	7773-06-0	200	24	E	200	24	E	20,000	2,400	E	20,000	2,400	E	200	24	E	200	24	E	NA
ANILINE	62-53-3	0.21	0.12	E	0.88	0.52	E	21	12	E	88	52	E	0.21	0.12	E	0.88	0.52	E	NA
ANTHRACENE	120-12-7	6.6	350	E	6.6	350	E	6.6	350	E	6.6	350	E	6.6	350	E	6.6	350	E	10
ATRAZINE	1912-24-9	0.3	0.13	E	0.3	0.13	E	30	13	E	30	13	E	0.3	0.13	E	0.3	0.13	E	NA
AZINPHOS-METHYL (GUTHION)	86-50-0	5.2	5.9	E	15	17	E	520	590	E	1,500	1,700	E	5.2	5.9	E	15	17	E	NA
BAYGON (PROPOXUR)	114-26-1	0.3	0.057	E	0.3	0.057	E	30	5.7	E	30	5.7	E	300	57	E	300	57	E	NA
BENOMYL	17804-35-2	27	130	E	110	530	E	200	970	E	200	970	E	27	130	E	110	530	E	20
BENTAZON	25057-89-0	20	2.9	E	20	2.9	E	2,000	290	E	2,000	290	E	20	2.9	E	20	2.9	E	NA
BENZENE	71-43-2	0.5	0.13	E	0.5	0.13	E	50	13	E	50	13	E	50	13	E	50	13	E	NA

[1] For other options see § 250.308 (relating to soil to groundwater pathway numeric values).
All concentrations in mg/kg
E—Number calculated by the soil to groundwater equation in § 250.308
C—Cap
NA—The soil buffer distance option is not available for this substance
N/A—Soil to groundwater values cannot be calculated for these compounds

Appendix A
Table 3—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Soil
B. Soil to Groundwater Numeric Values[1]

REGULATED SUBSTANCE	*CASRN*	*Used Aquifers*								*Nonuse Aquifers*				*Soil Buffer Distance (feet)*
		TDS ≤ 2500 mg/L				*TDS > 2500 mg/L*								
		Residential		*Nonresidential*		*Residential*		*Nonresidential*		*Residential*		*Nonresidential*		
		100 X GW MSC	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	
BENZIDINE	92-87-5	0.000092	0.12 E	0.0012	1.6 E	0.0092	12 E	0.12	160 E	0.092	120 E	1.2	1,600 E	5
BENZO[A]ANTHRACENE	56-55-3	**[0.03] 0.21**	**[26] 180** E	**[0.39] 1.1**	**[340] 960** E	1.1	960 E	1.1	960 E	1.1	960 E	1.1	960 E	5
BENZO[A]PYRENE	50-32-8	0.02	46 E	0.02	46 E	0.38	860 E	0.38	860 E	0.38	860 E	0.38	860 E	5
BENZO[B]FLUORANTHENE	205-99-2	**[0.018] 0.12**	**[25] 170** E	0.12	170 E	0.12	170 E	0.12	170 E	0.12	170 E	0.12	170 E	5
BENZO[GHI]PERYLENE	191-24-2	0.026	180 E	0.026	180 E	0.026	180 E	0.026	180 E	0.026	180 E	0.026	180 E	5
BENZO[K]FLUORANTHENE	207-08-9	**[0.018] 0.055**	**[200] 610** E	0.055	610 E	0.055	610 E	0.055	610 E	0.055	610 E	0.055	610 E	5
BENZOIC ACID	65-85-0	14,000	2,700 E	39,000	7,500 E	190,000	52,000 E	190,000	52,000 E	14,000	2,700 E	39,000	7,500 E	NA
BENZOTRICHLORIDE	98-07-7	0.005	0.012 E	0.021	0.051 E	0.5	1.2 E	2.1	5.1 E	0.5	1.2 E	2.1	5.1 E	30
BENZYL ALCOHOL	100-51-6	350	130 E	970	350 E	10,000	10,000 C	10,000	10,000 C	350	130 E	970	350 E	NA
BENZYL CHLORIDE	100-44-7	0.1	0.059 E	0.51	0.3 E	10	5.9 E	51	30 E	10	5.9 E	51	30 E	NA
BETA PROPIOLACTONE	57-57-8	0.0012	0.00015 E	0.0063	0.00076 E	0.12	0.015 E	0.63	0.076 E	0.012	0.0015 E	0.063	0.0076 E	NA
BHC, ALPHA	319-84-6	0.01	0.046 E	0.043	0.2 E	1	4.6 E	4.3	20 E	10	46 E	43	200 E	20
BHC, BETA-	319-85-7	0.036	0.21 E	0.15	0.88 E	3.6	21 E	10	59 E	10	59 E	10	59 E	15
BHC, GAMMA (LINDANE)	58-89-9	0.02	0.072 E	0.02	0.072 E	2	7.2 E	2	7.2 E	20	72 E	20	72 E	20
BIPHENYL, 1,1-	92-52-4	0.084	0.37 E	0.35	1.5 E	8.4	37 E	35	150 E	8.4	37 E	35	150 E	20
BIS(2-CHLOROETHOXY) METHANE	111-91-1	10	2.6 E	29	7.6 E	1,000	260 E	2,900	760 E	10	2.6 E	29	7.6 E	NA
BIS(2-CHLOROETHYL)ETHER	111-44-4	0.015	0.0045 E	0.076	0.023 E	1.5	0.45 E	7.6	2.3 E	1.5	0.45 E	7.6	2.3 E	NA
BIS(2-CHLORO-ISOPROPYL)ETHER	108-60-1	30	8 E	30	8 E	3,000	800 E	3,000	800 E	3,000	800 E	3,000	800 E	NA
BIS(CHLOROMETHYL)ETHER	542-88-1	0.000079	0.000012 E	0.0004	0.00006 E	0.0079	0.0012 E	0.04	0.006 E	0.0079	0.0012 E	0.04	0.006 E	NA
BIS[2-ETHYLHEXYL] PHTHALATE	117-81-7	0.6	130 E	0.6	130 E	29	6,300 E	29	6,300 E	29	6,300 E	29	6,300 E	10
BISPHENOL A	80-05-7	170	660 E	490	1,900 E	12,000	46,000 E	12,000	46,000 E	12,000	46,000 E	12,000	46,000 E	20
BROMACIL	314-40-9	7	1.8 E	7	1.8 E	700	180 E	700	180 E	7	1.8 E	7	1.8 E	NA
BROMOBENZENE	108-86-1	**[0.006] 6**	**[0.0047] 4.7** E	**[0.006] 6**	**[0.0047] 4.7** E	**[0.6] 600**	**[0.47] 470** E	**[0.6] 600**	**[0.47] 470** E	**[0.006] 6**	**[0.0047] 4.7** E	**[0.006] 6**	**[0.0047] 4.7** E	NA
BROMOCHLOROMETHANE	74-97-5	9	1.6 E	9	1.6 E	900	160 E	900	160 E	9	1.6 E	9	1.6 E	NA
BROMODICHLORO METHANE (THM)	75-27-4	8	2.7 E	8	2.7 E	800	270 E	800	270 E	8	2.7 E	8	2.7 E	NA
BROMOMETHANE	74-83-9	1	0.54 E	1	0.54 E	100	54 E	100	54 E	100	54 E	100	54 E	NA
BROMOXYNIL	1689-84-5	0.63	0.54 E	2.6	2.2 E	63	54 E	260	220 E	0.63	0.54 E	2.6	2.2 E	NA
BROMOXYNIL OCTANOATE	1689-99-2	0.63	28 E	2.6	120 E	8	360 E	8	360 E	8	360 E	8	360 E	15
BUTADIENE, 1,3-	106-99-0	0.11	0.045 E	0.45	0.19 E	11	4.5 E	45	19 E	11	4.5 E	45	19 E	NA
BUTYL ALCOHOL, N-	71-36-3	350	42 E	970	120 E	10,000	4,200 E	10,000	10,000 C	3,500	420 E	9,700	1,200 E	NA
BUTYLATE	2008-41-5	40	58 E	40	58 E	4,000	5,800 E	4,000	5,800 E	40	58 E	40	58 E	30

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REGULATED SUBSTANCE	*CASRN*	*Used Aquifers*												*Nonuse Aquifers*						*Soil Buffer Distance (feet)*
		TDS ≤ 2500 mg/L						*TDS > 2500 mg/L*												
		Residential			*Nonresidential*			*Residential*			*Nonresidential*			*Residential*			*Nonresidential*			
		100 X GW MSC	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		
BUTYLBENZENE, N-	104-51-8	170	1,100	E	490	3,100	E	1,500	9,500	E	1,500	9,500	E	170	1,100	E	490	3,100	E	15
BUTYLBENZENE, SEC-	135-98-8	350	820	E	970	2,300	E	1,700	4,000	E	1,700	4,000	E	350	820	E	970	2,300	E	30
BUTYLBENZENE, TERT-	98-06-6	350	630	E	970	1,800	E	3,000	5,400	E	3,000	5,400	E	350	630	E	970	1,800	E	30
BUTYLBENZYL PHTHALATE	85-68-7	34	2,900	E	140	10,000	C	270	10,000	C	270	10,000	C	270	10,000	C	270	10,000	C	10
CAPTAN	133-06-2	28	17	E	50	31	E	50	31	E	50	31	E	50	31	E	50	31	E	NA
CARBARYL	63-25-2	350	210	E	970	570	E	12,000	7,000	E	12,000	7,000	E	12,000	7,000	E	12,000	7,000	E	NA
[CARBAZOLE]	**[86-74-8]**	**[3.3]**	**[21]**	**[E]**	**[14]**	**[89]**	**[E]**	**[120]**	**[760]**	**[E]**	**[120]**	**[760]**	**[E]**	**[3.3]**	**[21]**	**[E]**	**[14]**	**[89]**	**[E]**	**[15]**
CARBOFURAN	1563-66-2	4	0.87	E	4	0.87	E	400	87	E	400	87	E	4	0.87	E	4	0.87	E	NA
CARBON DISULFIDE	75-15-0	150	130	E	620	530	E	10,000	10,000	C	10,000	10,000	C	150	130	E	620	530	E	NA
CARBON TETRACHLORIDE	56-23-5	0.5	0.26	E	0.5	0.26	E	50	26	E	50	26	E	5	2.6	E	5	2.6	E	NA
CARBOXIN	5234-68-4	70	53	E	70	53	E	7,000	5,300	E	7,000	5,300	E	70	53	E	70	53	E	NA
CHLORAMBEN	133-90-4	10	1.6	E	10	1.6	E	1,000	160	E	1,000	160	E	10	1.6	E	10	1.6	E	NA
CHLORDANE	57-74-9	0.2	49	E	0.2	49	E	5.6	1,400	E	5.6	1,400	E	5.6	1,400	E	5.6	1,400	E	10
CHLORO-1,1-DIFLUOROETHANE, 1-	75-68-3	10,000	1,800	E	10,000	7,300	E	10,000	10,000	C	10,000	10,000	C	10,000	1,800	E	10,000	7,300	E	NA
CHLORO-1-PROPENE, 3- (ALLYL CHLORIDE)	107-05-1	0.21	0.049	E	0.88	0.2	E	21	4.9	E	88	20	E	21	4.9	E	88	20	E	NA
CHLOROACETALDEHYDE	107-20-0	0.24	0.029	E	1	0.12	E	24	2.9	E	100	12	E	0.24	0.029	E	1	0.12	E	NA
CHLOROANILINE, P-	106-47-8	0.33	0.42	E	1.4	1.8	E	33	42	E	140	180	E	0.33	0.42	E	1.4	1.8	E	NA
CHLOROBENZENE	108-90-7	10	6.1	E	10	6.1	E	1,000	610	E	1,000	610	E	1,000	610	E	1,000	610	E	NA
CHLOROBENZILATE	510-15-6	0.59	3.9	E	2.5	17	E	59	390	E	250	1,700	E	590	3,900	E	1,300	8,600	E	15
CHLOROBUTANE, 1-	109-69-3	140	220	E	390	610	E	10,000	10,000	C	10,000	10,000	C	140	220	E	390	610	E	30
CHLORODIBROMO METHANE (THM)	124-48-1	8	2.5	E	8	2.5	E	800	250	E	800	250	E	800	250	E	800	250	E	NA
CHLORODIFLUORO METHANE (THM)	75-45-6	10,000	2,800	E	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	10,000	2,800	E	10,000	10,000	C	NA
CHLOROETHANE	75-00-3	**[2,100]** **840**	**[450]** **180**	E	**[8,800]** **3,500**	**[1,900]** **760**	E	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	NA
CHLOROFORM (THM)	67-66-3	8	2	E	8	2	E	800	200	E	800	200	E	80	20	E	80	20	E	NA
CHLORONAPHTHALENE, 2-	91-58-7	280	6,000	E	780	17,000	E	1,200	26,000	E	1,200	26,000	E	280	6,000	E	780	17,000	E	15
CHLORONITROBENZENE, P-	100-00-5	0.42	0.55	E	1.8	2.4	E	42	55	E	180	240	E	0.42	0.55	E	1.8	2.4	E	NA
CHLOROPHENOL, 2-	95-57-8	4	4.4	E	4	4.4	E	400	440	E	400	440	E	4	4.4	E	4	4.4	E	NA
CHLOROPRENE	126-99-8	0.016	0.0038	E	0.083	0.02	E	1.6	0.38	E	8.3	2	E	1.6	0.38	E	8.3	2	E	NA
[CHLOROPROPANE, 2-]	**[75-29-6]**	**[21]**	**[16]**	**[E]**	**[88]**	**[67]**	**[E]**	**[2,100]**	**[1,600]**	**[E]**	**[8,800]**	**[6,700]**	**[E]**	**[21]**	**[16]**	**[E]**	**[88]**	**[67]**	**[E]**	**[NA]**

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		TDS ≤ 2500 mg/L						*TDS > 2500 mg/L*												
		Residential			*Nonresidential*			*Residential*			*Nonresidential*			*Residential*			*Nonresidential*			
		100 X GW MSC	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		
CHLOROTHALONIL	1897-45-6	3.8	9.7	E	16	41	E	60	150	E	60	150	E	3.8	9.7	E	16	41	E	30
CHLOROTOLUENE, O-	95-49-8	10	20	E	10	20	E	1,000	2,000	E	1,000	2,000	E	10	20	E	10	20	E	30
CHLOROTOLUENE, P-	106-43-4	10	10	E	10	10	E	1,000	1,000	E	1,000	1,000	E	10	10	E	10	10	E	NA
CHLORPYRIFOS	2921-88-2	0.2	2.3	E	0.2	2.3	E	20	230	E	20	230	E	0.2	2.3	E	0.2	2.3	E	15
CHLORSULFURON	64902-72-3	**[69] 170**	**[9.6] 24**	E	**[190] 490**	**[26] 68**	E	**[6,900] 17,000**	**[960] 2,400**	E	19,000	2,600	E	**[69] 170**	**[9.6] 24**	E	**[190] 490**	**[26] 68**	E	NA
CHLORTHAL-DIMETHYL (DACTHAL) (DCPA)	1861-32-1	7	110	E	7	110	E	50	820	E	50	820	E	50	820	E	50	820	E	15
CHRYSENE	218-01-9	**[0.18] 0.19**	**[220] 230**	E	0.19	230	E	0.19	230	E	0.19	230	E	0.19	230	E	0.19	230	E	5
CRESOL(S)	1319-77-3	130	23	E	530	92	E	10,000	2,300	E	10,000	9,200	E	10,000	2,300	E	10,000	9,200	E	NA
CRESOL, 4,6-DINITRO-O-	534-52-1	0.28	0.21	E	0.78	0.59	E	28	21	E	78	59	E	28	21	E	78	59	E	NA
CRESOL, O- (2-METHYLPHENOL)	95-48-7	170	28	E	490	81	E	17,000	2,800	E	49,000	8,100	E	17,000	2,800	E	49,000	8,100	E	NA
CRESOL, M- (3-METHYLPHENOL)	108-39-4	170	34	E	490	97	E	10,000	3,400	E	10,000	9,700	E	10,000	10,000	C	10,000	10,000	C	NA
CRESOL, P- (4-METHYLPHENOL)	106-44-5	**[17] 69**	**[4] 16**	E	**[49] 190**	**[11] 44**	E	**[1,700] 6,900**	**[400] 1,600**	E	**[4,900] 19,000**	**[1,100] 4,400**	E	**[17,000] 69,000**	**[4,000] 16,000**	E	**[49,000] 190,000**	**[11,000] 44,000**	E	NA
CRESOL, P-CHLORO-M-	59-50-7	350	720	E	970	2,000	E	35,000	72,000	E	97,000	190,000	C	350	720	E	970	2,000	E	30
CROTONALDEHYDE	4170-30-3	**[0.034] 3.5**	**[0.0043] 0.44**	E	**[0.14] 9.7**	**[0.018] 1.2**	E	**[3.4] 350**	**[0.43] 44**	E	**[14] 970**	**[1.8] 120**	E	**[3.4] 350**	**[0.43] 44**	E	**[14] 970**	**[1.8] 120**	E	NA
CROTONALDEHYDE, TRANS-	123-73-9	**[0.034] 3.5**	**[0.0043] 0.44**	E	**[0.14] 9.7**	**[0.018] 1.2**	E	**[3.4] 350**	**[0.43] 44**	E	**[14] 970**	**[1.8] 120**	E	**[3.4] 350**	**[0.43] 44**	E	**[14] 970**	**[1.8] 120**	E	NA
CUMENE (ISOPROPYL BENZENE)	98-82-8	84	600	E	350	2,500	E	5,000	10,000	C	5,000	10,000	C	5,000	10,000	C	5,000	10,000	C	15
CYANAZINE	21725-46-2	0.1	0.061	E	0.1	0.061	E	10	6.1	E	10	6.1	E	0.1	0.061	E	0.1	0.061	E	NA
CYCLOHEXANE	110-82-7	1,300	1,700	E	5,300	6,900	E	5,500	7,200	E	5,500	7,200	E	1,300	1,700	E	5,300	6,900	E	NA
CYCLOHEXANONE	108-94-1	150	41	E	620	170	E	10,000	4,100	E	10,000	10,000	C	150	41	E	620	170	E	NA
CYFLUTHRIN	68359-37-5	0.1	33	E	0.1	33	E	0.1	33	E	0.1	33	E	0.1	33	E	0.1	33	E	10
CYROMAZINE	66215-27-8	1,700	5,300	E	4,900	15,000	E	170,000	190,000	C	190,000	190,000	C	1,700	5,300	E	4,900	15,000	E	20
DDD, 4,4'-	72-54-8	0.27	30	E	1.1	120	E	16	1,800	E	16	1,800	E	16	1,800	E	16	1,800	E	10
DDE, 4,4'-	72-55-9	0.19	41	E	0.8	170	E	4	870	E	4	870	E	4	870	E	4	870	E	10
DDT, 4,4'-	50-29-3	0.19	110	E	0.55	330	E	0.55	330	E	0.55	330	E	0.55	330	E	0.55	330	E	5
DI(2-ETHYLHEXYL)ADIPATE	103-23-1	40	10,000	C	40	10,000	C	4,000	10,000	C	4,000	10,000	C	10,000	10,000	C	10,000	10,000	C	5
DIALLATE	2303-16-4	1.1	0.64	E	4.5	2.6	E	110	64	E	450	260	E	1,100	640	E	4,000	2,300	E	NA
DIAMINOTOLUENE, 2,4-	95-80-7	0.016	0.0032	E	0.068	0.014	E	1.6	0.32	E	6.8	1.4	E	16	3.2	E	68	14	E	NA
DIAZINON	333-41-5	0.1	0.14	E	0.1	0.14	E	10	14	E	10	14	E	0.1	0.14	E	0.1	0.14	E	30
DIBENZO[A,H] ANTHRACENE	53-70-3	**[0.0052] 0.021**	**[23] 95**	E	0.06	270	E	0.06	270	E	0.06	270	E	0.06	270	E	0.06	270	E	5

