GUIDANCE FOR SCREENING LEVEL ECOLOGICAL RISK ASSESSMENTS (SLERA) UNDER HSCA

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOUCES AND ENVIRONMENTAL CONTROL
DIVISION OF WASTE AND HAZARDOUS SUBSTANCES
REMEDIATION SECTION

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ECOLOGICAL RISK ASSESSMENT GUIDANCE

1.0 Introduction

To eliminate or minimize the risk to public health, welfare, and the environment from the release of hazardous substances, the Delaware General Assembly passed the Hazardous Substance Cleanup Act (HSCA) in 1990. The Department of Natural Resources and Environmental Control (DNREC) was given authority to implement HSCA. The Secretary of DNREC was tasked with establishing regulations to implement the provisions of HSCA, which were generated and adopted in 1994 (Secretary's Order 94-SF-0013). Regulations promulgated in 1996 contain media-specific descriptions of general risk levels (cancer risk of 1 x 10 -5 or a Hazard Index (HI) value of 1.0 for non-cancer risk) used to determine the need for cleanup.

This technical guidance, for HSCA certified consultants only, provides direction and information for conducting a tiered Screening Level Ecological Risk Assessment (SLERA) at all DNREC HSCA and/or Resource Conservation and Recovery Act (RCRA) sites. A SLERA is the first part of an Ecological Risk Assessment (ERA) at a known or suspected contaminated site pursuant to the Delaware Hazardous Substance Cleanup Act (HSCA), (7 Del. C. Ch.91). HSCA consultants should understand the purpose and intent of this guidance and should comply with related guidance including, but not limited to, USEPA's *Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments*, EPA 540-R-97-006, Office of Solid Waste and Emergency Response, Washington, DC (ERAGS - USEPA, 1997a). The guidance follows HSCA Regulations Governing Hazardous Substance Cleanup requirements, the U.S. Environmental Protection Agency (USEPA) Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, and parallels a portion of the EPA 8-step ecological risk assessment process. Please note that this guidance supersedes all previous DNREC HSCA Ecological Guidance, checklist and methods.

The SLERA determines the probability of adverse risk to ecological receptors from exposure to contaminants. This guidance is not intended, nor designed, to generate cleanup goals. The goal of the SLERA is to evaluate the need to conduct a more detailed Baseline Ecological Risk Assessments (BERA) for a site. BERA specifics will be outlined in *Guidance for Baseline Ecological Risk Assessments (BERA) under HSCA*. Results of a SLERA provide the basis for a recommendation to either conduct a BERA or to indicate no further ecological evaluation is necessary. A HSCA certified consultant may conduct the SLERA. However, if it is determined that further ecological analysis beyond this guidance is necessary, a HSCA ecological certified consulting firm will be needed to perform the analysis. HSCA certified ecological consultants should consult the forthcoming BERA guidance prior to initiating an assessment. For information on becoming a HSCA ecological certified consultant, please refer to the DNREC-RS website. For questions or information on HSCA certifications, please see Section 6 Consultant Certification of the Delaware Regulations Governing Hazardous Substance Cleanup.

SLERAs and BERAs help determine current or potential ecological risks, when remedial actions are needed, and provide ecological risk-based remediation goals for potentially ecologically sensitive areas on or impacted by HSCA sites. As part of a complete ecological risk assessment, a SLERA is conducted on every site, regardless of location, remediation technique or potential future development. SLERAs consist of a DNREC modified EPA Ecological Screening Process as outlined in steps 1 and 2. A BERA consists of EPA Ecological Screening Process steps 3A through 8 (https://www.epa.gov/risk/guidelines-ecological-risk-assessment). A BERA is conducted if a SLERA indicates the need for further ecological investigation. When a Site's remedy (for human health) also addresses the potential ecological risk, a BERA may not need to be conducted (i.e. excavation/removal). SLERA steps 1 through 2 focuses on excluding further evaluation of chemicals that do not have a likelihood to cause ecological risk. A BERA, steps 3A through 8, focuses on the quantification of site-specific risk, and may include collection of toxicity data and concentrations of contaminants in tissues of the organisms. The HSCA and RCRA Corrective Action cleanup programs generally use BERAs to: "1) identify and characterize the current and potential threats to the environment from a hazardous substance release, 2) evaluate the ecological impacts of alternative remediation strategies, and 3) establish cleanup levels in the selected remedy that will protect those natural resources at risk." (U.S. EPA 1994e, OSW ER Directive # 9285.7-17)

