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## SECTION II. REMEDIATION STANDARDS

### A. Background Standard

#### 1. Introduction

This chapter presents procedures to be used in assessing site contamination and demonstrating attainment of the background standard. Use of this guidance and data submission formats should simplify reporting on the site and reduce delays in obtaining final report approval by the Department. This chapter is designed to help those involved understand and meet the requirement of the background standard under Act 2 and the regulations in Chapter 250. Environmental Cleanup Program staff in the Regional Offices are a valuable resource and will assist in answering questions on the background standard.

Background is the concentration of a regulated substance that is present at a site, but is not related to the release of regulated substances at the property. Attainment of the background standard for a regulated substance may be demonstrated by an analysis of environmental media within and around the site ([Act 2 Section 302](#)). Establishing the background concentration is discussed in [Subsection II.A.4](#) of this manual. In addition to Act 2, [Section 302, Subchapter B under Chapter 250](#) of the regulations discusses the background standard requirements.

In order to demonstrate compliance with the background standard, persons should demonstrate that onsite media do not exceed the background standard for a regulated substance(s) by statistically developing representative contaminant concentrations through onsite and background reference samples of the environmental media (mainly soils and water). [Subchapter G Chapter 250](#) of the regulations establishes statistical tests (methods) recognized by the Department for the demonstration of attainment. Background statistical attainment requirements are in [Section 250.707\(a\)\(1\)](#) of the regulations for background soils and [Section 250.707\(a\)\(2\) or \(3\)](#) of the regulations for background groundwater. Demonstration of attainment for background is discussed in [Subsection II.A.5.f](#) of this manual.

In reporting the completion of a remediation to the Department, a final report is required which contains a detailed description of the process taken to reach the background standard and the reasoning for choosing media for testing, such as soil and groundwater. [Section 250.204](#) in the regulations discusses the requirements for a final report. Also below in [Section II.A.5](#) of this manual is a discussion on the final report requirements for the background standard. Summaries of sampling methodology and analytical results showing attainment should be included with the report [[Act 2, Section 302\(b\)\(2\)](#)].

Institutional controls such as fencing and future land use restrictions on a site may **not** be used to attain the background standard. Institutional controls may be used to maintain the background standard after remediation occurs, however [[Act 2, Section 302\(b\)\(4\)](#)].

If the initial remediation chosen by the person fails to attain the background standard, that person may choose instead to meet the Statewide health or site-specific standards [Act 2, [Section 302\(c\)](#)]. Sites attaining and demonstrating compliance with the background standard are not required to meet the deed acknowledgment requirements of the SWMA or the HSCA [Act 2, [Section 302\(d\)](#)]. An existing acknowledgment contained in a deed prior to demonstrating compliance with the background standard may be removed.

## 2. Process Checklist for the Background Standard

- Review the historic and current information and present use of regulated substances at the property.
- Begin the site investigation/characterization and gathering information about the area on and around the property.
- As an option, begin using the [completeness list](#) (See Section V.K) to help verify that all requirements have been met.
- Determine if property/site is affected by regulated substances not from the property.
- For the groundwater background concentration, establish if it is naturally occurring/areawide or from an upgradient source. See [Section 250.707](#) of the regulations.
- For the soils background concentration, establish if it is a naturally occurring or areawide problem.
- If using the naturally occurring/areawide background distinction - Request in writing and receive back in writing the Department's approval that the site is indeed in an area of wide spread contamination for the regulated substance on your property/site before submitting the Notice of Intent to Remediate. See [Section 250.707\(a\)\(3\)\(I\)](#) of the regulations.
- Continue with the site characterization and required activities needed to complete the final report. See [Section 250.204](#) of the regulations.
- Submit a [Notice of Intent to Remediate](#) for the background standard. Also notice the municipality, publish a notice in a local newspaper, and obtain proof of publication for inclusion with the final report to the Department. Act 2 Section 302(e)(1). Procedures for submittal of notifications are contained in [Section I.D.9](#) of this manual. Links to sample forms are provided in Section V.H.
- Remediate the site to the background standard.
- Demonstrate attainment of the background standard. [Section 302\(b\)](#).
- Calculate mass of contaminants remediated using the procedure in [Section IV.C](#) of this manual.
- Complete the [final report summary](#) online.

- Prepare and submit the final report, along with the optional [completeness list](#) (if used) to DEP Regional Office. See Act 2 [Section 302\(b\)\(2\)](#), [Section 250.204](#) of the regulations, and [Section II.A.5](#) of this manual.
- If the final report is approved, the liability protection set forth in Act 2, Chapter 5 automatically applies.
- If engineering controls were used and postremediation care is required to maintain the standard, continue with the postremediation care program detailed in the final report. Postremediation care would not normally be used for the background standard.
- When the background standard can be maintained without engineering controls operating, document this to the Department and receive approval to terminate the postremediation care program.

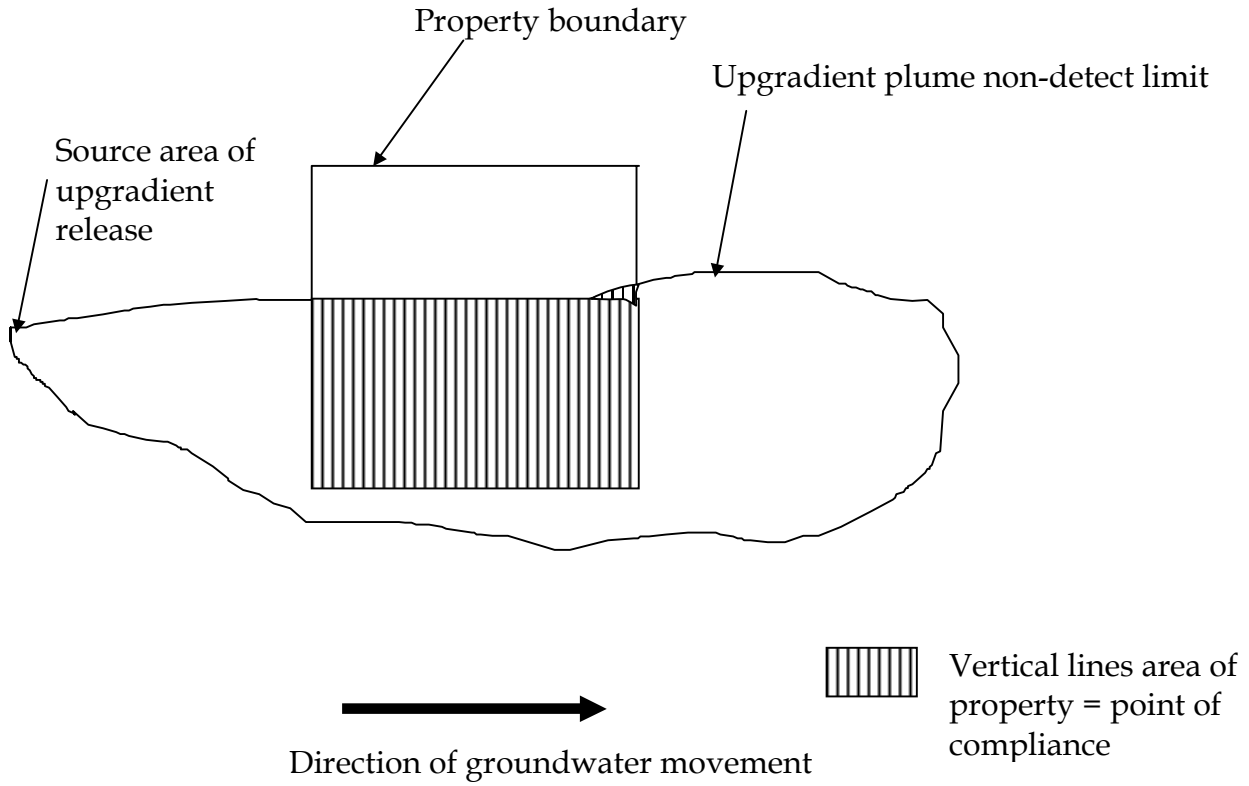
### **3. Point of Compliance (POC) for the Background Standard**

For the background standard the point of compliance (POC) for groundwater is throughout the area of contamination (plume) both from the offsite release on the property and any onsite release on the property, including areas to which the contamination has migrated off the property above the background standard as determined by the site characterization (See Figures [II-1](#) and [II-2](#)). This differs from the groundwater POC for the Statewide health and site-specific standards. (See [Section 250.203\(a\)](#) of the regulations).

**Figure II-1**

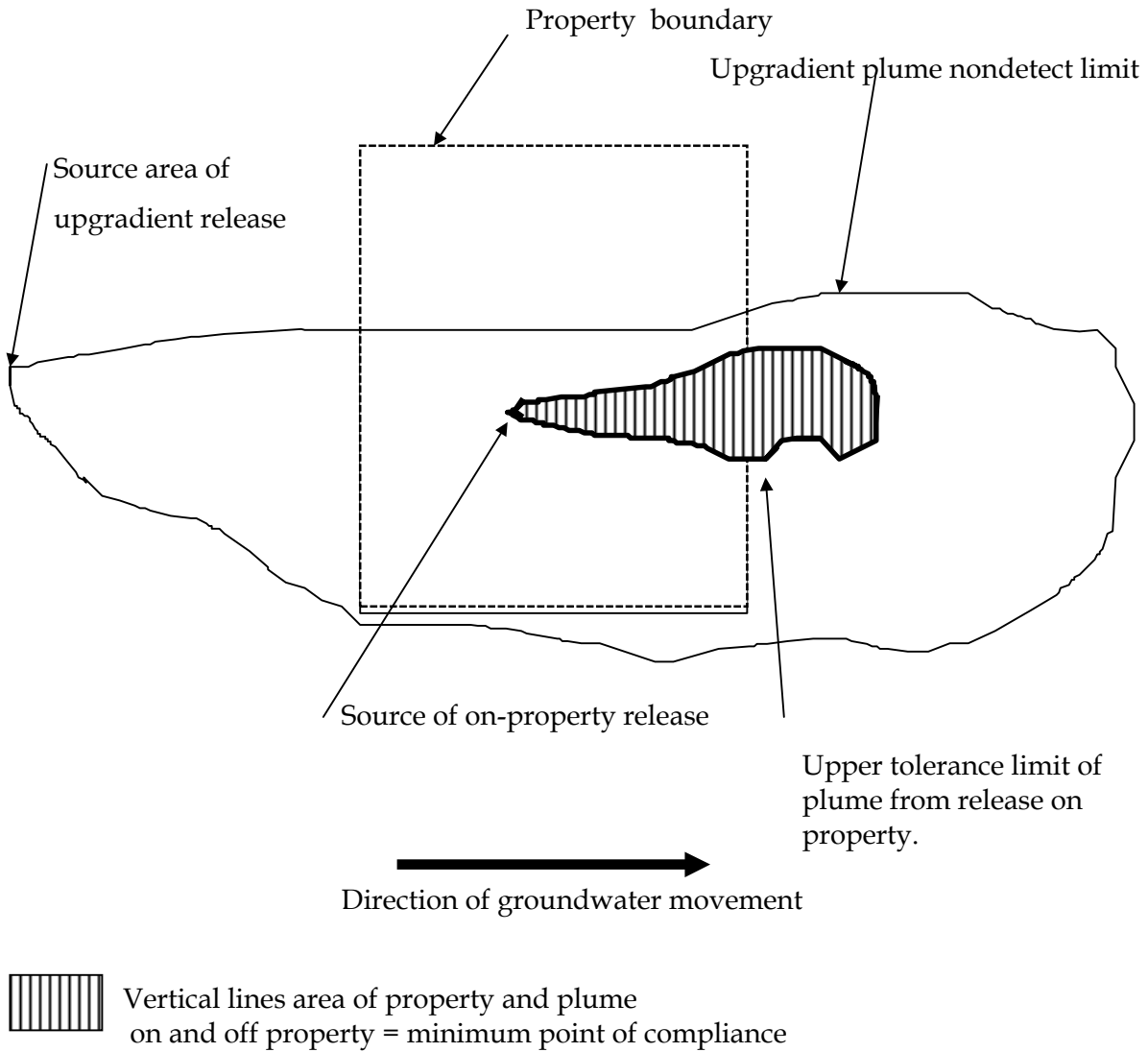
**Point of Compliance for the Background Standard**

Compliance with background from upgradient release with no on-property release



**Figure II-2**  
**Point of Compliance for the Background Standard**

Off-property migration with an upgradient groundwater source area release



For a property located within areawide contamination the minimum required point of compliance is the extent of plume contamination on and off the property if the plume from an on-property release migrated off the property, as shown in [Figure II-3](#). A person may choose to use a larger point of compliance by including all areas on the property which have been affected by a release not on the property. For example, in the case just

described, the remediator could choose to use the entire area shown as being affected by the release not on his property as the point of compliance. In such a case, the remediator would receive liability protection for the entire area affected by the upgradient release.

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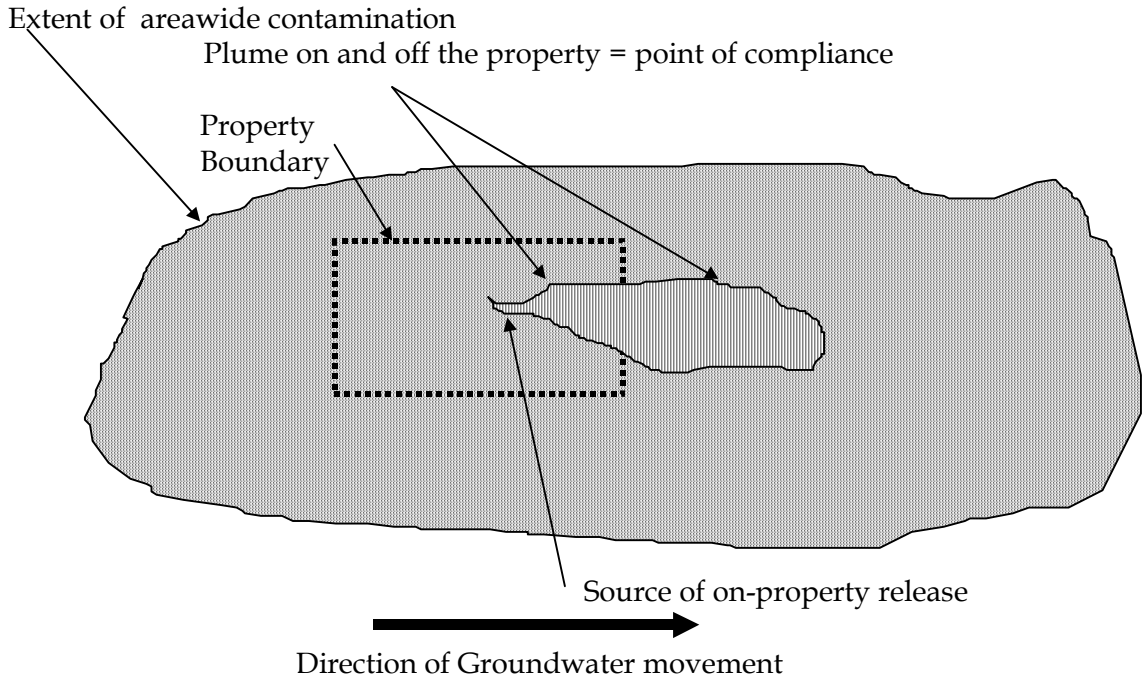
SECTION II - REMEDIATION STANDARDS

A. Background Standard

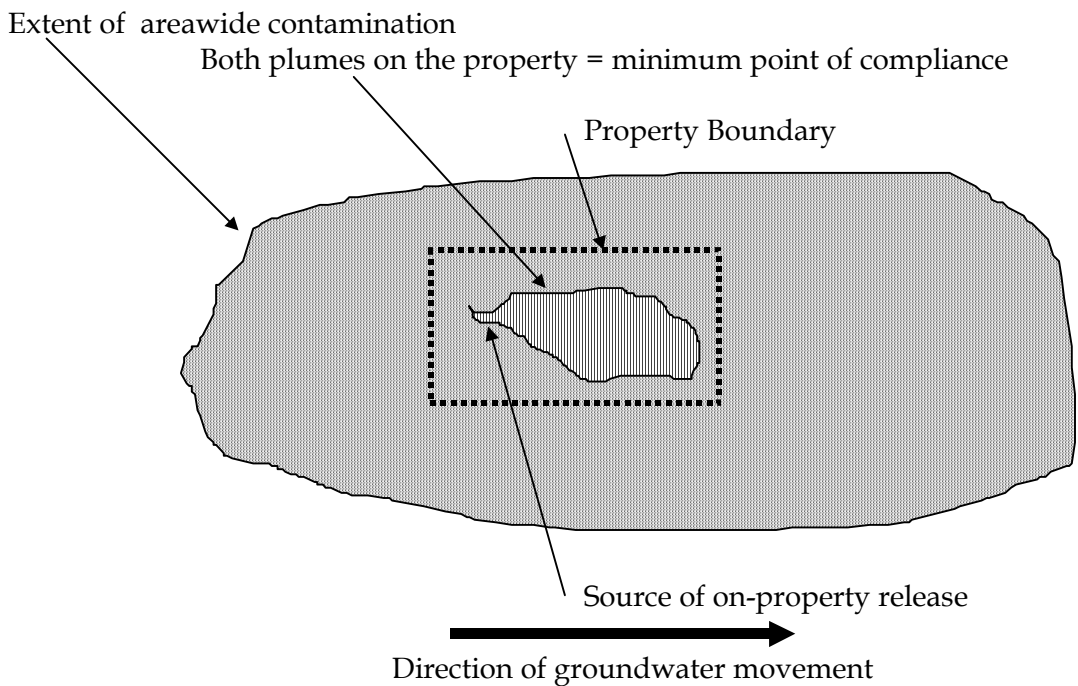
Figure II-3

Areawide Contamination

Areawide contamination with release above the area wide background concentration on site that extends off property. The plume on and off the property must attain the concentration of the areawide contamination



Areawide contamination with release that stays on the property. The entire plume must attain the standard.





The point of compliance for the background standard in soil is throughout the area of the soil that has been contaminated (See [Section 250.203\(b\)](#) of the regulations).

For surface water, point source discharges shall be measured at the point of discharge in accordance with limits in the National Pollutant Discharge Elimination System (NPDES) permit (See [Section 250.203\(c\)](#) of the regulations). Under the background standard, for spring or diffuse groundwater flow to surface waters, the attainment of the background standard for groundwater, which is the source of the diffuse groundwater flow, satisfies Act 2.

The background standard may allow a higher than health based level of cleanup, since the standard is established by the contamination moving to the property from an adjacent property or constituents that are naturally occurring. Background quality is the concentration of substances that have moved onto the site and which are unrelated to the release of regulated substances on the site.

#### **4. Establishing Background Concentration(s)**

The background concentrations will be determined using analysis of samples of regulated substances present at the property under investigation but not related to any release at the property. If all areas on the property are affected by a release at the property, then background samples will be taken in an area free of contamination from any release at the site including representative off-property areas. Persons may not obtain Chapter 5 relief by using a contaminated area as a background reference area when they are responsible for the contamination.

Background soil sampling locations must be representative of background conditions for the site, including soil type; physical, chemical, or biological characteristics; and depth below ground surface. Randomization of sampling at background and onsite locations must be comparable (See [Section 250.204\(f\)\(7\)](#) of the regulations).

Any wells that are used to establish groundwater concentration(s) must be hydrogeologically upgradient or otherwise justified from the groundwater onsite that is affected by any release at the property and that characterizes the flow onto the site. Upgradient wells may not be appropriate to detect movement of a dense nonaqueous phase liquid (DNAPL) since geologic structure rather than hydrogeologic gradient may influence DNAPL movement.

Background concentrations determination will be by a statistically valid method that is consistent with the methods used to demonstrate attainment. Statistical methods are included in [Section 250.707](#) of the regulations and in [Section II.A.5.f.i](#) of this manual.

For non-naturally occurring regulated substances (primarily organic compounds) the affected area shall be shown to be related to sources other than the release of regulated substance on the site. This may include transport of regulated substances onto the property in the gaseous, liquid or solid phases and associated mixing with or partitioning to onsite gaseous- liquid- or solid-phase media. For background conditions which are related to ongoing flux onto the site

(e.g., regulated substances dissolved in groundwater flowing onto the site or soil vapor transport onto the site), the background concentrations shall be determined by monitoring the concentrations of regulated substances associated with this flux where it enters the property. For background conditions which are not related to a continuing source of chemical flux onto the property (e.g., historical accumulation of airborne contaminants including particulate and associated deposition in surficial soils), the determination of background concentrations shall include the identification of the source(s), if possible, and a demonstration that the areal distribution of the background conditions extends beyond the limits of the property.

These same determinations should be made for naturally occurring regulated substances. However, an additional determination should be made as to the naturally occurring concentrations of these regulated substances independent of impacts from the release(s) or other background sources. Therefore, for naturally occurring regulated substances, the background standard would include the naturally occurring concentration plus contributions from sources not on the property.

Use of breakdown products of a regulated substance from offsite which form on the site undergoing remediation can be included in the assessment of attainment of the background standard. The Department is willing to consider breakdown products of substances released upgradient of the property. The remediator should submit historical information and fate and transport analyses to demonstrate that the substances onsite are a result of chemical breakdown and not a result of a release on the property.

The establishment of the groundwater background concentrations for a site using sampling and analysis allows for two different background conditions, as described in [Section 250.707\(a\)](#) of the regulations:

- Background from a known upgradient release of regulated substance.
- Background from naturally occurring or areawide contamination.

The Department provides different procedures to establish the background groundwater concentration depending on which background condition is present upgradient and adjacent to the property. The method used when establishing background and determining attainment of the background standard for a site must be the same.

**a) Background from a Known Upgradient Release of a Regulated Substance**

This groundwater distinction occurs when an adjacent or nearby property has had a release of the same regulated substance that flows onto the property under consideration for an Act 2 remediation. One option for determining background conditions is through the use of monitoring wells sampled during the site characterization to establish the well with the highest concentration of the groundwater migrating onto the site. Another option is to compare the statistical distribution of the background area with the impacted area onsite. [Section](#)

[250.707\(a\)\(2\)](#) in the regulations, [Section II.A.5.f](#) of this manual, and also the statistical requirements in Section IV.B of this manual discuss the handling of the statistical requirements for groundwater attainment in the background standard.

If a person remediating a site believes that it meets the following conditions and has eight or more samples, the person may request that the Department accept fewer than the eight quarters of samples. The conditions for reducing the number of sampling events are found in [Section 250.707\(a\)\(2\)\(x\)](#) of the regulations. The request may be sent along with supporting information, to the Regional Environmental Cleanup Program Manager. If the Department is not satisfied that these conditions are met, the person can continue to monitor for the remainder of the eight quarters.

The time frame for taking the background samples when remediation is not undertaken may start before the site characterization is completed. This will allow a user who has existing data to establish background without the need to monitor for an additional four or eight quarters as long as all the consecutive quarterly data total four or eight quarters, as applicable to that background condition.

If remediation action is undertaken, the attainment sampling is done after remediation is completed.

**b) Background from Naturally Occurring or Areawide Contamination.**

Some areas of the Commonwealth have naturally occurring or widespread groundwater contamination. The Department will make the final determination on the existence of areawide contamination. After the person has sent a written request with supporting data to the Department and provided documentation that areawide contamination exists, the Department will review the submitted data. When the Department agrees, through written acknowledgment to the person that the property under investigation is within a location of areawide contamination, the following approach for establishing background is allowed.

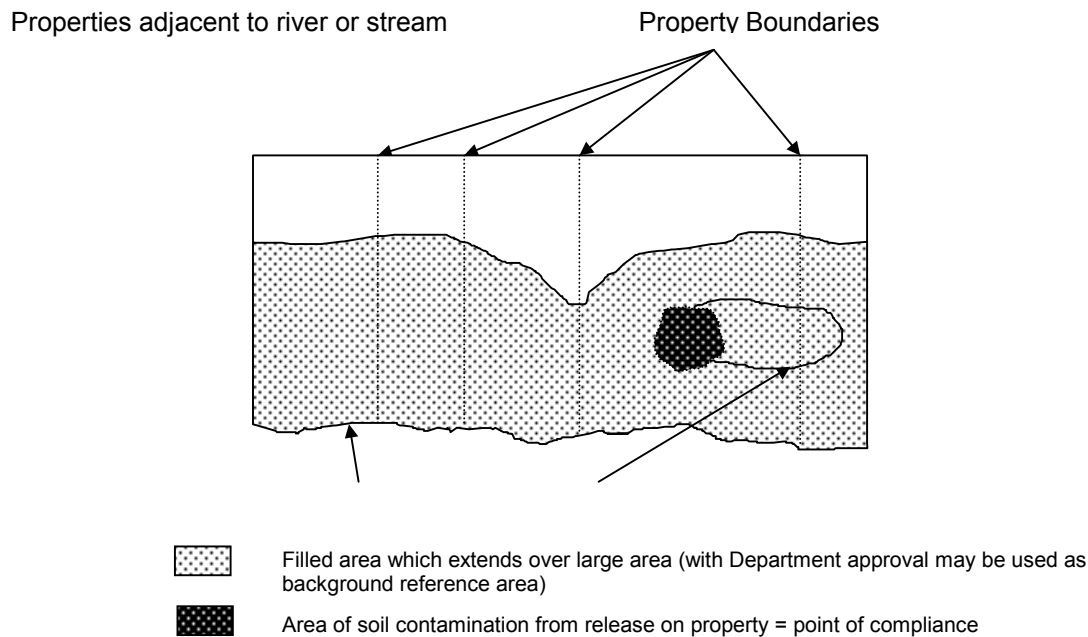
When the background groundwater condition is due to naturally occurring or areawide contamination, a minimum of twelve samples should be taken offsite and twelve samples taken onsite. The number of wells sampled onsite and offsite must be the same in each round of sampling. For example, if three wells are sampled offsite, three wells must be sampled onsite. In this example each of the wells must be sampled four times at a minimum. The samples must be independent of one another. The onsite and offsite samples must be taken at the same time. The time frame for establishing this condition is not predetermined, as it is in the upgradient release. By increasing the number of wells onsite and offsite, the number of sampling events necessary to meet the minimum of twelve samples can be reduced (two wells will require six sampling events, six wells will require two sampling events). The offsite wells must be located upgradient of the site. The number and horizontal and vertical location of the wells onsite must be adequate to characterize any release of regulated substance at each site. All sampling data must be reported to the Department.

The Department needs to agree in writing that the site is in an area of widespread groundwater contamination. This decision will be based on evidence presented to the Department in writing by the person seeking the determination.

Soils exhibiting the presence of naturally occurring regulated substances or soils where a large area was affected by a release of regulated substances off-property do not typically move from one location to another in comparison with the movement of groundwater. Natural movement of soil in Pennsylvania normally involves surface water transporting sediment, landslides or airborne transport of soil or contaminants.

Some sites may be located in an area where there has been widespread use of fill (Figure II-4). This fill may contain regulated substances. If a spill or discharge of a regulated substance occurs on a site that received fill long ago, the remediator can limit his remediation to the discharge that he has recently caused. In this case, the remediator would obtain relief from liability only for cleaning up what he has recently spilled. This includes contamination resulting from the onsite release in the soil and groundwater. Persons who wish to limit their cleanup to the levels that were already present in the fill should provide information to the Department indicating that the fill was historical (placed prior to 1980), not placed at their direction, widespread, and involved more than the subject property.

**Figure II-4**  
**Background Standard Areawide Fill**



An example of contamination through airborne transport may have occurred when leaded gasoline was commonly used in automobiles. The surface and near surface soils of properties along highways were found to have elevated levels of lead. Samples taken from a number of properties near and along the highways would be required to compare the on and off site conditions.

## **5. Final Report Requirements for the Background Standard**

For a site remediated under the background standard, the person conducting the remediation shall submit a final report to the Department which documents attainment of the selected standard. [Section 250.204](#) of the regulations discusses final report requirements.

A complete final report is prepared in accordance with scientifically recognized principles, standards and procedures. The report will present a thorough understanding of the site conditions. It will provide a detailed discussion on the areas of concern and a conceptual site model based on the results of the site characterization. Support for interpretations and conclusions will be based on data collected during all of the investigations at the site. The level of detail in the investigation and methods selected need to be sufficient to define the rate, extent and movement of the contaminants to assure continued attainment of the remediation standard. In accordance with [Section 250.204\(a\)](#) of the regulations, all interpretations of geologic and hydrogeologic data shall be prepared by a professional geologist licensed in Pennsylvania.