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		Residential			*Nonresidential*			*Residential*			*Nonresidential*			*Residential*			*Nonresidential*			
		100 X GW MSC	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		
DIBENZOFURAN	132-64-9	3.5	90	E	9.7	250	E	350	9,000	E	450	12,000	E	350	9,000	E	450	12,000	E	15
DIBROMO-3-CHLOROPROPANE, 1,2-	96-12-8	0.02	0.0092	E	0.02	0.0092	E	2	0.92	E	2	0.92	E	2	0.92	E	2	0.92	E	NA
DIBROMOBENZENE, 1,4-	106-37-6	35	140	E	97	400	E	2,000	8,200	E	2,000	8,200	E	35	140	E	97	400	E	20
DIBROMOETHANE, 1,2- (ETHYLENE DIBROMIDE)	106-93-4	0.005	0.0012	E	0.005	0.0012	E	0.5	0.12	E	0.5	0.12	E	0.5	0.12	E	0.5	0.12	E	NA
DIBROMOMETHANE	74-95-3	0.84	0.32	E	3.5	1.4	E	84	32	E	350	140	E	84	32	E	350	140	E	NA
DIBUTYL PHTHALATE, N-	84-74-2	350	1,400	E	970	4,000	E	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	20
DICAMBA	1918-00-9	400	45	E	400	45	E	40,000	4,500	E	40,000	4,500	E	400	45	E	400	45	E	NA
DICHLOROACETIC ACID (HAA)	76-43-6	6	0.79	E	6	0.79	E	600	79	E	600	79	E	6	0.79	E	6	0.79	E	NA
DICHLORO-2-BUTENE, 1,4-	764-41-0	0.0012	0.00067	E	0.006	0.0034	E	0.12	0.067	E	0.6	0.34	E	0.0012	0.00067	E	0.006	0.0034	E	NA
DICHLORO-2-BUTENE, TRANS-1,4-	110-57-6	0.0012	0.00078	E	0.006	0.0039	E	0.12	0.078	E	0.6	0.39	E	0.0012	0.00078	E	0.006	0.0039	E	NA
DICHLOROBENZENE, 1,2-	95-50-1	60	59	E	60	59	E	6,000	5,900	E	6,000	5,900	E	6,000	5,900	E	6,000	5,900	E	NA
DICHLOROBENZENE, 1,3-	541-73-1	60	61	E	60	61	E	6,000	6,100	E	6,000	6,100	E	6,000	6,100	E	6,000	6,100	E	NA
DICHLOROBENZENE, P-	106-46-7	7.5	10	E	7.5	10	E	750	1,000	E	750	1,000	E	750	1,000	E	750	1,000	E	30
DICHLOROBENZIDINE, 3,3'-	91-94-1	0.14	7.7	E	0.6	33	E	14	770	E	60	3,300	E	140	7,700	E	310	17,000	E	10
DICHLORODIFLUORO-METHANE (FREON 12)	75-71-8	100	100	E	100	100	E	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	NA
DICHLOROETHANE, 1,1-	75-34-3	3.1	0.75	E	16	3.9	E	310	75	E	1,600	390	E	31	7.5	E	160	39	E	NA
DICHLOROETHANE, 1,2-	107-06-2	0.5	0.1	E	0.5	0.1	E	50	10	E	50	10	E	5	1	E	5	1	E	NA
DICHLOROETHYLENE, 1,1-	75-35-4	0.7	0.19	E	0.7	0.19	E	70	19	E	70	19	E	7	1.9	E	7	1.9	E	NA
DICHLOROETHYLENE, CIS-1,2-	156-59-2	7	1.6	E	7	1.6	E	700	160	E	700	160	E	70	16	E	70	16	E	NA
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	10	2.3	E	10	2.3	E	1,000	230	E	1,000	230	E	100	23	E	100	23	E	NA
DICHLOROMETHANE (METHYLENE CHLORIDE)	75-09-2	0.5	0.076	E	0.5	0.076	E	50	7.6	E	50	7.6	E	50	7.6	E	50	7.6	E	NA
DICHLOROPHENOL, 2,4-	120-83-2	2	1	E	2	1	E	200	100	E	200	100	E	2,000	1,000	E	2,000	1,000	E	NA
DICHLOROPHENOXY ACETIC ACID, 2,4- (2,4-D)	94-75-7	7	1.8	E	7	1.8	E	700	180	E	700	180	E	7,000	1,800	E	7,000	1,800	E	NA
DICHLOROPROPANE, 1,2-	78-87-5	0.5	0.11	E	0.5	0.11	E	50	11	E	50	11	E	5	1.1	E	5	1.1	E	NA
DICHLOROPROPENE, 1,3-	542-75-6	0.65	0.12	E	2.7	0.48	E	65	12	E	270	48	E	65	12	E	270	48	E	NA
DICHLOROPROPIONIC ACID, 2,2- (DALAPON)	75-99-0	20	5.3	E	20	5.3	E	2,000	530	E	2,000	530	E	2,000	530	E	2,000	530	E	NA
DICHLORVOS	62-73-7	0.22	0.052	E	0.94	0.22	E	22	5.2	E	94	22	E	0.22	0.052	E	0.94	0.22	E	NA
DICYCLOPENTADIENE	77-73-6	0.063	0.13	E	0.26	0.56	E	6.3	13	E	26	56	E	0.063	0.13	E	0.26	0.56	E	30
DIELDRIN	60-57-1	0.0041	0.11	E	0.017	0.47	E	0.41	11	E	1.7	47	E	4.1	110	E	17	470	E	15

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REGULATED SUBSTANCE	*CASRN*	*Used Aquifers*												*Nonuse Aquifers*						*Soil Buffer Distance (feet)*
		TDS ≤ 2500 mg/L						*TDS > 2500 mg/L*												
		Residential			*Nonresidential*			*Residential*			*Nonresidential*			*Residential*			*Nonresidential*			
		100 X GW MSC	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		
DIETHYL PHTHALATE	84-66-2	2,800	880	E	7,800	2,400	E	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	NA
DIFLUBENZURON	35367-38-5	20	52	E	20	52	E	20	52	E	20	52	E	20	52	E	20	52	E	20
DIISOPROPYL METHYLPHOSPHONATE	1445-75-6	60	8.2	E	60	8.2	E	6,000	820	E	6,000	820	E	60	8.2	E	60	8.2	E	NA
DIMETHOATE	60-51-5	7.6	2.9	E	21	8.1	E	760	290	E	2,100	810	E	7,600	2,900	E	21,000	8,100	E	NA
DIMETHOXYBENZIDINE, 3,3-	119-90-4	0.041	0.14	E	0.17	0.57	E	4.1	14	E	17	57	E	41	140	E	170	570	E	20
DIMETHRIN	70-38-2	3.6	240	E	3.6	240	E	3.6	240	E	3.6	240	E	3.6	240	E	3.6	240	E	10
DIMETHYLAMINOAZO BENZENE, P-	60-11-7	0.014	0.037	E	0.059	0.15	E	1.4	3.7	E	5.9	15	E	14	37	E	59	150	E	20
DIMETHYLANILINE, N,N-	121-69-7	2.4	1.3	E	10	5.6	E	240	130	E	1,000	560	E	240	130	E	1,000	560	E	NA
DIMETHYLBENZIDINE, 3,3-	119-93-7	0.0059	0.33	E	0.025	1.4	E	0.59	33	E	2.5	140	E	5.9	330	E	25	1,400	E	10
DIMETHYL METHYLPHOSPHONATE	756-79-6	10	1.2	E	10	1.2	E	1,000	120	E	1,000	120	E	10	1.2	E	10	1.2	E	NA
DIMETHYLPHENOL, 2,4-	105-67-9	69	30	E	190	83	E	6,900	3,000	E	10,000	8,300	E	10,000	10,000	C	10,000	10,000	C	NA
DINITROBENZENE, 1,3-	99-65-0	0.1	0.049	E	0.1	0.049	E	10	4.9	E	10	4.9	E	100	49	E	100	49	E	NA
DINITROPHENOL, 2,4-	51-28-5	6.9	0.78	E	19	2.1	E	690	78	E	1,900	210	E	6,900	780	E	19,000	2,100	E	NA
DINITROTOLUENE, 2,4-	121-14-2	0.21	0.05	E	0.88	0.21	E	21	5	E	88	21	E	210	50	E	880	210	E	NA
DINITROTOLUENE, 2,6- (2,6-DNT)	606-20-2	0.043	0.013	E	0.18	0.053	E	4.3	1.3	E	18	5.3	E	43	13	E	180	53	E	NA
DINOSEB	88-85-7	0.7	0.29	E	0.7	0.29	E	70	29	E	70	29	E	700	290	E	700	290	E	NA
DIOXANE, 1,4-	123-91-1	0.65	0.085	E	2.7	0.35	E	65	8.5	E	270	35	E	6.5	0.85	E	27	3.5	E	NA
DIPHENAMID	957-51-7	20	12	E	20	12	E	2,000	1,200	E	2,000	1,200	E	20	12	E	20	12	E	NA
DIPHENYLAMINE	122-39-4	350	210	E	970	570	E	30,000	18,000	E	30,000	18,000	E	30,000	18,000	E	30,000	18,000	E	NA
DIPHENYLHYDRAZINE, 1,2-	122-66-7	0.022	0.039	E	0.11	0.19	E	2.2	3.9	E	11	19	E	2.2	3.9	E	11	19	E	30
DIQUAT	**[85-00-7] 2764-72-9**	2	0.24	E	2	0.24	E	200	24	E	200	24	E	2	0.24	E	2	0.24	E	NA
DISULFOTON	298-04-4	0.07	0.18	E	0.07	0.18	E	7	18	E	7	18	E	70	180	E	70	180	E	20
DITHIANE, 1,4-	505-29-3	8	1.3	E	8	1.3	E	800	130	E	800	130	E	8	1.3	E	8	1.3	E	NA
DIURON	330-54-1	6.9	5.9	E	19	16	E	690	590	E	1,900	1,600	E	6.9	5.9	E	19	16	E	NA
ENDOSULFAN	115-29-7	21	110	E	48	250	E	48	250	E	48	250	E	48	250	E	48	250	E	15
ENDOSULFAN I (ALPHA)	959-98-8	21	110	E	50	260	E	50	260	E	50	260	E	21	110	E	50	260	E	15
ENDOSULFAN II (BETA)	33213-65-9	21	120	E	45	260	E	45	260	E	45	260	E	21	120	E	45	260	E	15
ENDOSULFAN SULFATE	1031-07-8	12	70	E	12	70	E	12	70	E	12	70	E	12	70	E	12	70	E	15
ENDOTHALL	145-73-3	10	4.1	E	10	4.1	E	1,000	410	E	1,000	410	E	10	4.1	E	10	4.1	E	NA
ENDRIN	72-20-8	0.2	5.5	E	0.2	5.5	E	20	550	E	20	550	E	0.2	5.5	E	0.2	5.5	E	15
EPICHLOROHYDRIN	106-89-8	0.21	0.042	E	0.88	0.17	E	21	4.2	E	88	17	E	21	4.2	E	88	17	E	NA
ETHEPHON	16672-87-0	17	2	E	49	5.7	E	1,700	200	E	4,900	570	E	17	2	E	49	5.7	E	NA
ETHION	563-12-2	1.7	37	E	4.9	110	E	85	1,900	E	85	1,900	E	1.7	37	E	4.9	110	E	15

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		TDS ≤ 2500 mg/L						*TDS > 2500 mg/L*												
		Residential			*Nonresidential*			*Residential*			*Nonresidential*			*Residential*			*Nonresidential*			
		100 X GW MSC	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		
ETHOXYETHANOL, 2- (EGEE)	110-80-5	**[42] 8.4**	**[5.9] 1.2**	E	**[180] 35**	**[25] 4.9**	E	**[4,200] 840**	**[590] 120**	E	**[10,000] 3,500**	**[2,500] 490**	E	**[4,200] 840**	**[590] 120**	E	**[10,000] 3,500**	**[2,500] 490**	E	NA
ETHYL ACETATE	141-78-6	15	3.9	E	62	16	E	1,500	390	E	6,200	1,600	E	1,500	390	E	6,200	1,600	E	NA
ETHYL ACRYLATE	140-88-5	**[1.4] 1.7**	**[0.54] 0.66**	E	**[5.7] 7**	**[2.2] 2.7**	E	**[140] 170**	**[54] 66**	E	**[570] 700**	**[220] 270**	E	**[140] 170**	**[54] 66**	E	**[570] 700**	**[220] 270**	E	NA
ETHYL BENZENE	100-41-4	70	46	E	70	46	E	7,000	4,600	E	7,000	4,600	E	7,000	4,600	E	7,000	4,600	E	NA
ETHYL DIPROPYL THIOCARBAMATE, S- (EPTC)	759-94-4	170	120	E	490	350	E	10,000	10,000	C	10,000	10,000	C	170	120	E	490	350	E	NA
ETHYL ETHER	60-29-7	690	190	E	1,900	530	E	10,000	10,000	C	10,000	10,000	C	690	190	E	1,900	530	E	NA
ETHYL METHACRYLATE	97-63-2	63	10	E	260	43	E	6,300	1,000	E	10,000	4,300	E	63	10	E	260	43	E	NA
ETHYLENE CHLORHYDRIN	107-07-3	69	7.9	E	190	22	E	6,900	790	E	10,000	2,200	E	69	7.9	E	190	22	E	NA
ETHYLENE GLYCOL	107-21-1	1,400	170	E	1,400	170	E	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	NA
ETHYLENE THIOUREA (ETU)	96-45-7	0.28	0.031	E	0.78	0.087	E	28	3.1	E	78	8.7	E	280	31	E	780	87	E	NA
ETHYLP-NITROPHENYL PHENYLPHOSPHORO THIOATE	2104-64-5	0.035	0.11	E	0.097	0.3	E	3.5	11	E	9.7	30	E	0.035	0.11	E	0.097	0.3	E	20
FENAMIPHOS	22224-92-6	0.07	0.06	E	0.07	0.06	E	7	6	E	7	6	E	0.07	0.06	E	0.07	0.06	E	NA
FENVALERATE (PYDRIN)	51630-58-1	8.5	94	E	8.5	94	E	8.5	94	E	8.5	94	E	8.5	94	E	8.5	94	E	15
FLUOMETURON	2164-17-2	9	2.5	E	9	2.5	E	900	250	E	900	250	E	9	2.5	E	9	2.5	E	NA
FLUORANTHENE	206-44-0	26	3,200	E	26	3,200	E	26	3,200	E	26	3,200	E	26	3,200	E	26	3,200	E	10
FLUORENE	86-73-7	140	2,800	E	190	3,800	E	190	3,800	E	190	3,800	E	190	3,800	E	190	3,800	E	15
FLUOROTRICHLORO METHANE (FREON 11)	75-69-4	200	87	E	200	87	E	10,000	8,700	E	10,000	8,700	E	10,000	8,700	E	10,000	8,700	E	NA
FONOFOS	944-22-9	1	2.9	E	1	2.9	E	100	290	E	100	290	E	1	2.9	E	1	2.9	E	20
FORMALDEHYDE	50-00-0	100	12	E	100	12	E	10,000	1,200	E	10,000	1,200	E	10,000	1,200	E	10,000	1,200	E	NA
FORMIC ACID	64-18-6	0.063	0.0071	E	0.26	0.029	E	6.3	0.71	E	26	2.9	E	0.63	0.071	E	2.6	0.29	E	NA
FOSETYL-AL	39148-24-8	8,700	7,700	E	24,000	21,000	E	190,000	190,000	C	190,000	190,000	C	8,700	7,700	E	24,000	21,000	E	NA
FURAN	110-00-9	3.5	1.5	E	9.7	4.2	E	350	150	E	970	420	E	350	150	E	970	420	E	NA
FURFURAL	98-01-1	1.9	0.24	E	7.8	0.99	E	190	24	E	780	99	E	1.9	0.24	E	7.8	0.99	E	NA
GLYPHOSATE	1071-83-6	70	620	E	70	620	E	7,000	62,000	E	7,000	62,000	E	70	620	E	70	620	E	15
HEPTACHLOR	76-44-8	0.04	0.68	E	0.04	0.68	E	4	68	E	4	68	E	18	310	E	18	310	E	15
HEPTACHLOR EPOXIDE	1024-57-3	0.02	1.1	E	0.02	1.1	E	2	110	E	2	110	E	20	1,100	E	20	1,100	E	10
HEXACHLOROBENZENE	118-74-1	0.1	0.96	E	0.1	0.96	E	0.6	5.8	E	0.6	5.8	E	0.6	5.8	E	0.6	5.8	E	15
HEXACHLOROBUTADIENE	87-68-3	0.84	10	E	3.5	42	E	84	1,000	E	290	3,400	E	290	3,400	E	290	3,400	E	15
HEXACHLOROCYCLO PENTADIENE	77-47-4	5	91	E	5	91	E	180	3,300	E	180	3,300	E	180	3,300	E	180	3,300	E	15
HEXACHLOROETHANE	67-72-1	0.1	0.56	E	0.1	0.56	E	10	56	E	10	56	E	10	56	E	10	56	E	15

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REGULATED SUBSTANCE	*CASRN*	*Used Aquifers*								*Nonuse Aquifers*				*Soil Buffer Distance (feet)*
		TDS ≤ 2500 mg/L				*TDS > 2500 mg/L*								
		Residential		*Nonresidential*		*Residential*		*Nonresidential*		*Residential*		*Nonresidential*		
		100 X GW MSC	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	
HEXAFLUOROPROPYLENE OXIDE (HFPO) DIMER ACID	**13252-13-6**	**0.001**	**N/A**	**0.001**	**N/A**	**0.1**	**N/A**	**0.1**	**N/A**	**0.001**	**N/A**	**0.001**	**N/A**	**NA**
HEXAFLUOROPROPYLENE OXIDE (HFPO) DIMER ACID AMMONIUM SALT	**62037-80-3**	**0.001**	**N/A**	**0.001**	**N/A**	**0.1**	**N/A**	**0.1**	**N/A**	**0.001**	**N/A**	**0.001**	**N/A**	**NA**
HEXANE	110-54-3	150	1,400 E	580	5,300 E	950	8,700 E	950	8,700 E	150	1,400 E	580	5,300 E	15
HEXAZINONE	51235-04-2	40	8.5 E	40	8.5 E	4,000	850 E	4,000	850 E	40	8.5 E	40	8.5 E	NA
HEXYTHIAZOX (SAVEY)	78587-05-0	50	820 E	50	820 E	50	820 E	50	820 E	50	820 E	50	820 E	15
HMX	2691-41-0	40	4.8 E	40	4.8 E	500	60 E	500	60 E	40	4.8 E	40	4.8 E	NA
HYDRAZINE/HYDRAZINE SULFATE	302-01-2	0.001	0.00011 E	0.0051	0.00057 E	0.1	0.011 E	0.51	0.057 E	0.01	0.0011 E	0.051	0.0057 E	NA
HYDROQUINONE	123-31-9	1.1	0.15 E	4.5	0.61 E	110	15 E	450	61 E	1,100	150 E	4,500	610 E	NA
INDENO[1,2,3-CD]PYRENE	193-39-5	**[0.018] 0.21**	**[1,400] 16,000** E	**[0.23] 2.7**	**[18,000] 190,000**	**[E] C**	**[1.8] 6.2**	**[140,000] 190,000**	**[E] C**	6.2	190,000 C	6.2	190,000 C	5
IPRODIONE	36734-19-7	1.5	4.3 E	6.2	18 E	150	430 E	620	1,800 E	1.5	4.3 E	6.2	18 E	20
ISOBUTYL ALCOHOL	78-83-1	1,000	260 E	2,900	760 E	10,000	10,000 C	10,000	10,000 C	10,000	10,000 C	10,000	10,000 C	NA
ISOPHORONE	78-59-1	10	1.9 E	10	1.9 E	1,000	190 E	1,000	190 E	10,000	1,900 E	10,000	1,900 E	NA
ISOPROPYL METHYLPHOSPHONATE	1832-54-8	70	8.1 E	70	8.1 E	7,000	810 E	7,000	810 E	70	8.1 E	70	8.1 E	NA
KEPONE	143-50-0	0.0065	0.89 E	0.027	3.7 E	0.65	89 E	2.7	370 E	6.5	890 E	27	3,700 E	10
MALATHION	121-75-5	50	170 E	50	170 E	5,000	10,000 C	5,000	10,000 C	10,000	10,000 C	10,000	10,000 C	20
MALEIC HYDRAZIDE	123-33-1	400	47 E	400	47 E	40,000	4,700 E	40,000	4,700 E	400	47 E	400	47 E	NA
MANEB	12427-38-2	1.1	0.12 E	4.5	0.51 E	110	12 E	450	51 E	1.1	0.12 E	4.5	0.51 E	NA
MERPHOS OXIDE	78-48-8	1.7	230 E	4.9	650 E	170	10,000 C	230	10,000 C	1.7	230 E	4.9	650 E	10
METHACRYLONITRILE	126-98-7	0.35	0.057 E	0.97	0.16 E	35	5.7 E	97	16 E	0.35	0.057 E	0.97	0.16 E	NA
METHAMIDOPHOS	10265-92-6	0.17	0.021 E	0.49	0.061 E	17	2.1 E	49	6.1 E	0.17	0.021 E	0.49	0.061 E	NA
METHANOL	67-56-1	4,200	500 E	10,000	2,100 E	10,000	10,000 C	10,000	10,000 C	10,000	10,000 C	10,000	10,000 C	NA
METHOMYL	16752-77-5	20	3.2 E	20	3.2 E	2,000	320 E	2,000	320 E	20	3.2 E	20	3.2 E	NA
METHOXYCHLOR	72-43-5	4	630 E	4	630 E	4.5	710 E	4.5	710 E	4.5	710 E	4.5	710 E	10
METHOXYETHANOL, 2-	109-86-4	**[4.2] 1.5**	**[0.48] 0.17** E	**[18] 6.2**	**[2] 0.7** E	**[420] 150**	**[48] 17** E	**[1,800] 620**	**[200] 70** E	**[42] 15**	**[4.8] 1.7** E	**[180] 62**	**[20] 7** E	NA
METHYL ACETATE	79-20-9	3,500	650 E	9,700	1,800 E	10,000	10,000 C	10,000	10,000 C	3,500	650 E	9,700	1,800 E	NA
METHYL ACRYLATE	96-33-3	4.2	1 E	18	4.5 E	420	100 E	1,800	450 E	420	100 E	1,800	450 E	NA
METHYL CHLORIDE	74-87-3	3	0.38 E	3	0.38 E	300	38 E	300	38 E	300	38 E	300	38 E	NA
METHYL ETHYL KETONE	78-93-3	400	76 E	400	76 E	10,000	7,600 E	10,000	7,600 E	10,000	7,600 E	10,000	7,600 E	NA
METHYL HYDRAZINE	60-34-4	0.0042	0.00048 E	0.018	0.002 E	0.42	0.048 E	1.8	0.2 E	0.042	0.0048 E	0.18	0.02 E	NA