2.0 Screening Level Ecological Risk Assessment (SLERA)

The SLERA is based on a modification of Steps 1 and 2 of the EPA Ecological Screening Process. SLERA steps 1 and 2 evaluate if a site poses no or low risk, identifies Contaminants of Potential Ecological Concern (COPECs), and identifies exposure pathways that may need further evaluation. These steps are intentionally over-protective and are only to be used to exclude chemicals with no likelihood of causing risk from further evaluation. DNREC has modified EPA's Ecological Screening Process to address state specific needs. Results from both steps 1 and 2 should be included within a BFI, RI, or any report with an ecological risk evaluation that is submitted under HSCA and RCRA Corrective Action programs. The SLERA should meet all HSCA and/or RCRA requirements and federal guidance including, but not limited to the following:

1. U.S. EPA Wildlife Exposure Factors Handbook. Volumes 1 and 2. December 1993.
2. EPA Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA 1993.
3. Guidelines for ERA. EPA 1998.
4. The most current version of the DNREC-RS HSCA Screening Level Table.

Details regarding each step are provided below.

2.1 Step 1: Site Visit, Problem Formulation, and Toxicity Evaluation

Step 1 is important for identifying complete and potential exposure pathways, as well as the measurement end points and is comprised of a Site Visit, Problem Formulation, and Toxicity Evaluation. For DNREC SLERAs, the toxicity evaluation is defined using the Ecological Screening Levels (ESLs) contained in the HSCA Screening Level Table and the Delaware Surface Water Quality Standards. Unless pre-approved by DNREC, no further research is needed into additional ecological values. Several components of step 1 data are used in establishing the basis of the SLERA. Details and specific actions are below.

2.1.1 Site Visit

A site visit is necessary for gathering a thorough evaluation of the site's current condition and potential ecological concerns. This visit can be made in conjunction with the initial site reconnaissance for any other HSCA or RCRA required investigation. The person who will be completing the SLERA should be present for the site visit. The same person should be the one to evaluate the site from a comprehensive SLERA perspective; and should also assist with the completion of an accurate Conceptual Site Model (CSM) that includes ecological endpoints/receptors. It is important the CSM address how contaminants are potentially interacting with the environmental media, ecological habitats; and species present and/or potentially present, in addition to other contaminants on the site. It may be beneficial to collect for specific matrix characteristics, such as total organic carbon or sediment grain size, early in the process for later use, should the site need further evaluation.

2.1.2 Problem Formulation/Conceptual Site Model

Currently, DNREC does not require an ecological specific CSM. However, the CSM for the site should include information on the ecological setting, known or potential site contaminants; current and/or potential exposure pathways and fate and transport mechanisms. At minimum, the CSM should include the following:

1. Identification of any terrestrial or aquatic habitats
2. Identification of rare, threatened, and endangered species as identified by the DNREC Species Conservation and Research Program and the Delaware Wildlife Action Plan
3. Identification of any natural communities and other significant natural resources as identified by the DNREC Species of Conservation and Research Program, the Delaware Wildlife Action Plan or Delaware's Natural Areas Program.
4. Identification of designated uses of stream basins and water bodies as listed in the Delaware Surface Water Quality Standards (updated March 2023)
5. Identification of potential independent exposure areas
6. Acreage of the site
7. Current and past site conditions and uses
8. Topography

9. Description of surrounding land, and use, including any off-site Ecologically Sensitive Natural Resources (ESNR) possibly impacted by the site or site systems
10. Brief description of any COPECs determined through historical use or previous investigations. This can include Phase II reports, Site Investigations, or other applicable reports. The CSM should include a discussion of how the on-site contaminants behave in the environment, such as bioaccumulation status and information on mobility
11. Potential medias of concern

The ecological receptors do not restrict movement based on arbitrary boundaries. It should be noted that ecological risk is to be determined for the entire site and is not to be calculated for operable units (OUs). While there are many different sources of Delaware specific habitat data, DNREC-RS primarily relies on the recommendations from the Delaware Wildlife Action Plan (https://dnrec.alpha.delaware.gov/fish-wildlife/conservation/wildlife-action-plan) and the DNREC Species of Conservation and Research Program (https://dnrec.alpha.delaware.gov/fish-wildlife/conservation/).