Two copies of the final report should be submitted for the Department's review. The final report must include the information below, and it is preferred to be organized according to the outline in [Table II-1](#). The following paragraphs describe the information to be included in the final report:

### **a) Summary**

The [Final Report Summary form](#) is to be filled in and submitted to the Department electronically. The summary submitted with the final report should be a copy of that completed form.

### **b) Site Description**

Provide a description of the site in sufficient detail to give the reviewer an overall idea of the site and its location, and the types of operations that are currently and/or were formerly conducted on the site. As appropriate to the site, the description should include location, physical description of the property, ownership history, site use history, and regulatory action history (past cleanups).

### **c) Site Characterization**

The site characterization provides important information documenting the current conditions at the site, and shall be based on [Section 250.204](#) of the regulations. The two principal objectives of an investigation under the background standard are to determine what constitutes background for each of the regulated substances associated with the release, and to characterize the

nature, extent, direction, volume and composition of regulated substances that have been released. Considerations for establishing the background concentrations are found in the previous section. [Section 250.204](#) of the regulations has reporting requirements for the background standard.

For sites where there are multiple distinct areas of contamination, the site characterization process should be applied to each area individually.

Along with a narrative, the results from the site characterization and all sampling and analysis work should be provided on map(s) illustrating, to the extent possible, the interrelationship of the following:

All physical site characteristics.

- All groundwater, soil, sediment and other sample locations, including sample depth and contaminant concentration.
- The surveyed locations for all assessment structures (monitoring wells, soil borings, test pits, etc.). All elevations should be reported in reference to mean sea level (msl), where practical.
- Appropriate number of stratigraphic cross sections that adequately depict site stratigraphy, well locations, well depths, groundwater flow directions, equipotential lines, flow lines, hydraulic conductivity intervals and values, sampling intervals and concentrations. All elevations should be reported in reference to msl, where practical.
- Variation in potentiometric surfaces(s), potentiometric surface map(s), hydraulic gradients, and groundwater flow directions.
- All identified sources of releases.
- The extent and concentrations of contaminant plumes in all media. The horizontal and vertical extent of contaminant plumes including the relative density and thickness of any separate phase liquids (SPL) present.
- Top of bedrock contour (if encountered).

A conceptual site model should be developed and refined as information is gathered during the site characterization. The conceptual site model provides a description of the site and extent of contamination. Some of the information and data used to develop the site model would include:

- The type, estimated volume, composition, and nature of the released materials, chemicals or chemical compounds (Include all calculations and assumptions.)
- Source(s) and extent of release(s).
- Background concentrations for constituents of concern.
- The horizontal and vertical extent of contamination.
- Affected aquifer(s) or water bearing formation(s)/ member(s), hydrostratigraphic units.

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## SECTION II - REMEDIATION STANDARDS

### A. Background Standard

- All existing and potential migration pathways.



## Table II-1

### Suggested Outline for a Final Report under the Background Standard

#### I. Final Report Summary

The [final report summary](#) should be a copy of the electronic form submitted to the Department.

#### II. Site Description

Provide a description of the site in sufficient detail to give an overall view of the site ([Section II.A.5.b](#))

#### III. Site Characterization

Document current conditions at the site ([Section 250.204](#) of the regulations and [Section II.A.5.c](#))

#### IV. Background Standard

How the background standard was established ([Section II.A.5.d](#))

#### V. Remediation

Description of the remedial methodologies used to attain the selected standard ([Section II.A.5.e](#))

#### VI. Attainment

A. Soil background standard

B. Groundwater background standard

Both section A and B describe the statistical methods used to establish background and to demonstrate attainment of the standard ([Section II.A.5.f](#))

#### VII. Fate and Transport Analysis

Description of fate and transport analyses used and results and conclusions. ([Section II.A.5.g](#))

#### VIII. Postremediation Care Plan

This section is included only if necessary. It describes the engineering and institutional controls necessary to maintain the standard. ([Section II.A.5.h](#))

#### IX. References

([Section II.A.5.i](#))

#### X. Attachments

([Section II.A.5.j](#))

#### XI. Signatures

([Section II.A.5.k](#))



- The estimated volume of contaminated soil and water (include all calculations and any assumptions.)

For soils, include information on samples and measurements used to characterize the horizontal and vertical extent of contamination, and direction and rate of contaminant movement based on factors in the soil and the contaminant which affect migration. Soil and boring descriptions should be included as an attachment.

For groundwater, include information on samples and measurements used to characterize the horizontal and vertical extent of contamination, and direction and velocity of contaminant movement based on factors of the groundwater and the contaminant(s) which affect migration. Geologic boring descriptions and as-built drawings of wells should be included as an attachment. Text, tables, graphics, figures, maps and cross sections, as appropriate, can be utilized to describe the nature, location, and composition of the regulated substances at the site. Providing the data in an appropriate format will expedite the review of the report.

#### **d) Background Standard**

- How was the background concentration established.
- Type of background condition: upgradient release, or areawide contamination.
- Identify on a map the location of background soil samples and background groundwater wells.
- Document that point of compliance attainment for groundwater is throughout the plume.
- Attainment for each medium is to be determined by the same method as the method used to establish background levels.
- Summary of sampling methodology and analytical results relating to determination of background.

#### **e) Remediation**

Provide a description of the remedial methodologies used to attain the selected standard. Examples of the types of information typically included in this section include:

- Identification of areas remediated based on results of site characterization.
- Descriptions of treatment, removal, or decontamination procedures performed in remediation. Description of removal, what was removed, and amount removed. Results of any treatability, bench scale, or pilot scale studies, or other data collected to support the remedial action(s).
- Description of the methodology and analytical results used to direct the remediation and determine the cessation of remediation. This description

should document how the remediator determined that remediation was performed to address all areas that exceed the standard.

- Description of treatment technologies.
- Documentation of handling of remediation wastes in accordance with applicable regulations.
- Specific characteristics of the site that affected the implementation or effectiveness of the remedial action including such characteristics as topography, geology, depth of bedrock, potentiometric surfaces, and the existence of utilities.
- All other site information relevant to the conceptual design, construction, or operation of the remedial action.

In addition to the above, this section should also include the calculation of the mass of contaminants addressed during the remediation of soil and/or groundwater, using the methodology in Section IV.C.

#### **f) Attainment**

Appropriate statistical methods, discussed in Section IV.B, will confirm the attainment of cleanup under the background standard. Not all the statistical tests discussed in the manual are appropriate for the background standard attainment tests. [Section 250.707\(a\)](#) of the regulations describes statistical tests for the background standard. The following information shall be documented in a final report when a statistical method is applied except the highest measurement comparison test described in [Section 250.707\(a\)\(1\)\(i\)](#) of the regulations:

- Description of the statistical method, and the underlying assumptions of the method.
- A clear statement of the applicable decision rule in the form of a statistical hypothesis for each spatial unit and temporal boundary including the applicable statistical parameter of interest and the specific cleanup standard.
- Documentation showing that the sample data set meets the underlying assumptions of the method and explaining why the method is appropriate to apply to the data.
- Specification of false positive and false negative rates.
- Documentation of input and output data for the statistical test, presented in table and figures, or both, as appropriate; and identify, by medium, contamination levels remaining onsite.
- An interpretation and conclusion of the statistical test.

In demonstrating attainment of the background standard, concentrations of regulated substances are not required to be less than the limit related to the Practical Quantitation Limit (PQL) for that substance as provided for in [Section 250.701\(c\)](#) and as listed in [Section IV.F](#) of this manual.

### **i) Soil background standards**

The determination of attainment of soil background standards will be based on a comparison of the distributions of the background concentrations of a regulated substance with the concentrations in an impacted area. Act 2 regulations allow a person to use highest measurement comparison, combination of Wilcoxon Rank Sum test and Quantile test, or other appropriate methods to demonstrate attainment of background standards. No matter which method is used, Act 2 regulations require that the minimum number of soil samples to be collected is ten from the background reference area and ten from each cleanup unit. This requirement of ten samples is to ensure that any selected statistical test has sufficient power to detect contamination. The regulations do not specify the false negative rate because it is more appropriate to determine the false negative rate on a site-by-site basis. For the background standard, the false negative rate is the probability of mistakenly concluding that the site is clean when it is contaminated. It is the probability of making a Type II error.

### **ii) Groundwater background standards**

There are two general categories of background conditions for groundwater. The first is naturally occurring background or areawide contamination, neither of which is expected to exhibit seasonal patterns or trends. The second is background associated with a release of regulated substances at a location upgradient from the site that may be subject to such patterns and trends.

For naturally occurring background or areawide contamination, it is recommended that a minimum of twelve samples be collected from any combination of upgradient monitoring wells, provided that all data collected are used in determination of background concentrations. This same number of samples must then be collected from monitoring wells impacted by a release on the site during the same sampling event. In both cases, this sampling may be accelerated such that all samples be collected as quickly as possible so long as the frequency does not result in serial correlation in the data. The resulting values may be compared using nonparametric or parametric methods to compare the two populations, such as using the combination of the Mann-Wilcoxon Rank Sum test and the Quantile test. When comparing with the background results, the sampling results in the plume onsite should not exceed the sum of the arithmetic average and three times standard deviation calculated for the background reference area [[Section 250.707\(a\)\(3\)\(vii\)](#)].

For background associated with a release of regulated substances at a location upgradient from a property, the background groundwater concentrations will be determined at the hydrogeologically upgradient property line of the property, or a point hydrogeologically upgradient from the upgradient property line that is unaffected by the release.

For background associated with an upgradient release of regulated substances, [Section 250.707\(a\)\(2\)](#) of the regulations allows the use of the nonparametric tolerance limit procedure. The nonparametric tolerance limit procedure requires at least eight samples from each well over eight quarters to have sufficient power

to detect contamination. Once the nonparametric upper tolerance limit is established for upgradient data, data from downgradient compliance wells can be compared to the limit. A resampling strategy can be used when an analyte exceeds the nonparametric upper tolerance limit. The well is retested for the analyte of concern and the value is compared to the nonparametric upper prediction limit. These two-phase testing strategies can be very effective tools for controlling the facility-wide false positive rate while maintaining a high power of detecting contamination. See Sections 5.2.2 and 5.2.3 of the EPA Addendum (USEPA, 1992a) which describes the procedures to use along with recommended coverage and confidence levels.

### **g) Fate and Transport Analysis**

The Fate and Transport Section ([Section IV.A](#)) of this manual provides a discussion on fate and transport analysis. The amount of detail in the fate and transport analysis will vary from a simple narrative description to a very extensive detailed model with quantitative modeling as appropriate to the circumstances of the site. Whenever a model is used the Department must be provided with the assumptions, data, and information on the model necessary for Department staff to evaluate and run the model. Any parameters used in the analysis or models should use data from the site obtained during the site characterization.

The following are examples of situations where a fate and transport model/analysis is used to justify a special condition when attaining the background standard:

- When shortening the number of groundwater samples for establishing an upgradient release in the background determination, [Section 250.707\(a\)\(2\)\(x\)](#) of the regulations, it is required that fate and transport be fully evaluated.
- When contamination remains in the unsaturated soil, fate and transport must demonstrate that the contamination in the soils will not impact the groundwater and raise the level of regulated substances above the groundwater standard. This would be both when the soils and groundwater attain the background standard and when using a combination of standards; for example background standard in the groundwater and Statewide health in the soils.
- When the contamination on the site is the result of chemical transformations (*e.g.*, parent to daughter), fate and transport must demonstrate that the concentrations of regulated substances onsite were the result of releases not on the site.

While the previous examples will require detailed evaluation, when the source and any regulated substance that could have migrated from the source are removed before contamination reached the groundwater, the fate and transport analysis could be very short and non-quantitative.

When the background standard is attained in all media, the fate and transport analysis would confirm that no cross-media contamination will cause

contamination in one medium to raise the contamination in another medium above the standard.

If the standard will be exceeded in the future, a postremediation care plan is required.

**h) Postremediation Care Plan (if applicable)**

If engineering or institutional controls are needed to maintain the standard, a postremediation care plan must be documented in the final report in accordance with [Section 250.204\(g\)](#) of the regulations. The plan should include reporting of any instances of nonattainment; reporting of any measure to correct non-attainment conditions; periodic reporting of monitoring; sampling and analysis as required by the Department; maintenance of records at the property where the remediation is being conducted for monitoring, sampling and analysis; and a schedule for operation and maintenance of the controls and submission of any proposed changes. The Department may ask for documentation of financial ability to implement the remedy and to maintain the postremediation care controls. When the standard can be maintained without the controls operating and documentation is provided, the Department will approve termination of the postremediation care program.

**i) References**

Any references mentioned in the final report.

**j) Attachments**

Laboratory sheets and historical sampling data results

All raw data and summary of data

Quality Assurance and Quality Control Plan

Physical/chemical properties or toxicological/exposure factors of chemical compounds of concern. Include, as appropriate, water solubility, vapor pressure, Henry's Law constant, compound density, octanol/water partition coefficient ( $K_{ow}$ ), organic carbon partition coefficient ( $K_{oc}$ ), and soil/water partitioning coefficient ( $K_d$ ) as needed for determining performance of remedial equipment and/or fate and transport modeling for site-specific risk assessment

Calculations and formulas

Methods of data analysis

Health and Safety Plan

Sampling and Analysis Plan

All water level/liquid level measurements, including SPL measurements.

Maps and cross sections used which present information on site characterization and attainment

As-built well construction details, boring logs, cross sections, stratigraphic logs, including soil/rock characteristics and field instrument readings, and as-built drawings

Proofs required such as municipal and newspaper notices, proof of publication and Department acknowledgment of natural or areawide contamination.

Before and after remediation photographs

**k) Signatures**

The name, address, and signature of all those who participated in the remediation who are seeking relief from liability.

## B. Statewide Health Standard

### 1. Introduction

The Statewide health standards are established by Act 2, [Section 303](#), and are referred to as medium-specific concentrations (MSCs) that must be attained in order to achieve the liability protection provided for in the Act. The medium-specific concentrations calculated according to the methodologies in Sections [250.304](#) through 250.310 are those that establish the level that must be attained under the Statewide health standard to be eligible for liability protection as set forth in Act 2, Chapter 5.

The medium-specific concentrations are contained in Appendix A to Chapter 250, [Tables 1 through 6](#). Cleanup liability protection provided under Act 2 is contingent upon the attainment of the appropriate MSCs determined using the procedure described in [Section II.B.3](#) below.

This guidance presents the procedures to be used in assessing site contamination and demonstrating attainment of the Statewide health standard. Use of this guidance and data submission formats should simplify reporting on the site and reduce delays in obtaining final report approval by the Department. This guidance is designed to help understand and meet the requirements of the Statewide health standard under Act 2 and the regulations in Chapter 250. Environmental Cleanup Program staff in the Regional Office are a valuable resource and will assist as requested in answering questions on the Statewide health standard.

Failure to demonstrate attainment of the Statewide health standard may result in the Department requiring that additional remediation measures be taken to meet the Statewide health standard or the person may elect to attain one of the other standards.

### 2. Process Checklist for Remediations under the Statewide Health Standard

- Review the historical information and present use of regulated substances at the property.
- Begin the site investigation/characterization and gathering information about the area on and around the property.
- As an option, begin using the [completeness list](#) (See Section V.K) to help verify that all requirements have been met.
- Optionally, determine if the property/site is affected by regulated substances not from the property in order to determine if the background standard may be appropriate. Contact DEP Regional Office for information.
- Submit [Notice of Intent to Remediate](#) for the Statewide health standard. Also notice the Municipality, publish a notice in a local newspaper, and obtain proof of publication for inclusion with the final report. Procedures for submittal of notifications are contained in [Section I.D.9](#) of this manual.

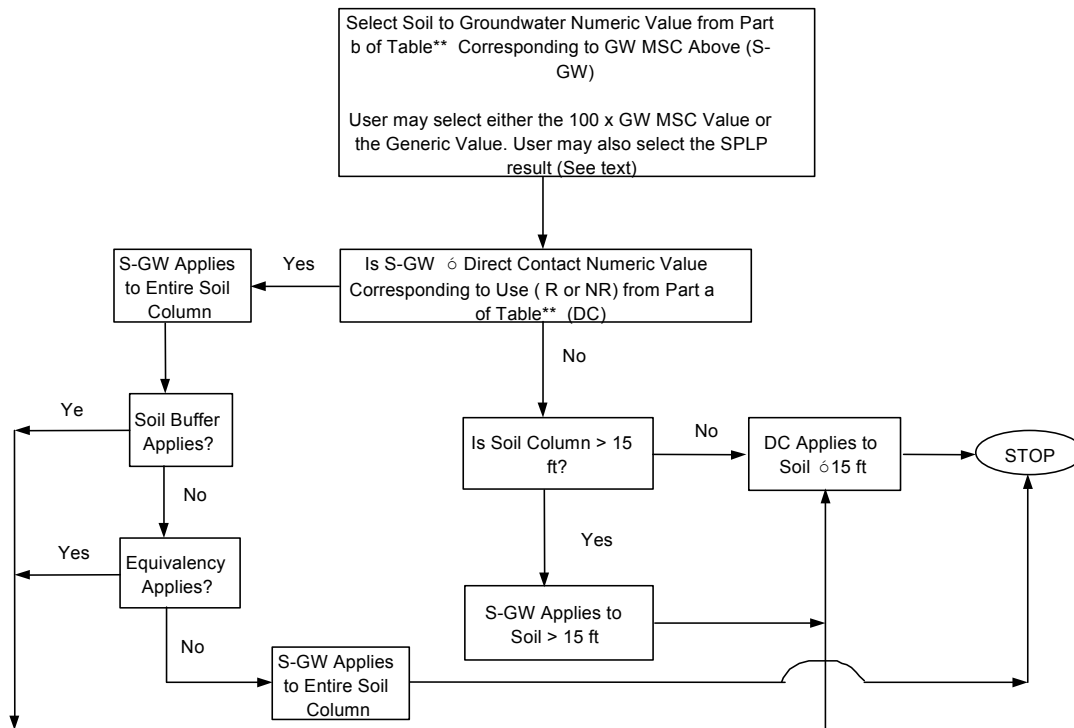
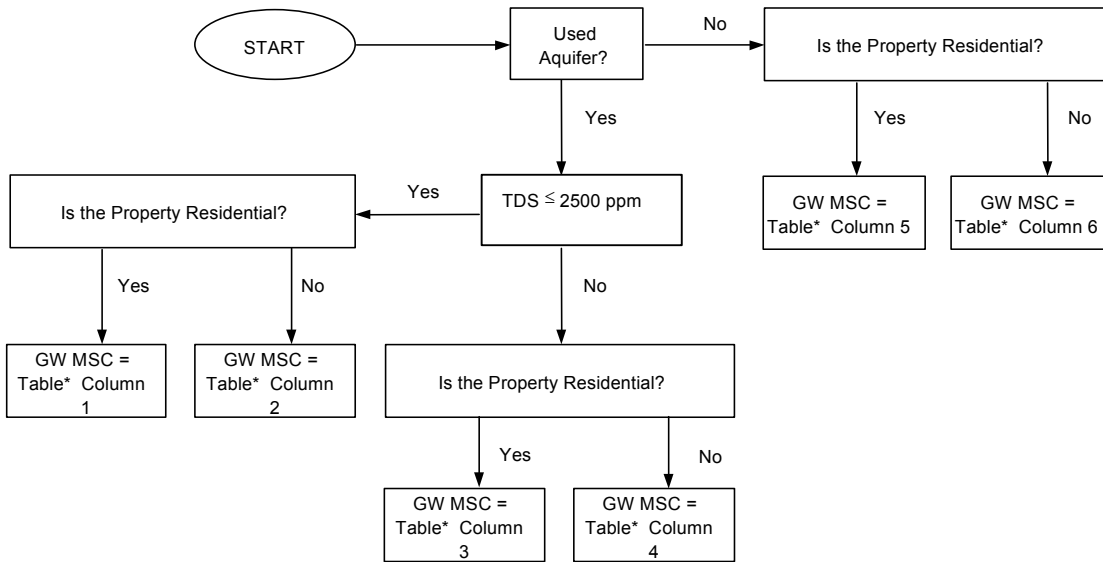
- Continue with the site characterization and required activities needed to complete the final report.
- Remediate the site to the Statewide health standard.
- Demonstrate attainment of the Statewide health standard. Methods for demonstrating attainment are described in [Section 250.707\(b\)](#) of the regulations, and in Section IV.B of this manual.
- Calculate the mass of contaminants remediated using the procedure in [Section IV.C](#) of this manual.
- Complete the [Final Report Summary](#) on line.
- Prepare and submit final report, along with the optional [completeness list](#) (if used), to the Department. Reporting requirements are established by [Section 250.312](#) of the regulations and are described in [Section II.B.6](#) of this manual.
- If engineering controls are needed to attain or maintain the Statewide health standard; if institutional controls are needed to maintain the standard; if the fate and transport analysis indicates that the remediation standard, including the solubility limitation, may be exceeded at the point of compliance in the future; if the remediation relies on natural attenuation; if a postremedy use is relied upon but is not implemented to eliminate complete exposure pathways to ecological receptors; or, if mitigative measures are used a postremediation care program must be implemented and documented in the final report, including the information required by [Section 250.204\(g\)](#).
- Receive approval of the final report from the Department, if the final report documents that the person has demonstrated compliance with the substantive and procedural requirements of the Statewide health standard (which automatically confers the Act 2 liability protection as set forth in Chapter 5 of Act 2).
- Except for the special case of a nonuse aquifer standard (See [Section II.B.4.c](#)), when the Statewide health standard can be maintained without engineering controls operating, document this to the Department and receive approval to terminate the postremediation care program.

### 3. Selection of MSCs

The Statewide health standards established under Act 2 are referred to as medium-specific concentrations (MSCs). The appropriate MSC for each regulated substance present at a site is determined for each environmental medium, particularly groundwater and soil. The flowchart in [Figure II-5](#) illustrates the thought process that goes into the selection of the appropriate MSCs for groundwater and soil.



**Figure II-5**  
**Flowchart for Selecting Statewide Health Standard MSCs for Groundwater and Soil**



\* For Organic Regulated Substances, use Table 1; Use Table 2 for Inorganic Regulated Substances  
 \*\* For Organic Regulated Substances, use Table 3; Use Table 4 for Inorganic Regulated Substances

**SECTION II - REMEDIATION STANDARDS**  
**B. Statewide Health Standard**

**a) Determining Groundwater MSCs**

Medium-specific concentrations (MSCs) for regulated substances in groundwater are found in [Appendix A](#) to Chapter 250, Table 1 for organic substances, and Table 2 for inorganic substances. To use the tables, the remediator needs to know the use status of the aquifer under the site, the naturally-occurring level of Total Dissolved Solids in the aquifer, and the land use of the site.

**b) Determining Soil MSCs**

In determining the applicable soil standard, the remediator must compare the appropriate soil-to-groundwater numeric value to the direct contact numeric value for the corresponding depth interval within 15 ft from the ground surface. The lower of these two values is the applicable MSC for soil. If either the soil buffer distance [described in Sections [250.308\(b\)](#) and [\(c\)](#) of the regulations] or the equivalency demonstration [described in Section [250.308\(d\)](#) of the regulations] is met, the soil-to-groundwater numeric value will be deemed to be satisfied, and the soil MSC will be the direct contact numeric value. At depths below 15 ft, the soil-to-groundwater numeric value is the MSC for soil, unless either the soil buffer distance or the equivalency demonstration is met. These values are determined in the following manner:

**i) Choosing the soil-to-groundwater numeric value**

The remediator should begin by determining the appropriate soil-to-groundwater numeric value from Part B of [Table 3](#) for organics or [Table 4](#) for inorganics. The numbers in the table include both the value which is 100 times the appropriate groundwater MSC and the number resulting from application of the soil-to-groundwater equation in the regulations (the “generic value”). The remediator must determine the use status of the aquifer underlying the site, its naturally-occurring TDS level, and the land use characteristics of the site. The numeric value may then be selected from the appropriate column on the table, and compared to the value for the Synthetic Precipitation Leaching Procedure (SPLP), if appropriate. Since the remediator has the choice of which soil-to-groundwater numeric value to use, he may choose the highest of these three values (*i.e.*, 100x GW MSC, the generic value, or the SPLP result) as the soil-to-groundwater numeric value. The remediator must keep in mind that for saturated soils, the generic value to use in this selection process is one-tenth the value listed in the table [[See Sections 250.308\(a\)\(2\)\(ii\) and 250.308\(a\)\(4\)\(ii\)](#) of the regulations].

The value for the SPLP is the concentration of a regulated substance in soil at the site that does not produce a leachate in which the concentration of the regulated substance exceeds the groundwater MSC. Since this test must be conducted on the actual site soil, no values for the SPLP could be published in the tables of MSCs in the regulations. The following procedure should be used to determine the alternative soil-to-groundwater value based upon the SPLP:

- During characterization, the remediator should obtain a minimum of ten samples from within the impacted soil area. The four samples with the highest total concentration of the regulated substance should be submitted for SPLP analysis. Samples obtained will be representative of the soil type and horizon impacted by the release of the regulated substance.
- Determine the lowest total concentration (TC) that generates a failing SPLP result. The alternative soil-to-groundwater standard will be the next lowest TC.
- If all samples result in a passing SPLP level, the alternative soil-to-groundwater standard will be the TC corresponding to the highest SPLP result. The remediator has the option of obtaining additional samples.
- If none of the samples generates a passing SPLP, the remediator can obtain additional samples and perform concurrent TC/SPLP analyses to satisfy the above requirements for establishing an alternative soil-to-groundwater standard.

**ii) Considering direct contact value in relation to the soil-to-groundwater value and soil depth**

The number selected according to the process outlined in [Section II.B.3.b.i](#) above for the soil-to-groundwater pathway numeric value must then be compared to the appropriate residential or nonresidential, surface or subsurface, direct contact numeric value from Part A of [Table 3](#) or [Table 4](#). The lower of the two numbers is the appropriate MSC for the regulated substance. If the soil buffer distance requirements are met or the equivalency demonstration has been made, then the soil-to-groundwater numeric value is deemed to be satisfied and the MSC is the appropriate direct contact numeric value for the regulated substance.

**iii) Selecting applicable MSCs - example**

The process for selecting the appropriate MSCs for a site is illustrated in [Figure II-6](#). This figure represents the cross section of a nonresidential site with soil contaminated with a petroleum product. The aquifer does not qualify as a nonuse aquifer. The remediator is interested in determining and applying the soil MSCs under the Statewide health standard. This example shows the process applied to one of the regulated substances- cumene.

Details of the site determined during the site characterization are as follows (see also [Figure II-6](#)).

- Soil characterized as contaminated with regulated substances from the petroleum product, including cumene (concentration values > PQL, see Section IV.F), is shown in gray shading and extends to a depth of 20 feet. For this example, the remediator characterized the soil to the level of the PQL, but could have selected any concentration level between the Statewide health standard and the PQL, with the appropriate justification.

- Soil contaminated at levels greater than the applicable Statewide health standard is shown as a subset of the contaminated area, and extends to a depth of 18 feet.
- Samples collected and analyzed according to the methodology in [Section II.B.3.b.i](#) established an alternative soil-to-groundwater value of 20 mg/kg.
- Shale bedrock is present at varying depths between 30 and 35 feet.
- The groundwater level is approximately 35 feet but fluctuates (annual high and low) between 28 to 40 feet and the natural total dissolved solids levels in the groundwater is 80 mg/L.
- The vertical distance from the bottom of the contaminated area (gray) to groundwater is  $h = 15$  feet.

Scenario #1 - the above conditions apply, and in addition, the results of sample analysis of the groundwater show no values greater than 2300  $\mu\text{g/L}$ .