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		Residential			*Nonresidential*			*Residential*			*Nonresidential*			*Residential*			*Nonresidential*			
		100 X GW MSC	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		
METHYL ISOBUTYL KETONE	108-10-1	**[280] 630**	**[43] 97**	E	**[780] 2,600**	**[120] 400**	E	10,000	**[4,300] 9,700**	E	10,000	10,000	C	10,000	**[4,300] 9,700**	E	10,000	10,000	C	NA
METHYL ISOCYANATE	624-83-9	0.21	0.029	E	0.88	0.12	E	21	2.9	E	88	12	E	0.21	0.029	E	0.88	0.12	E	NA
METHYL N-BUTYL KETONE (2-HEXANONE)	591-78-6	6.3	1.6	E	26	6.4	E	630	160	E	2,600	640	E	6.3	1.6	E	26	6.4	E	NA
METHYL METHACRYLATE	80-62-6	150	20	E	620	84	E	10,000	2,000	E	10,000	8,400	E	10,000	2,000	E	10,000	8,400	E	NA
METHYL METHANESULFONATE	66-27-3	0.66	0.082	E	2.7	0.34	E	66	8.2	E	270	34	E	0.66	0.082	E	2.7	0.34	E	NA
METHYL PARATHION	298-00-0	0.1	0.21	E	0.1	0.21	E	10	21	E	10	21	E	100	210	E	100	210	E	30
METHYL STYRENE (MIXED ISOMERS)	25013-15-4	8.4	47	E	35	200	E	840	4,700	E	3,500	10,000	C	8.4	47	E	35	200	E	15
METHYL TERT-BUTYL ETHER (MTBE)	1634-04-4	2	0.28	E	2	0.28	E	200	28	E	200	28	E	20	2.8	E	20	2.8	E	NA
METHYLCHLOROPHENOXYACETIC ACID (MCPA)	94-74-6	3	1.2	E	3	1.2	E	300	120	E	300	120	E	3,000	1,200	E	3,000	1,200	E	NA
METHYLENE BIS(2-CHLOROANILINE), 4,4'-	101-14-4	0.21	1.6	E	2.7	21	E	21	160	E	270	2,100	E	0.21	1.6	E	2.7	21	E	15
METHYLNAPHTHALENE, 2-	91-57-6	0.63	25	E	2.6	100	E	63	2,500	E	260	10,000	E	0.63	25	E	2.6	100	E	15
METHYLSTYRENE, ALPHA	98-83-9	240	420	E	680	1,200	E	10,000	10,000	C	10,000	10,000	C	240	420	E	680	1,200	E	30
METOLACHLOR	51218-45-2	70	40	E	70	40	E	7,000	4,000	E	7,000	4,000	E	70	40	E	70	40	E	NA
METRIBUZIN	21087-64-9	7	2.4	E	7	2.4	E	700	240	E	700	240	E	7	2.4	E	7	2.4	E	NA
MEVINPHOS	7786-34-7	0.087	0.019	E	0.24	0.053	E	8.7	1.9	E	24	5.3	E	0.087	0.019	E	0.24	0.053	E	NA
MONOCHLOROACETIC ACID (HAA)	79-11-8	6	0.67	E	6	0.67	E	600	67	E	600	67	E	6	0.67	E	6	0.67	E	NA
NAPHTHALENE	91-20-3	10	25	E	10	25	E	1,000	2,500	E	1,000	2,500	E	1,000	2,500	E	1,000	2,500	E	30
NAPHTHYLAMINE, 1-	134-32-7	0.036	0.29	E	0.15	1.2	E	3.6	29	E	15	120	E	3.6	29	E	15	120	E	15
NAPHTHYLAMINE, 2-	91-59-8	0.036	0.012	E	0.15	0.049	E	3.6	1.2	E	15	4.9	E	36	12	E	150	49	E	NA
NAPROPAMIDE	15299-99-7	420	970	E	1,200	2,800	E	7,000	16,000	E	7,000	16,000	E	420	970	E	1,200	2,800	E	30
NITROANILINE, O-	88-74-4	0.011	0.002	E	0.044	0.0079	E	1.1	0.2	E	4.4	0.79	E	0.011	0.002	E	0.044	0.0079	E	NA
NITROANILINE, P-	100-01-6	3.3	0.49	E	14	2.1	E	330	49	E	1,400	210	E	3.3	0.49	E	14	2.1	E	NA
NITROBENZENE	98-95-3	0.12	0.052	E	0.63	0.27	E	12	5.2	E	63	27	E	12	5.2	E	63	27	**[C] E**	NA
NITROGUANIDINE	556-88-7	70	7.8	E	70	7.8	E	7,000	780	E	7,000	780	E	70	7.8	E	70	7.8	E	NA
NITROPHENOL, 2-	88-75-5	28	5.7	E	78	16	E	2,800	570	E	7,800	1,600	E	2,800	570	E	7,800	1,600	E	NA
NITROPHENOL, 4-	100-02-7	6	4.1	E	6	4.1	E	600	410	E	600	410	E	600	410	E	600	410	E	NA

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B. Soil to Groundwater Numeric Values[1]

REGULATED SUBSTANCE	*CASRN*	*Used Aquifers*										*Nonuse Aquifers*				*Soil Buffer Distance (feet)*
		TDS ≤ 2500 mg/L				*TDS > 2500 mg/L*										
		Residential		*Nonresidential*		*Residential*		*Nonresidential*		*Residential*		*Nonresidential*				
		100 X GW MSC	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*			
NITROPROPANE, 2-	79-46-9	**[0.0018] 0.0084**	**[0.00029] 0.0014** E	**[0.0093] 0.043**	**[0.0015] 0.0069** E	**[0.18] 0.84**	**[0.029] 0.14** E	**[0.93] 4.3**	**[0.15] 0.69** E	**[0.018] 0.084**	**[0.0029] 0.014** E	**[0.093] 0.43**	**[0.015] 0.069** E			NA
NITROSODIETHYLAMINE, N-	55-18-5	0.000045	0.0000079 E	0.00058	0.0001 E	0.0045	0.00079 E	0.058	0.01 E	0.00045	0.000079 E	0.0058	0.001 E			NA
NITROSODIMETHYLAMINE, N-	62-75-9	0.00014	0.000019 E	0.0018	0.00024 E	0.014	0.0019 E	0.18	0.024 E	0.0014	0.00019 E	0.018	0.0024 E			NA
NITROSO-DI-N-BUTYLAMINE, N-	924-16-3	0.0031	0.0038 E	0.016	0.02 E	0.31	0.38 E	1.6	2 E	0.31	0.38 E	1.6	2 E			NA
NITROSODI-N-PROPYLAMINE, N-	621-64-7	0.0025	0.00035 E	0.013	0.0018 E	0.25	0.035 E	1.3	0.18 E	0.025	0.0035 E	0.13	0.018 E			NA
NITROSODIPHENYLAMINE, N-	86-30-6	1.9	3 E	9.6	15 E	190	300 E	960	1,500 E	190	300 E	960	1,500 E			30
NITROSO-N-ETHYLUREA, N-	759-73-9	0.00079	0.000091 E	0.01	0.0012 E	0.079	0.0091 E	1	0.12 E	0.79	0.091 E	10	1.2 E			NA
OCTYL PHTHALATE, DI-N-	117-84-0	35	10,000 C	97	10,000 C	300	10,000 C	300	10,000 C	300	10,000 C	300	10,000 C			5
OXAMYL (VYDATE)	23135-22-0	20	2.6 E	20	2.6 E	2,000	260 E	2,000	260 E	20	2.6 E	20	2.6 E			NA
PARAQUAT	1910-42-5	3	120 E	3	120 E	300	12,000 E	300	12,000 E	3	120 E	3	120 E			15
PARATHION	56-38-2	0.1	0.59 E	0.29	1.7 E	10	59 E	29	170 E	0.1	0.59 E	0.29	1.7 E			15
PCBS, TOTAL (POLYCHLORINATED BIPHENLYS) (AROCLORS)	1336-36-3	0.05	9.8 E	0.05	9.8 E	5	980 E	5	980 E	0.05	9.8 E	0.05	9.8 E			10
PCB-1016 (AROCLOR)	12674-11-2	0.24	66 E	0.68	190 E	24	6,600 E	25	6,900 E	0.24	66 E	0.68	190 E			10
PCB-1221 (AROCLOR)	11104-28-2	0.033	0.16 E	0.14	0.68 E	3.3	16 E	14	68 E	0.033	0.16 E	0.14	0.68 E			20
PCB-1232 (AROCLOR)	11141-16-5	0.033	0.13 E	0.14	0.54 E	3.3	13 E	14	54 E	0.033	0.13 E	0.14	0.54 E			20
PCB-1242 (AROCLOR)	53469-21-9	0.033	4 E	0.14	17 E	3.3	400 E	10	1,200 E	0.033	4 E	0.14	17 E			10
PCB-1248 (AROCLOR)	12672-29-6	0.033	16 E	0.14	67 E	3.3	1,600 E	5.4	2,600 E	0.033	16 E	0.14	67 E			10
PCB-1254 (AROCLOR)	11097-69-1	0.069	140 E	0.19	380 E	5.7	10,000 C	5.7	10,000 C	0.069	140 E	0.19	380 E			5
PCB-1260 (AROCLOR)	11096-82-5	0.033	150 E	0.14	630 E	3.3	15,000 E	8	36,000 E	0.033	150 E	0.14	630 E			5
PEBULATE	1114-71-2	**[170] 2.4**	**[290] 4** E	**[490] 6.8**	**[830] 11** E	**[9,200] 240**	**[10,000] 400**	**[C] E**	**[9,200] 680**	**[10,000] 1,100**	**[C] E**	**[170] 2.4**	**[290] 4** E	**[490] 6.8**	**[830] 11** E	30
PENTACHLOROBENZENE	608-93-5	2.8	220 E	7.8	620 E	74	5,900 E	74	5,900 E	74	5,900 E	74	5,900 E			10
PENTACHLOROETHANE	76-01-7	0.72	3.5 E	3	15 E	72	350 E	300	1,500 E	0.72	3.5 E	3	15 E			20
PENTACHLORO NITROBENZENE	82-68-8	0.25	5 E	1	20 E	25	500 E	44	870 E	44	870 E	44	870 E			15
PENTACHLOROPHENOL	87-86-5	0.1	5 E	0.1	5 E	10	500 E	10	500 E	100	5,000 E	100	5,000 E			10
PERFLUOROBUTANE SULFONATE (PFBS)	375-73-5	**[1] 0.2**	N/A	**[2.9] 0.2**	N/A	**[100] 20**	N/A	**[290] 20**	N/A	**[1] 0.2**	N/A	**[2.9] 0.2**	N/A			NA
PERFLUOROBUTANOIC ACID (PFBA)	**375-22-4**	**3.5**	**N/A**	**9.7**	**N/A**	**350**	**N/A**	**970**	**N/A**	**3.5**	**N/A**	**9.7**	**N/A**			**NA**

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REGULATED SUBSTANCE	*CASRN*	*Used Aquifers*								*Nonuse Aquifers*				*Soil Buffer Distance (feet)*
		TDS ≤ 2500 mg/L				*TDS > 2500 mg/L*								
		Residential		*Nonresidential*		*Residential*		*Nonresidential*		*Residential*		*Nonresidential*		
		100 X GW MSC	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	
PERFLUOROHEXANOIC ACID (PFHxA)	**307-24-4**	**1.7**	**N/A**	**4.9**	**N/A**	**170**	**N/A**	**490**	**N/A**	**1.7**	**N/A**	**4.9**	**N/A**	**NA**
PERFLUOROOCTANE SULFONATE (PFOS)	1763-23-1	**[0.007] 0.0018**	N/A	**[0.007] 0.0018**	N/A	**[0.7] 0.18**	N/A	**[0.7] 0.18**	N/A	**[0.007] 0.0018**	N/A	**[0.007] 0.0018**	N/A	NA
PERFLUOROOCTANOIC ACID (PFOA)	335-67-1	**[0.007] 0.0014**	N/A	**[0.007] 0.0014**	N/A	**[0.7] 0.14**	N/A	**[0.7] 0.14**	N/A	**[0.007] 0.0014**	N/A	**[0.007] 0.0014**	N/A	NA
PHENACETIN	62-44-2	30	12 E	120	46 E	3,000	1,200 E	12,000	4,600 E	30,000	12,000 E	76,000	29,000 E	NA
PHENANTHRENE	85-01-8	110	10,000 E	110	10,000 E	110	10,000 E	110	10,000 E	110	10,000 E	110	10,000 E	10
PHENOL	108-95-2	200	33 E	200	33 E	20,000	3,300 E	20,000	3,300 E	20,000	3,300 E	20,000	3,300 E	NA
PHENYL MERCAPTAN	108-98-5	3.5	5.3 E	9.7	15 E	350	530 E	970	1,500 E	3.5	5.3 E	9.7	15 E	30
PHENYLENEDIAMINE, M-	108-45-2	21	3 E	58	8.2 E	2,100	300 E	5,800	820 E	21,000	3,000 E	58,000	8,200 E	NA
PHENYLPHENOL, 2-	90-43-7	34	490 E	140	2,000 E	3,400	49,000 E	14,000	190,000 C	34,000	190,000 C	70,000	190,000 C	15
PHORATE	298-02-2	**[0.69] 0.59**	**[1.5] 1.3** E	**[1.9] 1.7**	**[4.1] 3.6** E	**[69] 59**	**[150] 130** E	**[190] 170**	**[410] 360** E	**[0.69] 0.59**	**[1.5] 1.3** E	**[1.9] 1.7**	**[4.1] 3.6** E	30
PHTHALIC ANHYDRIDE	85-44-9	4.2	1.3 E	18	5.6 E	420	130 E	1,800	560 E	420	130 E	1,800	560 C	NA
PICLORAM	1918-02-1	50	7.4 E	50	7.4 E	5,000	740 E	5,000	740 E	50	7.4 E	50	7.4 E	NA
POTASSIUM PERFLUOROBUTANE SULFONATE	**29420-49-3**	**0.2**	**N/A**	**0.2**	**N/A**	**20**	**N/A**	**20**	**N/A**	**0.2**	**N/A**	**0.2**	**N/A**	**NA**
PROMETON	1610-18-0	40	39 E	40	39 E	4,000	3,900 E	4,000	3,900 E	40	39 E	40	39 E	NA
PRONAMIDE	23950-58-5	260	160 E	730	450 E	1,500	920 E	1,500	920 E	260	160 E	730	450 E	NA
PROPACHLOR	1918-16-7	0.01	0.0046 E	0.01	0.0046 E	1	0.46 E	1	0.46 E	1	0.46 E	1	0.46 E	NA
PROPANIL	709-98-8	17	8.7 E	49	25 E	1,700	870 E	4,900	2,500 E	17	8.7 E	49	25 E	NA
PROPANOL, 2- (ISOPROPYL ALCOHOL)	67-63-0	42	7.3 E	180	31 E	4,200	730 E	10,000	3,100 E	42	7.3 E	180	31 E	NA
PROPAZINE	139-40-2	1	0.5 E	1	0.5 E	100	50 E	100	50 E	1	0.5 E	1	0.5 E	NA
PROPHAM	122-42-9	10	2.4 E	10	2.4 E	1,000	240 E	1,000	240 E	10	2.4 E	10	2.4 E	NA
PROPYLBENZENE, N-	103-65-1	210	400 E	880	1,700 E	5,200	9,900 E	5,200	9,900 E	210	400 E	880	1,700 E	30
PROPYLENE OXIDE	75-56-9	0.27	0.047 E	1.1	0.19 E	27	4.7 E	110	19 E	0.27	0.047 E	1.1	0.19 E	NA
PYRENE	129-00-0	13	2,200 E	13	2,200 E	13	2,200 E	13	2,200 E	13	2,200 E	13	2,200 E	10
PYRETHRUM	8003-34-7	35	4.4 E	35	4.4 E	35	4.4 E	35	4.4 E	35	4.4 E	35	4.4 E	NA
PYRIDINE	110-86-1	**[3.4] 3.5**	0.39 E	9.7	1.1 E	350	39 E	970	110 E	35	3.9 E	97	11 E	NA
QUINOLINE	91-22-5	0.022	0.074 E	0.091	0.31 E	2.2	7.4 E	9.1	31 E	22	74 E	91	310 E	20
QUIZALOFOP (ASSURE)	76578-14-8	30	47 E	30	47 E	30	47 E	30	47 E	30	47 E	30	47 E	30
RDX	121-82-4	0.2	0.057 E	0.2	0.057 E	20	5.7 E	20	5.7 E	0.2	0.057 E	0.2	0.057 E	NA
RESORCINOL	108-46-3	6,900	800 E	19,000	2,200 E	190,000	80,000 E	190,000	190,000 C	6,900	800 E	19,000	2,200 E	NA
RONNEL	299-84-3	170	270 E	490	760 E	4,000	6,200 E	4,000	6,200 E	170	270 E	490	760 E	30
SIMAZINE	122-34-9	0.4	0.15 E	0.4	0.15 E	40	15 E	40	15 E	0.4	0.15 E	0.4	0.15 E	NA