There are several other additional Delaware specific sources of information, including the Delaware data portal, "FirstMap" (https://de-firstmap-delaware.hub.arcgis.com/pages/data). FirstMap houses many datasets that can be used for the habitat assessment, including geospatial maps. These maps include known sensitive habitats such as wetlands, rivers, marshes, streams, ponds, and wildlife habitat.

The DNREC Fish and Wildlife's Delaware Ecological Network (DEN), which is also available through FirstMap, is an additional resource. The DEN is a statewide conservation network developed from Geographic Information System (GIS) and field-collected data that provides a consistent framework to help identify and prioritize areas for natural resource protection. The DEN is composed of the following elements: Core areas, which contain relatively intact natural ecosystems and provide high-quality habitat for native plants and animals; hubs, which are slightly fragmented aggregations of core areas, but have contiguous natural cover; and corridors, which link core areas together, allowing wildlife movement and seed and pollen transfer between them.

Additional sources include, but are not limited, to National Oceanic and Atmospheric Administration (NOAA), the USEPA, the United States Geologic Survey (USGS), the University of Delaware, and non-governmental organizations such as the Partnership for the Delaware Estuary, Delaware Nature Society and Delaware Geological Survey. If using additional sources in performing a SLERA, include a complete citation of the reference and rationale for inclusion.

Operable units (OUs) are used within human health risk assessments, when appropriate and approved by DNREC. However, OUs do not apply to ecological risk assessment. As a whole, the ecological risk should be determined by the entire site. Also, samples/data from appropriate soil depths for use in the SLERA should be collected. Unless otherwise discussed, a SLERA

will rely upon data from samples collected from 0-2 ft below the ground surface, as prescribed in the HSCA investigation guidance. Ecological specific depths may be required as part of a BERA based upon the site specific CSM. ESLs may be derived from external sources when the specific contaminant ESLs are not included in the HSCA Screening Level Table or the Delaware Surface Water Quality Standards. DNREC approval is necessary for all departures from the HSCA ecological risk assessment process.

2.1.3 Toxicity Evaluation

The SLERA toxicity evaluation stage includes identifying the ESLs that will be used for comparison to site data. Unless approved in writing by DNREC, as noted above, ESLs included in the HSCA Screening Level Table and the Delaware Surface Water Quality Standards should be used for any SLERA conducted under HSCA.

ESLs including in the HSCA Screening Level Tables were derived from numerous sources, are conservative in nature, assume no or low adverse effects to the most sensitive receptors, are media specific and are updated biannually by DNREC. Media specific ESLs include the following: surface soil, sediment for marine and freshwater systems; and surface water for marine and freshwater systems (both acute and chronic) per the Surface Water Quality Standards.

2.1.4 Determining a marine or freshwater system

Determining whether the site is a marine or freshwater system is important for the selection of the correct screening level. Marine water is defined in the Delaware Surface Water Quality Standards as having a salinity in excess of 5 parts per thousand (ppt). Freshwater is defined as having a salinity of 5 ppt or less. Please refer to Section 2.2.4 for information on how hardness can affect surface water results.

2.2 Step 2: Ecological Effects Evaluation, Exposure Assessment, and Risk Calculation

Step 2 involves the ecological effects evaluation and exposure assessment and the preliminary ecological risk calculation. Step 2 is the beginning of a series of refinements. Refinements include identifying exposure point concentrations (EPCs) for use in the exposure assessment, and Hazard Quotient (HQs) calculations. EPCs and HQs are necessary for identifying COPECs. Exposure assessment and risk calculation information should be included in the Remedial Investigation or Brownfield Investigation Report, under an Ecological Risk subheading.