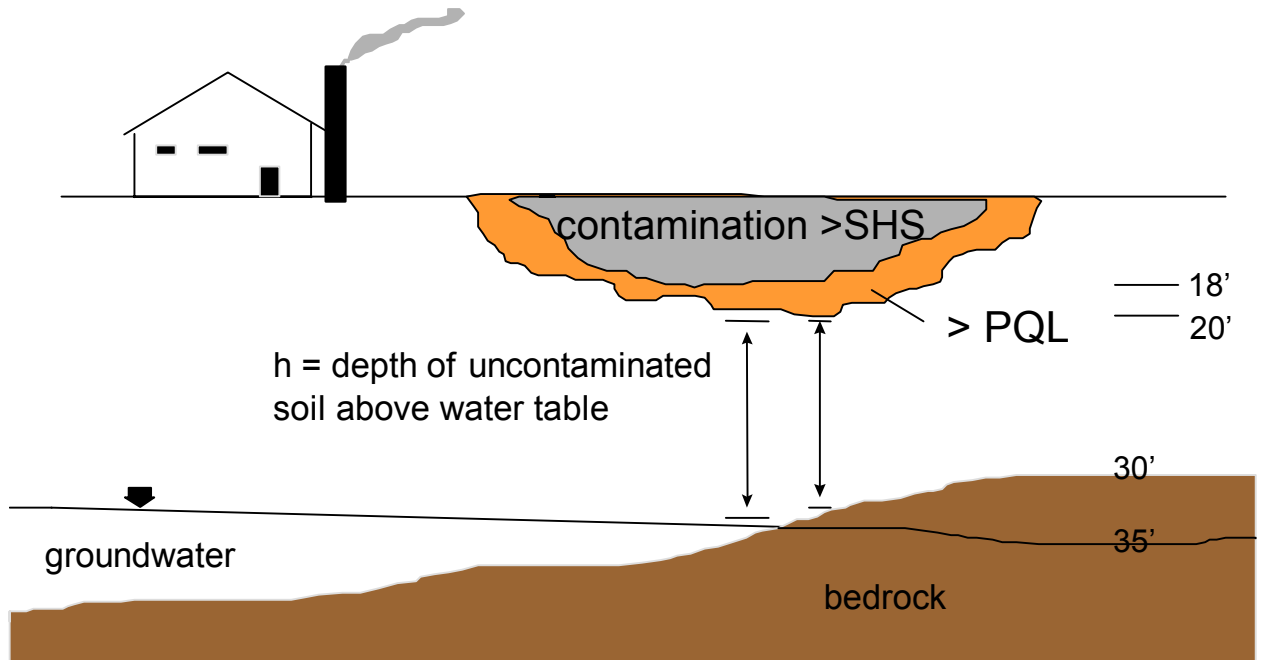
Scenario #2 - the above conditions apply, and in addition, free floating product (approximately 1 inch) is found on top of the groundwater level and the concentration of cumene below the groundwater level is 5000  $\mu\text{g/L}$ .

The remediator takes the following steps to determine appropriate MSCs for cumene at this site.

- 1) As a first step, turn to Land Recycling regulations, Chapter 250, Appendix A, [Table 1](#)- Medium Specific Concentrations (MSCs) for Organic Substances in groundwater. The remediator looks for the row for cumene, under the headings "Used Aquifers," "TDS $\leq$ 2500 mg/L," "NR" (for Nonresidential). The groundwater MSC is 2300  $\mu\text{g/L}$ .

Figure II-6

Application of MSC Selection Process



Under Scenario #1, the remediator concludes that there is no aquifer area which exceeds the groundwater MSC (2300 µg/L) and therefore no attainment demonstration is needed.

Under Scenario #2, the remediator concludes that the aquifer area exceeds the groundwater MSC (2300 µg/L) and therefore attainment demonstration is needed.

- 2) The remediator turns to Chapter 250, Appendix A, [Table 3- Medium Specific Concentrations \(MSCs\) for Organic Substances in Soil, Part B, Soil to Groundwater Numeric Values](#). The remediator looks for the row for cumene, under the Headings "Used Aquifers," "TDS ≤ 2500 mg/L," "Nonresidential." The two values listed are:
  - 100x GW MSC- 230 mg/kg
  - Generic Value - 1600 mg/kgThe remediator then looks over to the last column on the right for the soil buffer distance - 15 feet.
- 3) The remediator assesses the use of numeric soil-to-groundwater (s/gw) values. He has three options under the regulations ([Section 250.308](#)).

- 100x GW MSC - 230 mg/kg
- Generic Value - 1600 mg/kg
- SPLP value - 400 mg/kg (from analysis of site soil (see site characterization above)).

Among the three acceptable values, the generic value of 1600 mg/kg is the highest and the remediator considers using this option, but first wants to see if the site could qualify for the remaining two options for satisfying the s/gw numeric value, the soil buffer and groundwater equivalency options.

- 4) In examining the soil buffer option, the remediator checks to see if the site meets the three regulatory conditions under [250.308.\(b\)](#):

(b) The soil-to-groundwater pathway soil buffer is the entire area between the bottom of the area of contamination and the groundwater or bedrock and shall meet the following criteria:

- (1) The soil depths established in Appendix A, Tables 3B and 4B for each regulated substance;
- (2) The concentration of the regulated substance cannot exceed the limit related to the PQL or background throughout the soil buffer.
- (3) No karst carbonate formation underlies or is within 100 feet of the perimeter of the contaminated soil area. Karst carbonate formations are limestone or carbonate formations, where the formations are greater than 5 feet thick and present at the topmost geologic unit. Areas mapped by the Pennsylvania Geologic Survey as underlain by carbonate formations are considered karst areas unless geologic studies demonstrate the absence of the formations underlying or within 100 feet of the perimeter of the contaminated soil area.

Scenario #1 - Under Scenario #1- he concludes that the site meets the conditions for use of the soil buffer alternative to satisfy the s/gw numeric value and therefore only the direct contact numeric value applies and becomes the soil MSC for cumene.

5. Turning to Chapter 250, Appendix A, [Table 3a- Medium-specific Concentrations \(MSCs\) for Organic Regulated Substances in Soil, Direct Contact Numeric Values](#), it is noted that under the nonresidential land use, the numeric value for cumene is:

10,000 mg/kg applied to the 0'-2' zone in soil

10,000 mg/kg applied to the 2'-15' zone in soil.

Alternatively he could have considered use of the groundwater equivalency option [[Section 250.308\(d\)](#)], but this includes the condition that he monitor the

groundwater for 8 quarters prior to submitting the final report. The remediator chooses instead the soil buffer option above.

Scenario #2 - Under Scenario #2- he concludes that he DOES NOT meet the conditions for use of the soil buffer alternative because  $h=0$  since soil contamination extends to the water level and therefore there is no depth of clean soil between the bottom of contamination and the groundwater level.

5. The remediator then checks to see if he meets the requirements for use of the groundwater equivalency option. ([Section 250.308\(d\)](#) of the regulations and Section II.B.6.d of the Technical Manual). The site does NOT qualify because groundwater is contaminated above SHS and background.

Therefore he has to consider BOTH the s/gw numeric value and the direct contact (DC) value .

He chooses the s/gw numeric value based on the generic value of 1600 mg/kg, which applies to the zone(s) of the soil contaminated above this value;

zone 1- 0-18' (see Figure II-6)

Zone 2- the "smear zone" in the soil column created by groundwater level movement - 28'-40'. Note that this zone also is considered saturated soil under Chapter 250.

Next the remediator checks to see where each numeric value is applied:

	<b>Direct contact value</b>	<b>S/GW value</b>	<b>Resulting Soil MSC</b>
Zone 0'-2'	10,000 mg/kg	1600 mg/kg	1600 mg/kg
Zone 2'-15'	10,000 mg/kg	1600 mg/kg	1600 mg/kg
Zone 15'-18'	NA	1600 mg/kg	1600 mg/kg
Zone 28' to 40'	NA	400 mg/kg	400 mg/kg

Zone 28' to 40' is saturated soil. The selection of the applicable soil MSC for this zone must take into account the requirement that the published generic value be divided by 10. Therefore, the remediator may choose from the following values:

100 x GW MSC	230 mg/kg
Generic Value	160 mg/kg (0.1 x published value)
SPLP Value	400 mg/kg

Therefore, the remediator chooses the SPLP result as the applicable soil MSC.

For both scenarios, analysis of any attainment samples (determined under [Section II.B.6.g](#) of this manual) would be compared to the appropriate numeric value for the zone in which the sample was taken, and the attainment test (*e.g.*, 75%/10x) would be applied to the sample set as a whole (*e.g.*, the percentage of samples which exceeded the appropriate numeric value must be  $\leq 25\%$  and no sample may exceed the appropriate numeric value by more than 10 times [10x]).

#### 4. Nonuse Aquifer Determinations

##### a) General

[Section 250.303](#) provides for options for requesting a nonuse aquifer determination. Anytime a person is proposing an area for nonuse aquifer determination, they must meet the notification requirements of [Section 250.5](#), which are described in Section I.C.9, relating to public notice.

- A remediator may request from the Department approval to use alternative MSCs in groundwater at the point of compliance when the aquifer under a site is not used or planned to be used for drinking water or agricultural purposes. This determination is to be requested by the remediator, and the Department's concurrence must be obtained in writing before the remediation may begin. The notice requirements under the nonuse aquifer request are made separate to those under the NIR. Note that a Notice of Intent to Remediate (NIR) must be submitted with, or prior to, the nonuse aquifer determination request. Although not required, the Department suggests that this request be submitted in conjunction with an NIR.

In pursuing this process, a remediator may rely on a "nonuse aquifer certification area" (see below) as documentation that they have satisfied [Sections 250.303\(c\)\(1\), \(2\) and \(3\)](#), FOR THE SPECIFIC AREA defined as a "nonuse aquifer certification area". If the area they are required to document extends beyond the nonuse aquifer certification area, the remediator still has the obligation to document those subsection requirements in the area NOT covered by the nonuse aquifer certification area.

Another option a remediator may have is using the presence of a municipal ordinance meeting the performance requirements of [Section II.C.9](#) (relating to institutional controls and other post remedial measures) as documentation that the use restriction meets the requirements of [Sections 250.303\(c\)\(1\), \(2\) and \(3\)](#) IN THE AREA SUBJECT TO THE ORDINANCE.

- Municipal Authorities and political subdivisions may request determination that a specific geographic area meets the conditions of [Sections 250.303\(c\)\(1\), \(2\) and \(3\)](#). The area in question is then referred to as a nonuse aquifer certification area.

##### b) Request Initiated by a Remediator as Part of an NIR

This option would be used by a remediator who desires to use the alternative nonuse aquifer MSCs at a specific property. The area in which the determination is to be made includes the property itself, all areas within a radius of 1,000 ft downgradient of the property boundary, and all areas where the contamination has migrated, or may reasonably be expected to migrate, at concentrations exceeding the MSC for groundwater used or currently planned to be used [[Section 250.303\(b\)](#)]. In making the request, the remediator should provide the fate and transport analysis used to determine the area to which the contamination has migrated and is likely to migrate. The Department will accept or reject the remediator's request based primarily upon the adequacy of this



analysis. The area determined is the area of geographic interest to which the conditions of [Section 250.303\(c\)](#) apply. A form, Request for Nonuse Aquifer Determination, is available on the Department's web site at <http://www.dep.state.pa.us/dep/deputate/airwaste/wm/landrecy/Forms/LRWM0267.pdf> to be used by a remediator to expedite the Department's review of a nonuse aquifer demonstration. Use of this form is optional.

**c) Nonuse Aquifer Conditions to be Met in the Area of Geographic Interest**

In the area of geographic interest, as determined above [through [Section 250.303\(b\)](#)], or as part of the certification of a nonuse aquifer area (see Section II.B.4.d below), the requirements for demonstrating that an aquifer is not used are contained in [Section 250.303\(c\)](#). The remediator may make this demonstration by conducting door-to-door surveys of all downgradient properties, or by using other appropriate survey methods, and by contacting all community water suppliers downgradient of the property for service area information including plans for future water supply well development and service area expansion. If all of the requirements are met, the Department may determine that the aquifer is not used for drinking water or agricultural purposes. If the nonuse aquifer determination is made, the remediator may use the MSCs for groundwater in aquifers not used for drinking water or agricultural purposes in [Tables 1](#) and [2](#) of Appendix A to the regulations. In some cases, there may be a significant lapse in time between the nonuse aquifer determination approval and the submission of the final report. It is the intent of the DEP to ensure that the nonuse aquifer conditions when the final report is submitted to the Department are still representative. Therefore, at the time the final report is submitted to the Department for sites which have a nonuse aquifer determination approval, the DEP may require basic assessment of any changes which may have taken place since the nonuse aquifer determination approval was granted. This assessment would be similar to that applied under the postremediation care plan described below.

If a final report has been submitted to the Department which includes the use of a nonuse aquifer area, a postremediation care plan is required to provide reasonable confidence that the appropriate geographic area continues to meet the conditions of [Section 250.303\(c\)](#). Typical elements of such a post remediation care plan, which are relevant to the nonuse aquifer status, would include review of Department of Conservation and Natural Resources (DCNR) records to see if any well drilling reports have been received for the area included in the nonuse aquifer determination, inquiry to the water supplier of the area to determine if properties are still being billed for water, or communication with the municipalities to understand what changes may have taken place which may have an effect on the water use patterns in the area. The ecological screening process and the demonstration of compliance with surface water quality standards continue to apply in the area where the aquifer is determined not to be used for drinking water or agricultural purposes. Furthermore, in compliance with [Section 250.303\(d\)\(3\)](#), the property deed must be noticed to include the

requirements of the postremediation care plan. This will insure that subsequent landowners are aware of their responsibilities for postremediation care and monitoring. The postremediation care obligation will continue only until such time as the property owner demonstrates to the Department, by fate and transport analysis, that the MSC for groundwater in aquifers used or currently planned for use is not exceeded at the property boundary and all points downgradient therefrom.

**d) Request for Certification of a Nonuse Aquifer Area Initiated by a Local Government<sup>1</sup>**

This option would be used by municipal authorities and political subdivisions which desire to receive certification that a given geographic area meets the conditions of [Section 250.303\(c\)](#) (i.e. nonuse aquifer area conditions) where no specific property to be remediated has been identified. These conditions are based on [Section 250.303\(f\)](#) which requires an ordinance prohibiting groundwater use and which requires every property to be connected to the public water supply.

**e) Example**

The following figures illustrate the process for determining the area in which the conditions of [Section 250.303\(c\)](#) must be met in order for a site to qualify for a nonuse aquifer designation. The requirements of [Section 250.303\(c\)](#) must be met "within the site on the property and within a radius of 1,000 feet downgradient of the points of compliance, plus any additional areas to which the contamination has migrated and might reasonably be expected to migrate".

[Figure II-7](#) shows this area for an idealized site with a property line parallel to the ground water contour. Note that the area includes, first, all points within 1,000 feet of all compliance points that are at a lower groundwater elevation (downgradient) of the property line compliance point itself, plus any additional area to which the plume has migrated or may be expected to migrate, as determined by site characterization and fate and transport analysis.

[Figure II-8](#) shows the screening area for a site where the site characterization has determined that there is convergent groundwater flow. In this case the screening area is somewhat smaller than in the first figure because the area 1,000 feet downgradient (lower groundwater elevation) from the compliance points is smaller.

[Figure II-9](#) shows the screening area for an idealized site where the site characterization has determined there is divergent groundwater flow. In this case the screening area is somewhat larger than the other figures because the

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<sup>1</sup> This option will be available upon finalization of the proposed amendments to Chapter 250 published August 5, 2000 in the *PA Bulletin*.

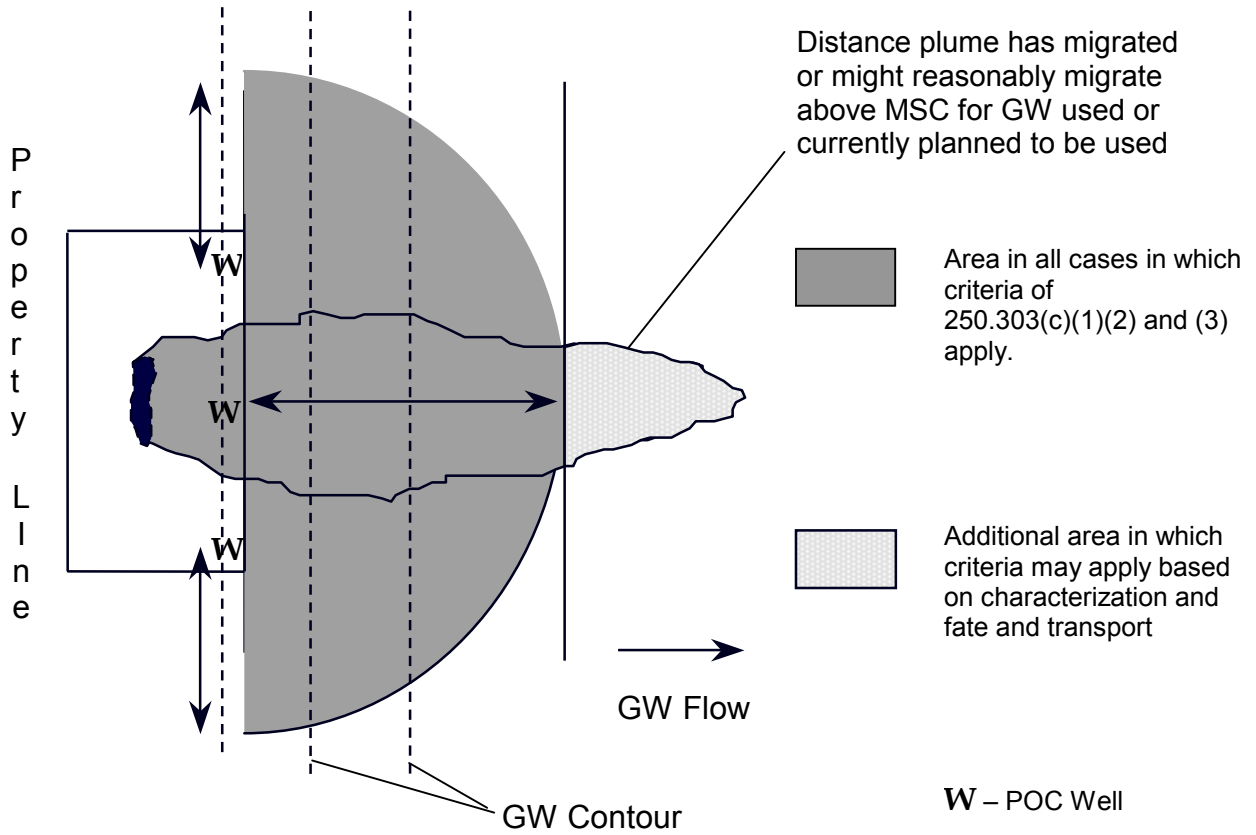
area 1,000 feet downgradient (lower groundwater elevation) from the compliance points is larger.

In areas with complex groundwater flow or other special features, the Department should be consulted to determine the appropriate screening area prior to conducting the required surveys.

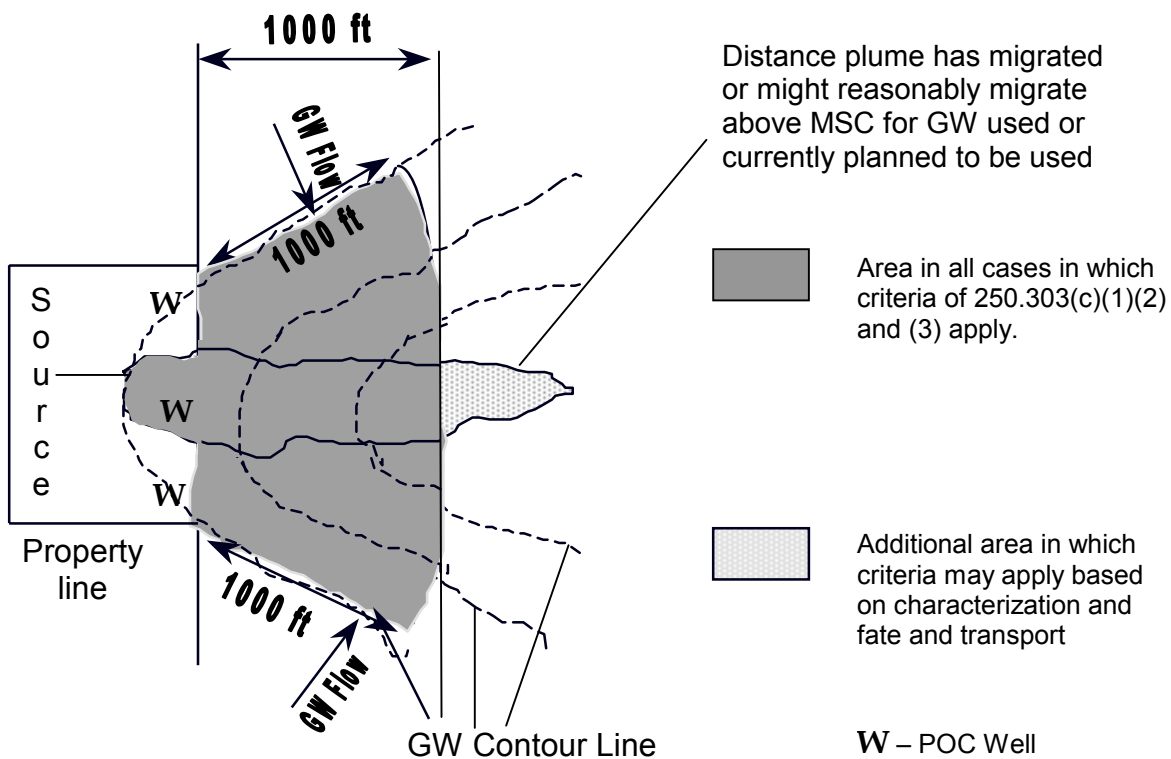
## **5. Ecological Screening**

All sites remediated to the Statewide health standard must be screened for impacts to the ecological receptors identified in [Section 250.311\(a\)](#). The presence of threatened or endangered species as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act requires that all requirements of that Act be met in addition to the requirements of Section 250.311. The person conducting the remediation has the option of either remediating the site to one-tenth of the applicable Statewide health MSC from [Tables 3 and 4](#) of Appendix A to the regulations, as described in [Section 250.311\(b\)](#), or using the ecological screening process described in [Section 250.311 \(b\) through \(e\)](#) and illustrated in [Figure II-10](#). The option of remediating to one-tenth the value in Tables 3 and 4 is not available if CPECs, listed in Table 8 of Appendix A, are present on the site. This choice, and the results of the screening process if used, should be documented in the final report.

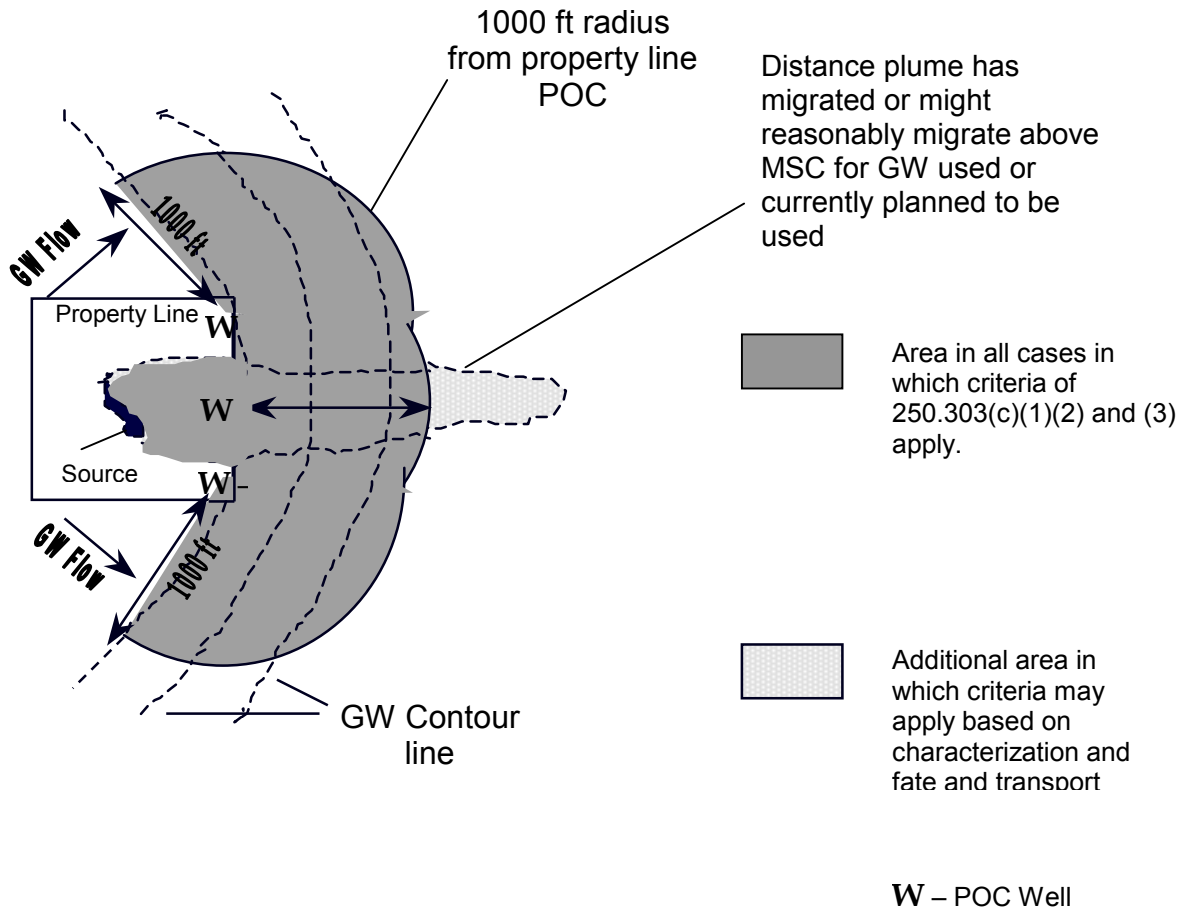
**Figure II-7  
Nonuse Aquifer Screening Area  
(Parallel Flow)**



**Figure II-8  
Nonuse Aquifer Screening Area  
(Convergent Flow)**



**Figure II-9  
Nonuse Aquifer Screening Area  
(Divergent Flow)**

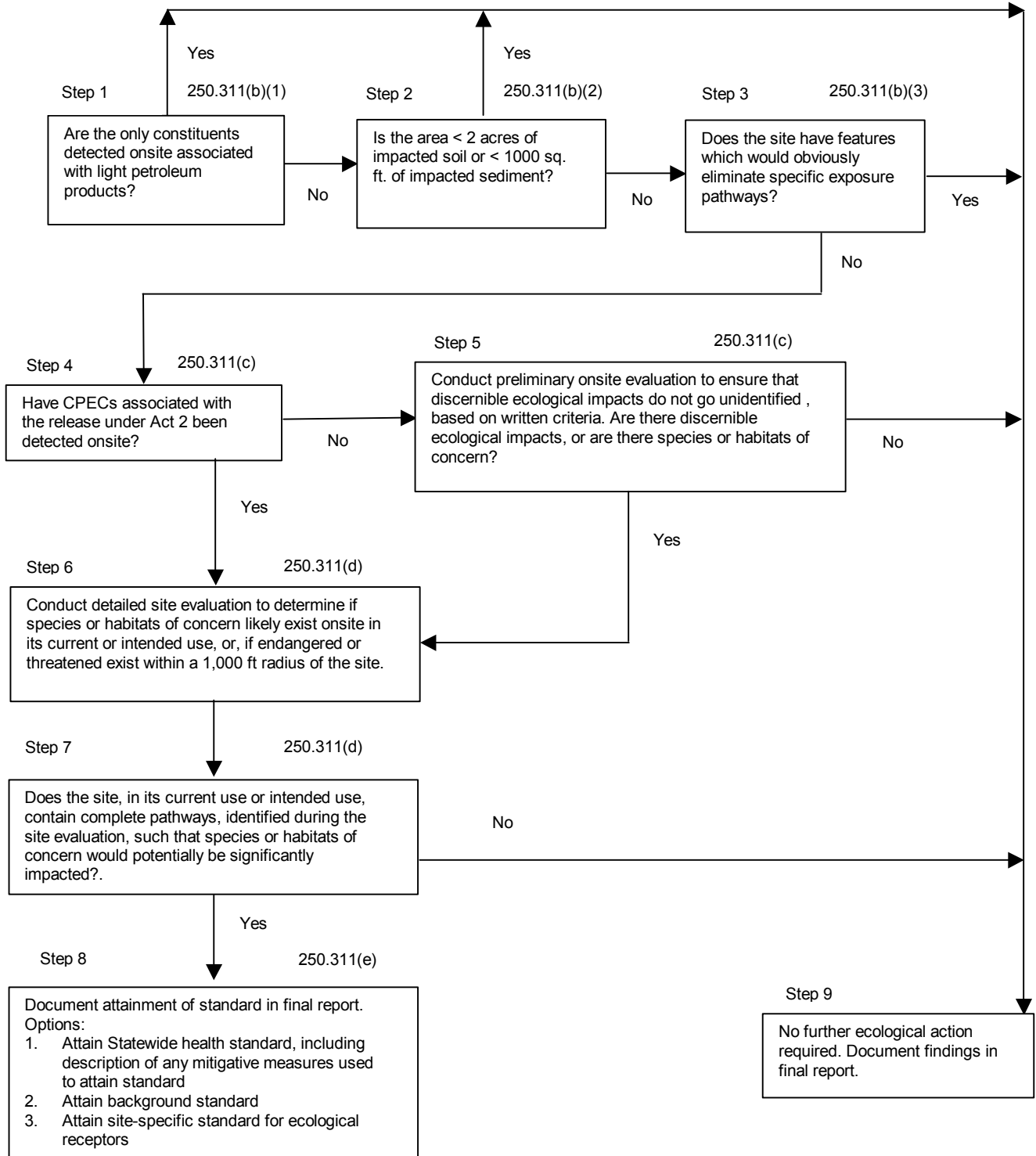


The objective of the ecological screening procedure is to quickly evaluate whether surface soils or sediments at a site have the potential to pose substantial ecological impact or impacts requiring further evaluation. The site screening procedure defines substantial impact as the potential for constituents detected onsite to cause a greater than 20% change in abundance of species of concern compared to an appropriate reference area, or a greater than 50% change in the extent or diversity of a habitat of concern compared to an appropriate reference area (Suter, 1993; Suter et al., 1995; U.S. EPA, 1989). Individuals of endangered or threatened species, and exceptional value wetlands are protected regardless of the percentage of change in the abundance of species or in the extent or diversity of habitat. The goal of the screening procedure is to minimize, to the extent practicable, the number of sites which require detailed ecological risk assessment, while remaining protective of the environment.