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		Residential		*Nonresidential*		*Residential*		*Nonresidential*				*Residential*		*Nonresidential*		
		100 X GW MSC	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*			*100 X GW MSC*	*Generic Value*	*100 X GW MSC*	*Generic Value*	
STRYCHNINE	57-24-9	1	0.81 E	2.9	2.4 E	100	81 E	290	240 E			1,000	810 E	2,900	2,400 E	NA
STYRENE	100-42-5	10	24 E	10	24 E	1,000	2,400 E	1,000	2,400 E			1,000	2,400 E	1,000	2,400 E	30
TEBUTHIURON	34014-18-1	50	83 E	50	83 E	5,000	8,300 E	5,000	8,300 E			50	83 E	50	83 E	30
TERBACIL	5902-51-2	9	2.2 E	9	2.2 E	900	220 E	900	220 E			9	2.2 E	9	2.2 E	NA
TERBUFOS	13071-79-9	0.04	0.055 E	0.04	0.055 E	4	5.5 E	4	5.5 E			0.04	0.055 E	0.04	0.055 E	30
TETRACHLOROBENZENE, 1,2,4,5-	95-94-3	**[1] 0.1**	**[4.6] 0.46** E	**[2.9] 0.29**	**[13] 1.3** E	**[58] 10**	**[270] 46** E	**[58] 29**	**[270] 130** E			58	270 E	58	270 E	20
TETRACHLORODIBENZO-P-DIOXIN, 2,3,7,8- (TCDD)	1746-01-6	0.000003	0.032 E	0.000003	0.032 E	0.0003	3.2 E	0.0003	3.2 E			0.0019	20 E	0.0019	20 E	5
TETRACHLOROETHANE, 1,1,1,2-	630-20-6	7	18 E	7	18 E	700	1,800 E	700	1,800 E			700	1,800 E	700	1,800 E	30
TETRACHLOROETHANE, 1,1,2,2-	79-34-5	0.084	0.026 E	0.43	0.13 E	8.4	2.6 E	43	13 E			8.4	2.6 E	43	13 E	NA
TETRACHLOROETHYLENE (PCE)	127-18-4	0.5	0.43 E	0.5	0.43 E	50	43 E	50	43 E			5	4.3 E	5	4.3 E	NA
TETRACHLOROPHENOL, 2,3,4,6-	58-90-2	100	1,600 E	290	4,500 E	10,000	160,000 E	18,000	190,000 C			18,000	190,000 C	18,000	190,000 C	15
TETRAETHYL LEAD	78-00-2	0.00035	0.0043 E	0.00097	0.012 E	0.035	0.43 E	0.097	1.2 E			0.35	4.3 E	0.97	12 E	15
TETRAETHYLDITHIO PYROPHOSPHATE	3689-24-5	1.7	2.5 E	4.9	7.3 E	170	250 E	490	730 E			1.7	2.5 E	4.9	7.3 E	30
TETRAHYDROFURAN	109-99-9	2.5	0.55 E	13	2.8 E	250	55 E	1,300	280 E			2.5	0.55 E	13	2.8 E	NA
THIOFANOX	39196-18-4	1	0.11 E	2.9	0.32 E	100	11 E	290	32 E			1	0.11 E	2.9	0.32 E	NA
THIRAM	137-26-8	52	140 E	150	390 E	3,000	7,800 E	3,000	7,800 E			52	140 E	150	390 E	20
TOLUENE	108-88-3	100	44 E	100	44 E	10,000	4,400 E	10,000	4,400 E			10,000	4,400 E	10,000	4,400 E	NA
TOLUIDINE, M-	108-44-1	4.1	1.9 E	17	7.8 E	410	190 E	1,700	780 E			4.1	1.9 E	17	7.8 E	NA
TOLUIDINE, O-	95-53-4	4.1	4.7 E	17	19 E	410	470 E	1,700	1,900 E			4,100	4,700 E	10,000	10,000 C	NA
TOLUIDINE, P-	106-49-0	2.2	2 E	9.1	8.3 E	220	200 E	910	830 E			2.2	2 E	9.1	8.3 E	NA
TOXAPHENE	8001-35-2	0.3	1.2 E	0.3	1.2 E	30	120 E	30	120 E			0.3	1.2 E	0.3	1.2 E	20
TRIALLATE	2303-17-5	**[0.091] 0.91**	**[0.47] 4.7** E	**[0.38] 3.8**	**[1.9] 19** E	**[9.1] 91**	**[47] 470** E	**[38] 380**	**[190] 1,900** E			**[0.091] 0.91**	**[0.47] 4.7** E	**[0.38] 3.8**	**[1.9] 19** E	15
TRIBROMOMETHANE (BROMOFORM) (THM)	75-25-2	8	3.5 E	8	3.5 E	800	350 E	800	350 E			800	350 E	800	350 E	NA
TRICHLORO-1,2,2-TRIFLUOROETHANE, 1,1,2-	76-13-1	1,100	3,400 E	4,400	10,000 C	10,000	10,000 C	10,000	10,000 C			10,000	10,000 C	10,000	10,000 C	20
TRICHLOROACETIC ACID (HAA)	76-03-9	6	0.97 E	6	0.97 E	600	97 E	600	97 E			6	0.97 E	6	0.97 E	NA
TRICHLOROBENZENE, 1,2,4-	120-82-1	7	27 E	7	27 E	700	2,700 E	700	2,700 E			700	2,700 E	700	2,700 E	20
TRICHLOROBENZENE, 1,3,5-	108-70-3	4	31 E	4	31 E	400	3,100 E	400	3,100 E			4	31 E	4	31 E	15

[1] For other options see § 250.308 (relating to soil to groundwater pathway numeric values).
All concentrations in mg/kg
E—Number calculated by the soil to groundwater equation in § 250.308
C—Cap
NA—The soil buffer distance option is not available for this substance
N/A—Soil to groundwater values cannot be calculated for these compounds

Appendix A
Table 3—Medium-Specific Concentrations (MSCs) for Organic Regulated Substances in Soil
B. Soil to Groundwater Numeric Values[1]

REGULATED SUBSTANCE	*CASRN*	*Used Aquifers*												*Nonuse Aquifers*						*Soil Buffer Distance (feet)*
		TDS ≤ 2500 mg/L						*TDS > 2500 mg/L*												
		Residential			*Nonresidential*			*Residential*			*Nonresidential*			*Residential*			*Nonresidential*			
		100 X GW MSC	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		*100 X GW MSC*	*Generic Value*		
TRICHLOROETHANE, 1,1,1-	71-55-6	20	7.2	E	20	7.2	E	2,000	720	E	2,000	720	E	200	72	E	200	72	E	NA
TRICHLOROETHANE, 1,1,2-	79-00-5	0.5	0.15	E	0.5	0.15	E	50	15	E	50	15	E	5	1.5	E	5	1.5	E	NA
TRICHLOROETHYLENE (TCE)	79-01-6	0.5	0.17	E	0.5	0.17	E	50	17	E	50	17	E	5	1.7	E	5	1.7	E	NA
TRICHLOROPHENOL, 2,4,5-	95-95-4	350	2,100	E	970	5,900	E	35,000	190,000	C	97,000	190,000	C	100,000	190,000	C	100,000	190,000	C	15
TRICHLOROPHENOL, 2,4,6-	88-06-2	3.5	10	E	9.7	28	E	350	1,000	E	970	2,800	E	3,500	10,000	E	9,700	28,000	E	20
TRICHLOROPHENOXY ACETIC ACID, 2,4,5- (2,4,5-T)	93-76-5	7	1.5	E	7	1.5	E	700	150	E	700	150	E	7,000	1,500	E	7,000	1,500	E	NA
TRICHLOROPHENOXY PROPIONIC ACID, 2,4,5- (2,4,5-TP)(SILVEX)	93-72-1	5	22	E	5	22	E	500	2,200	E	500	2,200	E	5	22	E	5	22	E	20
TRICHLOROPROPANE, 1,1,2-	598-77-6	17	2.9	E	49	8.4	E	1,700	290	E	4,900	840	E	17	2.9	E	49	8.4	E	NA
TRICHLOROPROPANE, 1,2,3-	96-18-4	**[4] 0.00071**	**[3.2] 0.00058**	E	**[4] 0.0091**	**[3.2] 0.0074**	E	**[400] 0.071**	**[320] 0.058**	E	**[400] 0.91**	**[320] 0.74**	E	**[400] 0.071**	**[320] 0.058**	E	**[400] 0.91**	**[320] 0.74**	E	NA
TRICHLOROPROPENE, 1,2,3-	96-19-5	0.063	0.037	E	0.26	0.15	E	6.3	3.7	E	26	15	E	0.063	0.037	E	0.26	0.15	E	NA
TRIETHYLAMINE	121-44-8	1.5	0.36	E	6.2	1.5	E	150	36	E	620	150	E	1.5	0.36	E	6.2	1.5	E	NA
TRIETHYLENE GLYCOL	112-27-6	6,900	870	E	10,000	2,400	E	10,000	10,000	C	10,000	10,000	C	6,900	870	E	10,000	2,400	E	NA
TRIFLURALIN	1582-09-8	1	1.9	E	1	1.9	E	100	190	E	100	190	E	1	1.9	E	1	1.9	E	30
TRIMETHYLBENZENE, 1,3,4- (TRIMETHYLBENZENE, 1,2,4-)	95-63-6	13	73	E	53	300	E	1,300	7,300	E	5,300	10,000	C	1,300	7,300	E	5,300	10,000	C	15
TRIMETHYLBENZENE, 1,3,5-	108-67-8	13	23	E	53	93	E	1,300	2,300	E	4,900	8,600	E	13	23	E	53	93	E	30
TRINITROGLYCEROL (NITROGLYCERIN)	55-63-0	0.5	0.2	E	0.5	0.2	E	50	20	E	50	20	E	50	20	E	50	20	E	NA
TRINITROTOLUENE, 2,4,6-	118-96-7	0.2	0.023	E	0.2	0.023	E	20	2.3	E	20	2.3	E	0.2	0.023	E	0.2	0.023	E	NA
VINYL ACETATE	108-05-4	42	5	E	180	21	E	4,200	500	E	10,000	2,100	E	42	5	E	180	21	E	NA
VINYL BROMIDE (BROMOETHENE)	593-60-2	**[0.15] 0.33**	**[0.073] 0.16**	E	**[0.78] 1.7**	**[0.38] 0.83**	E	**[15] 33**	**[7.3] 16**	E	**[78] 170**	**[38] 83**	E	**[1.5] 3.3**	**[0.73] 1.6**	E	**[7.8] 17**	**[3.8] 8.3**	E	NA
VINYL CHLORIDE	75-01-4	0.2	0.027	E	0.2	0.027	E	20	2.7	E	20	2.7	E	2	0.27	E	2	0.27	E	NA
WARFARIN	81-81-2	1	2.4	E	2.9	6.9	E	100	240	E	290	690	E	1,000	2,400	E	1,700	4,100	E	30
XYLENES (TOTAL)	1330-20-7	1,000	990	E	1,000	990	E	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	10,000	10,000	C	NA
ZINEB	12122-67-7	170	27	E	490	78	E	1,000	160	E	1,000	160	E	170	27	E	490	78	E	NA

[1] For other options see § 250.308 (relating to soil to groundwater pathway numeric values).
All concentrations in mg/kg
E—Number calculated by the soil to groundwater equation in § 250.308
C—Cap
NA—The soil buffer distance option is not available for this substance
N/A—Soil to groundwater values cannot be calculated for these compounds

Appendix A
Table 4—Medium-Specific Concentrations (MSCs) for Inorganic Regulated Substances in Soil
A. Direct Contact Numeric Values

REGULATED SUBSTANCE	*CASRN*	*Residential MSC 0—15 feet*		*Nonresidential MSCs*			
				Surface Soil 0—2 feet		*Subsurface Soil 2—15 feet*	
ALUMINUM	7429-90-5	190,000	C	190,000	C	190,000	C
ANTIMONY	7440-36-0	88	G	1,300	G	190,000	C
ARSENIC	7440-38-2	12	G	61	G	190,000	C
BARIUM AND COMPOUNDS	7440-39-3	44,000	G	190,000	C	190,000	C
BERYLLIUM	7440-41-7	440	G	6,400	G	190,000	C
BORON AND COMPOUNDS	7440-42-8	44,000	G	190,000	C	190,000	C
CADMIUM	7440-43-9	**[110] 22**	G	**[1,600] 320**	G	190,000	C
CHROMIUM III	16065-83-1	190,000	C	190,000	C	190,000	C
CHROMIUM VI	18540-29-9	37	G	180	G	140,000	N
COBALT	7440-48-4	66	G	960	G	190,000	N
COPPER	7440-50-8	7,200	G	100,000	G	190,000	C
CYANIDE, FREE	57-12-5	**[130] 140**	G	**[1,900] 2,000**	G	190,000	C
FLUORIDE	16984-48-8	8,800	G	130,000	G	190,000	C
IRON	7439-89-6	150,000	G	190,000	C	190,000	C
LEAD	7439-92-1	**[500] 200**	**[U] I**	**[1,000] 1,100**	**[S] A**	190,000	C
LITHIUM	7439-93-2	440	G	6,400	G	190,000	C
MANGANESE	7439-96-5	31,000	G	190,000	C	190,000	C
MERCURY	7439-97-6	35	G	510	G	190,000	C
MOLYBDENUM	7439-98-7	1,100	G	16,000	G	190,000	C
NICKEL	7440-02-0	4,400	G	64,000	G	190,000	C
PERCHLORATE	7790-98-9	150	G	2,200	G	190,000	C
SELENIUM	7782-49-2	1,100	G	16,000	G	190,000	C
SILVER	7440-22-4	1,100	G	16,000	G	190,000	C
STRONTIUM	7440-24-6	130,000	G	190,000	C	190,000	C
THALLIUM	7440-28-0	2.2	G	32	G	190,000	C
TIN	7440-31-5	130,000	G	190,000	C	190,000	C
VANADIUM	7440-62-2	1,100	G	16,000	G	190,000	C
ZINC	7440-66-6	66,000	G	190,000	C	190,000	C

All concentrations in mg/kg
G—Ingestion
N—Inhalation
C—Cap
[U—UBK Model]
[S—SEGH Model]
I—IEUBK Model
A—ALM Model

Appendix A
Table 5—Physical and Toxicological Properties
A. Organic Regulated Substances

Regulated Substance	*CAS*	*RfDo (mg/kg-d)*		*CSFo $(mg/kg\text{-}d)^{-1}$*		*RfCi (mg/m^3)*		*IUR $(\mu g/m^3)^{-1}$*		*Koc*	*VOC?*	*Aqueous Sol (mg/L)*	*Aqueous Sol Reference[1]*	*TF Vol from Surface Soil*	*TF Vol from Subsurface Soil*	*Organic Liquid*	*Boiling Point (degrees C)*	*Degradation Coefficient (K) (yr^{-1})*
ACENAPHTHENE	83-32-9	0.06	I							4900	X	3.8	1,5,6	17220	20833		279	1.24
ACENAPHTHYLENE	208-96-8	0.06	S[1]							4500	X	16.1	5,6,7	16493	19776		280	2.11
ACEPHATE	30560-19-1	0.0012	O							3		818000	6				340	
ACETALDEHYDE	75-07-0					0.009	I	0.0000022	I	4.1	X	1000000	1	13010	14945	X	20	
ACETONE	67-64-1	0.9	I			**[31]**	**[D]**			0.31	X	1000000	1	13007	14942	X	56	18.07
ACETONITRILE	75-05-8					0.06	I			0.5	X	1000000	1	13020	14958	X	82	4.50
ACETOPHENONE	98-86-2	0.1	I							170		5500	1			X	203	
ACETYLAMINO-FLUORENE, 2- (2AAF)	53-96-3			3.8	C			0.0013	C	1600		10.13	7				303	0.69
ACROLEIN	107-02-8	0.0005	I			0.00002	I			0.56	X	208000	1,2,4	13012	14948	X	53	4.50
ACRYLAMIDE	79-06-1	0.002	I	0.5	I	0.006	I	0.0001	I	25	X	2151000	4	12981	14906		193	
ACRYLIC ACID	79-10-7	0.5	I			**[0.001] 0.0002**	**[I] P[2]**			29	X	1000000	2	12978	14902	X	141	1.39
ACRYLONITRILE	107-13-1	**[0.04] 0.01**	D	0.54	I	0.002	I	0.000068	I	11	X	73500	1	13004	14939	X	77	5.50
ALACHLOR	15972-60-8	0.01	I	0.056	C					110		140	2				378	
ALDICARB	116-06-3	0.001	I							22		6000	2				287	0.40
ALDICARB SULFONE	1646-88-4	0.001	I							10		8000	5				317	
ALDICARB SULFOXIDE	1646-87-3	0.001	M							0.22		330000	5				307	
ALDRIN	309-00-2	0.00003	I	17	I			0.0049	I	48000		0.02	4,5,6				330	0.22
ALLYL ALCOHOL	107-18-6	**[0.005] 0.004**	**[I] P[2]**			0.0001	X			3.2	X	1000000	2	13003	14937	X	97	18.07
AMETRYN	834-12-8	0.009	I							389		185	5				345	
AMINOBIPHENYL, 4-	92-67-1			21	C			0.006	C	110		1200	5				302	18.07
AMITROLE	61-82-5			0.94	C			0.00027	C	120		280000	4				258	0.69
AMMONIA	7664-41-7	**[0.85]**	**[H]**			0.5	I			3	X	310000	2,5,7	13098	15059	X	-33	
AMMONIUM SULFAMATE	7773-06-0	0.2	I							3		2160000	10				603	
ANILINE	62-53-3	0.007	P	0.0057	I	0.001	I	0.0000016	C	190	X	33800	1	12959	14876	X	184	
ANTHRACENE	120-12-7	0.3	I							21000	X	0.066	1,5,6,7,8,9	30838	44562		340	0.28
ATRAZINE	1912-24-9	**[0.035] 0.003**	**[I] D[2]**	0.23	C					130		70	2,4,5				313	
AZINPHOS-METHYL (GUTHION)	86-50-0	0.0015	O			0.01	D			407.4		31.5	1, 2				421	
BAYGON (PROPOXUR)	114-26-1	0.004	I							31		2000	2,4,5				decomp.	4.50
BENOMYL	17804-35-2	0.05	I	0.0024	O					1,900		2	5				520	
BENTAZON	25057-89-0	0.03	I							13		500	2				415	
BENZENE	71-43-2	0.004	I	0.055	I	0.03	I	0.0000078	I	58	X	1780.5	1,2,3,4	13053	15000	X	81	0.35
BENZIDINE	92-87-5	0.003	I	230	I			0.067	I	530,000		520	1,2,4				400	15.81
BENZO[A]ANTHRACENE	56-55-3			**[0.7] 0.1**	**[X] R**			**[0.00011] 0.00006**	**[C] R**	350000		0.011	1,5,6				438	0.19
BENZO[A]PYRENE	50-32-8	0.0003	I	1	I	0.000002	I	0.0006	I	910000		0.0038	1,5,6				495	0.24

[1]Aqueous solubility references are keyed to the numbered list found at § 250.304(f) (relating to MSCs for groundwater). Where there are multiple sources cited. The table value is the median of the values in the individual references.

[2]Values recommended by USEPA Superfund program in May 2021 memo "Recommendations on the Use of Chronic or Subchronic Noncancer Values for Superfund Human Health Risk Assessments."