2.2.1 Ecological Effects Evaluation and Exposure Assessment

The ecological effects evaluation is important in identifying the COPECs. While similar to comparing site data to screening levels for human health, there are several differences based upon the media. Details regarding each media are listed below. However, the most conservative values of either EPA or DNREC criteria should be used for comparison. Please note that DNREC-RS does not evaluate the potential ecological risk from groundwater except for site specific situations where it is appropriate. One example would be impacted

groundwater discharging directly to surface water. In this case, a comparison of contaminant concentrations in groundwater to the Surface Water Quality Criteria should be completed to identify additional COPECs. Please discuss with DNREC whether the site should require a groundwater ecological risk assessment.

Like a human health risk assessment, both the maximum observed concentration (MOC) and 95% Upper Confidence Limit (UCL) can be used for comparison to applicable criteria in order to determine contaminants needing further evaluation. Using the MOC is most conservative, and assumes that an organism is being exposed to the highest concentration all of the time, and that the contaminant is 100% bioavailable.

If enough data is collected, after a MOC exceeds an ESL, a 95% UCL can be calculated and used for comparison to applicable criteria to determine contaminants that need further evaluation. USEPA's ProUCL software should be used to calculate a dataset 95% UCL (which represents a conservative estimate of the arithmetic average). The application of a calculated 95% UCL concentration considers organism mobility and that the organism is not being exposed to the highest concentration for its entire life. Dataset detects *and* non-detects should be included in the ProUCL software. Generally, ProUCL needs eight (8) data points of which five (5) must be detects, to calculate a statistically acceptable 95% UCL value. If a calculated 95% UCL is exceeding the MOC of a COPEC, then the MOC should be used instead of the 95% UCL. Additionally, the MOC should be used if there are not enough data points to calculate a 95% UCL. Tables documenting the decision process must be submitted as part of the SLERA. Table templates are found in Appendix A.

Note, if the CSM determines multiple exposure areas, then an EPC must be specified/calculated for each exposure area. For example, if a site has two ponds, and assuming there is no hydraulic connection between the ponds, the biota in one pond might not be exposed the same EPC as biota in the other pond. As previously stated, data from appropriate soil depths should be collected. Unless otherwise discussed, a SLERA will use data from the 0-2 ft depth samples that are collected as part of a HSCA investigation. Collection of data from ecological specific depths may be required as part of a BERA.

2.2.2 Determination of COPECs for Soil

Ecological soil screening levels were added to the HSCA Screening Level Table in January 2014. Soil screening values are mainly derived from the Risk Assessment Information System (RAIS), which cites several values from USEPA Region 4 and NOAA Screening Quick Reference Tables.

Similar to the federal ecological risk assessment process, determining shallow soil COPECs is achieved by first comparing the MOC to the ecological screening level. If the MOC exceeds the appropriate ecological screening level, and enough samples have been collected, the calculated 95% UCL calculation can be compared to the ecological screening level. If

the contaminant MOC or calculated 95% UCL is above the screening value, then the contaminant is retained as a COPEC. If the MOC or the calculated 95% UCL is below the ecological screening value, then the contaminant does not need to be considered further.

There are several specific considerations for surface soil.

1. ***PAHs***: Polycyclic Aromatic Hydrocarbons (PAHs) can be evaluated two ways. One is a comparison of the individual PAH values to the corresponding ESL. The second is a grouping of the PAHs into two classifications: high molecular weight (HMW) or low molecular weight (LMW). Then the individual HMW or LMW PAHs concentrations should be summed, and the Total HMW or Total LMW value should then be compared to the lowest of the available Ecological Soil Screening Levels (EcoSSL). If the sum of PAHs exceeds the EcoSSL, then further refinement will be necessary in the BERA. HMW and LMW PAHs are broken into the groups based on the number of benzene rings. HMW PAHs are compounds with four (4) or more benzene rings. Examples include the following: benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, and pyrene. LMW-PAHs are compounds with fewer than four (4) benzene rings. Examples include the following: naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, fluorene, anthracene, and phenanthrene.