The key elements of the screening procedure include the presence of light petroleum product constituents; the size of the site; the presence or absence of Constituents of Potential Ecological Concern (CPECs) on the site; the presence or absence of species of concern or habitats of concern; and the presence or absence of completed exposure pathways, taking into account the current or planned future use of the site. The ecological screening process is described in this manual as part of the site characterization process because the information required to evaluate a site for ecological receptors is most efficiently collected at the same time as other site characterization data. A more [detailed description](#) of the rationale behind each of the steps in the ecological screen is available from the [Land Recycling website](#).

Regardless of the outcome of the ecological screening, the results are documented in a written report. It is important to note that if all of the first three steps are not met, *i.e.*, there is contamination other than light petroleum products; the impacted area of surface soil is equal to or greater than 2 acres, the impacted area of sediments is greater than or equal to 1000 square feet; and all pathways are not obviously eliminated, completion of the site ecological screening process requires an onsite evaluation. Using a streamlined set of guidelines, this onsite evaluation is a critical component of the means of identifying those sites that may pose substantial ecological impacts, and of documenting the lack of ecological impacts at other sites. Without such a site evaluation, a weight of evidence-based evaluation cannot be achieved, as required by EPA guidance (*e.g.*, EPA's *Framework for Ecological Risk Assessment*, 1992) and ASTM standards (ASTM Designation: E1706-95). In addition, this screening procedure is consistent with the initial steps of EPA's ecological risk assessment guidelines for contaminated sites (U.S. EPA, 1997). The remainder of this section discusses each of the steps of the ecological screening procedure in more detail.

**Figure II-10  
Ecological Screening Flow Chart**



SECTION II - REMEDIATION STANDARDS  
B. Statewide Health Standard



## Step 1: Presence of Light Petroleum Product Constituents

The first step in the site ecological screening process is to determine whether the constituents present in surface soils (soils at a depth of up to two feet) or sediments are related only to light petroleum products (*i.e.*, gasoline, jet fuel A, kerosene, #2 fuel oil/diesel fuel), which have relatively low PAH content (ASTM Designation: E1739-95). If light petroleum product constituents (including BTEX) are the only constituents detected onsite, then the screening process moves to [Step 9](#) (final report: No Further Ecological Evaluation Required). If constituents in addition to, or other than, light petroleum product constituents are present, the screening process continues to [Step 2](#) (Site Size).

The purpose of this step is to eliminate from further evaluation those sites at which the only detected constituents are residual compounds from a release of light petroleum products. In general, remediation of light petroleum product release sites to prevent substantial ecological impacts is not required because the Statewide health standards for these compounds are generally protective of ecological receptors.

### a) Step 2: Site Size

The second step in the ecological screening process is determining the area of exposed and contaminated surface soil (soils at a depth of up to two feet) and sediments that are of potential ecological concern. The minimum areas are 2 acres of exposed and contaminated surface soil, and 1,000 square feet of contaminated sediment.

Sediments are those mineral and organic materials situated beneath an aqueous layer for durations sufficient to permit development of benthic assemblages. Indicators of benthic assemblages would include macroscopic algae, aquatic invertebrates, or aquatic plants. The aqueous layer may be static, as in lakes, ponds, or other water covered surface depressions greater than or equal to 1,000 square feet but necessarily contiguous (excluding permitted open water management units), or flowing, as in rivers and streams located on a site. (U.S. EPA, 1993b; U.S. EPA, 1991a).

If a site exceeds these specified minimum areas, then the screening process continues to [Step 3](#) (Obvious elimination of pathways). If the area of the site is smaller than the specified minimum areas, then the screening process moves to [Step 9](#) (Final Report: No Further Ecological Evaluation Required).

### b) Step 3 - Obvious Pathway Elimination

The third step accounts for those sites where features such as buildings, paving, or other development of the site are sufficiently extensive as to eliminate specific exposure pathways to ecological receptors. This primarily applies to sites in heavily industrialized or otherwise developed areas such that habitats or species of concern could not occur onsite or within a reasonable distance. Any site with features that obviously eliminate exposure pathways will drop out of the screening process at this point and proceed to [Step 9](#), Final Report - No Further Ecological Evaluation Required.

**c) Step 4 - Presence of Constituents of Potential Ecological Concern**

The fourth step in the ecological screening process is the determination of whether any of the constituents detected at the site and related to releases at the site are considered to be constituents of potential ecological concern (CPECs). CPECs are identified on [Table II-2](#).

In this and the following step, available site information would be reviewed to determine if CPECs are likely to have been released into the environment. If CPECs are not detected at the site, then the screening process continues to [Step 5](#) (Preliminary Onsite Evaluation). If one or more CPECs, either individually or in combination, are detected at the site, then the screening process moves to [Step 6](#) (Detailed Onsite Evaluation and Identification of Species and Habitats of Concern).

The ecological evaluation process that has been developed includes additional evaluation criteria for sites where CPECs are not found. [Step 5](#) (Preliminary Onsite Evaluation) is an evaluation of adverse chemical effects that may result from regulated substances other than CPECs, and as such reduces the probability that substantive adverse environmental impacts will go undetected. Also, surface water regulations and standards will remain applicable to those sites, adding to the overall protection of the environment at any site, as will other regulations applicable to species of concern, such as the Endangered Species Act.

**d) Step 5 - Preliminary Onsite Evaluation**

The fifth step of the site ecological screening process is a preliminary onsite evaluation, to be conducted by a qualified environmental scientist (common practice would use a person with a bachelor's degree in an environmental science field and 5 years of experience in an environmental field), using the criteria presented in this guidance. If, after conducting the preliminary onsite evaluation, the qualified environmental scientist determines that substantial ecological impacts are not probable or evident based on the weight of evidence available for the site, the screening process moves to [Step 9](#) (Final Report: No Further Ecological Evaluation Required). It must also document the presence of any endangered or threatened species within a radius of 2500 ft of the site, or exceptional value wetlands onsite. If after conducting the preliminary onsite evaluation, the qualified environmental scientist determines that substantial ecological impacts or impacts requiring further evaluation are or may be present, the screening process continues to [Step 6](#) (Detailed Onsite Evaluation and Identification of Species and Habitats of Concern).

The objective of the ecological evaluation conducted during the preliminary onsite evaluation is to ensure that ecological impacts resulting from regulated substances which are not CPECs are detected. The preliminary onsite evaluation involves three steps:

1. Review of readily available site information, including the operational history, chemicals used, and probable sources of

releases of regulated substances; and, environmental setting with emphasis on physical, chemical and biological factors that would influence the nature and extent of contamination.

2. A preliminary onsite investigation to identify physical and habitat features of the area and to identify nearby reference areas without contamination (if available) that are outside of the probable site (area of contamination associated with a particular release). The following should be noted during the evaluation:
  - signs of stressed or dead vegetation (*e.g.*, chlorotic vegetation),
  - discolored soil, sediment or water (*i.e.*, a sheen),
  - presence of non-native materials in sediments resulting from seeps or other discharges emanating from the subject site,
  - presence of deformed organisms (if encountered),
  - presence of exceptional value wetlands,
  - presence of federally designated threatened or endangered species.
3. Preparation of a brief written summary of findings including sketches of the suspected area of contamination and reference areas. To the extent practicable, differences of greater than 50% in the density of species of concern or in the diversity and extent of habitats of concern shall be regarded as potentially substantive (Suter, et al., 1995; U.S. EPA, 1989). However, the presence of federally endangered or threatened species within a 2500 ft radius of the site, or exceptional value wetlands onsite would trigger further evaluation.

Based on all of the information collected as part of the preliminary onsite evaluation, the investigator makes a determination as to whether substantial ecological impacts exist or are probable even though CPECs were not detected on the site. The conclusion, which documents the weight of evidence from the onsite evaluation, is summarized in bulleted format.

**Table II-2**  
**Constituents of Potential Ecological Concern**

<u>METALS</u>	<u>ORGANICS cont'd</u>
Arsenic III	Dichlorobenzene,1,3-
Arsenic V	Dichlorobenzene,1,4-
Barium	Dichloroethane,1,1-
Beryllium	Dieldrin
Cadmium	Diethyl phthalate
Chromium III	Di-n-butyl phthalate
Chromium VI	Endosulfan (mixed isomers)
Cobalt	Endosulfan, alpha
Copper	Endosulfan, beta
Iron	Endrin
Lead	Ethylbenzene
Manganese	Fluoranthene
Mercury, inorganic	Fluorene
Mercury, methyl	Heptachlor
Molybdenum	Hexachlorocyclohexane (Lindane)
Nickel	Hexachloroethane
Selenium	Kepone
Vanadium	Malathion
Zinc	Methoxychlor
Cyanide	Mirex
<u>ORGANICS</u>	Naphthalene
Acenaphthene	Pentachlorobenzene
Aldrin	Pentachlorophenol
Benzene	Polychlorinated biphenyls (PCBs)
Benzo(a)pyrene	Polynuclear aromatic hydrocarbons
Biphenyl	Phenanthrene
Bis(2-ethylhexyl)phthalate	Pyrene
Bromophenyl phenyl ether,4-	Tetrachloroethane,1,1,2,2-
Butylbenzyl phthalate	Tetrachloroethylene
Chlordane	Tetrachloromethane
Chlorobenzene	Toluene
DDT (and metabolites)	Toxaphene
Diazinon	Tribromomethane
Dibenzofuran	Trichlorobenzene,1,2,4-
Dichlorobenzene,1,2-	Trichloroethane,1,1,1-
	Trichloroethylene
	Xylenes

### e) **Step 6 - Detailed Onsite Evaluation**

The sixth step in the ecological screening process is a detailed onsite evaluation and a determination of whether species or habitats of concern exist on the site or, for endangered and threatened species, if those species exist on the site or within a 2,500-foot radius of the border of the site in its current or intended use or if exceptional value wetlands exist onsite. Species of concern are identified in Section V.G of this manual. If, during the detailed onsite evaluation, no species or habitats of concern are identified on the site and no threatened or endangered species exist within a 2,500 ft. radius of the border of the site and no exceptional value wetlands occur onsite, the screening process moves to [Step 9](#) (Final Report: No Further Ecological Evaluation Required). If species or habitats of concern are identified on the site, the screening process continues to [Step 7](#) (Identification of Completed Exposure Pathways).

Identification of species and habitats of concern requires a detailed onsite evaluation. Common practice is to have a certified ecologist or a trained environmental biologist perform this evaluation. At a minimum, the person conducting the detailed onsite evaluation should be a certified ecologist or hold a college degree in ecology or environmental science and have at least 5 years of experience conducting ecological field work and risk assessments.

The objective of the detailed onsite evaluation is to identify species or habitats of concern and to make observations that will permit a determination of whether complete exposure pathways are present at the site, as required by [Step 7](#) of the ecological screening process. If the detailed onsite evaluation is being conducted as the result of potential impacts being identified during a preliminary onsite evaluation, the information from the preliminary onsite evaluation may be used at this stage where the information requested duplicates efforts of the previous evaluation. However, depending on the nature of the particular site, it may be necessary to supplement this previously-developed information. The detailed onsite evaluation has the following components:

1. Review of readily available site background information including:
  - operational history, chemicals used, and probable sources of releases of CPECs;
  - environmental setting with emphasis on physical, chemical and biological factors that would influence the nature and extent of contamination; and,
  - readily available literature and other relevant documents related to recognition of species and habitats of concern, including endangered and threatened species.
2. The qualified investigator shall conduct the following evaluation:

- complete an onsite investigation to identify physical and habitat features of the area, then identify nearby reference areas, if available, which are outside of the probable site (area of contamination associated with a particular property);
  - qualitatively evaluate whether species or habitats of concern are present at the site and in the reference area; and,
  - in comparison to reference areas, the qualified investigator shall evaluate the following to the extent that they can be readily evaluated at a site:
    - ◆ signs of stressed or dead vegetation (*e.g.*, chlorotic vegetation);
    - ◆ discolored soil, sediment or water;
    - ◆ presence of non-native materials in sediments resulting from seeps or other discharges emanating from the subject property;
    - ◆ community composition differences readily distinguished by U.S. EPA protocols such as the Rapid Bioassessment procedures (U.S. EPA, 1989). (Note: Forthcoming PaDEP guidance will elaborate on conducting such evaluations and provide examples);
    - ◆ absence of biota (especially keystone species and ecological dominants) compared with similar areas of the same system;
    - ◆ presence of non-native or exotic species compared with reference areas (*e.g.*, *Phragmites*);
    - ◆ presence of deformed organisms (if encountered); and,
    - ◆ potential for residual contamination of habitats of concern and areas utilized by species of concern.
3. A brief written summary of findings including sketches of the suspected area of contamination and reference areas. Differences of greater than 20% in the density of species of concern or greater than 50% in the diversity or the extent of habitats of concern shall be regarded as potentially substantive (Suter, 1993; Suter, et al., 1995; U.S. EPA, 1989). However, the presence of exceptional value wetlands or federally-designated endangered or threatened species would trigger further evaluation.
  4. The site ecological screening process defines as species of concern as those that have been designated as either of special concern, endangered, threatened or candidate by the Pennsylvania Game Commission, Pennsylvania Fish & Boat Commission, and the DCNR Bureau of Forestry. Links to current lists of such species are presented in [Section V.G.](#)
  5. The ecological screening process defines as habitats of concern:

- typical wetlands with identifiable function and value, except for exceptional value wetlands, as defined by DCNR,
- breeding areas for species of concern,
- migratory stopover areas for species of concern (*e.g.*, migrant shorebirds, raptors or passerines),
- wintering areas for species of concern,
- habitat for State endangered plant and animal species,
- Federal, State, and Local parks and wilderness areas,
- areas designated<sup>2</sup> as wild, scenic, recreational; and,
- areas otherwise designated as critical or of concern by the Pennsylvania Game Commission, Pennsylvania Fish & Boat Commission, and the DCNR.

**f) Step 7 - Identification of Completed Exposure Pathways**

The seventh step in the ecological screening process is a determination of whether a completed exposure pathway from CPECs to species or habitats of concern exists at the site in its current or intended use. The existence of a completed exposure pathway<sup>3</sup> is determined during the detailed onsite evaluation, as described above for Step 6. Note that the CPECs in soil beneath a paved parking lot or below the root zone (top two feet) are not accessible to most species and habitats of concern, and therefore this pathway is classified as incomplete. If a complete pathway exists at the site, then the screening process moves to [Step 8](#) (Attainment of Standard and Mitigative Measures). If no complete exposure pathways are identified during the detailed site evaluation, then the screening process continues to [Step 9](#) (Final Report: No Further Ecological Evaluation Required).

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<sup>2</sup> as defined by guidance.

<sup>3</sup> Exposure pathway - the course a regulated substance(s) takes from the source area(s) to an exposed organism of a species of concern including absorption or intake into the organism. Each complete exposure pathway must include a source or release from a source, a point of exposure, and an exposure route into the organism. The mere presence of a regulated substance in the proximity of a receptor does not constitute a completed pathway. The receptor of concern must be capable of contacting the regulated substance in such a way that there is high probability that the chemical is absorbed into the organism (ASTM. E1739-95; modified to accommodate provisions of Act 2).

**g) Step 8 - Attainment of Standard and Mitigative Measures**

If the results of Steps 1 through 7 above do not result in the site being eliminated from further ecological consideration, the person conducting the remediation must demonstrate one of the following:

- attainment of the Statewide health standard is protective of ecological receptors,
- if the person cannot demonstrate that the Statewide health standard MSCs are protective of ecological receptors, the person shall demonstrate either that the post-remedy use will result in the elimination of all complete exposure pathways at the time of the final report, or in accordance with a postremediation care plan, or that mitigative measures have been implemented and a postremediation care program has been instituted,
- attainment of the background standard, or
- that the procedures of Sections [250.402 \(c\)](#) and [250.409](#) of the regulations and Sections [II.C](#) and IV.H. of this manual have been followed to demonstrate attainment of a site-specific standard for protection of ecological receptors.

Mitigative measures that may be used to demonstrate attainment of the Statewide health standard are identified in [Section 250.311\(f\)](#). These mitigative measures may only be used if no exceptional value wetlands have been identified by the screening process, and no state or federal laws or regulations prohibit the destruction of the habitats or species identified in the screening process.

The following mitigative measures may be used, and in the indicated order of preference:

- restoration onsite of species and habitats identified in the screening process.
- replacement onsite of species and habitats identified in the screening process.
- replacement on an area adjacent to the site of species and habitats identified in the screening process.
- replacement at a location within the municipality where the site is located of species and habitats identified in the screening process.

The Department shall review and approve any proposed mitigative measures prior to implementation to ensure that the intended use of the site minimizes the impact to ecological receptors identified in the screening process. In addition, the



postremediation care plan requirements in [Sections 250.312\(e\)](#) or [250.411\(f\)](#) of the regulations and [Section IV.D](#) of this manual must be implemented.

**h) Step 9 - Final Report - No Further Ecological Evaluation Required**

The ninth step of the ecological screening process requires that a report be written documenting the findings of the completed steps of the screening process, and the basis for the conclusion that a substantial ecological impact does not exist and that further ecological evaluation is not required. The conclusion that substantial ecological impact does not exist is based on one of the following:

- the presence of light petroleum-related constituents only (findings from Step 1);
- the area of impacted surface soil or sediment is less than the minimum size criterion (findings from Step 1 and 2);
- all pathways are obviously eliminated by specific site features (findings from Steps 1 through 3);
- no CPECs are present onsite and the preliminary site evaluation indicates that substantial ecological impacts have not been overlooked (findings from Steps 1 through 5);
- no species or habitats of concern, threatened or endangered species, or exceptional value wetlands were identified on the site during the detailed site evaluation (findings from Steps 1 through 6); or,
- no complete exposure pathways from CPECs or other contaminants onsite to species or habitats of concern were identified during the detailed site evaluation (findings from Steps 1 through 7).
- complete exposure pathways from CPECs or other contaminants onsite to species or habitats of concern were identified, but no significant impacts were observed during the detailed site evaluation.

**6. Final Report Requirements for the Statewide Health Standard**

To receive the liability protection afforded under Chapter 5 of Act 2 for sites remediated under the Statewide health standard, the person conducting the remediation shall submit a final report to the Department which documents attainment of the standard. [Section 250.312](#) of the regulations discusses final report requirements.

The final report shall be prepared in accordance with scientifically recognized principles, standards and procedures. The report should present a thorough understanding of the site conditions. It should provide a detailed discussion on the areas for concern and a conceptual site model based on the results of the site work. The report should support interpretations and conclusions with data

collected during all of the investigations at the site. The level of detail in the investigation and the methods selected shall sufficiently define the rate, extent and movement of contaminants to assure continued attainment of the remediation standard. All interpretations of geologic and hydrogeologic data shall be prepared by a professional geologist licensed in Pennsylvania.

Two copies of the final report should be submitted for the Department review. The final report must include the information below, and it is preferred to be organized according to the outline in [Table II-3](#), using the following headings:

**Table II-3**  
**Suggested Outline for a Final Report under the Statewide Health Standard**

**I. Final Report Summary**

The [final report summary](#) should be a copy of the electronic form submitted to the Department.

**II. Site Description**

Provide a description of the site in sufficient detail to give an overall view of the site ([Section II.B.6.b](#))

**III. Site Characterization**

Document current conditions at the site ([Section 250.204](#) of the regulations and [Section II.B.6.c](#))

**IV. Statewide Health Standard**

How the Statewide health standard was established ([Section II.B.6.d](#))

**V. Ecological Screening**

Provide the results of the Ecological Screen described in [Section 250.311](#) of the regulations and [Section II.B.5](#).

**VI. Remediation**

Description of the remedial methodologies used to attain the selected standard ([Section II.B.6.f](#))

**VII. Attainment**

- A. Soil Statewide health standard
- B. Groundwater Statewide health standard
- C. Diffuse groundwater flow into surface water
- D. Spring flow into surface water

Sections A, B, C and D describe the statistical methods used to demonstrate attainment of the standard ([Section II.B.6.g](#))

**VIII. Fate and Transport Analysis**

Description of Fate and Transport analyses used and results and conclusions. ([Section II.B.6.h](#))

**IX. Postremediation Care Plan**

This section is included only if necessary. It describes the engineering and institutional controls necessary to attain or maintain the standard. ([Section II.B.6.i](#))

**X. References**

([Section II.B.6.j](#))

**XI. Attachments**

[\(Section II.B.6.k\)](#)

**XII. Signatures**

[\(Section II.B.6.l\)](#)

**a) Summary**

The [Final Report Summary form](#) is to be filled in and submitted to the Department electronically. The summary submitted with the final report should be a copy of that completed form.

**b) Site Description**

Provide a description of the site in sufficient detail to give the reviewer an overall idea of the site and its location, and the types of operations that are currently and were formerly conducted on the site. As appropriate to the site, the description should include location, physical description of the property, ownership history, site use history, and regulatory action history (past cleanups).

**c) Site Characterization**

The site characterization provides important information documenting the current conditions at the site, information required by [Section 250.312](#) of the regulations, and information required for the proper demonstration of attainment. Information developed during the site characterization is primarily intended to describe the nature, extent and potential for movement of all contaminants present on the site, or that may have migrated from the site and as input for developing a site conceptual model and for the fate and transport analysis. For sites where there are multiple distinct areas of contamination, the site characterization process should be applied to each area individually.

Along with a narrative, the results from the site characterization and all sampling and analysis work should be provided on map(s) illustrating, to the extent possible, the interrelationship of the following:

- All physical site characteristics.
- All groundwater, soil, sediment and other sample locations; including sample depth and contaminant concentration.
- The surveyed locations for all assessment structures (monitoring wells, soil borings, test pits, etc.). All elevations should be reported in reference to mean sea level (msl), where practical.
- Appropriate number of stratigraphic cross sections that adequately depict site stratigraphy, well locations, well depths, groundwater flow directions, equipotential lines, flow lines, hydraulic conductivity intervals and values, sampling intervals and concentrations. All elevations should be reported in reference to msl, where practical.
- Variation in potentiometric surfaces(s), potentiometric surface map(s), hydraulic gradients, and groundwater flow directions.
- All identified sources of releases.
- The extent and concentrations of contaminant plumes in all media. The horizontal and vertical extent of contaminant plumes including density and thickness of any Separate Phase Liquids (SPLs) present.

- Top of bedrock contour (if encountered).

A conceptual site model should be developed and refined as information is gathered during the site characterization. The conceptual site model provides a description of the site and extent of contamination. Recommended information and data used to develop the site model include:

- The type, estimated volume, composition, and nature of the released materials, chemicals or chemical compounds (Include all calculations and assumptions.)
- Source(s) and extent of release(s).
- Background concentrations for constituents of concern.
- The horizontal and vertical extent of contamination.
- The portion of the horizontal and vertical extent of contamination which exceeds the selected standard.
- Affected aquifer(s) or water bearing formation(s)/ member(s), hydrostratigraphic units.
- All existing and potential migration pathways.
- The estimated volume of contaminated soil and water (include all calculations and any assumptions).

For soils, include information on samples and measurements used to characterize the horizontal and vertical extent of contamination, and direction and rate of contaminant movement based on factors in the soil and the contaminant which affect migration. Soil and boring descriptions should be included as an attachment.

For groundwater, include information on samples and measurements used to characterize the horizontal and vertical extent of contamination and direction and velocity of contaminant movement based on factors of the groundwater and the contaminant(s) which affect migration. Geologic boring descriptions and as built drawings of wells should be included as an attachment. Text, tables, graphics, figures, maps and cross sections, as appropriate, can be utilized to describe the nature, location, and composition of the regulated substances at the site. Providing the data in an appropriate format will expedite the review of the report.

#### **d) Selection of the Applicable Statewide Health Standard**

Documentation of the basis for selecting residential or nonresidential standards and for selecting the applicable MSCs according to the procedure in [Section II.B.3](#) of this manual.

If the site is in an area where groundwater is not used or planned to be used for drinking water or agricultural purposes, provide the following documentation:

- That no groundwater derived from wells or springs is used or currently planned to be used for drinking water or agricultural purposes.
- That all downgradient properties are connected to a community water system.
- That the nonuse area does not intersect a radius of 0.5 mile from a community water supply well and does not intersect an area designated by the Department as a zone 2 wellhead protection area under [Chapter 109](#).
- Results of the fate and transport analysis used to establish the nonuse area.
- A copy of the letter from the Department approving the use of the nonuse aquifer MSCs, as described in [Section II.B.4](#) of this manual.

If the soil buffer option is used to meet the requirements of the soil to groundwater numeric value, submit the following:

- Information demonstrating that the actual site soil column thickness below the contaminated soil is at least the thickness identified in [Tables 3B](#) and [4B](#) of Appendix A to the regulations. This information should be taken from soil sample borings conducted during the site characterization.
- Laboratory analyses demonstrating that the contaminant concentrations in the entire soil column below the contaminated zone do not exceed either the limit related to the PQL or background.
- The boring logs and all other data presented in appropriate maps, cross sections, figures, and tables.

If an equivalency demonstration is used to meet the requirements of the soil-to-groundwater numeric value, submit the following:

- Information describing the actual site soil column below the contaminated soil. This information should be taken from soil sample borings conducted during the site characterization.
- Information, including laboratory analyses, gathered during the site characterization that demonstrates that the groundwater is not impacted at levels exceeding either the groundwater MSC or background.
- The boring logs and all other data presented in appropriate maps, cross sections, figures, and tables.
- Sampling data, in a tabular format, that shows no exceedance for eight quarters of groundwater MSCs or the background standard, in accordance with [Section 250.308\(d\)\(2\)](#) of the regulations.
- Results of the fate and transport analysis that demonstrates that the regulated substance(s) will not migrate to bedrock or the groundwater within thirty years at concentrations exceeding the greater of the groundwater MSC or background in groundwater as the end point in soil pore water directly under the site.

**e) Ecological Screening**

Provide documentation of the implementation of the ecological screen described in [Section 250.311](#) of the regulations, and [Section II.B.5](#) of this manual.

**f) Remediation**

Remediation should be planned to remediate all areas to the selected standard.

Provide a description of the remedial methodologies used to remediate that portion of the contamination which exceeds the selected standard as determined by the site characterization. Examples of the types of information typically included in this section include:

- Identification of areas remediated based on results of site characterization.
- Descriptions of treatment, removal, or decontamination procedures performed in remediation. Description of removal, what was removed, and amount removed. Results of any treatability, bench scale, or pilot scale studies or other data collected to support the remedial action(s).
- Description of treatment technologies.
- Description of the methodology and analytical results used to direct the remediation and determine the cessation of remediation. This description should document how the remediator determined that remediation was performed to address all areas known to exceed the standard.
- Documentation of handling of remediation wastes in accordance with applicable regulations.
- Specific characteristics of the site that affected the implementation or effectiveness of the remedial action including such characteristics as topography, geology, depth of bedrock, potentiometric surfaces, and the existence of utilities.
- All other site information relevant to the conceptual design, construction, or operation of the remedial action.

In addition to the above, this section should also include the calculation of the mass of contaminants addressed during the remediation or soil and/or groundwater, using the methodology in [Section IV.C](#).

Remediation of surface water will typically be accomplished by eliminating or reducing the discharge of regulated substances into surface water to the level where surface water quality standards are being achieved. Given that the usual source of regulated substance discharge to surface water will be via non-point source groundwater discharge, the measures necessary to attain the surface water standard should be incorporated into the design of any groundwater remediation system.

Abatement of air quality discharges associated with the remediation (*e.g.*, vapor discharges from air stripping towers) shall be handled in accordance with the applicable air quality statutes and regulations.



During the implementation of any remediation plan, appropriate record keeping must be performed to provide ample documentation of the remedial actions taken, any changes made from the preplanned activities, and any sampling performed as field controls during implementation.