Toxicity Value Sources:
C = California EPA
D = ATSDR Minimal Risk Level
H = Health Effects Assessment Summary Table (HEAST)
I = Integrated Risk information System (IRIS)
M = EPA Drinking Water Regulations and Health Advisories
O = EPA Office of Pesticide Programs Human Health Benchmarks for Pesticides
P = EPA Provisional Peer-Reviewed Toxicity Value
TE = TERA ITER Peer-Reviewed Value
X = EPA Provisional Peer-Reviewed Toxicity Value Appendix
R = EPA 1993 Relative Potency Factors

S^1 Acenaphthene surrogate
S^2 Trans-Crotonaldehyde surrogate
S^3 Endosulfan surrogate
S^4 Naphthalene surrogate
S^5 2-Naphthylamine surrogate
S^6 4-Nitrophenol surrogate
S^7 Total PCBS surrogate
S^8 Anthracene surrogate
S^9 O-Toluidine surrogate
S^{10} 1,2,4-Trichlorobenzene surrogate

Appendix A
Table 5—Physical and Toxicological Properties
A. Organic Regulated Substances

Regulated Substance	*CAS*	*RfDo (mg/kg-d)*		*CSFo $(mg/kg\text{-}d)^{-1}$*		*RfCi (mg/m^3)*		*IUR $(\mu g/m^3)^{-1}$*		*Koc*	*VOC?*	*Aqueous Sol (mg/L)*	*Aqueous Sol Reference[1]*	*TF Vol from Surface Soil*	*TF Vol from Subsurface Soil*	*Organic Liquid*	*Boiling Point (degrees C)*	*Degradation Coefficient (K) (yr^{-1})*
BENZO[B]FLUORANTHENE	205-99-2			**[1.2] 0.1**	**[C] R**			**[0.00011] 0.00006**	**[C] R**	550000		0.0012	5,6,7				357	0.21
BENZO[GHI]PERYLENE	191-24-2	0.06	S[1]							2800000		0.00026	1,5,6				500	0.19
BENZO[K]FLUORANTHENE	207-08-9			**[1.2] 0.01**	**[C] R**			**[0.00011] 0.000006**	**[C]R**	4400000		0.00055	5,6,7				480	0.06
BENZOIC ACID	65-85-0	4	I							32	X	2700	2,3,4,5	12985	14913		249	
BENZOTRICHLORIDE	98-07-7			13	I					920	X	53	1,5,13	13494	15606	X	221	121413.60
BENZYL ALCOHOL	100-51-6	0.1	P							100		40000	1,2,3			X	205	
BENZYL CHLORIDE	100-44-7	0.002	P	0.17	I	0.001	P	0.000049	C	190	X	493	1	12940	14846	X	179	20.90
BETA PROPIOLACTONE	57-57-8			14	C			0.004	C	4	X	370000	2	13008	14937	X	162	0.01
BHC, ALPHA	319-84-6	0.008	D	6.3	I			0.0018	I	1800		1.7	4,5,6,7				288	0.94
BHC, BETA-	319-85-7			1.8	I			0.00053	I	2300		0.1	6				304	1.02
BHC, GAMMA (LINDANE)	58-89-9	**[0.0003] 0.00001**	**[I] D[2]**	1.1	C			0.00031	C	1400		7.3	4,5,6				323	1.05
BIPHENYL, 1,1-	92-52-4	**[0.05] 0.5**	I	0.008	I	0.0004	X			1,700	X	7.2	1	14027	16325		255	18.07
BIS(2-CHLORO ETHOXY)METHANE	111-91-1	0.003	P							61		100500	4,6,7,9,10,11			X	218	
BIS(2-CHLOROETHYL)ETHER	111-44-4			1.1	I			0.00033	I	76	X	10200	1,4,5	12942	14849	X	179	0.69
BIS(2-CHLORO-ISOPROPYL)ETHER	108-60-1	0.04	I	**[0.07]**	**[H]**			**[0.00001]**	**[H]**	62	X	1700	5	12947	14856	X	189	0.69
BIS(CHLOROMETHYL)ETHER	542-88-1			220	I			0.062	I	16	X	22000	6	12992	14922	X	105	57270.57
BIS[2-ETHYLHEXYL]PHTHALATE	117-81-7	0.02	I	0.014	I			0.0000024	C	87000		0.285	4,5,6			X	384	0.65
BISPHENOL A	80-05-7	0.05	I							1,500		120	4				220	0.69
BROMACIL	314-40-9	0.1	M							58		815	2				421	
BROMOBENZENE	108-86-1	0.008	I			0.06	I			268	X	445	1,2	12954	14866	X	156.1	
BROMOCHLOROMETHANE	74-97-5	0.01	M			0.04	X			27	X	16700	4	13007	14942	X	68	
BROMODICHLOROMETHANE	75-27-4	**[0.02] 0.008**	**[I] P[2]**	0.062	I			0.000037	C	93	X	4500	6	12984	14910	X	87	
BROMOMETHANE	74-83-9	0.0014	I			0.005	I			170	X	17500	2	13039	14981	X	4	6.66
BROMOXYNIL	1689-84-5	0.015	O	0.103	O					300		130	2				329	
BROMOXYNIL OCTANOATE	1689-99-2	0.015	O	0.103	O					18,000		0.08	12				414	5.75
BUTADIENE, 1,3-	106-99-0			0.6	C	0.002	I	0.00003	I	120	X	735	1	13115	15041	X	-4.5	4.50
BUTYL ALCOHOL, N-	71-36-3	0.1	I							3.2	X	74000	1	12998	14930	X	118	4.68
BUTYLATE	2008-41-5	0.05	I							540	X	45	2	13430	15519	X	138	
BUTYLBENZENE, N-	104-51-8	0.05	P							2,500	X	15	1,6,7	12943	14851	X	183	
BUTYLBENZENE, SEC-	135-98-8	0.1	X							890	X	17	1,6,7	12983	14910	X	174	
BUTYLBENZENE, TERT-	98-06-6	0.1	X							680	X	30	1,6,7	12979	14904	X	169	
BUTYLBENZYL PHTHALATE	85-68-7	0.2	I	0.0019	P					34000		2.69	4,5,6			X	370	1.39
CAPTAN	133-06-2	0.13	I	0.0023	C			0.00000066	C	200		0.5	4				259	589.39
CARBARYL	63-25-2	0.1	I							190		120	2,4,5				315	4.22

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[CARBAZOLE]	**[86-74-8]**			**[0.02]**	**[H]**					**[2,500]**		**[1.2]**	**[1,5,6]**				**[355]**	
CARBOFURAN	1563-66-2	0.005	I							43		700	2				311	
CARBON DISULFIDE	75-15-0	0.1	I			0.7	I			300	X	2100	1,2,3	13022	14961	X	46	
CARBON TETRACHLORIDE	56-23-5	0.004	I	0.07	I	0.1	I	0.000006	I	160	X	795	1,2,3	13117	15083	X	77	0.07
CARBOXIN	5234-68-4	0.1	I							260		170	5,6,8				407	
CHLORAMBEN	133-90-4	0.015	I							20		700	2				210	
CHLORDANE	57-74-9	0.0005	I	0.35	I	0.0007	I	0.0001	I	98000		0.056	4,5,7				351	0.09
CHLORO-1,1-DIFLUOROETHANE, 1-	75-68-3					50	I			22	X	1400	4	13117	15041	X	-9	
CHLORO-1-PROPENE, 3- (ALLYL CHLORIDE)	107-05-1			0.021	C	0.001	I	0.000006	C	48	X	3300	1,3,5,7,10	13142	15116	X	45	18.07
CHLOROACETALDEHYDE	107-20-0			0.27	X					3.2	X	1000000	9	13004	14938	X	85	
CHLOROACETOPHENONE, 2-	532-27-4					0.00003	I			76		1100	3				247	4.50
CHLOROANILINE, P-	106-47-8	**[0.004] 0.0005**	**[I] P[2]**	0.2	P					460	X	3900	1	13139	15127		232	
CHLOROBENZENE	108-90-7	0.02	I			0.05	P			200	X	490	3	12992	14922	X	132	0.84
CHLOROBENZILATE	510-15-6	0.02	I	0.11	C			0.000031	C	2600		13	4				415	3.60
CHLOROBUTANE, 1-	109-69-3	0.04	P							580	X	680	1,2,3,4	13007	14942	X	79	
CHLORODIBROMOMETHANE	124-48-1	0.02	I	0.084	I					83	X	4200	4,6,7,9	12973	14895	X	116	1.39
CHLORODIFLUOROMETHANE	75-45-6					50	I			59	X	2899	4	13141	15113	X	-41	
CHLOROETHANE	75-00-3					**[10] 4**	**[I] P[2]**			42	X	5700	1	13101	15038	X	12	4.50
CHLOROFORM	67-66-3	0.01	I	0.031	C	0.3	C	0.000023	I	56	X	8000	1,2,3	13044	14988	X	61	0.01
CHLORONAPHTHALENE, 2-	91-58-7	0.08	I							8500	X	11.7	1	19021	23532		256	
CHLORONITROBENZENE, P-	100-00-5	0.0007	P	0.06	P	0.002	P			480	X	220	1	13190	15196		242	
CHLOROPHENOL, 2-	95-57-8	0.005	I							400	X	24000	1,3,4	13053	15009	X	175	
CHLOROPRENE	126-99-8	**[0.02]**	**[H]**			0.02	I	0.0003	I	50	X	1736	9	13116	15075	X	59	0.69
[CHLOROPROPANE, 2-]	**[75-29-6]**					**[0.1001]**	**[H]**			**[260]**	**[X]**	**[3100]**	**[1,3,5]**	**[13055]**	**[15002]**	**[X]**	**[47]**	
CHLOROTHALONIL	1897-45-6	0.015	I	0.017	C					980		0.6	2				350	
CHLOROTOLUENE, O-	95-49-8	0.02	I							760	X	422	1,4,5	12941	14848	X	159	
CHLOROTOLUENE, P-	106-43-4	0.02	X							375	X	106	12	12961	14877	X	162	
CHLORPYRIFOS	2921-88-2	0.001	D							4600		1.12	2,4,6,7				377	
CHLORSULFURON	64902-72-3	**[0.02] 0.05**	O							11		192	2,5,6,8,9				531	
CHLORTHAL-DIMETHYL (DACTHAL) (DCPA)	1861-32-1	0.01	I							6,500		0.5	2,5,7				360	1.37
CHRYSENE	218-01-9			**[0.12] 0.001**	**[C] R**			**[0.000011] 0.0000006**	**[C] R**	490000		0.0019	1				448	0.13
CRESOL(S)	1319-77-3	0.1	D			0.06	C			25	X	20000	2	12976	14899	X	139	5.16
CRESOL, DINITRO-O-, 4,6-	534-52-1	0.00008	X							257	X	150	4	13025	14970		312	6.02
CRESOL, O- (METHYLPHENOL, 2-)	95-48-7	0.05	I							22	X	2500	3,5,6	12974	14896		191	18.07

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CRESOL, M (METHYLPHENOL, 3-)	108-39-4	0.05	I							35		2500	2			X	202	5.16
CRESOL, P (METHYLPHENOL, 4-)	106-44-5	**[0.005] 0.02**	**[H] P**							49		22000	6				202	9.03
CRESOL, P-CHLORO-M-	59-50-7	0.1	X							780		3846	2				235	
CROTONALDEHYDE	4170-30-3	0.001	S[2]	**[1.9]**	**[S[2]]**					5.6	X	180000	3	12998	14931	X	104	18.07
CROTONALDEHYDE, TRANS-	123-73-9	0.001	P	**[1.9]**	**[H]**					6.1	X	156000	1	13006	14940	X	104	18.07
CUMENE (ISOPROPYL BENZENE)	98-82-8	0.1	I			0.4	I			2800	X	50	1,5,6	12940	14846	X	152	15.81
CYANAZINE	21725-46-2	0.002	**[H] M**	**[0.84]**	**[H]**					199		171	2,5				369	
CYCLOHEXANE	110-82-7					6	I			479	X	55	1,2,4,5,6	13140	15112	X	81	
CYCLOHEXANONE	108-94-1	5	I			0.7	P			66	X	36500	1,2,4,5	12949	14858	X	157	
CYFLUTHRIN	68359-37-5	0.025	I							130,000		0.001	2				448	
CYROMAZINE	66215-27-8	0.5	O							1,200		11000	12				222	
DDD, 4,4'-	72-54-8	**[0.003] 0.0005**	**[X] D**	0.24	I			0.000069	C	44000		0.16	5,6,7				350	0.02
DDE, 4,4'-	72-55-9	**[0.0003] 0.0005**	**[X] D**	0.34	I			0.000097	C	87000		0.04	5				348	0.02
DDT, 4,4'-	50-29-3	0.0005	I	0.34	I			0.000097	I	240000		0.0055	5,6,7				260	0.02
DI(2-ETHYLHEXYL)ADIPATE	103-23-1	0.6	I	0.0012	I					47,000,000		200	5			X	214	4.50
DIALLATE	2303-16-4			0.061	H					190		40	2,4,6,8			X	328	1.39
DIAMINOTOLUENE, 2,4-	95-80-7			4	C			0.0011	C	36		7470	4				292	0.69
DIAZINON	333-41-5	0.0007	D							500		50	2,4,6,8			X	306	
DIBENZO[A,H]ANTHRACENE	53-70-3			**[4.1] 1**	**[C] R**			**[0.0012] 0.0006**	**[C] R**	1800000		0.0006	1,5,6				524	0.13
DIBENZOFURAN	132-64-9	0.001	X							10233	X	4.48	1,6,7,9	23885	31445		287	7.23
DIBROMO-3-CHLOROPROPANE, 1,2-	96-12-8	0.0002	P	0.8	P	0.0002	I	0.006	P	140	X	1000	4	12946	14856	X	196	0.69
DIBROMOBENZENE, 1,4-	106-37-6	0.01	I							1,600		20	1				220	
DIBROMOETHANE, 1,2- (ETHYLENE DIBROMIDE)	106-93-4	0.009	I	2	I	0.009	I	0.0006	I	54	X	4150	1,2,3,5	12972	14893	X	131	2.11
DIBROMOMETHANE	74-95-3	**[0.01]**	**[H]**			0.004	X			110	X	11400	1	12948	14858	X	96	4.50
DIBUTYL PHTHALATE, N-	84-74-2	0.1	I							1600		400	1,2,3			X	340	11.00
DICAMBA	1918-00-9	0.03	I							0.27		5600	4,5,6,8,10				329	
DICHLOROACETIC ACID	76-43-6	0.004	I	0.05	I					8.1	X	1000000	1	12994	14924	X	194	
DICHLORO-2-BUTENE, 1,4-	764-41-0							0.0042	P	180	X	850	9	12943	14851	X	156	
DICHLORO-2-BUTENE, TRANS-1,4-	110-57-6							0.0042	P	215	X	850	9	12940	14847	X	155	
DICHLOROBENZENE, 1,2-	95-50-1	0.09	I			**[0.2]**	**[H]**			350	X	147	1,4,5,6,7	12946	14855	X	180	0.69
DICHLOROBENZENE, 1,3-	541-73-1	0.09	M							360	X	106	1	12942	14849	X	173	0.69
DICHLOROBENZENE, P-	106-46-7	0.07	D	0.0054	C	0.8	I	0.000011	C	510	X	82.9	1	12943	14850		174	0.69
DICHLOROBENZIDINE, 3,3'-	91-94-1			0.45	I			0.00034	C	22000		3.11	4,5,6				368	0.69

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DICHLORODIFLUOROMETHANE (FREON 12)	75-71-8	0.2	I			0.1	X			360	X	280	1	13115	15041	X	-30	0.69
DICHLOROETHANE, 1,1-	75-34-3	0.2	P	0.0057	C	**[0.5]**	**[H]**	0.0000016	C	52	X	5000	2	13051	14998	X	57	0.16
DICHLOROETHANE, 1,2-	107-06-2	0.006	X	0.091	I	0.007	P	0.000026	I	38	X	8412	1,2,3,4	13010	14945	X	83	0.07
DICHLOROETHYLENE, 1,1-	75-35-4	0.05	I			0.2	I			65	X	2500	1,4,5	13145	15119	X	32	0.19
DICHLOROETHYLENE, CIS-1,2-	156-59-2	0.002	I			**0.04**	**P**			49	X	3500	1	13037	14979	X	60	0.01
DICHLOROETHYLENE, TRANS-1,2-	156-60-5	0.02	I			**0.04**	**P**			47	X	6300	1	13053	15000	X	48	0.01
DICHLOROMETHANE (METHYLENE CHLORIDE)	75-09-2	0.006	I	0.002	I	0.6	I	0.00000001	I	16	X	20000	1,2,3	13071	15023	X	40	4.50
DICHLOROPHENOL, 2,4-	120-83-2	0.003	I							160		4500	1				210	5.88
DICHLOROPHENOXYACETIC ACID, 2,4-(2,4-D)	94-75-7	0.01	I							59		677	4,5,6,7,10				215	1.39
DICHLOROPROPANE, 1,2-	78-87-5	0.04	P	0.037	P	0.004	I	**[0.0037]** **0.0000037**	P	47	X	2700	1,3,4	13016	14954	X	96	0.10
DICHLOROPROPENE, 1,3-	542-75-6	0.03	I	0.1	I	0.02	I	0.000004	I	27	X	2700	6	13038	14981	X	108	22.38
DICHLOROPROPIONIC ACID, 2,2-(DALAPON)	75-99-0	0.03	I							62	X	500000	5	12949	14860	X	190	2.11
DICHLORVOS	62-73-7	0.0005	I	0.29	I	0.0005	I	0.000083	C	50		10000	2,4,5			X	234	
DICYCLOPENTADIENE	77-73-6	0.008	P			0.0003	X			810	X	40	5	12957	14870		167	
DIELDRIN	60-57-1	0.00005	I	16	I			0.0046	I	11000		0.17	4,5,6				385	0.12
DIETHANOLAMINE	111-42-2	0.002	P			0.0002	P			4		1000000	2,3,9			X	269	
DIETHYL PHTHALATE	84-66-2	0.8	I							81		1080	4,5,6			X	298	2.25
DIFLUBENZURON	35367-38-5	0.02	I							1,000		0.2	2				201	
DIISOPROPYL METHYLPHOSPHONATE	1445-75-6	0.08	I							10	X	160000	9	12978	14903	X	190	
DIMETHOATE	60-51-5	0.0022	O							110		25000	4				361	2.26
DIMETHOXYBENZIDINE, 3,3-	119-90-4			1.6	P					1,300		60	9				331	0.69
DIMETHRIN	70-38-2	0.3	M							27,000		0.036	13				353	
DIMETHYLAMINOAZOBENZENE, P-	60-11-7			4.6	C			0.0013	C	1000		13.6	7				335	4.50
DIMETHYLANILINE, N,N-	121-69-7	0.002	I	0.027	P					180	X	1200	5,6,7,9	12944	14852	X	192	0.69
DIMETHYLBENZIDINE, 3,3-	119-93-7			11	P					22,000		1300	10				300	18.07
DIMETHYL METHYLPHOSPHONATE	756-79-6	0.06	P	0.0017	P					5	X	1000000	14	12998	14930	X	181	
DIMETHYLPHENOL, 2,4-	105-67-9	0.02	I							130		7869	1,4,6,7			X	211	18.07
DINITROBENZENE, 1,3-	99-65-0	0.0001	I							150		523	3,5,6,7				291	0.69
DINITROPHENOL, 2,4-	51-28-5	0.002	I							0.79		5600	2,4,5,6,7				332	0.48
DINITROTOLUENE, 2,4-	121-14-2	0.002	I	0.31	C			0.000089	C	51		270	4,5,6				300	0.69
DINITROTOLUENE, 2,6- (2,6-DNT)	606-20-2	0.0003	X	1.5	P					74		200	6				300	0.69
DINOSEB	88-85-7	0.001	I							120		50	5				223	1.03
DIOXANE, 1,4-	123-91-1	0.03	I	0.1	I	0.03	I	0.000005	I	7.8	X	1000000	5	12996	14928	X	101	0.69
DIPHENAMID	957-51-7	0.03	I							200		260	5				210	

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DIPHENYLAMINE	122-39-4	0.1	O							190		300	3				302	4.50
DIPHENYLHYDRAZINE, 1,2-	122-66-7			0.8	I			0.00022	I	660	X	0.252	6	13375	15446		309	0.69
DIQUAT	**[85-00-7] 2764-72-9**	0.0022	I							2.6		700000	5				355	
DISULFOTON	298-04-4	0.00004	I							1000		25	4,5,6			X	332	6.02
DITHIANE, 1,4-	505-29-3	0.01	I							22.7	X	3000	15	12976	14899		199	
DIURON	330-54-1	0.002	I							300		42	2,4,5				354	
ENDOSULFAN	115-29-7	0.006	I							2,000		0.48	4				401	2.78
ENDOSULFAN I (ALPHA)	959-98-8	0.006	S[3]							2000		0.5	6				401	
ENDOSULFAN II (BETA)	33213-65-9	0.006	S[3]							2300		0.45	6				390	
ENDOSULFAN SULFATE	1031-07-8	0.006	S[3]							2300		0.117	7,9				409	
ENDOTHALL	145-73-3	0.02	I							120		100000	2				350	
ENDRIN	72-20-8	0.0003	I							11000		0.23	4,6,7,9				245	
EPICHLOROHYDRIN	106-89-8	0.006	P	0.0099	I	0.001	I	0.0000012	I	35	X	65800	1,3,4	12972	14893	X	116	4.50
ETHEPHON	16672-87-0	0.005	I							2		1240000	12				201	
ETHION	563-12-2	0.0005	I							8700		0.85	4,6,9,10			X	415	
ETHOXYETHANOL, 2- (EGEE)	110-80-5	0.09	P			**[0.2] 0.04**	**[I] P[2]**			12	X	1000000	2	13100	15040	X	136	4.50
ETHYL ACETATE	141-78-6	**[0.9] 0.7**	**[I] P[2]**			0.07	P			59	X	80800	1,2,3,4,5,6	12963	14881	X	77	18.07
ETHYL ACRYLATE	140-88-5	0.005	P	**[0.048]**	**[H]**	0.008	P			110	X	15000	1,2,6	12951	14863	X	100	18.07
ETHYL BENZENE	100-41-4	**[0.1] 0.05**	**[I] P[2]**	0.011	C	1	I	0.0000025	C	220	X	161	1,3,4	13004	15000	X	136	1.11
ETHYL DIPROPYLTHIOCARBAMATE, S-(EPTC)	759-94-4	0.05	O							240	X	365	2	13056	15014	X	127	
ETHYL ETHER	60-29-7	0.2	I							68	X	60400	1	12982	14908	X	35	
ETHYL METHACRYLATE	97-63-2	**[0.09]**	**[H]**			0.3	P			22	X	4635.5	9,10	12991	14921	X	117	
ETHYLENE CHLORHYDRIN	107-07-3	0.02	P							1	X	1000000	9	13006	14941	X	128	
ETHYLENE GLYCOL	107-21-1	**[2] 0.8**	**[I] D[2]**			0.4	C			4.4	X	1000000	2	13004	14938	X	198	10.54
ETHYLENE THIOUREA (ETU)	96-45-7	0.00008	I	0.045	C			0.000013	C	0.23		20000	2				347	4.50
ETHYL P-NITROPHENYL PHENYLPHOSPHORO THIOATE	2104-64-5	0.00001	I							1,200		3.1	4				215	
FENAMIPHOS	22224-92-6	0.00025	I							300		329	2				390	
FENVALERATE (PYDRIN)	51630-58-1	0.025	I							4,400		0.085	5			X	300	
FLUOMETURON	2164-17-2	0.013	I							68		97.5	2,5,6,8				318	
FLUORANTHENE	206-44-0	0.04	I							49000		0.26	1,5,6				375	0.29
FLUORENE	86-73-7	0.04	I							7900	X	1.9	1	20155	25294		298	2.11