2. ***DDT***: Like PAHs, dichloro-diphenyl-trichloroethane (DDT) concentrations can be screened two ways. One is by comparing the individual DDT compounds to the corresponding EcoESL value. The second is to sum the values of DDT, dichloro-diphenyl-dichloroethylene (DDD) and dichloro-diphenyl-dichloroethane (DDE) to generate a concentration of Total DDTx (aka DDT and metabolintes, Total DDT or DDTx). The Total DDTx concentration is then compared to the EcoSSL value for DDTx. At the time of this guidance, the lowest EcoSSL value is 0.021 mg/kg. This value is derived based for DDTx and the approach is consistent with EPA Region 4.

3. ***Essential Nutrients***: essential nutrients do not have ESLs. Essential nutrients include calcium, iron, magnesium, potassium, and sodium.

The chosen Screening Values should be included on the COPEC tables (example in Appendix A). The report must include justification for using screening levels other than the previously provided sources. Note: DNREC pre-approval is needed for using ecological screening levels outside of the previously provided sources.

2.2.3 Determination of COPECs for Sediment

Ecological sediment screening values were added to the HSCA Screening Level Table in January 2014. The sediment values are derived from USEPA Region 3 Biological Technical Assistance Group (BTAG) Screening Benchmarks with some exceptions. Additionally, US EPA Region 4 values for sediment should be used when there currently is not a value provided on the HSCA Screening Level Table.

Sediment values are listed for both marine and freshwater system. The criteria chosen for comparison should be determined based upon the salinity of the surface water at the location where the sediment samples were collected. As noted previously, marine water has salinity greater than 5 ppt, while freshwater has salinity of 5 ppt or less. This is consistent with the Delaware Surface Water Quality Standards.

There are several specific considerations that should be considered for sediment.

1. PAHs: PAHs can be evaluated two ways. One, comparison of the individual PAH values to the corresponding ESL. Two, grouping of the PAHs into two classifications: HMW or LMW. The individual HMW or LMW PAHs concentrations should be summed, and the summation compared to the selected HSCA Screening Values for either freshwater or marine sediment. If the sum of PAHs exceeds the Screening Value, then further refinement will be necessary in the BERA. HMW or LMW PAHs are broken into the groups based on the number of benzene rings. HMW PAHs are compounds with four (4) or more benzene rings. Examples include the following: benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, and pyrene. LMW-PAHs are compounds with fewer than four (4) benzene rings. Examples include the following: naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, fluorene, anthracene, and phenanthrene.

2. DDT: Like PAHs, DDT concentrations can be screened two ways. One, comparison of the individual DDT compounds to the corresponding HSCA Screening Level. Two, summation of the values of DDT, DDD and DDE and then comparing the summation to the EcoSSL DDTx value for either freshwater or marine sediment.

3. Essential Nutrients: essential nutrients do not have ESLs. Essential nutrients include calcium, iron, magnesium, potassium, and sodium.

Selected screening values should be included on the COPEC tables (example in Appendix A). The report must include justification for using screening levels other than the previously provided sources. Note: DNREC pre-approval is needed for using ecological screening levels outside of the previously provided sources.

2.2.4 Determination of COPECs for Surface Water

Ecological surface water screening values were added to the HSCA Screening Level Table in January 2014. Surface water values are derived from EPA Region 3 BTAG Screening Benchmarks with some exceptions.

Surface water criteria as listed for both marine and freshwater environments. Marine water has salinity greater than 5 ppt. Freshwater has salinity of 5 ppt or less. This is consistent with the Delaware Surface Water Quality Standards.

Using dissolved metal surface water results is recommended for comparison to the ESLs except for arsenic, iron, mercury, selenium, and thallium. For those metals, the total concentrations should be used for comparison to the ESLs. As previously stated, the screening levels are based on the Delaware Surface Water Quality Criteria for Protection of Aquatic Life and the USEPA Region 3 BTAG Screening Benchmarks. Dissolved concentrations are used in their assessments except for the above-mentioned metals.