**g) Attainment**

Provide documentation that the remediation has attained the selected standard at the point of compliance and that the standard will not be violated in the future as a result of remaining contamination. The demonstration of attainment, like the site characterization, should be applied to each distinct area of contamination. Attainment must meet the requirements of Chapter 250 [Subchapter G](#) ( Demonstration of Attainment).

If the Statewide health standard is numerically less than the background standard, the remediator may elect the background standard, and attainment of the background standard should be demonstrated according to [Section 302](#) of Act 2.

**i) Point of compliance**

**(a) groundwater**

The point of compliance (POC) for groundwater under the Statewide health standard is the property boundary. Under certain circumstances the point of compliance may be moved, as described below. Prior approval from the Department to move the POC is required.

The remediator may request the movement of the POC for situations described in [Section 250.302\(a\)](#) of the regulations. If any of those conditions exist, the remediator must request, in writing, that the Department approve moving the POC. The Department will respond in writing to the request, and the response must be obtained before the adjusted POC may be used and the final report submitted.

For substances with a Secondary Maximum Contaminant Level (SMCL) established by EPA under the [National Secondary Drinking Water Regulations](#), the remediator may request that the POC be moved for those substances with SMCLs. The Department will consider moving the POC in a range anywhere from the property boundary up to the point of use. Therefore, demonstration of attainment at a site may involve POCs for SMCLs which are different from the POCs applicable to the other identified regulated substances.

**(b) soil**

The POC for soil is the entire area of contamination. Demonstration of attainment of the appropriate standard is to be made in the entire volume shown in the site characterization to be contaminated by regulated substances at concentrations exceeding the Statewide health standard. Some sites may have different Statewide health standards for varying depths or conditions of soil. For

example, on a nonresidential site, if the soil-to-groundwater numeric value is lower than the direct contact number, there may be one standard for the 0-2 ft interval, another for the 2-15 ft interval, and a third for the soil at depths greater than 15 ft. In addition, if any of these depths are in the saturated zone, the appropriate standard may be different because of the requirement for reducing the generic value of the soil-to-groundwater numeric value by a factor of 10 (see [Section II.B.3.b.ii](#)). For the purpose of demonstrating attainment, the saturated zone is considered to extend below the seasonal high water table level.

### **(c) spring flow into surface water**

Except if an NPDES permit is required for purposes of complying with surface water quality in a spring, the point of compliance is the point of first designated or existing use as defined in 25 Pa Code [93.1](#), [93.4](#), and [93.9](#). This could mean right by the spring itself or some point downstream from the spring discharge. Determining the point of first designated use is necessary because it establishes the point where Chapter 93 water quality standards apply.

Technical guidance to determine point of first use is found in [Implementation Guidance for Evaluating Wastewater Discharges to Drainage Ditches and Swales, revised August, 1997](#). In essence this guidance relies on biological techniques to determine the first downstream point where aquatic life can be documented. It applies to both perennial and intermittent streams with definable bed and banks, but not to ephemeral streams, that is, areas of overland runoff which occur only during or immediately following rainfall events and where there is no defined stream channel and stream substrate.

### **ii) Statistical tests**

Attainment tests appropriate for the Statewide health standard are described in [Section 250.707\(b\)](#) of the regulations, and in [Section IV.B](#) of this manual, and include:

- the 75%/10x rule for soil and groundwater at the point of compliance, and the 75%/2x rule for groundwater off the property.
- for groundwater, no exceedance of the Statewide health standard.
- the 95% UCL test.
- for sites that are remediated without prior full site characterization, a “no exceedance” of the Statewide health standard.
- a method that meets the performance requirements of [Section 250.707\(d\)](#) of the regulations.

If the 75%/10X rule is not used, appropriate statistical tests must be employed to demonstrate attainment of the Statewide health standard. The following information should be documented in a final report:

- Description of the statistical method, and the underlying assumptions of the method.

- Documentation showing that the sample data set meets the underlying assumptions of the method and explaining why the method is appropriate to apply to the data.
- Specification of false positive rates.
- Documentation of input and output data for the statistical test, presented in table and figures, or both, as appropriate; and identify, by media, contamination levels remaining onsite.
- An interpretation and conclusion of the statistical test.

In addition to the attainment tests described above, the remediator must demonstrate, for groundwater remediated to the Statewide health standard, that the standard has been attained and that it will continue to be attained in the future, as indicated by a fate and transport analysis .

In demonstrating attainment of the Statewide health standard, concentrations of regulated substances are not required to be less than the limit related to the Practical Quantitation Limit (PQL) for that substance as provided for in Sections [250.4](#) and [250.701\(c\)](#), and as listed in [Section IV.F](#) of this manual. Where the plume of contamination currently impacts or may impact properties with different land use categories (*i.e.*, residential and nonresidential), the Statewide health standard appropriate for the impacted property must be attained and maintained. For example, where a plume of contamination emanating from a nonresidential property adjoins a residential property that will be impacted by the plume, the nonresidential Statewide health standard must be attained and maintained at the downgradient boundary of the nonresidential property (See [Section 250.702](#)) and the residential Statewide health standard applies at the residential property. Demonstration that the appropriate standard will be attained and maintained must be demonstrated by a combination of sampling and fate and transport analysis.

In demonstrating attainment of the Statewide health standard in groundwater in aquifers not currently used or planned to be used, the remediator must show that the nonuse aquifer MSC has been met at the point of compliance using the appropriate tests for demonstrating attainment in [Section 250.707\(b\)\(2\)](#), and further described in Section IV.B of this manual. In addition, the requirements of [Section 250.705](#) must be met regarding the use of a fate and transport analysis to show that the MSC for groundwater in aquifers used or currently planned to be used will not be exceeded at and beyond all points on a radius of 1000 ft downgradient from the property boundary within 30 years. This fate and transport analysis should meet the requirements specified in [Section IV.A](#) of this manual.

#### **(a) 75%/10x rule**

The 75%/10X rule is a statistical ad hoc rule that determines if the true site median concentration is below the cleanup standard. This rule requires that 75% of the samples collected for demonstration of attainment be equal to or below the

cleanup standard and that no single sample result exceeds the standard by more than ten times.

For the 75%/10X rule, the number of soil sample points required for each distinct area of contamination is specified in the Act 2 regulations and is as follows:

- For soil volumes equal to or less than 125 cubic yards, at least eight samples.
- For soil volumes up to 3,000 cubic yards, at least 12 sample points.
- For each additional volume of up to 3,000 cubic yards, an additional 12 sample points.
- Additional sampling points may be required based on site--specific conditions.

These soil volumes may be comprised of zones where different MSCs apply (*e.g.*, depths of 0-15 ft and greater than 15 ft). For purposes of demonstrating attainment, the analysis of samples, based on their physical location by the systematic random sampling method (Section IV.B), must be compared to the applicable MSC for that physical location.

To use this rule for demonstrating attainment of groundwater MSCs, eight samples from each compliance well must be obtained during eight consecutive quarters. If a shorter sampling period is then used, the no exceedance rule [[Section 250.704\(d\)\(3\)](#) of the Act 2 regulations] must be used rather than the 75%/10X rule.

In groundwater monitoring wells beyond the property boundary, the rule is slightly modified. The attainment criteria are that 75% of the sampling results must be below the standard, with no individual value being more than 2 times the standard (75%/2X rule). This rule would have to be met in each individual monitoring well.

#### **(b) 95% UCL rule**

The minimum number of samples is as specified in [Section IV.B](#) of this manual.

#### **(c) No exceedance rule**

For sites with a release of petroleum products, remediation is often conducted based on visual observations or field screening, without having conducted a full site characterization. These sites may demonstrate attainment of the Statewide health standard using the procedure described in [Section IV.B.5.b.i.c](#) of this Manual.

#### **h) Fate and Transport Analysis**

The Fate and Transport Section ([Section IV.A](#) of this manual) provides a discussion on fate and transport analysis. The amount of detail in the fate and transport analysis may vary from a description to a very extensive detailed model with quantitative modeling. Whenever a model is used the Department

must be provided with the assumptions, data, and information on the model necessary for Department staff to evaluate and run the model. Any parameters used in the analysis or models used should use data from the site obtained during the site characterization.

Following are examples of situations when the Statewide health standard will require a fate and transport analysis/ model:

- The demonstration of attainment of a standard at the POC includes a fate and transport analysis to show that the standard will not be violated in the future.
- In an area where the groundwater is not used for drinking water or agricultural purposes, a fate and transport analysis is required to show that the used aquifer MSC is not exceeded at and beyond a radius of 1,000 ft downgradient from the property boundary within 30 years.
- In using the equivalency demonstration to meet the soil-to-groundwater numeric value, a fate and transport analysis is required to show that soils remediated to the direct contact numeric value will not result in regulated substances migrating to groundwater at concentrations exceeding either the groundwater MSC or background.

**i) Postremediation Care Plan (if applicable)**

If engineering controls are needed to attain or maintain the Statewide health standard; if institutional controls are needed to maintain the standard; if a nonuse aquifer designation has been approved for the site; if the fate and transport analysis indicates that the remediation standard, including the solubility limitation, may be exceeded at the point of compliance in the future; if the remediation relies on natural attenuation; if a post-remedy use is relied upon but is not implemented to eliminate complete exposure pathways to ecological receptors; or, if mitigative measures are used, a postremediation care program, which includes the information required by [Section 250.204\(g\)](#), must be documented in the final report in accordance with Section 250.204(g). The plan typically should include:

- reporting of any instance of nonattainment;
- reporting of any measures to correct nonattainment conditions;
- periodic reporting of monitoring, sampling and analysis as required by the Department;
- maintenance of records at the property where the remediation is being conducted for monitoring, sampling and analysis; and
- a schedule for operation and maintenance of the controls and submission of any proposed changes.

If the postremediation care plan is being used to document the continuing applicability of an approved nonuse aquifer designation, the following are required:

- Procedures for documenting that the nonuse criteria continue to be met after the original request is approved.
- Report details and schedule for submittal to the Department.

See [Section II.C.9](#) under the site-specific standard for the range of institutional controls available to a remediator.

The Department may ask for documentation of financial ability to implement the remedy and to maintain the postremediation care controls. Except for the special case of a nonuse aquifer designation under Section [250.303 \(c\) and \(d\)](#), when the standard can be maintained without the controls operating, and the fate and transport analysis shows that the standard will not be exceeded in the future, the Department will approve termination of the postremediation care program.

**j) References**

Any references cited in the final report.

**k) Attachments**

Laboratory sheets and historical sampling data results

All raw data and summary of data

Quality Assurance and Quality Control Plan

Calculations and formulas

Methods of data analysis

Health and Safety Plan

Sampling and Analysis Plan

All water level/liquid level measurements, including SPL measurements

Maps and cross sections used which present information on site characterization and attainment

As-built well construction details, boring logs, cross sections, stratigraphic logs, including soil/rock characteristics and field instrument readings

Proofs required, such as municipal and newspaper notices, proof of publication and Department acknowledgment of natural or areawide contamination

Before and after remediation photographs

**l) Signatures**

All those who participated in the remediation who are seeking relief from liability.

## 7. References

- ASTM Designation: E 1706-95. Standard Test Methods for Measuring the Toxicity of Sediment-Associated Contaminants with Fresh Water Invertebrates. Section 5.1.7.
- ASTM Designation: E 1739-95. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites.
- Feenstra, S., D.M. Mackay, and J.A. Cherry. 1991. A Method for Assessing Residual NAPL Based on Organic Chemical Concentrations in Soil Samples. GWMR. Spring.
- Suter II, G.W. 1993. Ecological Risk Assessment. Lewis Publishers. Chelsea, MI.
- Suter II, G.W., B.W. Cornaby, C.T. Haddne, R.N. Hull, M. Stack, and F.A. Zafran. 1995. An Approach for Balancing Health and Ecological Risks at Hazardous Waste Sites. Risk Analysis 15(2).
- U.S. EPA. 1989. Rapid Bioassessment Protocols For Use In Streams And Rivers: Benthic Macroinvertebrates and Fish. Office of Water. EPA/444/4-89/001.
- U.S. EPA. 1991a. Compendium of ERT Surface Water and Sediment Sampling Procedures. EPA/540/P-91/005.
- U.S. EPA. 1991b. Risk Assessment Guidance for Superfund: Volume I, Human Health Evaluation manual, Part B: Development of Risk-based Preliminary Remediation Goals. Office of Emergency and Remedial Response. Publication no. 9285.7-01B.
- U.S. EPA. 1992. Framework for Ecological Risk Assessment. Risk Assessment Forum. EPA/630/R-92/001.
- U.S. EPA. 1993a. Wildlife Exposure Factors Handbook. Office of Research and Development. EPA/600/R-93/187a.
- U.S. EPA. 1993b. Sediment Quality Criteria for the Protection of Benthic Organisms: Acenaphthene. EPA-822-R-93-013.
- U.S. EPA. 1994b. BTAG Forum. EPA/540/F-94/048.
- U.S. EPA. 1996. Ecotox Thresholds. Eco Update vol. 3, number 2. EPA 540/F-95/038. January.
- U.S. EPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA/540-R-97-006. PB97-963211. June 16, 1997.
- Wild Resource Conservation Fund. 1995. Endangered and Threatened Species of Pennsylvania. Published in cooperation with Pennsylvania Game Commission, Pennsylvania Fish & Boat Commission, and Bureau of Forestry.



## C. Site-Specific Standard

### 1. Introduction

The objective of the site-specific standard is to develop and evaluate detailed site information using a rigorous scientific evaluation of a remedy to provide a protective cleanup standard unique to that site. Use of this standard requires the Department's review and approval (as required by statute) of the remedial investigation report, risk assessment report (if necessary), cleanup plan (if necessary) and final report. The relationship of these steps in the risk assessment process is illustrated in [Figure II-11](#). The remedial investigation report, risk assessment report, and cleanup plan may be submitted at the same time. In some cases, only a remedial investigation report and final report are required, and these can be combined (see [Section II.C.8](#) of this manual). In other cases (such as simple pathway elimination of all present and future exposure pathways), the risk assessment report and cleanup plan can be simplified. All pathways of exposure are evaluated and the past, current and future use of the land is considered. The resulting cleanup remedy selected to meet site-specific soil and groundwater standards may be a combination of treatment/removal efforts, and engineering and institutional controls. The extent to which treatment and removal efforts are balanced with engineering and institutional controls is determined by the factors used in remedy selection. These factors are described in [Section 304\(j\)](#) of Act 2.

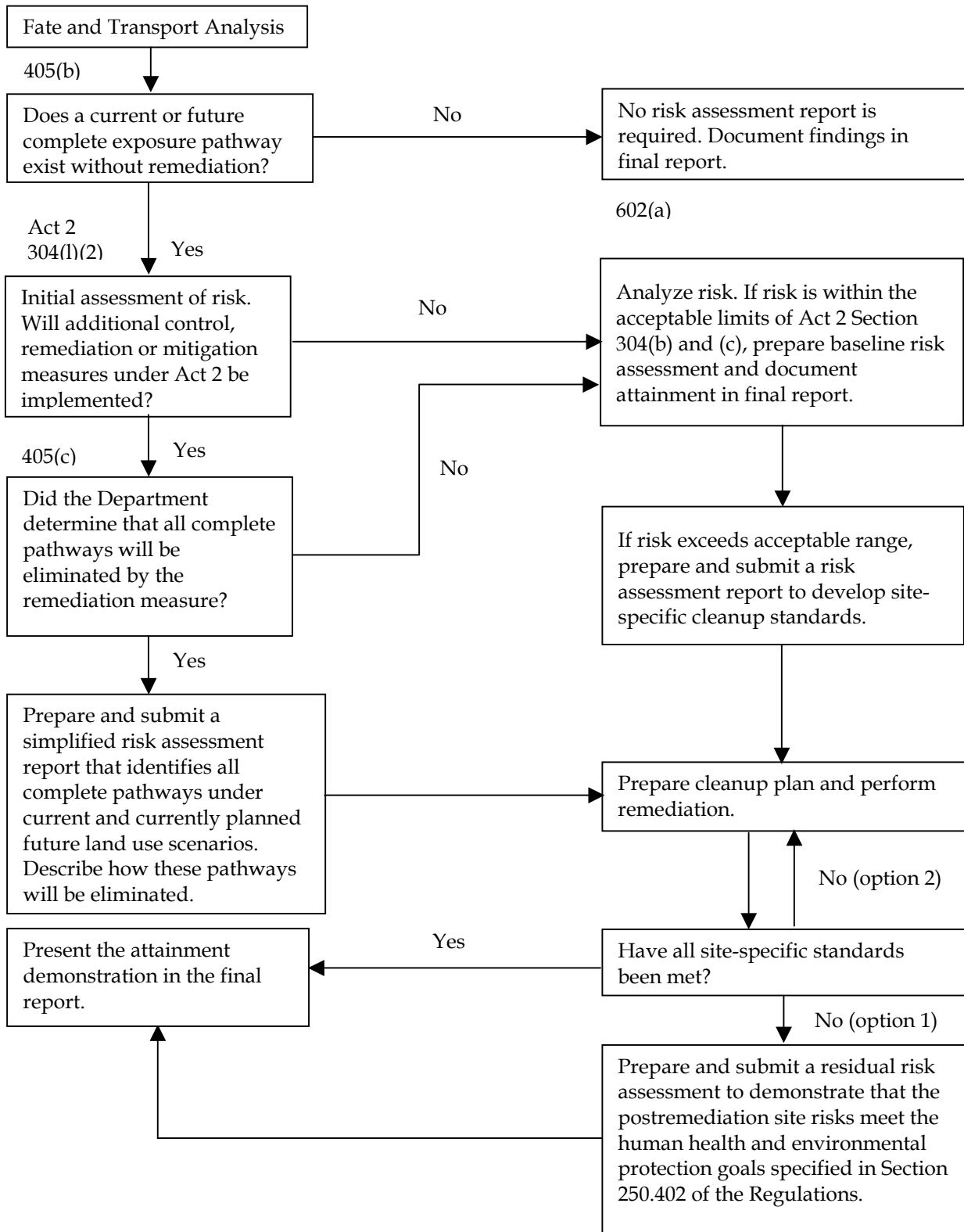
Persons utilizing the site-specific standards must comply with the applicable deed acknowledgment requirements under the SWMA or HSCA [[Section 304 \(m\)](#)], notice and review [[Section 304 \(n\)](#)], and community involvement requirements [[Section 304 \(o\)](#)] of Act 2.

The site-specific standard is a risk management approach. It offers more flexibility to the person than background or Statewide health standards because detailed site-specific information is collected for the evaluation. The guidance contained in [Section I.D.7](#) of this manual provides a structure and process for this data collection or remedial investigation. The additional information does involve more time and effort to collect and additional reviews are required by the Department under Act 2. This approach differs in that full and total use of the site may not be possible to the extent that specific land uses were presumed and engineering and institutional controls are used in the final remedy. The site-specific standard approach addresses future use limitations by deed notice. Also, use of the site-specific standard requires public involvement if the municipality requests to be involved in the remediation.

In determining soil and groundwater standards, consideration should be given to appropriate exposure factors to receptors based on land use of the site, the effectiveness of institutional or other controls placed on the future land use, potential pathways for human exposure, and appropriate statistical techniques.



**Figure II-11**  
**Risk Assessment Flowchart**



## 2. Process Checklist for the Site-Specific Standard

A checklist for site-specific standard is provided below and can be used to ensure administrative completeness.

- Submit [Notice of Intent to Remediate](#) for the site-specific standard to the Department. Also send a copy of the NIR to the municipality, publish a summary of the notice in a newspaper of general circulation serving the area in which the site is located, and provide proof of publication to the Department. Procedures are in [Section I.D.9](#) of this manual.
- Notify the municipality, publish a notice in a local newspaper, and provide proof of publication to the Department each time a remedial investigation report, risk assessment report, cleanup plan or final report is submitted to the Department. Procedures are in [Section I.D.9](#) of this manual.
- Prepare and submit public involvement plan if requested by municipality. Procedures are in [Section I.D.9](#) of this manual.
- Begin the remedial investigation. See Sections [II.C.3](#) and [I.D.7](#) of this manual for guidance.
- As an option, begin using the [completeness list](#) (See Section V.K) to help verify that all requirements have been met.
- Prepare and submit a remedial investigation report which includes fate and transport analysis to determine if any exposure pathways exist at the site. A fee of \$250 is required. Reporting requirements are established by Sections [250.404](#) and [250.408](#) of the regulations and are described in [Section II.C.7.a](#) or [II.C.8](#) of this manual.
- Prepare and submit a risk assessment report (baseline risk assessment report and risk assessment report to develop site-specific standard) along with a fee of \$250 to the Department. A baseline risk assessment report is not required if the Department, in its remedial investigation report or cleanup plan approval, determines that a specific remediation measure that eliminates all pathways, other than a no-action remedial alternative, can be implemented to attain the site-specific standard [[Section 250.405\(c\)](#) of the regulations]. No risk assessment report is required if no present or future exposure pathways exist, as documented by a fate and transport analysis. Risk assessment requirements are established by Sections [250.402-407](#), [250.409](#) and [Subchapter F](#) of the regulations. Guidances are provided in Sections [II.C.4](#), [IV.G](#) and [IV.H](#) of this manual. Reporting requirements are described in [Section II.C.7.a](#) of this manual.
- Prepare a cleanup plan. A cleanup plan is not required if no present or future exposure pathways exist. The cleanup plan is also not required if the approved baseline risk assessment report indicates that the site does not pose unacceptable risks to human health and the environment under current and planned future conditions. Cleanup plan requirements are established by

[Sections 304\(j\)](#) and [304\(l\)\(3\)](#) of the Act and [Section 250.410](#) of the regulations. Guidance on the cleanup plan is provided in [Section II.C.5](#) of this manual.

- Submit the cleanup plan, if required, and a fee of \$250.
- Remediate the site to the site-specific standard in accordance with the approved cleanup plan. No remedy is required if no present or future exposure pathways exist.
- Establish attainment of the site-specific standard in accordance with the requirements in [Subchapter C](#) of the regulations. Guidances are provided in Sections [II.C.6](#) and [IV.B](#) of this manual.
- Calculate the mass of contaminants remediated using the procedure in [Section IV.C](#) of this manual.
- Complete the [Final Report Summary](#) online.
- Submit final report, along with the optional [completeness list](#) (if used), and a fee of \$500 to the Department. Include information in [Sections 250.411](#) and [250.204\(f\)\(1\)-\(5\)](#) of the regulations. Include postremediation care plan in accordance with [Section 250.204\(g\)](#) as appropriate. Document cooperation of third parties where access is needed for remediation or monitoring. Reporting requirements for the final report are described in [Section II.C.7.d](#) of this manual.
- Upon the Department's approval of the final report demonstrating compliance with substantive and procedural requirements of the site-specific standard, the site is automatically afforded the liability protection as outlined in Chapter 5 of Act 2.
- If engineering controls are used and postremediation care is needed to maintain the standard, if fate and transport analysis indicates standard may be exceeded at the point of compliance in the future, if remediation relies on natural attenuation, or if mitigation measures are implemented in accordance with [Section 250.311\(f\)](#), continue with the postremediation care program detailed in the final report. If areas of the source property were shown to have no current or probable future complete exposure pathway, the postremediation controls described in [Section II.C.9](#) are needed.
- When the site-specific standard can be maintained without engineering controls operating and mitigation measures have been successfully sustained, document this to the Department and receive approval to end the postremediation care program.

### **3. Site Investigation**

The principal objectives of an investigation under the site-specific standard are to characterize the nature, extent, direction, volume and composition of regulated substances that have been released, and to obtain detailed site information, including identification of exposure pathways, in order to develop a protective cleanup standard unique to that site.

Important tasks during the site investigation include site characterization, ecological screening, and pathway identification. The development of a site conceptual model and identification of contaminants of concern are also important steps in the site investigation process. This section provides specific information and procedures regarding site characterization, ecological screening, and pathway identification. At the conclusion of the site investigation, a remedial investigation report should be submitted to the Department for review and approval [Act 2, [Section 304\(l\)\(1\)](#)]. [Section II.C.7.a](#) of this manual describes specific information required to be included in the remedial investigation report.

#### **a) Site Characterization**

The site characterization must be conducted in accordance with scientifically recognized principles, standards, and procedures. The level of detail in the investigation and the methods selected shall sufficiently characterize the nature, present and future extent, direction, volume, and composition of regulated substances that have been released. The determination of the site conditions will be used to select the remedy alternative used to clean up the site. All interpretations of geologic and hydrogeologic data shall be prepared by a professional geologist licensed in Pennsylvania.

Methodologies presented in [Section I.D.7](#) of this manual should be followed while conducting the site investigation. When evaluating the nonpoint source groundwater discharge to surface water, a person may consult EPA guidances in "A Review of Methods for Assessing Nonpoint Source Contaminated Groundwater Discharge to Surface Water, EPA 570/9-91-010, April 1991," and "Handbook: Stream Sampling for Waste Load Allocation Application. EPA/625/6-80/013." [Section IV.A.3](#) of this manual provides guidance to evaluate impacts on surface water from diffuse flow of contaminated groundwater.

As directed from specific knowledge of the subject property, historic use of the subject property, or chemical usage information regarding the subject property, and based upon the guidance in [Section I.D.7](#) of this manual, an appropriate number of sample locations should be investigated from the identified media of concern in order to characterize the nature and composition of the contaminants, including the characterization of the source of the regulated substances and development of a conceptual site model, the vertical and horizontal extent of contamination with each medium of concern, the direction, rate, extent and fate of contaminant movement within each medium of concern, and to identify the appropriate remedial technology options for each medium of concern.

When determining the relative location of soil or groundwater samples necessary to characterize the horizontal and vertical extent of contamination, factors such as hydraulic conductivity of the soils, heterogeneity of the soils, and the nature of the contaminants should be considered.

If groundwater is determined to be a medium of concern, adequate characterization of the effects of a release on groundwater will require a hydrogeologic study to determine how naturally occurring physical and

geochemical characteristics define the hydrostratigraphy (position of aquifers, aquitards, and aquicludes) where appropriate, an assessment of the homogeneity and isotropy of aquifer materials based on hydraulic conductivity values (measured or published), and an assessment of local and regional groundwater flow directions and any influence from pumping centers. Characterizing the horizontal extent of contamination of regulated substance(s) will be defined by a minimum of two rounds of groundwater sampling from properly constructed and developed monitoring wells. The initial sampling event should be conducted no less than fourteen days from the date of the most recent well development, or a shorter time frame is permissible if it is demonstrated that, through development, pH and conductivity of the groundwater has stabilized. The second and subsequent sampling events should occur no less than fourteen days from the preceding sampling event. When characterizing the vertical extent of groundwater contamination, consider the specific gravity of the regulated substances identified in the site's groundwater, and the potential for naturally occurring or induced downward vertical hydraulic gradients. If characterizing the vertical extent of groundwater contamination is necessary, properly constructed monitoring wells or nested monitoring wells should be utilized to focus groundwater sampling in zones of potential contaminant accumulation (*i.e.*, directly above a confining layer).

The determination of the use of groundwater is also an important task of site characterization. The uses of groundwater may include drinking water use, agricultural use, industrial uses, etc. As mandated by Act 2, groundwater will not be considered a current or potential source of drinking water where groundwater has a background total dissolved solid concentration greater than 2,500 milligrams per liter. Other than that mandate, current and probable future uses of groundwater must be determined on a site-specific basis. Current drinking water or agricultural uses of groundwater, at the time contamination was discovered, should be identified for protection. Additional requirements on the determination of the use of groundwater is in [Section 250.403](#) of the regulations.

Development of a site conceptual model is an important step in identifying additional data needs in site characterization and in defining exposure. A site conceptual model identifies all potential or suspected sources of contamination, types and concentrations of contaminants detected at the site, potentially contaminated media, potential exposure pathways, and receptors. Many components of exposure (such as the source, receptors, migration pathways, and routes of exposure) are determined on a site-specific basis. The site conceptual model provides a systematic way to identify and summarize this information to ensure that potential exposures at the site are accounted for accurately.

The conceptual model may be graphical, tabular or narrative but should provide an accurate understanding of complete exposure pathways for the site. Examples of site conceptual models may be found in EPA or ASTM guidance documents, including Section 4.2 of *U.S. EPA Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (RAGS/HHEM), Part A*, *ASTM E-1739 RBCA, Tier 2 Guidance Manual*, and *ASTM E1689-95, Standard Guide for Developing*

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## SECTION II - REMEDIATION STANDARDS

### C. Site-Specific Standard

*Conceptual Site Models for Contaminated Sites.* It is suggested that the development of the site conceptual model be coordinated with the regulatory risk manager to ensure that potential pathways are adequately and appropriately addressed prior to performing the assessment.