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FLUOROTRICHLOROMETHANE (FREON 11)	75-69-4	0.3	I			**[0.7]**	**[H]**			130	X	1090	1,4,5,6	13107	15060	X	24	0.35
FONOFOS	944-22-9	0.002	I							1100		13	5,6,8			X	324	
FORMALDEHYDE	50-00-0	0.2	I	0.021	C	0.009	C	0.000013	I	3.6	X	55000	1	13046	14990	X	-21	18.07
FORMIC ACID	64-18-6	0.9	P			0.0003	X			0.54	X	1000000	2	12940	14846	X	101	18.07
FOSETYL-AL	39148-24-8	2.5	O							310		120000	2				464	
FURAN	110-00-9	0.001	I							130	X	10000	1	13019	14956	X	31	2.25
FURFURAL	98-01-1	0.003	I	0.0349	O	**[0.05]**	**[H]**			6.3	X	91000	1,2,3	12998	14930	X	162	
GLYPHOSATE	1071-83-6	0.1	I							3500		12000	1,5,6				417	
HEPTACHLOR	76-44-8	**[0.0005]** **0.0001**	**[I]** **D[2]**	4.5	I			0.0013	I	6800		0.18	4,6,7				310	46.84
HEPTACHLOR EPOXIDE	1024-57-3	0.000013	I	9.1	I			0.0026	I	21000		0.311	4,6,7,9				341	0.23
HEXACHLOROBENZENE	118-74-1	**[0.0008]** **0.00001**	**[I]** **P[2]**	1.6	I			0.00046	I	3800		0.006	1,4,5				319	0.06
HEXACHLOROBUTADIENE	87-68-3	0.001	P	0.078	I			0.000022	I	4700		2.89	4,5,6,7			X	215	0.69
HEXACHLOROCYCLOPENTADIENE	77-47-4	0.006	I			0.0002	I			7200		1.8	5,6,7			X	239	4.50
HEXACHLOROETHANE	67-72-1	0.0007	I	0.04	I	0.03	I	0.000011	C	2200	X	50	1	14825	17421		187	0.69
HEXAFLUOROPROPYLENE OXIDE (HFPO) DIMER ACID	**13252-13-6**	**0.000003**	**M**							**12**	**X**	**751000**	**23**	**12974**	**14896**	**X**	**129**	
HEXAFLUOROPROPYLENE OXIDE (HFPO) DIMER ACID AMMONIUM SALT (GEN-X)	**62037-80-3**	**0.000003**	**M**							**12**		**739000**	**23**			**X**	**108**	
HEXANE	110-54-3	**[0.06]**	**[H]**			0.7	I			3600	X	9.5	1,5,6	13105	15056	X	69	
HEXAZINONE	51235-04-2	0.033	I							41		330000	1,2				408	
HEXYTHIAZOX (SAVEY)	78587-05-0	0.025	I							6,500		0.5	2				539	
HMX	2691-41-0	0.05	I							4		5	16				436	
HYDRAZINE/HYDRAZINE SULFATE	302-01-2			3	I	0.00003	P	0.0049	I	0.0053	X	1000000	2	13026	14966	X	114	18.07
HYDROQUINONE	123-31-9	0.04	P	0.06	P					10		70000	2,3,5				285	18.07
INDENO[1,2,3-CD]PYRENE	193-39-5			**[1.2]** **0.1**	**[C]** **R**			**[0.00011]** **0.00006**	**[C]** **R**	31000000		0.062	5				536	0.17
IPRODIONE	36734-19-7	0.04	I	0.0439	O					1,100		13	2				545	
ISOBUTYL ALCOHOL	78-83-1	0.3	I							60	X	81000	1,2,3,4,5	12954	14866	X	108	17.57
ISOPHORONE	78-59-1	0.2	I	0.00095	I	2	C			31		12000	2,4,5			X	215	4.5
ISOPROPYL METHYLPHOSPHONATE	1832-54-8	0.1	I							1.84		50000	13			X	230	
KEPONE	143-50-0	0.0003	I	10	I			0.0046	C	55000		7.6	4				350	0.17
MALATHION	121-75-5	0.02	I							1300		143	4			X	351	2.46
MALEIC HYDRAZIDE	123-33-1	0.5	I							2.8		6000	4				260	
MANEB	12427-38-2	0.005	I	0.0601	O					1		23	9,13				351	
MERPHOS OXIDE	78-48-8	0.0005	D							53,000		2.3	8,10,12			X	392	
METHACRYLONITRILE	126-98-7	0.0001	I			0.03	P			21	X	25700	1	12994	14925	X	90	

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METHAMIDOPHOS	10265-92-6	0.00005	I							5		2000000	5				223	
METHANOL	67-56-1	2	I			20	I			2.8	X	1000000	2	13025	14964	X	65	36.14
METHOMYL	16752-77-5	0.025	I							20		58000	2				228	
METHOXYCHLOR	72-43-5	0.005	I							63000		0.045	4,5,6				346	0.69
METHOXYETHANOL, 2-	109-86-4	0.005	P			**[0.02] 0.007**	**[I] P[2]**			1	X	1000000	2	13141	15115	X	124	4.50
METHYL ACETATE	79-20-9	1	X							30	X	243500	4,5,6	12982	14908	X	57	
METHYL ACRYLATE	96-33-3	**[0.03]**	**[H]**			0.02	P			55	X	52000	1,2,5	12971	14892	X	70	18.07
METHYL CHLORIDE	74-87-3			**[0.013]**	**[H]**	0.09	I	**[0.0000018]**	**[H]**	6	X	6180	1,2,3,4	13103	15038	X	-24	4.50
METHYL ETHYL KETONE	78-93-3	0.6	I			5	I			32	X	275000	1,2,3,4,5	12974	14897	X	80	2.57
METHYL HYDRAZINE	60-34-4	0.001	P			0.00002	X	0.001	X	1	X	1000000	2	13011	14947	X	88	5.27
METHYL ISOBUTYL KETONE	108-10-1	**[0.08]**	**[H]**			3	I			17	X	19550	1,2,4,5	12983	14910	X	117	18.07
METHYL ISOCYANATE	624-83-9					0.001	C			10	X	100000	7	13021	14959	X	40	
METHYL N-BUTYL KETONE (2-HEXANONE)	591-78-6	0.005	I			0.03	I			54	X	17500	1	12955	14868	X	128	
METHYL METHACRYLATE	80-62-6	1.4	I			0.7	I			10	X	15600	1	13001	14934	X	100	4.50
METHYL METHANESULFONATE	66-27-3			0.099	C			0.000028	C	5.2		200000	2			X	203	
METHYL PARATHION	298-00-0	0.00025	I							790		25	4,5,6				348	3.61
METHYL STYRENE (MIXED ISOMERS)	25013-15-4	0.006	H			0.04	H			2,200	X	89	9	12945	14853	X	163	
METHYL TERT-BUTYL ETHER (MTBE)	1634-04-4			0.0018	C	3	I	0.00000026	C	12	X	45000	1,2,4,6	13014	14950	X	55	0.69
METHYLCHLOROPHENOXYACETIC ACID (MCPA)	94-74-6	0.0005	I							112		1000	5,6,8,9				287	1.39
METHYLENE BIS(2-CHLOROANILINE), 4,4'-	101-14-4	0.002	P	0.1	P			0.00043	C	3,000		13.9	10				379	
METHYLNAPHTHALENE, 2-	91-57-6	0.004	I			0.003	S[4]			16000	X	25	1	12955	14870		241	
METHYLSTYRENE, ALPHA	98-83-9	0.07	H							660	X	560	9	12942	14850	X	165	
METOLACHLOR	51218-45-2	0.15	I							182	X	530	1,5	13035	14985	X	100	
METRIBUZIN	21087-64-9	0.025	I							95		1200	1,5				367	
MEVINPHOS	7786-34-7	0.000025	O							44	X	600000	6	12947	14856		**106**	
MONOCHLOROACETIC ACID	79-11-8	**[0.002] 0.01**	**[H] M**							0.24	X	858000	17	13008	14943		189	
NAPHTHALENE	91-20-3	0.02	I	0.12	C	0.003	I	0.000034	C	950	X	30	3	13284	15323		218	0.98
NAPHTHYLAMINE, 1-	134-32-7			1.8	S[5]					3200	X	1690	2	15517	18386		301	0.69
NAPHTHYLAMINE, 2-	91-59-8			1.8	C					87		6.4	6				306	0.69
NAPROPAMIDE	15299-99-7	0.12	O							880		70	2				399	
NITROANILINE, O-	88-74-4	0.01	X			0.00005	X			27	X	1200	6	12967	14886		284	
NITROANILINE, P-	100-01-6	0.004	P	0.02	P	0.006	P			15		800	2				332	
NITROBENZENE	98-95-3	0.002	I			0.009	I	0.00004	I	130	X	2000	2	12940	14847	X	211	0.64
NITROGUANIDINE	556-88-7	0.1	I							0.13		4400	9				231	

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NITROPHENOL, 2-	88-75-5	0.008	S[6]							37	X	2100	1,2,3,4,5,6	12966	14884		215	9.01
NITROPHENOL, 4-	100-02-7	0.008	M							230	X	16000	2	12960	14878		279	25.81
NITROPROPANE, 2-	79-46-9					0.02	I	**[0.0027] 0.00058**	**[H] P**	20	X	16700	1,3,4,5	12984	14911	X	120	0.69
NITROSODIETHYLAMINE, N-	55-18-5			150	I			0.043	I	26	X	93000	10	12974	14896	X	176	0.69
NITROSODIMETHYLAMINE, N-	62-75-9	0.000008	P	51	I	0.00004	X	0.014	I	8.5	X	1000000	2	13001	14934	X	154	0.69
NITROSO-DI-N-BUTYLAMINE, N-	924-16-3			5.4	I			0.0016	I	450	X	1200	9, 10, 11	13008	14946	X	235	0.69
NITROSODI-N-PROPYLAMINE, N-	621-64-7			7	I			0.002	C	11	X	9900	6	12986	14914	X	206	0.69
NITROSODIPHENYLAMINE, N-	86-30-6			0.0049	I			0.0000026	C	580	X	35	1	13148	15140		269	3.72
NITROSO-N-ETHYLUREA, N-	759-73-9			27	C			0.0077	C	2		13000	9				223	1734.48
OCTYL PHTHALATE, DI-N-	117-84-0	0.01	P							980000000		3	5			X	234	0.69
OXAMYL (VYDATE)	23135-22-0	0.025	I							7.1		280000	2				334	
PARAQUAT	1910-42-5	0.0045	I							16200		660000	6,8				352	
PARATHION	56-38-2	0.00003	O							2300		20	2,4,5,6,7			X	375	
PCBS, TOTAL (POLYCHLORINATED BIPHENYLS) (AROCLORS)	1336-36-3			2	I			0.0001	I	78100		0.0505	10,13				360	
PCB-1016 (AROCLOR)	12674-11-2	0.00007	I							110000		0.25	5			X	325	
PCB-1221 (AROCLOR)	11104-28-2			2	S[7]			0.0001	S[7]	1900	X	0.59	5	13810	16032	X	275	
PCB-1232 (AROCLOR)	11141-16-5			2	S[7]			0.0001	S[7]	1500		1.45	7			X	290	
PCB-1242 (AROCLOR)	53469-21-9			2	S[7]			0.0001	S[7]	48000		0.1	5			X	325	
PCB-1248 (AROCLOR)	12672-29-6			2	S[7]			0.0001	S[7]	190000		0.054	7,9,11			X	340	
PCB-1254 (AROCLOR)	11097-69-1	0.00002	I							810000		0.057	5			X	365	
PCB-1260 (AROCLOR)	11096-82-5			2	S[7]			0.0001	S[7]	1800000		0.08	5				385	
PEBULATE	1114-71-2	**[0.05] 0.0007**	**[H] O**							630		92	5			X	303	
PENTACHLOROBENZENE	608-93-5	0.0008	I							32000		0.74	1,5,6,7				277	0.37
PENTACHLOROETHANE	76-01-7			0.09	P					1905	X	480	1,3	13120	15102	X	160	
PENTACHLORONITROBENZENE	82-68-8	0.003	I	0.26	H					7900		0.44	4,6,8				328	0.36
PENTACHLOROPHENOL	87-86-5	0.005	I	0.4	I			0.0000051	C	20000		14	1,2,4,5				310	0.17
PERFLUOROBUTANE SULFONATE (PFBS)	375-73-5	0.0003	P							**[61.7] 62**	**X**	56600	9			X	**[211] 152**	
PERFLUOROBUTANOIC ACID (PFBA)	**375-22-4**	**0.001**	**I**							**76**	**X**	**49000**	**25**			**X**	**120**	
PERFLUOROHEXANOIC ACID (PFHxA)	**307-24-4**	**0.0005**	**I**							**120**	**X**	**160000**	**25**			**X**	**168**	
PERFLUOROOCTANE SULFONATE (PFOS)	1763-23-1	**[0.00002] 0.0000031**	M	**[0.07]**	**[M]**					**[2.57] 370**		680	19,20,21,22,23				258	
PERFLUOROOCTANOIC ACID (PFOA)	335-67-1	**[0.00002] 0.0000039**	M							**[2.06] 120**	**X**	9500	24				192	
PHENACETIN	62-44-2			0.0022	C			0.00000063	C	110		763	2,3,9				341	4.50
PHENANTHRENE	85-01-8	0.3	S[8]							38000	X	1.1	1,4,5	41808	70721		341	0.63

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S[6] 4-Nitrophenol surrogate
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Appendix A
Table 5—Physical and Toxicological Properties
A. Organic Regulated Substances

Regulated Substance	*CAS*	*RfDo (mg/kg-d)*		*CSFo $(mg/kg\text{-}d)^{-1}$*		*RfCi (mg/m^3)*		*IUR $(\mu g/m^3)^{-1}$*		*Koc*	*VOC?*	*Aqueous Sol (mg/L)*	*Aqueous Sol Reference[1]*	*TF Vol from Surface Soil*	*TF Vol from Subsurface Soil*	*Organic Liquid*	*Boiling Point (degrees C)*	*Degradation Coefficient (K) (yr^{-1})*
PHENOL	108-95-2	0.3	I			0.2	C			22	X	84300	1,2,3,4	12977	14901		182	36.14
PHENYL MERCAPTAN	108-98-5	0.001	P							562	X	653	5,9	13039	14989	X	170	
PHENYLENEDIAMINE, M-	108-45-2	0.006	I							12		351000	3				286	4.50
PHENYLPHENOL, 2-	90-43-7			0.00194	H					5,700		700	5				280	18.07
PHORATE	298-02-2	**[0.0002] 0.00017**	O							810		50	2			X	319	
PHTHALIC ANHYDRIDE	85-44-9	2	I			0.02	C			79	X	6170	2	13018	14956		285	13490.40
PICLORAM	1918-02-1	0.07	I							15		430	2				373	
POTASSIUM PERFLUOROBUTANE SULFONATE	**29420-49-3**	**0.0003**	**M**							**62**		**46**	**9**				**447**	
PROMETON	1610-18-0	0.015	I							346		750	2,5				347	
PRONAMIDE	23950-58-5	0.075	I							200		15	2				321	
PROPACHLOR	1918-16-7	0.013	I							139	X	**613**	**8**	12952	14865		110	1.73
PROPANIL	709-98-8	0.005	I							160		225	2				355	
PROPANOL, 2- (ISOPROPYL ALCOHOL)	67-63-0	2	P			0.2	P			25	X	1000000	2	12981	14906	X	82	
PROPAZINE	139-40-2	0.02	I							155		8.6	1,5			X	318	
PROPHAM	122-42-9	0.02	I							51		250	5				257	
PROPYLBENZENE, N-	103-65-1	0.1	X			1	X			720	X	52	6	12971	14891	X	159	
PROPYLENE OXIDE	75-56-9	0.001	O	0.24	I	0.03	I	0.0000037	I	25	X	405000	1	13239	15057	X	34	
PYRENE	129-00-0	0.03	I							68000		0.132	1				393	0.07
PYRETHRUM	8003-34-7	0.044	O							5.62	X	0.35	13			X	170	
PYRIDINE	110-86-1	0.001	I							0.0066	X	1000000	2	13142	15114	X	115	18.07
QUINOLINE	91-22-5			3	I					1,300		60000	1,3,5			X	238	12.65
QUIZALOFOP (ASSURE)	76578-14-8	0.009	I							580		0.3	2				220	
RDX	121-82-4	0.004	I	0.08	I					70		59.9	1,9				353	
RESORCINOL	108-46-3	2	TE							2		717000					280	
RONNEL	299-84-3	0.05	H							580		40	2				349	
SIMAZINE	122-34-9	0.005	I	0.12	H					110		5	5				225	
STRYCHNINE	57-24-9	0.0003	I							280		143	5				270	4.50
STYRENE	100-42-5	0.2	I			1	I			910	X	300	5	12942	14850	X	145	1.20
TEBUTHIURON	34014-18-1	0.07	I							620		2500	2				394	
TERBACIL	5902-51-2	0.013	I							53		710	2				396	
TERBUFOS	13071-79-9	0.000025	H							510		5	6			X	332	
TETRACHLOROBENZENE, 1,2,4,5-	95-94-3	**[0.0003] 0.00003**	**[I] P[2]**							1,800		0.583	1,5,6,7				245	0.69
TETRACHLORODIBENZO-P-DIOXIN, 2,3,7,8- (TCDD)	1746-01-6	0.0000000007	I	130000	C	0.00000004	C	38	C	4300000		0.0000193	6				412	0.21
TETRACHLOROETHANE, 1,1,1,2-	630-20-6	0.03	I	0.026	I			0.0000074	I	980	X	1100	1	12990	14921	X	131	3.79
TETRACHLOROETHANE, 1,1,2,2-	79-34-5	0.02	I	0.2	I			0.000058	I	79	X	2860	2	12957	14871	X	147	0.56

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Appendix A
Table 5—Physical and Toxicological Properties
A. Organic Regulated Substances