Delaware's freshwater acute and chronic aquatic life criteria for some metals (i.e., cadmium, chromium (III), lead, nickel, silver, and zinc) are dependent upon water hardness. The Delaware Surface Water Quality Criteria for Protection of Aquatic Life (https://regulations.delaware.gov/AdminCode/title7/5000/7400/7401.shtml, Table 1) provides the equations for calculating criteria for those specific metals using hardness data. Hardness can be measured or estimated using calcium and magnesium concentrations and the following equation: (2.497 ug/L (Ca) + 4.118 ug/L (Mg)). USEPA's National Recommended Aquatic Life Criteria table lists criteria for hardness dependent parameters using an assumed hardness of 100 milligrams per liter (mg/L) as CaCO3.

The use of acute and chronic criteria values can depend on the specific evaluation and site use. Acute values are more applicable for short term exposures, such as exposure to buried sediment during dredging or excavation activities. The use of chronic values is more applicable to existing, ambient conditions where the exposure is for a prolonged duration. The text of the report should include the justification for the use of acute or chronic values. In addition, DNREC may request the evaluation of both acute and chronic due to specific project needs.

It is important to note that Table 2 of the Delaware Surface Water Quality Standards includes criteria related to the protection of human health from the consumption of organisms (I.e. fish). Although the criteria were not derived to protect an ecological receptor itself from adverse impacts (those criteria are included in Table 1 of the Delaware Surface Water Quality Standards), they do represent concentrations that are protective when considering bioaccumulation of contaminants within an ecological receptor. As such, where applicable, surface water data and/or groundwater data should be screened against the bioaccumulation-based criteria to add context to potential ecological exposure and associated potentially linked human health risk.

There are several specific considerations that should be considered for surface water.

1. *Aluminum:* the bioavailability of aluminum in surface water is pH dependent, which can in turn influence its toxicity. As a result, it is important to measure pH values for the individual surface water samples. If the MOC or 95% UCL of aluminum exceeds the ESL, and the pH of the sample is between 6.5-9.0, then aluminum should be retained as a COPEC. If the pH of the sample is below 6.5, then it does not need to be retained as a COPEC, per Table 1 of the Surface Water Quality Criteria.

2. PAHs: PAHs can be evaluated two ways. One, comparing individual PAH values to the corresponding ESLs. Two, group the PAHs into two classifications: HMW or LMW. The individual HMW or LMW PAHs concentrations should be summed, and the summation compared to the Region 3 BTAG values for either freshwater or marine water. If the sum of PAHs exceeds the Region 3 BTAG value, then further refinement will be necessary in the BERA. HMW and LMW PAHs are broken into the groups based on the number of benzene rings. HMW PAHs are compounds with four (4) or more benzene rings. Examples include the following: benz[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, fluoranthene, indeno[1,2,3-cd]pyrene, and pyrene. LMW-PAHs are compounds with fewer than four (4) benzene rings. Examples include the following: naphthalene, 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, fluorene, anthracene, and phenanthrene.

3. DDT: Like PAHs, DDT concentrations can be screened two ways. One, comparison of the individual DDT compounds to the corresponding ESLs. Two, summing the values of DDT, DDD and DDE and comparing the summation to the US EPA Region 3 BTAG DDTx value for either freshwater or marine water, which is included on the HSCA Screening Level Table.

4. Essential Nutrients: essential nutrients do not have ESLs. Essential nutrients include calcium, iron, magnesium, potassium, and sodium.

Selected screening values should be included on the COPEC tables (example in Appendix A). The report must include justification for using screening levels other than the previously provided sources. Note: DNREC pre-approval is needed for using ecological screening levels outside of the previously provided sources.

2.2.5 Screening Level Ecological Non- Cancer Risk Calculation

The risk calculation of a SLERA involves the calculation of a HQ or a non-cancer risk. For ecological risk, the HQ is calculated using a ratio calculation. An HQ is calculated for each media and for each area, should that be applicable to the site.

For calculating a media specific and area specific HQ, use the following formula:

$$\frac{Maximum\ Contaminant\ Concentration\ for\ Media\ and\ Area}{Screening\ Level} = HQ$$

Similar to assessing human health risk, a calculated HQ above 1 indicates a potential risk that must be evaluated further. First the calculation is performed using the MOC of each contaminant per media. If the MOC exceeds the HQ of 1, then the previously calculated 95% UCL can be used in place of the MOC, and the HQ can be recalculated. Should the HQ exceed 1, then site specific considerations can be further evaluated or a BERA must be performed. It is important to

note that a BERA must be performed by a HSCA ecological certified consultant. The calculated HQs should be reported using one (1) significant digit.