#### **b) Preliminary Ecological Screening**

To ensure that any substantial present or probable future risk to the environment is eliminated, both human health and ecological risk evaluations are necessary. The objective of the Preliminary Ecological Screening is to quickly evaluate whether surface soil or sediments at a site have the potential to pose significant ecological impact or impacts requiring further evaluation. The site-specific initial screening procedure described in [Section IV.H](#) of this manual may be used during or immediately after the site characterization process to assess the potential for significant ecological impact. It should be noted that the ecological screening procedures under the Statewide health standard (in [Section II.B.5](#) of this manual) should not be used to replace the site-specific initial screen procedure (Steps 1-2 in [Section IV.H](#) of this manual) when the site-specific standard is selected to protect human health and the environment. This is because the assumption to use the ecological screening procedures under the Statewide health standard is that the site has met Statewide health standards to protect human health. This underlying assumption cannot be made when the site-specific standard is selected to protect human health.

For sites that have met Statewide health standards to protect human health, but fail the ecological screening procedure under the Statewide health standard (in [Section II.B.5](#) of this manual), and the remediator has elected to conduct a formal site-specific ecological risk assessment, the site-specific initial screen (Steps 1-2 in [Section IV.H](#) of this manual) can be ignored, because the site is beyond the decision point whether the site has the potential to pose significant ecological impact or not.

When conducting an ecological screening under the site-specific standard, the following should be performed:

- an ecological risk assessment to determine if an impact has occurred or will occur if the release of a regulated substance goes unabated;
- an ecological risk assessment conducted in accordance with Department-approved EPA or ASTM guidance to establish acceptable remediation levels or alternative remedies based on current and future use that are protective of ecological receptors;
- implementation of the selected remedy, which may include mitigation measures under [Section 250.311\(f\)](#), that is protective of ecological receptors.

The results of the ecological screening should be provided in the remedial investigation report rather than in the final report when a person selects to comply with site-specific standards.

#### **c) Pathway Identification ([Section 250.404](#) of the Regulations)**



Once the development of the site conceptual model is completed, current and future exposure pathways should be identified based on this site conceptual model. An exposure pathway describes the course a chemical or physical agent takes from the source to the exposed receptor. An exposure pathway analysis links the sources, locations, and types of environmental releases with population locations and activity patterns to determine the significant pathways of exposure.

A potentially complete exposure pathway generally consists of four elements:

- a source and mechanism of chemical release,
- a retention or transport medium (or media in cases involving media transfer of chemicals),
- a point of potential receptor contact with the contaminated medium (the exposure point), and
- an exposure route (*e.g.*, ingestion) at the exposure point.

The person should consult the most recent U.S. EPA or ASTM guidances to identify any potential current and future exposure pathways for both human receptors and environmental receptors. The pathway identification should take into account current pathways and the effects of engineering and institutional controls. Future exposure pathways should be based on currently planned future land use. Guidance on land use considerations can be found in the USEPA OSWER Directive: *Land Use in The CERCLA Remedy Selection Process*. DEP guidance entitled *Site-Specific Human Health Risk Assessment Procedures* in Section IV.G of this manual provides more information on pathway identification for human exposure. Guidance such as described in Sections 6.2 and 6.3 (relating to characterization of exposure setting and relating to identification of exposure pathways) of *U.S. EPA's Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (RAGS/HHEM), Part A*, provides a framework for pathway identification for human exposure. Subsection 6.3.2 of RAGS/HHEM, Part A particularly provides guidances to perform fate and transport analysis.

If no complete present or future exposure pathways exist, a risk assessment report and cleanup plan are not required and no remedy is required to be proposed or completed [Act 2, [Section 304\(l\)\(1\)\(v\)](#)]. When no complete present or future exposure pathways exist, a person only needs to follow the streamlined reporting requirements in [Section II.C.8](#) of this manual instead of the reporting requirements in [Section II.C.7](#) of this manual.

The following is an example of no existence of complete exposure pathways: Contaminated soil is only detected beneath the concrete slab floor of an industrial building and the concrete slab is free from any contamination. The contaminant has very low mobility (low solubility in water, and is not volatile). The groundwater table is at a good distance from the contaminated soil and is not contaminated. In this case, the exposure to contaminated soil through direct contact, such as ingestion of soils, is very unlikely if a deed restriction regarding the contaminated soil is in place and the concrete cap is maintained. The low

mobility of the contaminant and distance of contaminated soils from the groundwater table also make the contamination of groundwater unlikely. No groundwater exposure, such as ingestion of contaminated groundwater is expected. The nonvolatile characteristic of the contaminant and the absence of contaminated surface soil will also rule out inhalation pathways.

Prior to the identification of exposure routes, a person must identify sources and receiving media, evaluate fate and transport in release media, and identify exposure points. The following exposure scenarios contain examples of what should be considered:

#### **i) Groundwater**

The person shall identify routes of exposure for groundwater such as human exposure to groundwater by ingestion, human inhalation of regulated substances from volatilization and migration of these substances into buildings or other areas where humans could be exposed or through indoor use of groundwater, human ingestion of regulated substances in surface water, or other site-specific surface water exposure pathways with respect to groundwater discharges or releases to surface water, human inhalation of regulated substances in air, such as via the use of industrial process water or via volatilization, or other site-specific air exposure pathways with respect to releases of regulated substances from groundwater to air. The person should consider effects of discharge of groundwater into surface water and the effects on ecological receptors.

With respect to the groundwater ingestion pathway, the following guidance is provided. When determining whether groundwater on or off the source property must be protected under the site-specific standard for drinking water uses, the following will be applied [from Act 2, [Section 304 \(d\)](#)]:

- The *current and probable* future use of groundwater shall be identified and protected. Groundwater that has a background total dissolved solids content greater than 2,500 milligrams per liter or is not capable of transmitting water to a pumping well in usable and sustainable quantities shall not be considered a current or potential source of drinking water.
- Site-specific sources of contaminants and potential receptors shall be identified.
- Natural environmental conditions affecting the fate and transport of contaminants, such as natural attenuation, shall be determined by appropriate scientific methods."

And from [Section 250.403](#) the following apply:

- Groundwater will not be considered a current or potential source of drinking water where groundwater has a background total dissolved solids concentration greater than 2,500 milligrams per liter.



- Except for groundwater excluded by the total dissolved solids limitation described above, current and probable future use of groundwater *shall be determined on a site-specific basis*.
- Drinking water use of groundwater shall be made suitable by at least meeting the primary and secondary MCLs at all points of exposure identified in [250.404](#) (relating to pathway identification and elimination).
- Current drinking water or agricultural uses of groundwater, *at the time contamination was discovered*, shall be protected.” [emphasis added]

In the example of contamination within a city with an established public water system and groundwater contamination which extends off-property, the complete exposure pathways will depend on volatilization potential of contamination to receptors, and the current use or “probability” that future groundwater ingestion may occur. If surrounding properties are developed and have public water service, then it may be assumed that the probability is that those established patterns of water use would continue into the future. Therefore, there are no current or probable future uses of groundwater as a drinking water source and the groundwater ingestion pathway may (all other information supporting) be determined to be incomplete.

Note however, that even in cases where the groundwater ingestion pathway is determined to be incomplete, the final report must include one or a combination of institutional controls or postremedial measures which provide assurance that the status of no complete groundwater ingestion pathway continues to exist in the future. See [Section II.C.9](#) under the site-specific standard for the range of institutional controls or post remedial measures available to a remediator. If a complete groundwater ingestion pathway is found to exist in the future, then the responsible person must demonstrate attainment of one of the three Act 2 standards.

## ii) Soil

The person shall consider current and probable future exposure scenarios, such as human ingestion of soil when direct contact exposure to the soil may reasonably occur, exposure to groundwater by ingestion with respect to leaching of regulated substances from soils to aquifer groundwater, human inhalation of regulated substances from volatilization and migration of these substances into buildings or other areas where humans could be exposed, 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, 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. When evaluating the indoor exposure pathways, a person needs to address impacts of volatile organic compounds from soil and groundwater, not extraneous sources.

**iii) Cases where there is no current groundwater ingestion route, but there is probable future exposure.**

An example of this situation would be where an open field is adjacent to the source property with no current users of groundwater. In general the Department will take the cautious position that undeveloped property has probable future exposure, since future development may include onsite groundwater use. Cases of probable future exposure would require actions to eliminate this probable exposure. A municipal ordinance prohibiting groundwater use would be one method of eliminating the pathway.

**iv) Cases where no complete current or future exposure pathway exists**

If, after completing the site characterization including exposure pathway identification described above, no current or probable future complete exposure pathways exist without remediation, then no risk assessment report is required. Findings of no complete exposure pathway should be documented in the final report. When approved, the final report documents that the site meets the site-specific standard including meeting the allowable risk specified by Act 2, [Sections 304 \(b\) and \(c\)](#). Therefore no specific numeric concentration value (standard) is applied to the site.

In the specific and common case where no pathways exist because water users are being served by a public water system, then the final report must include one or a combination of institutional controls or post remedial measures which provide assurance that the status of no complete pathways continues to exist in the future. See [Section II.C.9](#) for the range of measures available to a remediator.

**v) Cases where complete pathways exist but the risk is within the allowable range**

Many times a pathway exposure analysis identifies complete exposure pathways, but upon analysis of the current and future risk *without remediation applied* (i.e. baseline risk assessment), it is found that the risk is below what is allowable by Act 2 and no remediation is required [[Section 250.602\(a\)](#)]. If this is the case, the remediator should prepare and submit a baseline risk assessment report documenting the current and future risk *without remediation applied* being within the allowable levels as per [Act 2, Section 304](#). When approved, the final report documents that the site meets the site-specific standard including meeting the allowable risk specified by [Act 2, Sections 304 \(b\) and \(c\)](#). Therefore no specific numeric concentration value (standard) is applied to the site.

If part of the exposure analysis found that some pathways were not complete because water users are being served by a public water system, then the final report must include one or a combination of institutional controls or post remedial measures which provide assurance that the status of no complete

pathways continues to exist in the future. See [Section II.C.9](#) for the range of measures available to a remediator.

In cases where the baseline risk assessment indicates that there are no unacceptable non-cancer hazards from systemic toxicants, and that the cumulative excess lifetime cancer risk is less than 1 in 10,000, the remediator may substitute the values that were used to demonstrate that the risk is within the statutory range [established by [Section 304\(b\) and \(c\)](#)], without performing a new calculation of a site-specific cleanup level. The person must also conduct a separate analysis of risk to ecological receptors.

#### **4. Risk Assessment and Development of Site-Specific Standards**

This section provides general information on risk assessment, developing site-specific standards and pathway elimination. Sections [IV.G](#) and [H](#) of this manual provide guidance on site-specific human health and ecological risk assessment procedures. This guidance should be followed to conduct a baseline risk assessment or to develop site-specific standards. During the development of site-specific cleanup levels with emphasis on the cumulative risks, a person should consider PQLs to ensure that the cleanup levels developed can be quantified.

Any person selecting the site-specific standard established by [Section 304](#) of Act 2 should submit a risk assessment report to the Department for review and approval unless no present or future complete exposure pathways exist as demonstrated by a fate and transport analysis. If no such complete exposure pathways exist, a person only needs to follow a streamlined reporting requirements in [Section II.C.8](#) of this manual instead of the reporting requirements in [Section II.C.7](#) of this manual. If complete exposure pathways exist, the fate and transport analysis, which is a part of the exposure assessment, should be documented in the risk assessment report.

Although it might be helpful in some cases to establish the leaching potential of constituents in soil, passing the TCLP does not automatically indicate attainment of the site-specific standard. The TCLP is used for RCRA hazardous waste determinations. The risk associated with the regulated substances is considered in the site-specific risk assessment under Act 2.

To determine if a site-specific risk assessment is necessary, a site conceptual model should be developed that defines potential exposure scenarios and pathways. The exposure scenario (*e.g.*, residential, industrial, recreational), which will define the exposure pathways, must be based on site-specific land use considerations. The pathways, which describe the mechanism by which receptors may be exposed to a source, are also site-specific. Engineering or institutional controls that are to be implemented which will eliminate exposure pathways must be incorporated into the conceptual model. Then, a risk assessment only needs to be performed if complete exposure pathways for humans and/or ecological receptors exist under current or future planned conditions.

A complete exposure pathway exists if there is a receptor to be exposed through an exposure route. For ecological receptors, a pathway is complete even if the current ecological receptors are not present as a result of the contamination. A pathway is not complete if there is no reasonable route; *i.e.*, the contaminant is not in an available form to affect the receptors.

However, before getting into the mechanics of performing the risk assessment, it is important to clearly define the problem that is to be addressed, the objectives of the study and how the results will be used to meet these objectives. This initial step is critical to ensure a successful outcome (accurate, protective, timely, cost-effective evaluation) and that the level of effort is commensurate with the scope of the problem.

Under Act 2, a risk assessment report may include the following:

- a baseline risk assessment report that describes the potential adverse effects, including the evaluation of ecological receptors, under both current and planned future conditions caused by the presence of regulated substances in the absence of any further control, remediation or mitigation measures;
- a risk assessment report that documents which exposure pathways will be eliminated by a pathway elimination measure so that any substantial present or probable future risk to human health or the environment is eliminated;
- a risk assessment report that describes the methods used to develop a concentration level at which human health and the environment are protected; and
- the comments obtained as a result of a public comment period, if any, and the responses to those public comments.

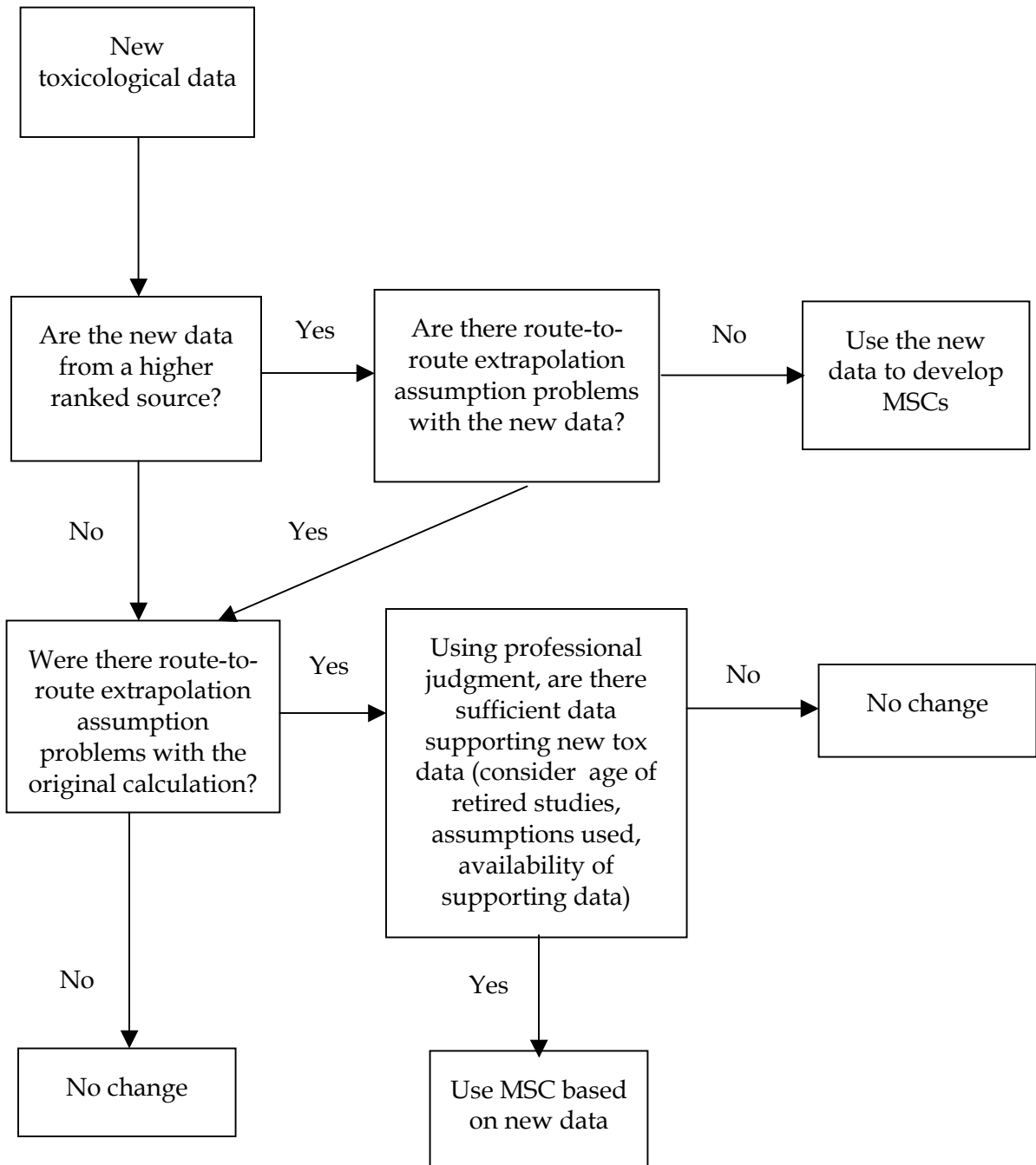
If an unacceptable risk is identified at a site, a person may develop site-specific standards based on a site-specific risk assessment. A baseline risk assessment report is not required if the Department, in its remedial investigation report or cleanup plan approval, determines that a specific remediation measure, other than a no-action remedial alternative, can be implemented to attain the site-specific standard [[Act 2, Section 304\(1\)\(2\)](#) and [Section 250.405\(c\)](#) of the regulations ]. A baseline risk assessment is that portion of a risk assessment that evaluates a risk in the absence of the proposed site-specific measure.

In developing site-specific standards, a person may either use the toxicological data presented in Appendix A, Tables [5a](#) and [5b](#) of Chapter 250, or the procedure used by the Department to evaluate changes in those toxicity values based upon new or more appropriate information. The procedure for assessing the appropriateness of new or revised toxicity data is illustrated on [Figure II-12](#) and explained below.

When new toxicological data are available for any regulated substance, the first decision is whether the new source is from a "higher" ranked data source (according to [Section 250.605](#)). If yes, then a determination is made as to whether the new value is based on route-to-route extrapolation assumptions which are inappropriate. (e.g., port of entry effects). If appropriate, the new value is used. If

not appropriate, or if the first decision point was answered "no", then a determination is made as to whether the original toxicity calculation was based on inappropriate route-to-route extrapolation assumptions, and if not then there would be no change in the toxicity value for that regulated substance. If this second determination finds that an inappropriate assumption was used, then professional judgment (by a person trained and experienced in the field of toxicology) is used to consider the change. Professional judgments would include consideration of the assumptions and the age of any retired study (e.g., retired NCEA provisional values). In cases where no data are available supporting the new toxicological value, no change would be proposed for use under Chapter 250.

**Figure II-12**  
**Process for Evaluating New Toxicological Data**



As an alternative to developing site-specific numerical cleanup standards and remediation, individuals may choose to perform a combination of engineering and institutional controls to achieve pathway elimination for regulated substances of concern. Common methodologies used to eliminate exposure pathways include permanent capping of non-volatile contaminated soils with parking lots or building slab construction, deed restrictions, slurry or cutoff walls, or liner systems.

Use of pathway elimination may require interface with the Solid Waste Management Act (see [Section III.A](#)), particularly for offsite removal of contaminated media or management of existing waste onsite.

To prepare the development of the site-specific standards risk assessment report, all current and probable future complete exposure pathways as identified in the fate and transport analysis should be addressed. When pathway elimination measures are planned and preapproved, the remaining pathways and the eliminated pathways under the post-remedial conditions should be identified in the site-specific standard risk assessment report. Site-specific cleanup levels should be developed to address the risks associated with these remaining pathways. Where all pathways have not been eliminated, a risk assessment report is required.

In addition to human health protection, the risk assessment must evaluate ecological receptors. An ecological risk assessment should be conducted with considerations of the site-specific ecological risk assessment procedure provided in Section IV.H of this manual and the most recent U.S. EPA or ASTM guidances, including those listed in [Table II-4](#), to determine whether an impact has occurred or will occur if a release goes unabated, to establish acceptable remediation levels or alternative remedies based on current or intended future land use that are protective of the ecological receptors.

Ecological receptors include:

- individuals of threatened or endangered species as designated by the U.S. Fish and Wildlife Service under the Endangered Species Act;
- exceptional value wetlands as defined in [25 Pa. Code Section 105.17](#) (relating to wetlands);
- habitats of concern as defined in [Section 250.1](#) of the regulations; and
- species of concern as identified in [Section V.G](#) of this manual.

At the conclusion of the risk assessment, a risk assessment report should be submitted to the Department for review and approval. [Section II.C.7.b](#) of this manual describes specific information required to be included in the risk assessment report.

## Table II-4

### List of Ecological Risk Assessment Guidances

U.S. EPA. 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. EPA/540-R-97-006. PB97-963211. June 16, 1997.

U.S. EPA. 1989. Ecological Assessment of Hazardous Waste Sites: A Field and Laboratory Reference Document. EPA/600/3-89/013. PB89205967. March, 1989.

U.S. EPA. 1993a. Wildlife Exposure Factors Handbook, Volume I of II. EPA/600/R-93/187a. PB94-174778. December, 1993.

U.S. EPA. 1993b. Wildlife Exposure Factors Handbook, Volume II of II, Appendix: Literature Review Database. EPA/600/R-93/187b. PB94-177789. December, 1993.

U.S. EPA. 1992. Guidelines for Exposure Assessment; 57 FR, 22888-22938, May 29, 1992

ASTM, E 1739, Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites.



## 5. Cleanup Plan

[Section II.C.7.c](#) of this manual describes specific information required to be included in the cleanup plan. A cleanup plan is not required and no remedy is required to be proposed or completed if neither current nor future exposure pathways exist. The future exposure pathways should be based on currently planned future land use. Subject to the Department's approval of the baseline risk assessment report, a cleanup plan is also not required if the baseline risk assessment indicates the site is within the human health and environmental protection goals specified in [Section 250.402](#) of the regulations under both current and currently planned future site conditions. After the site has been characterized using the suggested guidelines (or some equivalent technique) and a risk assessment performed using equivalent or recommended guidelines to develop site-specific standards for soil and groundwater, a remediation (cleanup) plan should be developed, which consists of identification and evaluation of remedial alternatives, including risk assessment of the selected remedy, selection of a proposed remedy, and plans for the development, construction, and initial operation of the proposed remedy. A number of factors required by Act 2 for consideration in selecting the remedy are set forth in [Section 304 \(j\)](#) of Act 2. As described in [Section 304 \(i\)](#) of Act 2, remediation to site-specific standards may include treatment, removal, engineering or institutional controls and may include innovative or other demonstrated measures. However, institutional controls such as fences, warning signs or future land use restriction may not be the sole remedy unless based upon exposure scenarios applicable at the time the contamination was discovered.

To evaluate the short-term and long-term effectiveness of a remedial alternative, the potential risk associated with implementation of the alternative and the risk associated with exposure to the remediated media must be evaluated. The algorithms that were defined in the exposure assessment should be used to characterize these potential risks.

The risk characterization associated with short-term effectiveness considers the exposure of workers at the site and exposure of receptors in the vicinity surrounding the site to migrating media during the implementation of the remedial alternative. A comparison of a focused list of remedial alternatives may help predict the risks associated with the implementation of the remedial alternative or whether the implementation of alternatives may have any significant impact to human health and the environment.

The risk characterization associated with long-term effectiveness evaluates whether the remedial alternative may attain the remedial objectives (site-specific standards) and whether postremedial risks may achieve the acceptable levels of risk. There may be times when a specific cleanup goal for one constituent may not be attained, but the overall postremedial risk may be within acceptable levels. Evaluation of the postremedial risk is based on a prediction of what the postremedial exposure concentration would be. For example, a cap would eliminate exposure to surface soils, thus rendering the risk to surface soils to be negligible. If bioremediation is considered, the remedial objective would be the

concentration that provides the basis for characterization of the postremedial risk. If the calculated postremedial risk is within the acceptable range, the remedial alternative would be considered a viable solution.

A person evaluating long-term and short-term risks of remedial alternatives should consider *EPA's Risk Assessment Guidance for Superfund (RAGS)*, Volume 1, Part C, Chapter 2 for additional guidance. It should be noted that a quantitative risk assessment of remedial alternatives will not need to be conducted for all sites. In most cases, a qualitative rather than a detailed quantitative evaluation of both long-term and short-term risks is all that is needed to select the most appropriate alternative. However, the Department may require a quantitative risk assessment of the selected remedy if a quantitative risk assessment is needed to select the most appropriate remedy or a perceived risk of a selected remedy is high. No matter whether the risk evaluation is qualitative or quantitative, the cleanup plan should always discuss the degree of uncertainty associated with the risk assessment of the selected remedy.

Where there are imminent or immediate threats to human health or the environment, such as waste releasing from corroding tanks or drums, mitigating measures should be undertaken to prevent releases and further exposure as soon as these threats are identified.

The cleanup plan must document the evaluation of the factors listed in Section 304(j) of Act 2. The Department will review the alternative evaluated, the evaluation of the selected remedy in terms of the [Section 304\(j\)](#) criteria, public comments and response of the responsible person to the comments in the cleanup plan. The Section 304(j) criteria address a few general areas, such as the effectiveness of the remedy (long/short term) to manage risk; the extent to which the risks are being reduced; the ability to implement the remedy; reduction of toxicity, mobility, or volume of regulated substances; reliability and postremediation care; and cost-benefit considerations.

The Department may require further evaluation of the selected remedy or of one or more alternative remedies on its own analysis of 304(j) factors in Act 2 or in response to comments received from the community surrounding the site as a result of the implementation of the community involvement plan or as a result of the Department's review of the cleanup plan. Persons shall submit to the Department, upon request, such additional information as may reasonably be required to complete the evaluation.

## **6. Remediation and Demonstration of Attainment**

Remediation to the site-specific standards should be implemented in accordance with the approved cleanup plan.

The point of compliance for demonstration of the attainment of site-specific standards is described in [Section 250.407](#) of the regulations. Site-specific standards shall be attained at and beyond the point of compliance, where the plume has migrated beyond the property boundary. For groundwater, the point of compliance is the property boundary that existed at the time the

contamination was discovered. The remediator may request the movement of the point of compliance in certain circumstances described in [Section 250.407\(a\)](#). If any of those conditions exist, the remediator must request in writing prior to or at the time of submission of the cleanup plan to move the point of compliance. The Department will respond in writing to the request. The written approval must be obtained before using the adjusted point of compliance.

Except if an NPDES permit is required for purposes of complying with surface water quality in a spring, the point of compliance is the point of first designated or existing use as defined in 25 Pa Code [93.1](#), [93.4](#), and [93.9](#). This could mean right by the spring itself or some point downstream from the spring discharge. Determining the point of first designated use is required because it establishes the point where Chapter 93 water quality standards apply.

Technical guidance to determine point of first use is found in [Implementation Guidance for Evaluating Wastewater Discharges to Drainage Ditches and Swales, revised August, 1997](#). In essence this guidance relies on biological techniques to determine the first downstream point where aquatic life can be documented. It applies to both perennial and intermittent streams with definable bed and banks, but not to ephemeral streams, that is, areas of overland runoff which occur only during or immediately following rainfall events and where there is no defined stream channel and stream substrate.

The site characterization will be the basis on which the vertical and horizontal extent of contamination above the standard is determined. Once this volume of the site is determined and remediation, if necessary, has been performed, then attainment of the standard will focus on the environmental media contained within that volume of the site. Where multiple releases occur on a property which produce distinctly separate zones of contamination, the characterization and subsequent attainment demonstrations will apply individually to the separate releases.

The three methods to demonstrate that the site-specific standard has been met are pathway elimination using an engineering/geologic evaluation, the 95% upper confidence limit of the arithmetic mean or other appropriate statistical methods to show that the site meets numerical site-specific standards, and a residual risk assessment following implementation of the remedy to demonstrate that the risk associated with the site following remediation falls within the allowable risk range in Act 2. The residual risk assessment will be based on resampling and a reassessment of the cumulative risks associated with concentrations occurring following remediation.

In demonstrating attainment of the site-specific standard, concentrations of regulated substances are not required to be less than the limit related to the Practical Quantitation Limit (PQL) for that substance as provided for in [Section 250.701\(c\)](#), and as listed in [Section IV.F](#) of this manual.

In demonstrating attainment of the site-specific standard, the removal of separate phase liquids is not required if attainment can be demonstrated in accordance with the requirements of [Section 250.702\(b\)\(3\)](#) of the regulations.