Regulated Substance	*CAS*	*RfDo (mg/kg-d)*		*CSFo $(mg/kg\text{-}d)^{-1}$*		*RfCi (mg/m^3)*		*IUR $(\mu g/m^3)^{-1}$*		*Koc*	*VOC?*	*Aqueous Sol (mg/L)*	*Aqueous Sol Reference[1]*	*TF Vol from Surface Soil*	*TF Vol from Subsurface Soil*	*Organic Liquid*	*Boiling Point (degrees C)*	*Degradation Coefficient (K) (yr^{-1})*
TETRACHLOROETHYLENE (PCE)	127-18-4	0.006	I	0.0021	I	0.04	I	0.00000026	I	300	X	162	1,2,3,4,5	13017	14955	X	121	0.03
TETRACHLOROPHENOL, 2,3,4,6-	58-90-2	0.03	I							6200		183	6				288	0.69
TETRAETHYL LEAD	78-00-2	0.0000001	I							4900		0.8	5			X	202	4.50
TETRAETHYLDITHIOPYROPHOSPHATE	3689-24-5	0.0005	I							550		25	2			X	349	
TETRAHYDROFURAN	109-99-9	0.9	I	0.0076	I	2	I	0.00000194	I	43	X	300000	1,6,7	12970	14891	X	66	
THIOFANOX	39196-18-4	0.0003	H							0.022		5200	9				280	
THIRAM	137-26-8	0.015	O							1000		30	4				339	
TOLUENE	108-88-3	0.08	I			5	I			130	X	532.4	1,2,3,4	13016	14953	X	111	9.01
TOLUIDINE, M-	108-44-1			0.016	S[9]			0.000051	S	140		15030	6			X	203	
TOLUIDINE, O-	95-53-4			0.016	P			0.000051	C	410		15000	1,3,5			X	200	18.07
TOLUIDINE, P-	106-49-0	0.004	X	0.03	P					320		7410	1,2,3				200	
TOXAPHENE	8001-35-2	0.00009	P	1.1	I			0.00032	I	1500		3	2,4,5				432	
TRIALLATE	2303-17-5	0.025	O	**[0.717] 0.0717**	O					2,000		4	5			X	343	
TRIBROMOMETHANE (BROMOFORM)	75-25-2	0.02	I	0.0079	I			0.0000011	I	130	X	3050	1,2,3,4	12942	14849	X	149	0.69
TRICHLORO-1,2,2-TRIFLUOROETHANE, 1,1,2-	76-13-1	30	I			5	P			1,200	X	170	1	13064	15014	X	48	0.35
TRICHLOROACETIC ACID	76-03-9	0.02	I	0.07	I					20	X	1200000	2,3,5,9	13291	15077		196	
TRICHLOROBENZENE, 1,2,4-	120-82-1	0.01	I	0.029	P	0.002	P			1500	X	44.4	1,4,6,7	13217	15233	X	213	0.69
TRICHLOROBENZENE, 1,3,5-	108-70-3	0.006	M			0.002	S[10]			3100	X	5.8	5	15677	18611		208	
TRICHLOROETHANE, 1,1,1-	71-55-6	2	I			5	I			100	X	1495	1,4,5,6	13116	15082	X	74	0.05
TRICHLOROETHANE, 1,1,2-	79-00-5	0.004	I	0.057	I	0.0002	X	0.000016	I	76	X	4420	1	12982	14909	X	114	0.03
TRICHLOROETHYLENE (TCE)	79-01-6	0.0005	I	0.046	I	0.002	I	0.000004	I	93	X	1100	1	13070	15022	X	87	0.02
TRICHLOROPHENOL, 2,4,5-	95-95-4	0.1	I							2400		1000	1,2,4				246	0.14
TRICHLOROPHENOL, 2,4,6-	88-06-2	0.001	P	0.011	I			0.0000031	I	1100		850	1,2,4,5				246	0.14
TRICHLOROPHENOXYACETIC ACID, 2,4,5- (2,4,5-T)	93-76-5	0.01	I							43		278	2,4,5				279	1.39
TRICHLOROPHENOXYPROPIONIC ACID, 2,4,5- (2,4,5-TP)(SILVEX)	93-72-1	0.008	I							1700		140	2				353	
TRICHLOROPROPANE, 1,1,2-	598-77-6	0.005	I							24	X	2700	14	13145	15119	X	117	
TRICHLOROPROPANE, 1,2,3-	96-18-4	0.004	I	30	I	0.0003	I			280	X	1896	1,4,6	12974	14896	X	157	0.35
TRICHLOROPROPENE, 1,2,3-	96-19-5	0.003	X			0.0003	P			190	X	2700	14	13047	14992	X	142	
TRIETHYLAMINE	121-44-8					0.007	I			51	X	55000	1,4	12951	14862	X	90	
TRIETHYLENE GLYCOL	112-27-6	2	P							6		1000000	12			X	285	
TRIFLURALIN	1582-09-8	0.0075	I	0.0077	I					720		4	2,5,6,7				382	
TRIMETHYLBENZENE, 1,3,4- (TRIMETHYLBENZENE, 1,2,4-)	95-63-6	0.01	I			0.06	I			2,200	X	56	1	12978	14904	X	169	4.50
TRIMETHYLBENZENE, 1,3,5-	108-67-8	0.01	I			0.06	I			660	X	48.9	1	12961	14876	X	165	

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A. Organic Regulated Substances

Regulated Substance	*CAS*	*RfDo (mg/kg-d)*		*CSFo $(mg/kg\text{-}d)^{-1}$*		*RfCi (mg/m^3)*		*IUR $(\mu g/m^3)^{-1}$*		*Koc*	*VOC?*	*Aqueous Sol (mg/L)*	*Aqueous Sol Reference[1]*	*TF Vol from Surface Soil*	*TF Vol from Subsurface Soil*	*Organic Liquid*	*Boiling Point (degrees C)*	*Degradation Coefficient (K) (yr^{-1})*
TRINITROGLYCEROL (NITROGLYCERIN)	55-63-0	0.0001	P	0.017	P					116	X	1800	2,3,5	12941	14848	X	190	18.07
TRINITROTOLUENE, 2,4,6-	118-96-7	0.0005	I	0.03	I					1		100	2				240	
VINYL ACETATE	108-05-4	1	H			0.2	I			2.8	X	20000	1	13017	14955	X	73	
VINYL BROMIDE (BROMOETHENE)	593-60-2					0.003	I	**[0.000032] 0.000015**	**[H] P**	150	X	4180	12	13086	15043	X	16	0.09
VINYL CHLORIDE	75-01-4	0.003	I	1.5	I	**[0.1] 0.08**	**[I] P[2]**	0.0000088	I	10	X	2700	1	13109	15040	X	-13	0.09
WARFARIN	81-81-2	0.0003	I							910		17	4				356	4.50
XYLENES (TOTAL)	1330-20-7	0.2	I			0.1	I			350	X	175	13	12982	14909	X	140	0.69
ZINEB	12122-67-7	0.05	I							19		10	4				474	

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S^{10} 1,2,4-Trichlorobenzene surrogate

Appendix A
Table 5—Physical and Toxicological Properties
B. Inorganic Regulated Substances

Regulated Substance	*CAS*	*RfDo (mg/kg-d)*		*CSFo (mg/kg-d)$^{-1}$*		*RfCi (mg/m^3)*		*IUR [(ug/m^3)$^{-1}$] (µg/m^3)$^{-1}$*		*Kd*
ALUMINUM	7429-90-5	1	P			0.005	P			9.9
ANTIMONY	7440-36-0	0.0004	I			**0.0003**	**D**			45
ARSENIC	7440-38-2	0.0003	I	1.5	I	0.000015	C	0.0043	I	29
BARIUM AND COMPOUNDS	7440-39-3	0.2	I			**[0.0005]**	**[H]**			41
BERYLLIUM	7440-41-7	0.002	I			0.00002	I	0.0024	I	790
BORON AND COMPOUNDS	7440-42-8	0.2	I			**[0.02]**	**[H]**			3
CADMIUM	7440-43-9	**[0.0005] 0.0001**	**[I] D[1]**			0.00001	D	0.0018	I	75
CHROMIUM III	16065-83-1	1.5	I							1,800,000
CHROMIUM VI	18540-29-9	0.003	I	0.5	C	0.000008	I	0.012	I	19
COBALT	7440-48-4	0.0003	P			0.000006	P	0.009	P	45
COPPER	7440-50-8	0.0325	H							430
CYANIDE, FREE	57-12-5	**[0.0006] 0.00063**	I			0.0008	I			9.9
FLUORIDE	16984-48-8	0.04	C			0.013	C			
IRON	7439-89-6	0.7	P							25
LEAD	7439-92-1			0.0085	C			0.000012	C	900
LITHIUM	7439-93-2	0.002	P							300
MANGANESE	7439-96-5	0.14	I			0.00005	I			65
MERCURY	7439-97-6	0.00016	C			0.0003	I			52
MOLYBDENUM	7439-98-7	0.005	I			0.002	D			20
NICKEL	7440-02-0	0.02	I			0.00009	D	0.00024	Is	65
NITRATE NITROGEN	14797-55-8	1.6	I							
NITRITE NITROGEN	14797-65-0	0.1	I							
PERCHLORATE	7790-98-9	0.0007	I							0
SELENIUM	7782-49-2	0.005	I			0.02	C			5
SILVER	7440-22-4	0.005	I							8.3
STRONTIUM	7440-24-6	0.6	I							
THALLIUM	7440-28-0	0.00001	X							71
TIN	7440-31-5	0.6	H							250
VANADIUM	7440-62-2	0.005	Id			0.0001	D			1,000
ZINC	7440-66-6	0.3	I							62

[1]Value recommended by USEPA Superfund program in May 2021 memo "Recommendations on the Use of Chronic or Subchronic Noncancer Values for Superfund Human Health Risk Assessments."

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C = California EPA Cancer Potency Factor
D = ATSDR Minimal Risk Level
H = Health Effects Assessment Summary Table (HEAST)
I = Integrated Risk Information System (IRIS)
Id = IRIS derived – Value derived from the IRIS oral RfD for Vanadium Pentoxide (0.009 mg/kg-day). Vanadium constitutes 56% of the molecular weight of the Vanadium Pentoxide molecule. 0.009 mg/kg-day x 0.56 = 0.005 mg/kg-day.
P = EPA Provisional Peer-Reviewed Toxicity Value
S = surrogate
X = EPA Provisional Peer-Reviewed Toxicity Value Appendix

APPENDIX A
Table 7
DEFAULT VALUES FOR CALCULATING MEDIUM-SPECIFIC CONCENTRATIONS FOR LEAD

[Input Values Used in UBK Model for Lead (for residential exposure scenario)

Geometric Standard Deviation (GSD)	**1.42 (default)**	**Drinking water intake**	**Model default**
Outdoor air lead concentration	**0.2 μg/m^3 (default)**	**Soil lead level**	**495 μg/g**
Indoor air lead concentration (% of outdoor)	**30**	**Indoor dust lead level**	**495 μg/g**
Time spent outdoors	**Model default**	**Soil/dust ingestion weighting factor (%)**	**45**
Ventilation rate	**Model default**	**Paint lead intake**	**Model default**
Lung absorption	**Model default**	**Maternal contribution method**	**Infant model**
Dietary lead intake	**Model default**	**Mother's blood lead at birth**	**7.5 μg/dL blood (model default)**
GI method/bioavailability	**Non-linear**	**Target blood lead level**	**10 μg/dL blood**
Lead concentration in drinking water	**4.00 μg/L (default)]**		

[Input Values Used in SEGH Equation (for nonresidential exposure scenario)

Concentration of lead in soil (S)	**987 μg/g**
Target blood lead level in adults (T)	**20 μg/dL blood**
Geometric standard deviation of blood lead distribution (G)	**1.4**
Baseline blood lead level in target population (B)	**4 μg/dL blood**
Number of standard deviations corresponding to degree of protection required for the target population (n)	**1.645 (for 95% of population)**
Slope of blood lead to soil lead relationship (δ)	**7.5 μg/dL blood per μg/g soil]**

[REFERENCE

WIXSON, B.G. (1991). The Society for Environmental Geochemistry and Health (SEGH) Task Force Approach to the Assessment of Lead in Soil. Trace Substances in Environmental Health . 11-20.]

Input Values Used in IEUBK Model for Lead (for residential exposure scenario)		
Parameter	**Value**	
Outdoor Air Pb Concentration (µg/m^3)	**Constant Value: 0.1**	
Dietary Lead Intake (µg/day)	**Age (Years)**	**Input**
	0-1	**2.66**
	1-2	**5.03**
	2-3	**5.21**
	3-4	**5.38**
	4-5	**5.64**
	5-6	**6.04**
	6-7	**5.95**
Water Consumption (L/day)	**Age (Years)**	**Input**
	0-1	**0.4**
	1-2	**0.43**
	2-3	**0.51**
	3-4	**0.54**
	4-5	**0.57**
	5-6	**0.6**
	6-7	**0.63**
Use Alternate Water Value?	**NO**	
Lead concentration in drinking water (µg/L)	**0.9**	
MEDIA	**ABSORPTION FRACTION PERCENT**	
Soil	**30**	
Dust	**30**	
Water	**50**	
Diet	**50**	
Alternate	**0**	
Calculate PRG (primary remediation goal)		
Select Age Group for Graph	**0 to 84 months**	
Change Cutoff (Target Blood Lead Level)	**5 µg/dL**	
Change GSD	**1.6**	
Probability of Exceeding the Cutoff	**5**	

Input Values Used in the Adult Lead Model (ALM) (for non-residential exposure scenario)			
Variable	**Description of Variable**	**Units**	**Value**
$PbB_{fetal,\ 0.95}$	Target PbB in fetus	µg/dL	5
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	µg/dL per µg/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	µg/dL	0.6
IR_S	Soil ingestion rate	g/day	0.050
$AF_{S,\ D}$	Absorption fraction	--	0.12
$EF_{S,\ D}$	Exposure frequency	days/yr	219
$AT_{S,\ D}$	Averaging time	days/yr	365

Explanation for Removal of HEAST Toxicity Values

The Health Effects Assessment Summary Tables (HEAST) is a comprehensive list, established by the U.S. Environmental Protection Agency (EPA), of human health toxicity values relative to the oral and inhalation routes of chemicals. HEAST provides information to assist in human health risk assessments and decision making during the remediation process. The values listed include but are not limited to:

- Reference Dose (RfD): An estimate of oral exposure to the human population that is likely to be without an appreciable risk of negative health effects during a lifetime.
- Reference Concentration (RfC): An estimate of a continuous inhalation exposure to the human population that is likely to be without an appreciable risk of negative health effects during a lifetime.
- Oral Slope Factor (OSF): An estimate of the increased cancer risk from an oral exposure to a dose of 1 mg/kg-day over a lifetime.
- Inhalation Unit Risk (IUR): An estimate of the increased cancer risk from inhalation exposure to a concentration of 1 ug/m3 over a lifetime.

When performing human health risk assessments, toxicological information is drawn from various sources. In Volume I, Part A, Chapter 7.4.1 of Risk Assessment Guidance for Superfund, available at https://www.epa.gov/sites/default/files/2015-09/documents/rags_a.pdf, the EPA established a hierarchy of sources of human health toxicity information used in risk assessments. In December 05, 2003, the EPA's Office of Superfund Remediation and Technology Innovation (OSRTI) revised the hierarchy of sources of human health toxicity values that generally should be used for human health risk assessments. See the EPA's "Human Health Toxicity Values in Superfund Risk Assessments" OWSER Directive 9285.7-53 memorandum, available at https://www.epa.gov/sites/default/files/2015-11/documents/hhmemo.pdf. The revised hierarchy is comprised of 3 tiers:

I. EPA's Integrated Risk Information System (IRIS).

II. Provisional Peer-Reviewed Toxicity Values (PPRTV) used in EPA's Superfund Program.

III. Other (peer-reviewed) toxicity values, including:

- Minimal Risk Levels produced by the Agency for Toxic Substances and Disease Registry (ATSDR),
- California Environmental Protection Agency (CalEPA) values, and
- EPA Health Effects Assessment Summary Table (HEAST) values.

IRIS is the first tier because IRIS values have been verified through a peer review and EPA consensus review. Tier II consists of the PPRTVs. PPRTVs are generated through reviews of toxicity values previously published in HEAST. Upon completion of the reviews, the new toxicity

values developed are entered into the PPRTV database and the previous toxicity values are to be removed from HEAST. The toxicity values listed in HEAST are generally considered to be provisional, which means the toxicity or cancer value has had some EPA review using all information available at the time of evaluation but are not considered verified and entered into IRIS. HEAST previously was updated with new compounds and toxicity values on a quarterly basis; however, HEAST has not been updated since 1997. In contrast, IRIS and PPRTVs continue to be updated as new information on compounds of interest becomes available. As per the 2003 EPA memo, priority should be given to Tier I and Tier II.

Based on that guidance the Department reviewed the Land Recycling Program Toxicity Database for toxicity values with HEAST as the source. Toxicity values for compounds for which an IRIS value or PPRTV was generated subsequent to the listing of the compound in HEAST were replaced with the toxicity values listed in IRIS or PPRTV for that compound. If the IRIS or PPRTV review of a compound indicated there was not sufficient information to derive the toxicity value previously listed in HEAST the toxicity value was removed from the Land Recycling Program Toxicity Database.

The following compounds have HEAST toxicity values proposed to be removed from the LRP Toxicity Database with PPRTV assessments subsequent to determination of HEAST toxicity value:

Ammonia (CAS 7664-41-7) HEAST Toxicity Value: RfDo = 0.85 mg/kg/day
(Provisional Peer Reviewed Toxicity Values for Ammonia; EPA/690/R-05/006F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Ammonia.pdf)

- "Because adequate data are lacking for oral exposure to ammonia, previous determinations of toxicity reference values (U.S. EPA, 1981, 1987, 1997) have used organoleptic (taste) data to estimate acceptable ammonium levels in drinking water at 34-35 mg/L. However, organoleptic (taste) data are not reliable predictors of either toxicity or intake."
- "Due to the high uncertainty associated with use of the organoleptic (taste) data for ammonia, no oral subchronic or chronic p-RfD is derived."

Bis(2-chloroisopropyl)ether (CAS 108-60-1) HEAST Toxicity Values: CSFo = 0.07 $(mg/kg/day)^{-1}$; IUR = 1E-05 $(ug/m3)^{-1}$
(Provisional Peer Reviewed Toxicity Values for Bis(2-chloro-1-methylethyl)ether; EPA/690/R-11/012F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Bis2chloro1methylethylether.pdf)

- "No published studies demonstrating carcinogenic effects of chronic-duration oral exposure to relatively pure BCMEE in humans or animals were identified. An obsolete oral slope factor (OSF), of 7 × 10−2 reported in the HEAST (U.S. EPA, 2010b), was derived from an NTP (1982) gavage study in mice. Existing studies showing a positive dose-response relationship between BCMEE exposure and tumor formation in mice (NTP, 1982)—but not in rats (NCI, 1979)—used a mixture of 69.4% BCMEE and 30% other

isomers and could not be used to derive an OSF for pure BCMEE. Consequently no p-OSF is developed."

Carbazole (CAS 86-74-8) HEAST Toxicity Value: CSFo = 0.02 $(mg/kg/day)^{-1}$
(Provisional Peer Reviewed Toxicity Values for Carbazole; EPA/690/R-08/006F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Carbazole.pdf)

- "Because of the lack of carcinogenic data in humans or animals, under the 2005 Guidelines for Carcinogen Risk Assessment (U.S. EPA, 2005), this PPRTV document classifies carbazole as having "Inadequate Information to Assess Carcinogenic Potential."
- "Neither a p-OSF nor a p-IUR could be derived for carbazole because of the lack of suitable oral or inhalation data in both humans and animals."

2-Chloropropane (CAS 75-29-6) HEAST Toxicity Value: RfCi = 0.1 mg/m^3
(Provisional Peer Reviewed Toxicity Values for 2-Chloropropane; EPA/690/R-05/012F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Chloropropane2.pdf)

- "Dow Chemical (1958) found lesions in the liver of rats exposed to 1000 ppm of 2-chloropropane for 6 months, but also found lesions in the kidneys and lungs of some of the other species tested under the same conditions. This study examined only one dose level, rendering it inadequate for RfC derivation."
- "The inhalation data for 2-chloropropane are inadequate to support derivation of an RfC."

trans-Crotonaldehyde (CAS 123-73-9) HEAST Toxicity Value: CSFo = 1.9 $(mg/kg/day)^{-1}$
(Provisional Peer Reviewed Toxicity Values for trans-Crotonaldehyde; EPA/690/R-21/001F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Crotonaldehydetrans.pdf)

- "A provisional cancer assessment was not prepared for trans-crotonaldehyde. Although IRIS (U.S. EPA, 2005) conducted a cancer assessment for this compound (weight of evidence [WOE] = "C; possible human carcinogen"), the data were not adequate for deriving quantitative estimates of carcinogenic risk by oral or inhalation exposure."

Dibromomethane (CAS 74-95-3) HEAST Toxicity Value: RfDo = 0.01 mg/kg/day
(Provisional Peer Reviewed Toxicity Values for Methylene bromide; EPA/690/R-09/031F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/MethyleneBromide.pdf)

- "No chronic oral toxicity studies of methylene bromide were located. The only adequate repeated-dose oral study is the 28-day drinking water study in rats (Komsta et al., 1988) used to derive the subchronic p-RfD. The short duration of this study precludes using it for derivation of a chronic p-RfD."

1,1-Dichloroethane (CAS 75-34-3) HEAST Toxicity Value: RfCi = 0.5 mg/m^3
(Provisional Peer Reviewed Toxicity Values for 1,1-Dichloroethane; EPA/690/R-06/012F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Dichloroethane11.pdf)

- "The available inhalation toxicity data for 1,1-dichloroethane are inadequate for derivation of provisional subchronic or chronic RfC values."