2.2.6 Further Site-Specific Refinement of COPECs

2.2.6.1 Presence of Free Product (NAPL)

The Ecological Risk Assessment Guidance strongly recommends the removal of all free product from a site independent of a SLERA or BERA. Should free product be encountered at the site, the proposed remedial action must include its removal, separate from any determined ecological risk from COPECs.

2.2.6.2 Site Specific Background Concentrations

The DNREC HSCA Screening Level Table includes Background Screening Values (BSV). However, when values are not found in the DNREC HSCA Screening Tables, USEPA EcoSSLs can be used for further refinement of the COPECs Level Table. Selected values should be state or region specific and must be pre-approved by DNREC prior to use. Also, selecting any other values from other sources that are to be considered as background must be pre-approved by DNREC prior to use.

2.2.6.3 Mass Loading Calculations

A mass loading calculation can be performed using surface soil sample results for all sites within 1,000 feet of an open waterway. Please refer to applicable DNREC guidance on calculating mass loadings.

2.2.6.4 Uncertainty Analysis

After completing calculations and refining exposure estimates, an uncertainty analysis narrative must be included. Uncertainties can be related to non-detect data, laboratory detection limits, and laboratory interferences, among other things. DNREC SOPCAP should be used as a guide for evaluating uncertainties. The uncertainty narrative should be included within the applicable Uncertainty Evaluation section of the report.

2.2.7 Site Specific Considerations

While an ecological evaluation is necessary for every site regardless of re-development or potential use, not every site will have a potential ecological impact on potential biota. As a result, the site location should be considered to provide additional context while evaluating the site. To note: the location of the site does not preclude an ecological evaluation, nor does it eliminate the possibility of further ecological evaluation within a BERA. Adequate information must be presented to conclude that no, or negligible ecological risk exists, and that a BERA not is required.

3.0 Reporting and Submission of Data

The ecological risk assessment is documented within several stages of the HSCA process. First, as part of the CSM for the site. The CSM is important for documenting site conditions. Second, any HSCA report should include tables documenting the selection of screening values and COPECs. Please refer to the Appendix A for templates on the required tables.

4.0 Baseline Ecological Risk Assessment Determination

Evaluation of potential ecological risks beyond this SLERA Guidance are to be addressed within a BERA. A BERA must be performed by a HSCA certified ecological consultant and not a HSCA certified consultant. A list of HSCA certified ecological consultants can be on the DNREC website (dnrec.alpha.delaware.gov/waste-hazardous/remediation/hsca). A SLERA may recommend no further ecological evaluation based on the HSCA Screening Level Table. However, DNREC may request further ecological evaluation under certain conditions such as updated Surface Water Quality Criteria, EPA screening values or other guidance and screening values recommended by the Department that are not included within the current screening level table.

To note: Independent of the SLERA recommendation, site conditions may indicate a BERA is needed to fully assess the potential ecological risk. These include, but are not limited to, site location, DNREC Species Conservation and Research Program recommendations, and federally listed threatened or endangered species.

5.0 Definitions

Acute: An acute effect involves a stimulus severe enough to rapidly induce an adverse response, in toxicity test, an adverse response observed in 96 hours or less is typically considered acute. An acute effect is not always measured in terms of lethality, it can measure a variety of short-term adverse effects.

Background Value: A background value is the concentration of substances widely present in the soil, sediment or surface water in the vicinity of the site or at a comparable reference area, due to natural causes or other activities as determined by DNREC.

Chronic: A chronic effect involves a stimulus that produces an adverse response that lingers or continues for a relatively long period of time, often one-tenth of the life span or more. Chronic should be considered a relative term depending on the life span of the organism. A chronic effect can be lethality, growth or reproductive impairment, or other longer term adverse effect.

Contaminants of Potential Ecological Concern (COPEC)- A hazardous substance that may or may not be contributing to an unacceptable ecological risk at the site.