If the site-specific standard is numerically less than the background standard, the remediator may select the background standard, and attainment of the background standard should be demonstrated according to [Section 303](#) of Act 2.

To ensure that contaminant concentration at the point of compliance will not exceed the selected standard in the future, a statistical time trend analysis, knowledge of the plume stability, or other acceptable method must be provided in the final report to the Department for review and approval.

Guidance on applying statistical methods to demonstrate attainment can be found in [Section IV.B.](#) of this manual. A person should consider the general guidelines of risk assessment in Sections [IV.G](#) and [IV.H](#) of this manual to perform the residual risk assessment. When submitting the final report, a person should ensure that the items identified in [Section II.C.7.d](#) of this manual are included.

## **7. Reporting Requirements for the Site-Specific Standard**

The remedial investigation report, risk assessment report, cleanup plan, and final report detailed below are not to be submitted to the Department until the 30-day public and municipal comment period has expired.

### **a) Remedial Investigation Report ([Section 250.408](#) of the Regulations)**

The site characterization shall be conducted in accordance with scientifically recognized principles, standards and procedures. The level of detail in the investigation and the selected methods and analyses, that may include models, shall sufficiently define the rate of movement and the present and future extent and fate of contaminants, to ensure continued attainment of the remediation standard. All interpretations of geologic and hydrogeologic data shall be prepared by a professional geologist licensed in Pennsylvania. A suggested outline for a remedial investigation report is provided in [Table II-5](#). The remedial investigation report should include the following information:

#### **i) Summary**

Provide a summary paragraph(s) which will provide the reviewer with an overview of the site. This will serve to highlight the important issues and conclusion which will be presented in the report.

#### **ii) Site description**

Provide a description of the site in sufficient detail as to give the reviewer an idea of the site location, and the types of operations that are currently and/or were formerly conducted on the site. As appropriate to the site, the description should include location, physical description of the property, ownership history, site use history, and regulatory action history (past cleanups).

TABLE II-5

**Suggested Outline for Remedial Investigation Report under the Site-Specific Standard**

- I. Summary**  
([Section II.C.7.a.i](#))
- II. Site Description**  
Provide a description of the site in sufficient detail to give an overall view of the site. ([Section II.C.7.a.ii](#))
- III. Site Characterization**  
Document current conditions at the site. ([Sections II.C.7.a.iii-v](#))
- IV. Fate and Transport Analysis**  
Description of Fate and Transport analyses used and results and conclusions. ([Sections II.C.7.a.vi](#) and IV.A)
- V. Other Information Required under the Site-Specific Standard**  
Provide the results of ecological receptor evaluation. Describe the public benefits of the use or reuse of the property. Identify complete exposure pathways. ([Section II.C.7.a.vi](#))
- VI. Conclusions and Recommendations**  
Draw conclusions regarding the existence of exposure pathways and the potential effectiveness of institutional or engineering controls for pathway elimination. Identify the appropriate remedial technology options. ([Section II.C.7.a.vii](#))
- VII. References**
- VIII. Attachments**  
([Section II.C.7.a.viii](#))
- IX. Public Comments**  
Include the comments obtained as a result of a public involvement plan, if any, and the responses to those public comments. ([Section II.C.7.a.viii](#))
- X. Signatures**  
([Section II.C.7.a.ix](#))

### **iii) Site characterization**

The site characterization provides important information documenting the current conditions at the site. Information developed during the site characterization is primarily intended to describe the nature, concentrations, extent, and potential for movement of all contaminants present on the site, or that may have migrated from the site. For sites where there are multiple distinct areas of contamination, the site characterization process should be applied to each area individually.

### **iv) Source and identification of constituents of concern.**

For the area being investigated, include description of source characterization which may be in the form of a conceptual site model.

### **v) Nature and extent of contamination**

Information needed to meet the requirements below should be included here.

For soils, include information on samples and measurements used to characterize the horizontal and vertical, present and future extent and fate of contamination and direction and rate of contaminant movement based on factors in the soil and the contaminant which affect migration. Soil and boring descriptions should be included as an attachment.

For groundwater, include information on samples and measurements used to characterize the horizontal and vertical, present and future extent and fate of contamination and direction and velocity of contaminant movement based on factors of the groundwater and the contaminant (s) which affect migration. Geologic boring descriptions and as built drawings of wells should be included as an attachment.

Text, tables, graphics, figures, maps and cross sections should be used to describe the nature, location, and composition of the regulated substances at the site. Providing the data in an appropriate format will expedite the review of the report.

### **vi) Other information required under the site specific standard**

The results of the evaluation of ecological receptors discussed in [Section II.C.3.b](#) of this manual.

Description of the existing or potential public benefits of the use or reuse of the property for employment opportunities, housing, open space, recreation or other uses. Describe the past, present, and future use of the site.

Information obtained from attempts to comply with the background or Statewide health standards, such as background concentrations for constituents of concern.

A fate and transport analysis to identify all existing and potential migration pathways, if applicable. This part of the report should document the pathway

identification process and provide justification if a pathway has been excluded and summarize pathways for current land use and any probable future land use separately.

Modeling (optional) - Data Interpretation.

- Identify any programs or modeling used to interpret site conditions or predict plume migration. Identify codes used and any modifications made.
- Models should be developed from site-specific data.
- Identify limitations/assumptions used in the model(s).
- Models should be validated to reproduce conditions measured in the field.
- Submit modeling files (input and output files).

### **vii) Conclusions and recommendations**

In addition to documenting the items listed above, the remedial investigation report should draw conclusions regarding the existence of exposure pathways and the potential effectiveness of institutional or engineering controls in eliminating some or all of these pathways. The report also should identify the appropriate remedial technology options for each medium of concern.

### **viii) Attachments**

Laboratory sheets for all data, applicable laboratory quality control results, historical sampling data results, and data eliminated from consideration based on data validation protocols. All data should be presented in tabular form.

Quality Assurance Plan

Health and Safety Plan

Sampling and Analysis Plan

Maps and cross sections used which present information on site characterization

Boring logs and as-built drawings

Proofs required, such as municipal notice, newspaper notice proof of publication.

Physical/chemical properties or toxicological/exposure factors including, but not limited to water solubility, vapor pressure, Henry's Law constant, compound density, octanol/water partition coefficient ( $K_{ow}$ ), organic carbon partitioning coefficient ( $K_{oc}$ ), and soil/water partitioning coefficient ( $K_d$ ) needed for determining performance of remedial equipment and/or fate and transport analysis

The comments obtained as a result of a public involvement plan, if any, and the responses to those public comments

**ix) Signatures:**

All those who participated in the remediation who are seeking relief from liability.

**b) Risk Assessment Report ([Section 250.409](#) of the Regulations)**

A baseline risk assessment report is not required if the Department, in its remedial investigation report or cleanup plan approval, determines that a specific remediation measure that eliminates all pathways, other than a no-action remedial alternative, can be implemented to attain the site-specific standard [[Section 250.405\(c\)](#) of the regulations ]. No risk assessment report is required if no present or future exposure pathways exist, as documented in the remedial investigation report by a fate and transport analysis.

A suggested outline for a risk assessment report is provided in [Table II-6](#). The items in the outline are suggested as minimum requirements for inclusion in the report; the order and titles are not mandatory. If a baseline risk assessment is not required and a person submits the development of site-specific standard risk assessment report as a stand-alone document, more detailed risk assessment information should be provided in the development of site-specific standard risk assessment report.



## TABLE II-6

### Suggested Outline for a Risk Assessment Report under the Site-Specific Standard

#### EXECUTIVE SUMMARY

#### PART 1 - Human Health Risk Assessment

##### I. Introduction

(See Site-Specific Human Health Risk Assessment Procedures, pages 1-2)

- Objectives of Risk Assessment
- Organization of Report

##### II. SITE Characterization

(See Site-Specific Human Health Risk Assessment Procedures, pages 2-3)

- Site history (brief)
- Site location/map
- Description of sources
- Nature and extent of contamination
- Identification of constituents of concern
- Site conceptual model

##### III. Exposure Assessment

(See Site-Specific Human Health Risk Assessment Procedures, pages 3-8)

- Exposure scenarios based on land use (current and future)
- Potential receptors based on land use (current and future)
- Summary of complete pathways (including fate and transport considerations)
- Quantification of exposure (not required, if all exposure pathways will be eliminated through pathway elimination measures.)

##### IV. Toxicity Assessment

(See Site-Specific Human Health Risk Assessment Procedures, pages 9-10. Not required if all exposure pathways will be eliminated through pathway elimination measures.)

- Toxicity values for constituents of concern
- Derivation of chemical-specific toxicity criteria (if applicable)
- Supporting data listing all relevant information on toxicity

**TABLE II-6 (cont'd)**  
**Suggested Outline for a Risk Assessment Report under the Site-Specific Standard**

**V. Risk Characterization**

(See Site-Specific Human Health Risk Assessment Procedures, pages 10-12)

- Algorithms (not required if all exposure pathways will be eliminated through pathway elimination measures.)
- Calculations and Results. (not required if all exposure pathways will be eliminated through pathway elimination measures.)
- Description and fulfillment of risk assessment objectives
- Discussion of uncertainty for all sections of report, including uncertainties associated with site characterization, toxicity assessment, exposure assessment and risk characterization.

**VI. References**

**PART 2 - Ecological Risk Assessment**

This section reports the results of the ecological risk assessment conducted using the guidance in [Section IV.H](#) and, as applicable, EPA guidance.

**Public Comments**

Include the comments obtained as a result of a public involvement plan, if any, and the responses to those public comments.

**Signatures**

**c) Cleanup Plan ([Section 250.410](#) of the regulations)**

The cleanup plan is not required if no current and probable future exposure pathways exist. The cleanup plan is also not required if the approved baseline risk assessment report indicates that the site does not pose unacceptable risks to human health and the environment under current and planned future conditions. A suggested outline for a cleanup plan is provided in [Table II-7](#). The cleanup plan should include the following items:

**i) Introduction**

Provide a summary of the investigation report(s) and risk assessment report and an interpretation of the conditions at the site (refined conceptual site model). Discuss the chosen method(s) of remediation. The remedy should be evaluated in accordance with the requirements of [Section 304 \(j\)](#) of Act 2. The groundwater portions of the cleanup plan should be prepared and certified by a Registered Professional Geologist licensed in Pennsylvania and any drawings and designs of engineered systems should be prepared by a Professional Engineer licensed in Pennsylvania.

**ii) List of contacts**

Name, address, and telephone number of project manager responsible for submittal of the cleanup plan.

Names, addresses, and telephone numbers of consultants or other persons responsible for preparing the cleanup plan.

**iii) Site map(s) which indicate(s):**

The boundaries of the site and all adjacent/contiguous properties.

The location of all proposed and existing utilities, structures, and roads.

All areas in which remedial action activities will be conducted.

Horizontal and vertical boundaries and respective concentrations of contamination in the soils and groundwater.

**iv) Remedial alternative**

Identify remediation alternatives considered and evaluate the ability and effectiveness of the selected remedy to achieve the site-specific standards, based on the factors set forth in [Section 304 \(j\)](#) of Act 2. The cleanup plan must document how each of the factors set forth in Section 304 (j) of Act 2 was evaluated. The evaluation should include a risk assessment of the proposed remedy. In evaluating the other alternatives, no risk assessment is required; rather a narrative describing the consideration of Section 304(j) factors relative to the proposed remedy should be included.

**TABLE II-7**

**Suggested Outline for a Cleanup Plan under the Site-Specific Standard**

- I. Introduction**  
([Section II.C.7.c.i](#))
- II. List of Contacts**  
([Section II.C.7.c.ii](#))
- III. Site Maps**  
([Section II.C.7.c.iii](#))
- IV. Remedial Alternative**  
Identify remediation alternatives considered and evaluate the ability and effectiveness of the selected remedy to achieve the site-specific standards, based on the factors set forth in Section 304 (j) of Act 2. ([Section II.C.7.c.iv](#))
- V. Treatability Studies**  
Provide results of any treatability, bench scale, or pilot scale studies or other data collected to support the remedial action(s). ([Section II.C.7.c.v](#))
- VI. Design Plans and Specifications**  
Consists of adequate design plans and specifications sufficient to evaluate the proposed remedy. ([Section II.C.7.c.vi](#))
- VII. Postremediation Care Plan**  
([Section II.C.7.c.vii](#))
- VIII. Cooperation or Agreement of Third Party**  
([Section II.C.7.c.viii](#))
- IX. Public Comments**  
([Section II.C.7.c.ix](#))
- X. Signatures**  
([Section II.C.7.c.x](#))

#### **v) Treatability studies**

Provide results of any treatability, bench scale, or pilot scale studies or other data collected to support the remedial action(s).

All other site information relevant to the conceptual design, construction, or operation of the remedial action.

Specific characteristics of the site that may affect the implementation or effectiveness of the remedial action including such characteristics as topography, geology, depth of bedrock, potentiometric surfaces, and the existence of utilities.

#### **vi) Design plans and specifications**

Consists of adequate design plans and specifications sufficient to evaluate the proposed remedy including, but not limited to:

- Detailed description of the remedial action (treatment and/or removal) and remedial technology to be implemented. Adequate design plans and specifications for all remedial activities, including remedial design, onsite treatment, storage, removal and disposal activities.
- Estimated volume of each medium to be treated and/or removed. Provide methodology and calculations used to estimate contaminant mass.
- Remedial Action Status Plan - To evaluate the short-term and long-term effectiveness of the remedial action to include, but not limited to, the following:
  - Location and construction details of all monitoring points.
  - Sampling and Analysis Plan, including QA/QC plan.
  - Other site specific monitoring as appropriate.
- Construction QA/QC Plan including engineering certification.
- Locations, telephone numbers, and contacts of offsite disposal facilities, including names, addresses, and telephone numbers of waste transportation companies.
- Site specific Health & Safety Plan which includes adherence to all applicable OSHA and NIOSH regulations and recommendation.
- Erosion and Sedimentation Control Plan Consistent with [Chapter 102](#) (Erosion Control) relating to earth disturbance during remedial activities.
- Site Security Plan.
- A schedule for implementation of the proposed remedial action.
- Operation and Maintenance Plan which shall describe:
  - Startup testing, inspection and maintenance over the first year and subsequent years of operation.

- Identification of equipment necessary for operation and maintenance.
- Specification of the type, frequency, and duration of testing or maintenance to verify optimal remedial system performance.
- All federal, State and local permits and approvals and any agreements necessary for the construction and operation of the approved remedial action shall be identified.

#### **vii) Postremediation care Plan**

Document proposed postremediation care requirements in a plan if they are needed to maintain the standards.

#### **viii) Cooperation or agreement of third party**

When a person proposes a remedy that relies on access to properties owned by third parties, for remediation or monitoring, documentation of cooperation or agreement shall be submitted.

#### **ix) Public comments**

Include the comments obtained during the public and municipal comment period and the public involvement plan, if any, and the responses to those public comments.

#### **x) Signatures**

All those who participated in the remediation who are seeking relief from liability.

#### **d) Final Report [[Section 250.411](#) of the Regulations]**

A suggested outline for a final report under the site-specific standard is provided in [Table II-8](#).

#### **i) Summary**

The [Final Report Summary](#) form is to be filled in and submitted to the Department electronically. The summary submitted with the final report should be a copy of that form.

**TABLE II-8**

**Suggested Outline for a Final Report under the Site-Specific Standard**

- I. Summary**  
The [final report summary](#) should be a copy of the electronic form submitted to the Department.
- II. Remediation**  
Description of the remedial methodologies used to attain the selected standard. (Sections [II.C.7.d.i](#) and [II.C.7.d.ii](#))
- III. Attainment**  
Demonstration of attainment of a numerical standard
- Soil site-specific standard
  - Groundwater site-specific standard
  - Surface water site-specific standard, and/or
  - Sediment site-specific standard
- Describe the statistical methods used to demonstrate attainment of the standard.
- Demonstration of Pathway Elimination
- Residual Risk Assessment
- IV. Fate and Transport Analysis**  
Description of Fate and Transport analyses used and results and conclusions. ([Section IV.A](#))
- V. Postremediation Care Plan (if applicable)**  
This section is included only if necessary. It describes the engineering and institutional controls necessary to maintain the standard. ([Section II.C.7.d.v](#))
- VI. References**
- VII. Attachments**  
([Section II.C.7.d.vii](#))
- VIII. Public Comments**  
([Section II.C.7.d.vii](#))
- IX. Signatures**  
([Section II.C.7.d.viii](#))

## ii) Remediation

Documentation of the methodologies used to attain the site-specific standard. Includes removal and/or treatment technologies used, and any engineering and/or institutional controls used to attain or maintain the selected standard. This section should also include the calculation of the mass of contaminants addressed during the remediation of soil and/or groundwater, using the methodology in [Section IV.C](#).

## iii) Attainment

Documentation that the remedy has been completed in accordance with an approved cleanup plan.

- Descriptions of treatment, removal, or decontamination procedures performed in remediation. Documentation of handling of remediation wastes in accordance with applicable regulations.
- Descriptions of the sampling methodology and analytical results.
- All sampling data, including QA/QC data.

The demonstration of attainment should be applied separately for each distinct area of contamination. Demonstration of attainment in a final report should include one or more of the following three types of information:

- Demonstration attainment of a numerical standard

The information includes demonstration that the calculated numerical site-specific standards have been met through the application of appropriate statistical tests, and demonstration that shows contaminant concentration at the point of compliance will not exceed the selected standard. The following information shall be documented in a final report when a statistical method is applied:

- A description of the statistical method;
- A clear statement of the applicable decision rule in the form of statistical hypothesis for each spatial unit and temporal boundary including the applicable statistical parameter of interest and the cleanup standard;
- A description of the underlying assumptions of the method;
- Documentation showing that the sample data set meets the underlying assumptions of the method and demonstrate that the method is appropriate to apply to the data;
- Specification of false positive rates;
- Documentation of input and output data for the statistical test, presented in tables, figures or both, as appropriate; and
- An interpretation and conclusion of the statistical test.



Demonstration that contaminant concentration at the point of compliance will not exceed the selected standard should be based on a statistical time trend analysis, knowledge of the plume stability or other acceptable method.

- Demonstration of pathway elimination

This demonstration should be based on either an engineering or hydrogeologic analysis, or both, which includes fate and transport analysis that some or all of the exposure pathways have been eliminated. The eliminated pathways and the remaining pathways should be clearly identified. The pathway elimination demonstration should include the following:

- Identifying all exposure pathways prior to the implementation of pathway elimination technology, based on fate and transport analysis; and
- Identifying all exposure pathways after the implementation of pathway elimination technology, based on fate and transport analysis.

- Residual Risk Assessment

As an alternative to demonstrating the attainment of numerical standards, a person may perform a residual risk assessment to show that the risk which remains at a site following remediation is within the acceptable risk range specified in Act 2. The residual risk assessment will be based on resampling and a reassessment of the cumulative risks associated with concentrations occurring following remediation.

#### **iv) Fate and transport analysis**

The Fate and Transport Section ([Section IV.A](#) of this manual) provides a discussion on fate and transport analysis. The amount of detail in the fate and transport analysis may vary from a description to a very extensive detailed model with quantitative modeling. Whenever a model is used the Department must be provided with the assumptions, data, and information on the model necessary for Department staff to evaluate and run the model. Any parameters used in the analysis or models used should use data from the site obtained during the site characterization.

#### **v) Postremediation care plan (if applicable) and other postremedial obligations (such as monitoring or institutional controls).**

If engineering or institutional controls are needed to maintain a standard, if the fate and transport analysis indicates that the remediation standard may be exceeded at the point of compliance in the future, or, if the remediation relies on natural attenuation, a postremediation care plan must be documented in the final report. The plan should include:

- Reporting of any instance of nonattainment;
- Reporting of any measures to correct nonattainment conditions;
- Monitoring on a quarterly basis, or as otherwise approved by the Department, that demonstrates the effectiveness of the remedy and periodic reporting of monitoring results and analysis;
- Maintenance of records at the property where the remediation is being conducted for monitoring, sampling and analysis;
- A schedule for operation and maintenance of the controls and submission of any proposed changes; and
- If requested by the Department, documentation of financial ability to implement the remedy and the postremediation care plan.

If mitigation measures are implemented to restore or replace equivalent ecological resources in the local area of the site, a postremediation care plan to maintain the mitigated ecological resources is documented in the final report. The plan should include:

- reporting of the ongoing success or failure of the mitigation measure implemented;
- mitigation measures instituted at the time of the final report shall be successfully accomplished and sustained up to five years from final report approval.
- In some cases, postremedial obligations described in [Section II.C.9](#) could require documentation in a postremediation care plan.

#### **vi) References**

#### **vii) Attachments**

Laboratory Sheets

Quality Assurance and Quality Control Plan

Health and Safety Plan

Sampling and Analysis Plan

Public comments include the comments obtained during the public and municipal comment period and as a result of a public involvement program, if any, and the responses to those public comments.

Before and after photographs

#### **viii) Signatures**

All those who participated in the remediation who are seeking relief from liability.

## **8. Streamlined Reporting Requirements for Site-Specific Standard when No Current and Future Complete Exposure Pathways Exist**

The combined remedial investigation report and final report detailed below are not to be submitted to the Department until the 30-day public and municipal comment period has expired. A suggested outline for the combined remedial investigation report/final report under the site-specific standard is provided in [Table II-9](#).

### **a) Combined Remedial Investigation Report/Final Report**

The site characterization shall be conducted in accordance with scientifically recognized principles, standards and procedures. The level of detail in the investigation and the selected methods and analyses, that may include models, shall sufficiently define the rate of movement and the present and future extent and fate of contaminants, to ensure continued attainment of the remediation standard. All interpretations of geologic and hydrogeologic data shall be prepared by a professional geologist licensed in Pennsylvania. The combined remedial investigation report/final report should include the following information:

TABLE II-9

**Suggested Outline for the Combined Remedial Investigation Report/Final Report  
under the Site-Specific Standard When No Current and Future Complete Exposure  
Pathways Exist**

- I. Final Report Summary**

The [final report summary](#) should be a copy of the electronic form submitted to the Department.
- II. Site Description**

Provide a description of the site in sufficient detail to give an overall view of the site. ([Section II.C.8.a.ii](#))
- III. Site Characterization**

Document current conditions at the site. ([Sections II.C.8.a.iii-v](#))
- IV. Fate and Transport Analysis**

Description of fate and transport analyses used and results and conclusions. (Sections [II.C.8.a.vi](#) and IV.A)
- V. Other Information Required under the Site-Specific Standard**

Provide the results of ecological receptor evaluation. Describe the public benefits of the use or reuse of the property. Identify complete exposure pathways. ([Section II.C.8.a.vi](#))
- VI. Conclusions and Recommendations**

Draw conclusions regarding the existence of exposure pathways and the potential effectiveness of institutional or engineering controls for pathway elimination. Identify the appropriate remedial technology options. ([Section II.C.8.a.vii](#))
- VII. Postremediation Care Plan (if applicable)**

This section is included only if necessary. It describes the engineering and institutional controls necessary to maintain the standard. ([Section II.C.8.a.viii](#))
- VIII. References**
- IX. Attachments**

([Section II.c.8.a.x](#))
- X. Public Comments**

([Section II.C.8.a.x](#))
- XI. Signatures**

([Section II.C.8.a.xi](#))

### **i) Summary**

Provide a summary paragraph(s) which will provide the reviewer with an overview of the site. This will serve to highlight the important issues and conclusion which will be presented in the report.

### **ii) Site description**

Provide a description of the site in sufficient detail as to give the reviewer an idea of the site location, and the types of operations that are currently and/or were formerly conducted on the site. As appropriate to the site, the description should include: location, physical description of property, ownership history, site use history, and regulatory action history (past cleanups).

### **iii) Site characterization**

The site characterization provides important information documenting the current conditions at the site. Information developed during the site characterization is primarily intended to describe the nature, concentrations, extent, and potential for movement of all contaminants present on the site, or that may have migrated from the site. For sites where there are multiple distinct areas of contamination, the site characterization process should be applied to each area individually.

### **iv) Source and identification of constituents of concern.**

For the area being investigated, include description of source characterization which may be in the form of a conceptual site model.

### **v) Nature and extent of contamination**

Information needed to meet the requirements below should be included here.

- For soils, include information on samples and measurements used to characterize the horizontal and vertical, present and future extent and fate of contamination and direction and rate of contaminant movement based on factors in the soil and the contaminant which affect migration. Soil and boring descriptions should be included as an attachment
- For groundwater, include information on samples and measurements used to characterize the horizontal and vertical, present and future extent and fate of contamination and direction and velocity of contaminant movement based on factors of the groundwater and the contaminant (s) which affect migration. Geologic boring descriptions and as built drawings of wells should be included as an attachment.

Text, tables, graphics, figures, maps and cross sections need to be used to describe the nature, location, and composition of the regulated substances at the site. Providing the data in an appropriate format will expedite the review of the report.

#### **vi) Other information required under the site specific standard**

The results of the evaluation of ecological receptors discussed in [Section II.C.3.b](#) of this manual.

Description of the existing or potential public benefits of the use or reuse of the property for employment opportunities, housing, open space, recreation or other uses.

Information obtained from attempts to comply with the background or Statewide health standards, such as background concentrations for constituents of concern.

A fate and transport analysis to demonstrate no current and probable future exposure pathways exist. This part of the report should document the pathway identification process and provide justification if a pathway has been excluded. The fate and transport analysis should be performed for current land use and any probable future land use separately.

Modeling (optional) - Data Interpretation.

- Identify any programs or modeling used to interpret site conditions or predict plume migration. Identify codes used and any modifications made.
- Models should be developed from site specific data.
- Identify limitations/assumptions used in the model(s).
- Models should be validated to reproduce conditions measured in the field.
- Submit modeling files (input and output files).

#### **vii) Conclusions and recommendations of remedial Investigation**

In addition to documenting the items listed above, the remedial investigation report should draw conclusions regarding the existence of exposure pathways and the potential effectiveness of institutional or engineering controls in eliminating some or all of these pathways. The report also should identify the appropriate remedial technology options for each medium of concern.

#### **viii) Postremediation care plan (if applicable)**

If engineering or institutional controls are needed to maintain a standard, if the fate and transport analysis indicates that the remediation standard may be exceeded at the point of compliance in the future, or if the remediation relies on natural attenuation, a postremediation care plan must be documented in the final report. In most cases, the plan should include:

- Reporting of any instance of nonattainment;
- Reporting of any measures to correct nonattainment conditions;

- Monitoring on a quarterly basis, or as otherwise approved by the Department, that demonstrates the effectiveness of the remedy and periodic reporting of monitoring results and analysis;
- Maintenance of records at the property where the remediation is being conducted for monitoring, sampling and analysis;
- A schedule for operation and maintenance of the controls and submission of any proposed changes; and
- If requested by the Department, documentation of financial ability to implement the remedy and the postremediation care plan.

If the postremediation care plan or an institutional control (See [Section II.C.9](#)) is being used to verify that a site continues to have incomplete exposure pathway status, the following are required in the postremediation care plan:

- Procedures and schedule for how the incomplete exposure pathway status will be reviewed.
- Reporting details and schedule for submittal to the Department.

If mitigation measures are implemented to restore or replace equivalent ecological resources in the local area of the site, a postremediation care plan to maintain the mitigated ecological resources is documented in the final report. The plan should include:

- reporting of the ongoing success or failure of the mitigation measure implemented;
- mitigation measures instituted at the time of the final report shall be successfully accomplished and sustained up to five years from final report approval.
- In some cases, postremedial obligations described in [Section II.C.9](#) could require documentation in a postremediation care plan.

#### **ix) References**

#### **x) Attachments**

Laboratory sheets for all data, applicable laboratory quality control results, historical sampling data results, and data eliminated from consideration based on data validation protocols. All data should be presented in table form.

Quality Assurance Plan

Health and Safety Plan

Sampling and Analysis Plan

Maps and cross sections used which present information onsite characterization

Boring logs and as-built drawings

Proofs required, such as: municipal notice, newspaper notice. proof of publication.

Physical/chemical properties or toxicological/exposure factors including, but not limited to: water solubility, vapor pressure, Henry's Law constant, compound density, octanol/water partition coefficient ( $K_{ow}$ ), organic carbon partitioning coefficient ( $K_{oc}$ ), and soil/water partitioning coefficient ( $K_d$ ) needed for determining performance of remedial equipment and/or fate and transport analysis.

The comments obtained as a result of a public involvement plan, if any, and the responses to those public comments.

photographs

#### **xi) Signatures**

All those who participated in the remediation who are seeking relief from liability.

### **9. Institutional Controls and other Postremedial Measures**

#### **a) Defining**

An institutional control is a legal or administrative tool or action taken to reduce the potential for exposure to hazardous substances. There are some postremedial measures which, although they are not strictly institutional controls, can nonetheless be effective in providing assurance that an incomplete ingestion pathway continues to exist. Institutional controls and other post remedial obligations may include, but are not limited to, use restrictions, environmental monitoring requirements, and site access and security measures. Postremediation care is often required in conjunction with institutional controls, but by itself is not considered an institutional control measure.

The sole purpose of the institutional control is to provide human health protectiveness as part of a remediation under Act 2.

#### **b) Implementing**

Institutional controls are most commonly intended to be used in conjunction with a remedy that directly provides pathway elimination, or on sites where a risk analysis has determined that a current or probable future complete pathway for exposure does not exist. The other set of cases where institutional controls are used is when current or probable future exposure is present and the institutional control is effectively the only factor preventing exposure. Examples of this type of use are contaminated soil with NO physical cap, or where groundwater contamination exists on properties above drinking water levels and those properties are undeveloped (e.g. open field) and have a reasonable chance for future groundwater use for drinking or agricultural purposes.



The institutional control measures listed below can be chosen, at the option of the remediator, for the purpose of reducing the opportunity for future human exposure to regulated substances from the site. To the extent that the remediator chooses to implement multiple or more substantive or restrictive controls, the less likely the chance that conditions will result in the loss of liability protection due to a successful reopener under Act 2, [Section 505](#).

This concept of the remediator choosing the institutional controls can be thought of similarly to the incentive a remediator has to conduct a sound and complete site characterization (as discussed in Section I of this manual), namely the effectiveness of the institutional controls chosen affects the soundness of the liability protection provided for under [Act 2, Chapter 5](#).

The Department may suggest and guide the remediator in selecting the combination of controls best suited to the site, but in the end the remediation method- including any institutional controls- is the choice of the remediator. The Department will base its approval or disapproval of the final report on whether the remedy, at present, has been shown to attain one of the three standards and, if remedies are to remain in place after the approval (e.g. caps, nonuse groundwater), that there is an adequate postremediation care plan in place to assure that those remedies remain effective in maintaining the chosen standard and that implementation actions and results are routinely reported to the Department.

The Department is developing a database of information to track all sites with institutional controls applied as a part of an Act 2 remediation. The purpose of this listing is to allow the Department to have continued monitoring of those institutional controls and when fully functional, for the benefit of the public having access to the information in the Department's eFacts system.

### **c) Listing**

Potential controls are listed below. Keep in mind that sometimes it may be most appropriate to use more than one of these controls on a single Act 2 site.

#### **i) Routine and periodic assessments**

This type of postremedial obligation should be used in areas determined in the final report to have no exposure and no probable future exposure, to assure that conditions have not changed from those exposure assumptions. The details of these would be specified in the approved final report.

This postremediation management approach is appropriate for groundwater areas in which an approved final report documents the area as either having present contamination or the likelihood of future contamination above the applicable drinking water standard, and where it has been demonstrated (as part of the final report) and accepted by the Department that there is *no current or probable future use* of the groundwater. Such demonstrations would in most cases involve documenting that all the properties overlain by the plume or areas where it is expected to migrate at concentrations above the applicable drinking

water standard, are fully developed and supplied by a public water system. There are exceptions to this rule however. Take for example the case of a source property which has adjacent to it a railroad property followed by a major river. The downgradient property where the contamination could migrate may not have public water or buildings, but is developed in a way that it is more than reasonable to assume there would be no future groundwater supply wells for drinking or agricultural use.

The conditions for carrying out these assessments are to be incorporated into a postremediation care plan, which includes regular reporting to the Department. There are several benefits to this approach:

- the Department directly receives routine status reports on the effectiveness of the control,
- the Department has clear authority to enforce the controls if they prove ineffective in protecting human health and the environment, and
- the Department can more easily allow termination of this approach when it is determined that it is not necessary to protect human health and the environment. Such cases would be typical when groundwater contamination naturally attenuates over time.

## **ii) Equitable servitude and easements**

Commonly called deed restrictions, these are conditions placed on the deed which restrict use of or access to the property to some degree. Sites where equitable servitude and easements are particularly effective would be cases where the Department has not agreed that no current or probable future use of the groundwater for drinking or agricultural purposes exists, and would include:

- source properties, as a pathway elimination measure,
- properties containing, or adjacent to, contamination sources which are not fully developed (e.g. open fields),
- properties which do not currently have connection to a public water supply, and
- properties where probable future development of the groundwater for drinking purposes may take place.

These controls have the advantage of being effective in maintaining themselves over multiple transfers of property ownership and there is not as much need for continued monitoring of the presence of the deed restriction once it is in place.

Disadvantages include:

- the ability to enforce these restrictions is not under the direct control of the Department

- it essentially remains on the deed for perpetuity, even beyond the point of its usefulness in protecting human health (although the Department may provide a future letter terminating its interest in the need for the restriction), and
- the inability (in some cases) to implement it in off-source properties (e.g. groundwater contamination extending off the source property). This is particularly significant in cases of groundwater contamination in urban areas where plumes can extend to dozens, or even hundreds, of properties, obliterating the effectiveness of this form of control unless ALL of the deeds for the extensive number of properties can be modified at the same time.

The use of these deed restrictions in cases where groundwater contamination above drinking water levels has migrated, or may migrate, off the source property may be considered by the Department to be a requirement where it has determined that current or probable future groundwater use will occur. At this time, the Department considers determinations of probable future use to be subjective and believes that there is a lack of a foundation of individual site determinations across the Commonwealth upon which written guidance for regional use can be based. Therefore, the Department will require both regional and central offices to approve, in each case, the requirement for deed restrictions on such sites. The Department believes this approval procedure will help maintain consistency in the implementation of Act 2. In addition to the documentation of the deed restriction, the Department will require documentation of the agreement with the property owner to place said restriction(s). These documentations will be recorded in the Department tracking database of institutional controls.

The Department is concerned about the perpetual stigma placed on properties that have deed restrictions after they have served their function for public health protection purposes. Persons with properties having deed restrictions may at any future time propose, through the Act 2 NIR process, to attain a standard not requiring a deed restriction. This may be used in cases where future owners may want to conduct further remediation on the property, or far into the future when natural attenuation may effectively result in a site meeting a Statewide health standard. Upon approval of attaining an appropriate Act 2 standard (i.e., one to which a deed restriction is not integral), the use restriction may be removed from the deed.

### **iii) Environmental notice**

These are controls such as the deed acknowledgements required under HSCA, Act 108, section 512(b). The area and contaminants present are documented in the deed as notice. This has some of the same advantages as the equitable servitude and easements. Owners could modify the area and change use at their own caution.

#### **iv) Local ordinance**

This type of control includes zoning, which is a control put on by local government. It has the advantage of being under the control and enforcement of the local government level. This is consistent with Commonwealth and Department initiatives to encourage involvement of local governments in land and water use planning. The Department anticipates that one use of the local ordinance method will be to eliminate the groundwater ingestion pathway under the site-specific standard and the nonuse aquifer Statewide health standard. An ordinance used to satisfy [Section 250.303\(c\)\(1\), 2\) and \(3\)](#) (relating to documenting no groundwater ingestion and community water connections) must meet the following performance criteria:

- Establish a specific geographic area to which the ordinance relates. This may be part of a political subdivision or multiple subdivisions.
- Establish prohibition of use of groundwater for the following:
  - i) Drinking water use
  - ii) Agricultural purposes, as defined by [Section 250.5](#) (definitions).
- Require that all properties in the specified area connect to community water supply for uses described above.
- Notification to water suppliers servicing the area of the conditions of the ordinance.
- Provide for notification to the Department if and when the ordinance is modified or eliminated.

#### **v) Groundwater use restriction zone.**

Provided for in [Section 250.303\(f\)](#), nonuse aquifer certification areas are zones in which local governments have identified groundwater as not being used for potable purposes. Under [Section 250.303\(b\)](#) of the regulations, all groundwater in aquifers is presumed to be used or currently planned for use, unless criteria outlined in [Section 250.303\(c\)](#) are met. The revision to [Section 250.303\(f\)](#) provides for areas meeting the criteria in [Section 250.303\(c\)](#) to be certified by the Department as areas of groundwater nonuse. This application for areal certification may be made by a municipality, redevelopment or economic development authority, or other governmental or quasi-governmental agency. Upon certification by the Department, these areas are overlain by local controls restricting future groundwater use.

## D. Special Industrial Areas

### 1. Introduction

The special industrial area provision established in [Section 305](#) of Act 2 creates incentives to reuse industrial properties. Cleanups at these special industrial areas have reduced remediation requirements which are intended to allow these sites to be put back into productive use in the community. Act 2 established this provision to encourage the redevelopment of properties used for industrial activities. The remediator, reuser, and the property must meet eligibility requirements to be considered as a special industrial area under Act 2, perform necessary remediation, and meet required notification and reporting requirements.

### 2. Eligibility Determination

Specific eligibility requirements in [Section 250.502](#) of the regulations provide for qualification of a property for reuse as a special industrial area and for the qualification of a remediator to use this special provision of Act 2. The property must have been used for industrial activity. The extent of industrial activity is defined very broadly and is detailed in [Section 103](#), of Act 2. If the property qualifies as having been used for industrial activity, the following additional qualifications must be met:

- The property must be one where there is no financially viable responsible person, or it is located within a designated enterprise zone,
- The remediator must not have caused or contributed to releases at the property. A person who is interested in purchasing a property and undertaking a reuse of that property should contact the Department before the reuser purchases the property.
- The term responsible person includes the owner of the property, regardless as to whether he has or has not caused or contributed to the contamination. Therefore, prospective purchasers of property which could be eligible as a special industrial area should sign a special industrial area agreement with the Department prior to the purchasing of the property. The standard template for this type of agreement is located on the Department's WEB site at: *(Note: web address not currently available)* . Signing a special industrial area agreement does not bind the prospective purchaser if he does not purchase the property.
- Actions in themselves that do not cause or contribute to contamination taken under [Act 2 Section 307](#) relating to emergency and interim responses will not prejudice eligibility determinations under the special industrial area designation.
- It is the responsibility of the reuser to demonstrate to the Department that the reuser has not had an environmental impact on the property, just as it is the responsibility of the remediator to document that the property meets the

other eligibility criteria for a special industrial area. In order to accomplish this, certain information must be presented to the Department regarding the above eligibility requirements.

- Documentation that the property has been used for industrial activities by including information on the ownership and operational history of the property as part of the work plan for the baseline remedial investigation.
- Verification that no financially viable responsible party exists to address the contamination on the property. Financial information for existing responsible parties must be included in the ownership and operational history. Financially viable is generally defined as having sufficient financial resources to be able to perform part or all of the cleanup required at a particular property

To qualify as a property within an Enterprise Zone or Keystone Opportunity Zone, the municipality where the property is located must be designated by the Pennsylvania Department of Community and Economic Development as an Enterprise Zone or Keystone Opportunity Zone. In order to determine whether a particular property is within an Enterprise Zone or Keystone Opportunity Zone, contact DCED or the appropriate zone contact person. DCED is currently undergoing a process of reevaluating the status of Enterprise Zones across the state and all Enterprise Zones have established exit dates. If a remediator wants to determine the eligibility of a site for the special industrial area provisions, when a financially viable responsible party is present, the remediator will need to verify the existence of the Enterprise Zone designation for the area where the site is located.

A letter from either the DCED or enterprise zone contact person should be provided with the work plan to verify the status of the property. Persons remediating a site in an enterprise zone where a viable responsible party may still exist are only responsible for remediation of contamination identified in the baseline environmental report and specified in the Consent Order and Agreement with the Department as required for remediation prior to the new use of the property. Additional remediation may be pursued by the Department with the responsible person. Responsible persons under HSCA must resolve their liability to the Department pursuant to HSCA. See [Section III.E](#) of this manual.

### **3. Process Checklist for Special Industrial Areas**

- Evaluate the property potential for redevelopment.
- Determine if the property was used previously for industrial activity or if it is located within an enterprise zone. [Act 2 Section 305\(a\)](#) and [Section 250.502](#) of the regulations.
- Determine if there is a financially viable responsible party. If the property is located within an enterprise zone, financial viability is not a requirement for special industrial area use. [Act 2 Section 305\(a\)](#) and [Section 250.502](#) of the regulations.

- The remediator must demonstrate to the Department that he did not cause or contribute to contamination on the property. [Act 2 Section 305\(a\)](#) and [Section 250.502](#) of the regulations.
- Review the historical information and present use of regulated substances at the property.
- Prepare a work plan for a baseline remedial investigation. [Act 2 Section 305\(b\)](#) and [Section 250.503\(b\)](#) of the regulations.
- The work plan must be approved by the Department prior to performing the investigation. [Act 2 Section 305\(b\)](#) and [Section 503\(b\)](#) of the regulations.
- Begin baseline remedial investigation. Use [Section II.D.5](#) of this manual, [Act 2 Section 305\(b\)](#) and [Section 503\(c\)](#) of the regulations.
- Submit Notice of Intent to Remediate (NIR) for the special industrial area to the Department. Also notice the municipality, publish a notice of submission of the NIR in a local newspaper, and provide proof of publication to the Department.
- Prepare public involvement plan (if requested by municipality).
- Prepare baseline environmental report based on baseline remedial investigation. [Act 2 Section 305\(b\)](#) and [Section 503\(d\)](#) of the regulations.
- Department review of baseline environmental report.
- Meet with the Department and concur on Consent Order and Agreement. Act 2 [Sections 305\(e\)](#) and [502\(a\)](#).
- Remediate the property to the special industrial area requirements specified in the baseline environmental report and agreed to in the Consent Order and Agreement. [Act 2 Section 502\(b\)](#).
- Calculate the mass of contaminants remediated using the procedure in Section IV.C of this manual.
- Complete the [Final Report Summary](#) on line.
- Protection from liability occurs upon the signing of the Consent Order and Agreement with the Department, subject to the remediator's compliance with the Consent Order and Agreement demonstrating attainment of the special industrial area requirements in accordance with Chapters [3](#) and [5](#) of Act 2.

#### **4. Aspects of Special Industrial Areas**

##### **a) Immediate, Direct or Imminent Threats to Human Health and the Environment**

One of the significant aspects of Act 2 is the cleanup liability protection provided for special industrial areas. The cleanup liability for the person undertaking remediation and reuse of a special industrial area is dependent upon the person performing remediation of immediate, direct or imminent threats to public



health or the environment which would prevent the property from being occupied for the remediator's intended purpose.

The immediate, direct or imminent threats are to be determined by the baseline remedial investigation and defined in the baseline environmental report. The baseline environmental report will become the basis for the Consent Order and Agreement between the Department and the remediator. The exposures, and potential exposures, presented by a special industrial area site must be identified in the baseline remedial investigation. Defining immediate, direct, or imminent threats is relevant to the remediator's intended use of the property. Therefore, it is necessary for the remediator to specify the intended use of the property. The identification of these threats needs to be addressed at the time of the baseline remedial investigation work plan and in performance of the investigation. Only concerns identified in the baseline environmental report and included in the agreement can be considered in any relief from liability afforded to the remediator by Act 2. For this reason, it is paramount that the remediator perform a comprehensive investigation of a special industrial area.

Immediate and imminent threats are pending threats likely to happen without delay or momentarily in time. Direct threats, though sometimes similar in immediacy, also include chronic exposure. As a minimum, immediate, direct or imminent threats will entail:

- Contained wastes which present immediate, direct or imminent threats. Examples are regulated substances in drums, barrels, tanks, or other bulk storage containers; and contained wastes, such as wastes in drums, above or below ground tanks, and small containers.
- All wastes which are not containerized and which present a direct threat to workers or other persons on the property. These may include, but are not limited to, open containers, pits, waste piles and others that allow wastes to be exposed and accessible on the site.
- In addition to situations listed above, actual exposure for onsite human populations to any regulated substances.
- Actual contamination of drinking water by regulated substances. Also, contaminated groundwater, if groundwater use will expose persons on the property to contaminants.
- Contaminated soil presenting a direct contact threat to workers or other persons on the property. Direct contact may occur in a zone of soil at and below the surface. The depth of consideration of surface soil shall be the first two feet from the ground surface, unless reuse of the property presents exposure threats at depths greater than two feet.
- Environmental remediation undertaken at a special industrial area shall comply with one of the standards established by Act 2. [Act 2 [Section 305\(a\)](#)]
- Regulated substances presenting a threat of fire or explosion.



- Surface water and sediments contaminated with regulated substances, if persons are or may become exposed to these contaminants.
- Regulated substances contained as product may remain on the property if maintained according to appropriate regulations. The remediator is responsible for releases occurring as a result of the remediator's actions.

**b) Consideration of Chronic Exposure in Evaluation of the Reuse of a Special Industrial Area**

[Section 250.503\(c\)\(5\)](#) of the regulations pertains to property to be reused and includes the terminology and states "Evaluation of exposure conditions within the portion of the property to be reused to identify existing contamination that poses an immediate, direct or imminent threat to public health or the environment which is inconsistent with the intended reuse of that portion of the property." Initially, the determination of property use for nonresidential or residential purposes will focus determination of direct contact exposure. In the use of the definition of "immediate, direct or imminent," the word "direct" includes chronic exposure. In the scope of chronic exposure, workers or other persons using a property with existing contamination are to be protected from chronic exposure levels of contaminants, as well as to acute exposure levels. Direct contact includes contamination which persons may come in contact with when working, living at, or visiting a site. Direct contact may occur by several routes. Some examples are ingestion of soil, contact with soil, or inhalation of soil particles or vapor from the soil. Additional direct contact pathways may be caused by leaching from the soil to groundwater, vapor intrusion into buildings, inhalation of contaminated process water, surface water run off to water bodies, and exposure of wildlife and ecosystems. Soil available for direct contact must meet the human health and environmental protection standards established by Act 2.

**c) Contaminant Migration Off Property**

There are no obligations or liability for off-property contamination placed upon an innocent person using the special industrial area provision. For cases where the off-property pollution is significant, there may be other available options for addressing these risks. If there is an existing viable responsible party (property located within an enterprise zone), the viable responsible party would continue to be responsible for off-property contamination. For sites where there is no viable responsible party, the cleanup may either be remediated by a purchaser of the property (voluntary cleanup), or addressed under other state or federal programs. In either case, the innocent purchaser would not be responsible for off-property contamination, as long as he or she did not cause or contribute to that contamination. Although assessment at the time of the baseline remedial investigation is not required off-property, the remediator should determine whether contamination is moving off the property.

If contamination which requires remediation is found at a future date, and the nature, concentration, and location were not identified in the baseline

environmental report, the remediator may be liable to perform cleanup of the contamination to one of the three standards.

**d) Contamination Identified Subsequent to Remediation and Agreement Conditions**

Under [Section 502\(b\)](#) the remediator is only relieved from liability for contamination which was identified in the baseline environmental report. For this reason it is to the remediator's benefit to conduct a comprehensive investigation.

**e) Storage Tank Closure and Corrective Action at Special Industrial Areas**

Remediators are only responsible for addressing the immediate, direct or imminent threats posed at special industrial areas. In all cases this includes removal of waste in containers. Materials remaining in tanks must be removed and handled in accordance with applicable laws and regulations. Product may remain in the tanks if it is rendered inert and poses no risk. The actual tanks are required to be removed or rendered safe. The remediator should follow the Storage Tank Program regulations and guidance to achieve a safe closure of tanks. Smaller containers will likely be required to be removed. Releases from tanks that occur after the remediator becomes the owner or operator are the responsibility of the remediator.

**f) Consent Orders and Agreements**

Remediation of all threats relevant to a special industrial area reuse which were detailed in the baseline environmental report will be detailed in a Consent Order and Agreement. Contamination not identified in the baseline environmental report will become the responsibility of the remediator.

A change in use of the property, from that defined in the Agreement, may necessitate a change in the Agreement or modification of the proposed property reuse. A land use change for a special industrial area may trigger a reopener under [Section 505\(4\) of Act 2](#). The Consent Order and Agreement with the Department will require the remediator to provide the Department with written notice of any change in the use of the property and to remediate any contamination which would prevent the use of the property for its new purpose.

**g) Remediation**

Remediation in special industrial areas must meet the following requirements:

- Cleanup may utilize treatment, containment, removal, or control methods, or any combination of the above.
- Cleanup must address all containerized waste at the property in accordance with applicable regulations.
- Soil available for direct contact must meet one of the three remediation standards.

- Cleanup of any wastes or cleanup of any medium contaminated with regulated substances which pose an immediate, direct or imminent threat to human health or the environment based on the intended use of the property must be to one of the three remediation standards.

If groundwater is to be used at the property, the groundwater must either be remediated inground or at the point of use so that it is safe for its intended use and occupation of the property.

#### **h) Deed notice**

A deed acknowledgment, as required by the Solid Waste Management Act or the Hazardous Sites Cleanup Act, will be required at all special industrial area remediations. Future use limitations due to disposal of hazardous wastes or regulated substances may be required as part of the remedy and may be identified as part of the deed acknowledgment.

### **5. Work Plan for Baseline Remedial Investigation and Baseline Environmental Report**

#### **a) Work Plan for Baseline Remedial Investigation**

A baseline remedial investigation is required for evaluation of a property that will be part of a special industrial area agreement. The objective of the baseline remedial investigation is to establish a reference point documenting contamination that existed prior to the redevelopment. A work plan for the baseline remedial investigation is required to be prepared by the remediator and approved by the Department prior to initiation of the investigation. The findings and conclusions of the baseline remedial investigation shall be documented in a report known as a baseline environmental report.

The work plan for the baseline remedial investigation shall be designed considering the unique considerations of special industrial areas and tailored for the specific property. The work plan shall address how the remediator will perform the baseline remedial investigation and shall address the items below and any additional items determined to be appropriate by the person proposing remediation, or requested by the Department. The work plan for the remedial investigation shall include the steps to be taken to document the following:

- A description of the property and detailed ownership history.
- Identification of the historical regulated substance use, handling and disposal activities on the property, and any known or suspected releases associated with these activities. This is obtained by conducting environmental site characterization, review of historical records, and interviews with persons who may have knowledge of the property.
- Characterization of the regulated substances on the property. Identification of existing contamination that poses an immediate, direct or imminent threat to public health or the environment which would prevent the property from being occupied for the intended use.

- Identification of potential migration pathways off the property, or onto the property, and any potential receptors from any release on the property. Where migration pathways and receptors have been identified, the remediator shall perform environmental sampling of the groundwater at the downgradient property boundary to determine if regulated substances from releases on the property have migrated off the property.
- In addition to the above, environmental sampling, if indicated by the investigation, in all potential media of concern to confirm whether releases have occurred.

**b) Baseline Environmental Report**

The baseline environmental report shall provide the results of the baseline remedial investigation and describe the historical use, location of areas of contamination, the intended reuse, sampling results, contaminant migration occurrence or potential, and the proposed remediation measures to ensure that the special industrial area requirements are met. Portions of the baseline environmental report containing information about geologic or hydrogeologic investigations shall be prepared and certified by a Registered Professional Geologist licensed in Pennsylvania. The baseline environmental report shall be submitted in triplicate without binding. The following is a recommended scope of a baseline environmental report:

**Summary:** Provide a summary paragraph(s) that will give the reviewer an overview of the property. This will serve to highlight the important issues and conclusion that will be presented in the report.

**Description of property:** Provide a description of the property in sufficient detail to give the reader an overall idea of the property and its location. Describe the following:

- Buildings and other site features such as lagoons, tanks, treatment plants, and other structures on the property. Include a site map (scale 1 inch = 200 feet).
- The location of all onsite wells, septic systems, floor drains, sumps and associated piping, storage areas, and chemicals or chemical compounds used, stored, treated or disposed.
- A description of present conditions at the property including any evidence of a release, contaminated media, tanks, and identification of areas of uncontained and/or separate phase liquids.
- The location and name of any public or private water supply on or near the property.
- The location, name and elevation of surface water bodies (springs, streams, lakes, ponds, wetlands) within 2500 feet of the property.

- The location of utility lines at and near the area of investigation including any municipal or private water supply lines or natural gas lines, sanitary or sewer lines, and any other subsurface utilities.
- The location of active and inactive oil and gas wells, injection wells, surface and underground coal and non-coal mines, mine pool discharge points, landfills, and surface disposal areas within 2500 feet of the property.
- Identify features within 2500 feet of the property, such as threatened or endangered species habitat, recreational river corridors, State and federal forests and parks, historic and archaeological sites, national wildlife refuges, State natural areas, prime farm land, wetlands, special protection watersheds designated under [Chapter 93](#) and other features.

**Ownership History:** Provide a detailed property ownership history since the release of regulated substances onsite. Include company or individual name and address (if available), ownership period, and the general operational use of the property during each ownership period.

**Site Use History:** Provide detail on past and current uses of property and adjoining properties; including treatment, storage, and disposal of regulated substances. Indicate the type, estimated volume, composition, and nature of the released materials, chemicals or chemical compounds. Indicate the sources of regulated substances; description of spills, leaks, releases on the property; and migration or migration potential to adjacent properties; and remedial action to date. Include a brief description of agency actions such as violation notices, administrative orders, and environmental permits.

**Site Characterization:** The site characterization provides important information documenting the current conditions at the property. Information developed during the site characterization is primarily intended to describe the nature, extent, and potential for movement of all contaminants present on the property, or that may have migrated from the property. For sites where there are multiple distinct areas of contamination, the site characterization process should be applied to each area individually. The remediator must use scientifically recognized principles, standards and procedures.

**Geology/Hydrogeology** - Description should be based on existing literature and data (SCS soil surveys, geologic maps, Water Resource Reports, reports on nearby properties and sampling) including:

- Descriptions of the soils, fill materials, geologic, hydrologic and hydrogeologic conditions at and surrounding the property. These descriptions should be detailed enough to provide an understanding of the site with respect to local geologic conditions and to determine if property groundwater is in an aquifer as defined by Act 2.
- A local stratigraphic column including lithology, physical characteristics and the approximate thickness of each stratum, include location and depth of aquifer(s) (if known).

- The geologic structure within the property boundaries and its relation to the regional geologic structure (if known).
- The location(s) of sinkholes, fracture traces, outcrops, and lineaments (if known).
- Screening of soils, sediments and water (as appropriate). Submit all results, include Quality Assurance/Quality Control (QA/QC) documentation. Identify field screening methods and sampling procedures. Cone Penetration Technologies (CPT) and other drive/push technologies (DPT) may be used for sampling of solids, soil gases, and groundwater. CPT and DPT results should be useful to more accurately site permanent monitoring wells in areas of concern. Soil gas surveys should be conducted in accordance with ASTM Standard D 5314 or other Department approved method. Sample locations should be depicted on a site map. Incorporate results from past sampling, if applicable.

Soil investigations shall be performed to establish baseline quality of surface, shallow, and subsurface soils at the site. Investigations will involve actual, as well as potential, sources of contamination, underground storage tanks, stained soils, and building drains, sumps, and storm/sewer systems. Investigations of underground storage tanks will identify any potential impacts from possible leakage of the tanks. Sampling will be performed. Property boundary soil sampling may also be performed to assess soil quality conditions and compared to the appropriate residential or nonresidential standards based on the proposed use of the property. Groundwater investigations shall be performed to establish baseline quality of the shallow and aquifer groundwater conditions. Investigations will involve wells (both monitoring and supply, and including appropriate off-property wells), sample analysis and water quality, and groundwater level measurement.

**Identified Contamination:** Characterize the source and nature, concentration, and location and extent of the regulated substances. Text, tables, graphics, figures, maps and cross sections, may be used to describe the nature, location, and composition of the contaminants on the property. Determine the extent, if any, of regulated substances that have migrated beyond the property boundary. Indicate all existing and potential migration pathways. Indicate the direction and rate of contaminant movement within each medium of concern.

**Proposed Remediation Measures:** The baseline environmental report shall include the proposed plan for remediation of the property and will serve as the basis for the Consent Order and Agreement. Therefore, the remedial action must be fully defined and described. The remediation of all threats relevant to the special industrial area reuse will be reiterated in the Consent Order and Agreement. Identification of contamination is very important in establishing what the remediator will be obligated to cleanup, and the extent of the cleanup liability protection afforded by Act 2.

**Public Notice:** Provide information concerning all public notifications performed. Supply copies of the notifications and proof of publication of the NIR

in a newspaper of general circulation serving the area where the property is located. Indicate if a municipality requested a public involvement, and if so, include the public involvement plan and all comments received, and responses to those comments.

**Public Benefits:** The baseline environmental report should include a description of the existing or potential public benefits of the use or reuse of the property for employment opportunities, housing, open space, recreation or other uses. An estimate of the potential employment anticipated by the reuse of the property is also requested.

**Signatures:** All those who participated in the remediation who are seeking relief from liability.

**Attachments** (optional)