Ethyl Acrylate (CAS 140-88-5) HEAST Toxicity Value: CSFo = 0.048 $(mg/kg/day)^{-1}$
(Provisional Peer Reviewed Toxicity Values for Ethyl Acrylate; EPA/690/R-14/005F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/EthylAcrylate.pdf)

- "The tumor incidence data from the high concentration gavage studies are not considered suitable for quantitative estimation of cancer risk for ethyl acrylate at the low doses likely to be encountered by humans. The lack of sufficient information about the potential carcinogenic activity of ethyl acrylate at lower doses that do not induce local irritation precludes derivation of a quantitative estimate of cancer risk for ethyl acrylate by oral exposure."

Ethyl Methacrylate (CAS 97-63-2) HEAST Toxicity Value: RfDo = 0.09 mg/kg/day
(Provisional Peer Reviewed Toxicity Values for Ethyl Methacrylate; EPA/690/R-10/014F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/EthylMethacrylate.pdf)

- "There are no chronic oral studies of ethyl methacrylate. A subchronic neurotoxicity study using only one species (rat) and sex (male) has been conducted, and this study did not identify a NOAEL. Data for evaluating systemic effects other than neurotoxicity and reproductive/developmental toxicity via i.p. exposure are not available nor are any oral toxicological data in another species or in female animals. Due to these database deficiencies, the data do not support the derivation of a chronic p-RfD."

Fluorotrichloromethane (Freon 11) (CAS 75-69-4) HEAST: RfCi = 0.7 mg/m^3
(Provisional Peer Reviewed Toxicity Values for Trichlorfluoromethane; EPA/690/R-09/066F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Trichlorofluoromethane.pdf)

- "Due to the brevity of available studies and insufficient justifications for considering long-term effects, no chronic value is developed."

Hexane (CAS 110-54-3) HEAST Toxicity Value: RfDo = 0.06 mg/kg/day
(Provisional Peer Reviewed Provisional Subchronic Toxicity Values for n-Hexane; EPA/690/R-09/025F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Hexanen.pdf)

- "No epidemiology or case report studies examining health effects in humans or chronic laboratory studies evaluating potential health effects in animals following oral exposure to n-hexane are available. An RfD for n-hexane cannot be derived in the absence of a suitable oral study of sufficient duration that evaluates an array of endpoints."

Methyl Acrylate (CAS 96-33-3) HEAST Toxicity Value: RfDo = 0.03 mg/kg/day
(Provisional Peer Reviewed Toxicity Values for Methyl Acrylate; EPA/690/R-12/021F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/MethylAcrylate.pdf)

- "Neither a subchronic nor a chronic p-RfD can be derived because no published studies investigating the effects of subchronic or chronic oral toxicity of methyl acrylate in

humans or animals were obtained that are acceptable for use in dose-response assessment."

Methyl Chloride (CAS 74-87-3) HEAST Toxicity Values: CSFo = 0.013 $(mg/kg/day)^{-1}$; IUR = 1.8E-06 $(ug/m3)^{-1}$
(Provisional Peer Reviewed Toxicity Values for Chloromethane; EPA/690/R-12/008F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/Chlormethane.pdf)

- "The evaluation of chloromethane for IRIS determined that the human data are inadequate to judge the carcinogenic potential of methyl chloride and that the findings in the single animal study on carcinogenicity (CIIT, 1981) are equivocal. The lack of data on the carcinogenicity of chloromethane precludes the derivation of quantitative estimates for either oral (p-OSF) or inhalation (p-IUR) exposure."

Monochloroacetic Acid (CAS 79-11-8)
HEAST Toxicity Value: RfDo = 0.002 mg/kg/day
(Provisional Peer Reviewed Toxicity Values for Chloroacetic Acid; EPA/690/R-04/004F; Online: https://cfpub.epa.gov/ncea/pprtv/documents/ChloroaceticAcid.pdf)

- "The data do not support derivation of a provisional chronic RfD for chloroacetic acid."

The following compounds have HEAST toxicity values proposed to be removed from the LRP Toxicity Database with IRIS assessments subsequent to determination of HEAST toxicity value:

Barium and Compounds (CAS 7440-39-3) HEAST Toxicity Value: RfCi = 0.0005 mg/m^3
(Integrated Risk Information System (IRIS) Chemical Assessment Summary; Online: https://iris.epa.gov/static/pdfs/0010_summary.pdf)

- "An RfC for barium is not recommended at this time. The human and animal inhalation and intratracheal studies suggest that the respiratory system is a target of barium toxicity. The data also suggest that systemic effects, such as hypertension, may occur following inhalation exposure. The human studies cannot be used to derive an RfC for barium because exposure concentrations were not reported."

Boron and Compounds (CAS 7440-42-8) HEAST Toxicity Value: RfCi = 0.02 mg/m^3
(Integrated Risk Information System (IRIS Chemical Assessment Summary; Online: https://iris.epa.gov/static/pdfs/0410_summary.pdf)

- "An RfC for boron is not recommended at this time."
- "These data are inadequate to support derivation of an RfC for boron because the data available do not include a well-conducted study that adequately evaluated the respiratory tract and no NOAEL or LOAEL could be established."

Chloroprene (CAS 126-99-8) HEAST Toxicity Value: RfDo = 0.02 mg/kg/day
(Integrated Risk Information System (IRIS Chemical Assessment Summary; Online: https://iris.epa.gov/static/pdfs/1021_summary.pdf)

- "There are no human data involving oral exposure to chloroprene. The only lifetime oral study in animals exposed rats to chloroprene at one dose (50 mg/kg/day) and only qualitatively reported noncancer effects (Ponomarkov and Tomatis, 1980)."

Cyanazine (CAS 21725-46-2) HEAST Toxicity Values: RfDo = 0.002 mg/kg/day; CSFo = 0.84 $(mg/kg/day)^{-1}$
(Integrated Risk Information System (IRIS Chemical Assessment Summary; Online: https://iris.epa.gov/static/pdfs/0145_summary.pdf)

- "The Oral RfD for cyanazine has been withdrawn on 07/01/1992 as a result of further review. A new RfD summary is in preparation by the RfD/RfC Work Group."
- Not assessed for quantitative estimate of carcinogenic risk from oral exposure under IRIS Program
- Status: The EPA announced in a 2004 Federal Register Notice that chemicals used as pesticides would not be re-assessed by the IRIS Program.

Methyl Isobutyl Ketone (CAS 108-10-1) HEAST Toxicity Value: RfDo = 0.08 mg/kg/day
(Integrated Risk Information System (IRIS Chemical Assessment Summary; Online: https://iris.epa.gov/static/pdfs/0173_summary.pdf)
"An oral RfD for methyl isobutyl ketone (MIBK) was withdrawn on 03/01/91. The health effects data for MIBK were reviewed by EPA at that time and determined to be inadequate for derivation of an oral RfD."

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

July 2, 2024

David Sumner
Executive Director
Independent Regulatory Review Commission
333 Market Street, 14th Floor
Harrisburg, PA 17120

Re: Proposed Rulemaking: Administration of the Land Recycling Program (#7-575)

Dear Mr. Sumner:

Pursuant to Section 5(a) of the Regulatory Review Act, please find enclosed a copy of the Administration of the Land Recycling Program proposed rulemaking for review by the Independent Regulatory Review Commission (Commission). The Environmental Quality Board adopted this rulemaking on March 12, 2024. This proposal is scheduled for publication in the *Pennsylvania Bulletin* on July 13, 2024, with a 60-day public comment period ending on September 11, 2024. In-person public hearings are scheduled in Pittsburgh on August 19, 2024, and in Norristown on August 27, 2024. A virtual public hearing is scheduled for September 4, 2024.

The Commonwealth's Land Recycling Program, established by Act 2 (35 P.S. §§ 6026.101—6026.908), encourages the voluntary cleanup and reuse of contaminated commercial and industrial sites. It provides potential land developers with clear cleanup standards based on risk and an end to liability when cleanup standards are achieved. Every three years, the Department of Environmental Protection (Department) is required by regulation to evaluate new scientific information and, as necessary, propose changes to the medium-specific concentrations (MSC) that are a part of the statewide health standard for cleanup of soil and groundwater. This proposed rulemaking adds groundwater and soil MSCs for five compounds in the Per- and Polyfluoroalkyl substances (PFAS) family of compounds and updates regulations relating to lead, including models used to calculate the soil direct contact numeric values for lead and reduce the target blood lead value for lead from 10 micrograms per deciliter (µg/dL) to 5 µg/dL. In addition, this proposed rulemaking revises methods for attaining toxicity values for certain compounds, updates the interpretation of toxicity values, adopts more stringent toxicity values for 19 compounds, and clarifies administrative processes relating to effective dates of MSCs and requirements for regulated entities.

As set forth in the Regulatory Review Act, the Department will consider any comments and recommendations made by the Commission, as well as the House and Senate Environmental Resources and Energy Committees and the public, prior to final adoption of the enclosed rulemaking.

Please contact me by e-mail at laurgriffi@pa.gov or by telephone at 717.772.3277 if you have any questions or need additional information.

Sincerely,

Laura Griffin
Regulatory Coordinator

Enclosures

From: Leah Brown
To: Campbell, Laura; Code&Bulletin
Cc: Adeline E. Gaydosh; Reiley, Robert A.; Garst, High; Griffin, Laura
Subject: [External] RE: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)
Date: Tuesday, July 2, 2024 10:58:55 AM

Good morning Laura!
Thank you for submitting this proposed rulemaking. This proposed rulemaking is scheduled for the July 13th issue of the Bulletin!
Please let me know if you need anything further!
Have a great holiday week!
Leah

From: Campbell, Laura <laurcampbe@pa.gov>
Sent: Tuesday, July 2, 2024 10:04 AM
To: Code&Bulletin <codeandbulletin@palrb.us>
Cc: Leah Brown <lbrown@palrb.us>; Adeline E. Gaydosh <agaydosh@palrb.us>; Reiley, Robert A. <rreiley@pa.gov>; Garst, High <argarst@pa.gov>; Griffin, Laura <laurgriffi@pa.gov>
Subject: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)
Importance: High

Good morning,

Pursuant to Section 5(a) of the Regulatory Review Act, please find attached the Administration of the Land Recycling Program Proposed Rulemaking (#7-575) for review by the Senate Environmental Resources and Energy Committee. The rulemaking documents are attached in a compressed folder. We are sending the PDF files for official filing. The Word files were provided on May 6, 2024. In addition, we are reviewing the galley sent on Monday and will provide a marked PDF by Wednesday morning.

A copy of the transmittal sheet is attached for your records.

Please confirm receipt of this rulemaking.

Thank you,

Laura

Laura Campbell | Regulatory Coordinator
Department of Environmental Protection | Policy Office
Rachel Carson State Office Building
400 Market Street | Harrisburg, PA 17101
Phone: 717.772.5830 | Fax: 717.783.8926
(she/her/hers) laurcampbe@pa.gov | www.dep.pa.gov

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Independent Regulatory
Review Commission

July 2, 2024

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Independent Regulatory Review Commission
July 2, 2024

From: Eyster, Emily
To: Campbell, Laura; Osenbach, Matt
Cc: Garst, High; Reiley, Robert A.; Nezat, Taylor; Troutman, Nick; Griffin, Laura
Subject: Re: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)
Date: Tuesday, July 2, 2024 10:11:15 AM

Received. Thank you Laura!

Emily Eyster
Executive Director, Senate Environmental Resources and Energy Committee
Legislative Director, Office of Senator Carolyn T. Comitta
Cell: (717) 756-4702
Phone: (717) 787-5709
www.pasenatorcomitta.com

From: Campbell, Laura <laurcampbe@pa.gov>
Sent: Tuesday, July 2, 2024 9:46:09 AM
To: Osenbach, Matt <mosenbach@pasen.gov>; Eyster, Emily <Emily.Eyster@pasenate.com>
Cc: Garst, High <argarst@pa.gov>; Reiley, Robert A. <rreiley@pa.gov>; Nezat, Taylor <tnezat@pa.gov>; ntroutman@pasen.gov <ntroutman@pasen.gov>; Griffin, Laura <laurgriffi@pa.gov>
Subject: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)

Good morning,

Pursuant to Section 5(a) of the Regulatory Review Act, please find attached the Administration of the Land Recycling Program Proposed Rulemaking (#7-575) for review by the Senate Environmental Resources and Energy Committee. The rulemaking documents are attached in a compressed folder and the cover letters for Senator Yaw and Senator Comitta are attached separately.

A copy of the transmittal sheet is attached for your records – all ERE Committee chairs are receiving the rulemaking electronically.

Please confirm receipt of this rulemaking by replying to all recipients.

Thank you,

Laura

Laura Campbell | Regulatory Coordinator

Department of Environmental Protection | Policy Office
Rachel Carson State Office Building
400 Market Street | Harrisburg, PA 17101
Phone: 717.772.5830 | Fax: 717.783.8926
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Independent Regulatory
Review Commission
July 2, 2024

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Independent Regulatory Review Commission

July 2, 2024

From: Osenbach, Matt
To: Campbell, Laura
Cc: Eyster, Emily; Garst, High; Reiley, Robert A.; Nezat, Taylor; Troutman, Nick; Griffin, Laura
Subject: Re: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)
Date: Tuesday, July 2, 2024 10:08:58 AM

Message received.

Thank you!

Matt Osenbach

Director, Environmental Resources & Energy Committee

Office of State Senator Gene Yaw (R-23)

362 Main Capitol Building, Senate Box 203023

Harrisburg, PA 17120

T: (717) 787-3280

F: (717) 772-0575

www.SenatorGeneYaw.com

On Jul 2, 2024, at 9:48 AM, Campbell, Laura <laurcampbe@pa.gov> wrote:

CAUTION : External Email
Good morning,

Pursuant to Section 5(a) of the Regulatory Review Act, please find attached the Administration of the Land Recycling Program Proposed Rulemaking (#7-575) for review by the Senate Environmental Resources and Energy Committee. The rulemaking documents are attached in a compressed folder and the cover letters for Senator Yaw and Senator Comitta are attached separately.

A copy of the transmittal sheet is attached for your records – all ERE Committee chairs are receiving the rulemaking electronically.

Please confirm receipt of this rulemaking by replying to all recipients.

Thank you,

Laura

Laura Campbell | Regulatory Coordinator
Department of Environmental Protection | Policy Office
Rachel Carson State Office Building
400 Market Street | Harrisburg, PA 17101
Phone: 717.772.5830 | Fax: 717.783.8926
(she/her/hers) laurcampbe@pa.gov<mailto:laurcampbe@pa.gov> |
www.dep.pa.gov<http://www.dep.pa.gov/>

<7-575_Administration of the Land Recycling Program.zip>
<7-575_Ch250_Proposed_Transmittal Sheet.doc>
<Comitta_7-575_Ch250_Proposed.pdf>
<Yaw_7-575_Ch250_Proposed.pdf>

RECEIVED

Independent Regulatory
Review Commission
July 2, 2024

From: Michele Musgrave
To: Campbell, Laura; Franzese, Evan B.
Cc: Shupe, Hayley; Garst, High; Nezat, Taylor; Reiley, Robert A.; Griffin, Laura
Subject: RE: [EXTERNAL]: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)
Date: Tuesday, July 2, 2024 9:57:02 AM

Received, thanks!

Michele Musgrave
Administrative Assistant II
Representative Martin Causer
Environmental Resources &
Energy Committee
Room 47 East Wing
PO Box 202067
Harrisburg, PA 17120-2067
717-787-5075

From: Campbell, Laura <laurcampbe@pa.gov>
Sent: Tuesday, July 2, 2024 9:52 AM
To: Michele Musgrave <Mmusgrav@pahousegop.com>; Franzese, Evan B. <EFranzese@pahouse.net>
Cc: Shupe, Hayley <HShupe@pahouse.net>; Garst, High <argarst@pa.gov>; Nezat, Taylor <tnezat@pa.gov>; Reiley, Robert A. <rreiley@pa.gov>; Griffin, Laura <laurgriffi@pa.gov>
Subject: [EXTERNAL]: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)
Importance: High

Good morning,

Pursuant to Section 5(a) of the Regulatory Review Act, please find attached the Administration of the Land Recycling Program Proposed Rulemaking (#7-575) for review by the Senate Environmental Resources and Energy Committee. The rulemaking documents are attached in a compressed folder and the cover letters for Representative Vitali and Representative Causer are attached separately.

A copy of the transmittal sheet is attached for your records – all ERE Committee chairs are receiving the rulemaking electronically.

Please confirm receipt of this rulemaking by replying to all recipients.

Thank you,

Laura

Laura Campbell | Regulatory Coordinator
Department of Environmental Protection | Policy Office
Rachel Carson State Office Building
400 Market Street | Harrisburg, PA 17101
Phone: 717.772.5830 | Fax: 717.783.8926
(she/her/hers) laurcampbe@pa.gov | www.dep.pa.gov

From: Franzese, Evan B.
To: Campbell, Laura; Michele Musgrave
Cc: Shupe, Hayley; Garst, High; Nezat, Taylor; Reiley, Robert A.; Griffin, Laura
Subject: RE: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)
Date: Tuesday, July 2, 2024 9:58:43 AM

Received. Thank you!

Evan Franzese-Peterson
Executive Director | House Environmental Resources & Energy Committee (D)
Representative Greg Vitali
Pennsylvania House of Representatives
P: 717-787-7647
F: 717-780-4780

From: Campbell, Laura <laurcampbe@pa.gov>
Sent: Tuesday, July 2, 2024 9:52 AM
To: Michele Musgrave <Mmusgrav@pahousegop.com>; Franzese, Evan B. <EFranzese@pahouse.net>
Cc: Shupe, Hayley <HShupe@pahouse.net>; Garst, High <argarst@pa.gov>; Nezat, Taylor <tnezat@pa.gov>; Reiley, Robert A. <rreiley@pa.gov>; Griffin, Laura <laurgriffi@pa.gov>
Subject: Delivery of Proposed Rulemaking - Administration of the Land Recycling Program (7-575)
Importance: High

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Pursuant to Section 5(a) of the Regulatory Review Act, please find attached the Administration of the Land Recycling Program Proposed Rulemaking (#7-575) for review by the Senate Environmental Resources and Energy Committee. The rulemaking documents are attached in a compressed folder and the cover letters for Representative Vitali and Representative Causer are attached separately.

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Please confirm receipt of this rulemaking by replying to all recipients.

Thank you,

Laura

Laura Campbell | Regulatory Coordinator
Department of Environmental Protection | Policy Office
Rachel Carson State Office Building
400 Market Street | Harrisburg, PA 17101
Phone: 717.772.5830 | Fax: 717.783.8926

TRANSMITTAL SHEET FOR REGULATIONS SUBJECT TO THE REGULATORY REVIEW ACT

I.D. NUMBER: 7-575

SUBJECT: Administration of the Land Recycling Program

AGENCY: DEPARTMENT OF ENVIRONMENTAL PROTECTION
ENVIRONMENTAL QUALITY BOARD

TYPE OF REGULATION

RECEIVED
Independent Regulatory Review Commission
July 2, 2024

X Proposed Regulation

Final Regulation

Final Regulation with Notice of Proposed Rulemaking Omitted

120-day Emergency Certification of the Attorney General

120-day Emergency Certification of the Governor

Delivery of Tolled Regulation
a. With Revisions b. Without Revisions

FILING OF REGULATION

DATE	SIGNATURE	DESIGNATION	
		HOUSE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY	
July 2, 2024	Evan Franzese-Peterson *(via electronic delivery)*	MAJORITY CHAIR	Representative Greg Vitali
July 2, 2024	Michele Musgrave *(via electronic delivery)*	MINORITY CHAIR	Representative Martin Causer
		SENATE COMMITTEE ON ENVIRONMENTAL RESOURCES & ENERGY	
July 2, 2024	Matt Osenbach *(via electronic delivery)*	MAJORITY CHAIR	Senator Gene Yaw
July 2, 2024	Emily Eyster *(via electronic delivery)*	MINORITY CHAIR	Senator Carolyn Comitta
		INDEPENDENT REGULATORY REVIEW COMMISSION	
	(via electronic delivery)	EXECUTIVE DIRECTOR	David Sumner
~~_____~~	~~_____~~	~~*ATTORNEY GENERAL* (for Final Omitted only)~~	
July 2, 2024	Leah Brown *(via electronic delivery)*	*LEGISLATIVE REFERENCE BUREAU* (for Proposed only)	