Ecologically Sensitive: As defined by the DNREC including, but not limited to, wetlands, forested areas, meadowlands, surface water bodies, or others as determined by DNREC.

Ecological Setting- A description of the terrestrial and aquatic habitats, sensitive or critical habitats, and exposure areas.

Ecological Risk Assessment- Systematic framework for assessing and integrating professional judgements about probable adverse conditions and/or events through an 8-step process. Evaluates the likelihood that adverse ecological effects may or are occurring as a result of exposure to one or more stressors (biological, chemical, or physical).

Exposure- Contact between a receptor and a potential contaminant.

Exposure Pathway- The route a chemical or a physical agent takes from a source area to an exposed organism or receptor.

Exposure Point Concentration: An estimate of the average chemical concentration in an environmental medium.

Hazard- The potential of a negative event.

Maximum Observed Concentration- The highest concentration for a specific contaminant detected in an environmental medium. This value is determined through a review of the analytical sample results.

Receptor- Aquatic and/or terrestrial species and organisms that are prone to potential toxicity at the site.

Surface Soil- The surface soil refers to the top six (6) inches below the ground surface of soil/grass.

6.0 References and Helpful Links

Biological Technical Assistance Group (BTAG) Screening Values. 2022. United States Environmental Protection Agency, Region 3. https://www.epa.gov/risk/biological-technical-assistance-group-btag-screening-values

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Appendix A: Tables for COPECs Selection

Table 1: Selection of Contaminants of Potential Ecological Concern - SOIL

Site Name

DE# XXXX

Chemical	Maximum Concentration	Lab Qualifier	Sample Units	pH	Salinity (ppt)	DNREC Screening Level (mg/kg)	COPEC Flag (Y/N)	Comment

Table 2: Selection of Contaminants of Potential Ecological Concern – SEDIMENT (FRESH/MARINE)
Site Name
DE# XXXX

Chemical	Maximum Concentration	Lab Qualifier	Sample Unit	pH	Salinity (ppt)	DNREC Screening Level (mg/kg)	COPEC Flag (Y/N)	Comment

Table 3: Selection of Contaminants of Potential Ecological Concern - SURFACE WATER (FRESH/MARINE)
Site Name
DE# XXXX

Chemical	Maximum Concentration	Lab Qualifier	Sample Unit	pH	Salinity (ppt)	DNREC Screening Level (ug/L)	COPEC Flag (Y/N)	Comment

Appendix B: Acronym List

ACRONYM LIST

BERA	Baseline Ecological Risk Assessment
BFI	Brownfield Investigation
BSV	Background Screening Value
BTAG	Biological Technical Assistance Group
Ca	Calcium
CaCO3	Calcium Carbonate
COPEC	Contaminant of Potential Ecological Concern
CSM	Conceptual Site Model
DDD	Dichloro-Diphenyl-Dichloroethylene
DDE	Dichloro-Diphenyl-Dichloroethane
DDT	Dichloro-Diphenyl-Trichloroethane
DEN	Delaware Ecological Network
DNREC	Department of Natural Resources and Environmental Control
EcoSSLs	Ecological Soil Screening Levels
EPA	United States Environmental Protection Agency
EPC	Exposure Point Concentrations
ERA	Ecological Risk Assessment
ESL	Ecological Screening Level
ESNR	Ecologically Sensitive Natural Resource
GIS	Geographic Information System
HMW	High Molecular Weight
HI	Hazard Index

HQ	Hazard Quotient
HSCA	Hazardous Substance Cleanup Act
LMW	Low Molecular Weight
Mg	Magnesium
mg/kg	Milligram per Kilogram
mg/L	Milligrams per Liter
MOC	Maximum Observed Concentration
NOAA	National Oceanic and Atmospheric Administration
PAHs	Polycyclic Aromatic Hydrocarbons
ppt	Parts Per Thousand
RAIS	Risk Assessment Information System
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RS	Remediation Section
SLERA	Screening Level Ecological Risk Assessment
SOPCAP	Standard Operating Procedures for Chemical Analytical Programs under HSCA
UCL	Upper Confidence Limit (95%)
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey