

## 2. Statewide Health Standard

### a) Introduction

The Statewide health standards are established by Act 2, Sections [303](#) and [301](#), 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.2.c 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.

### b) Process Checklist for Remediations under the Statewide Health Standard

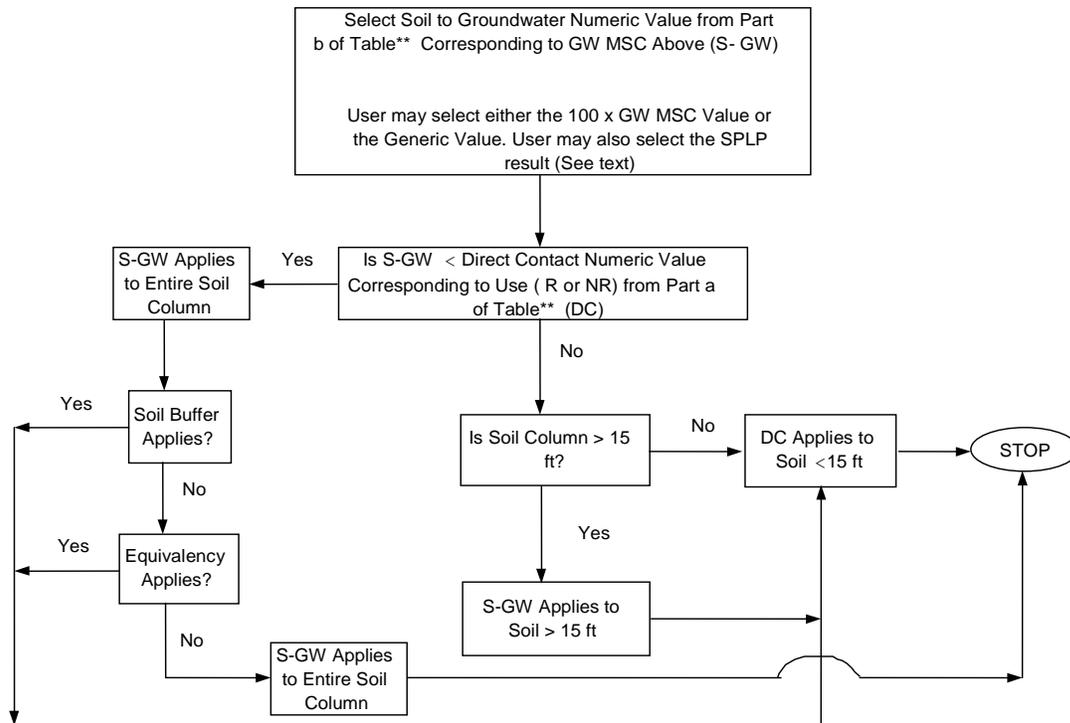
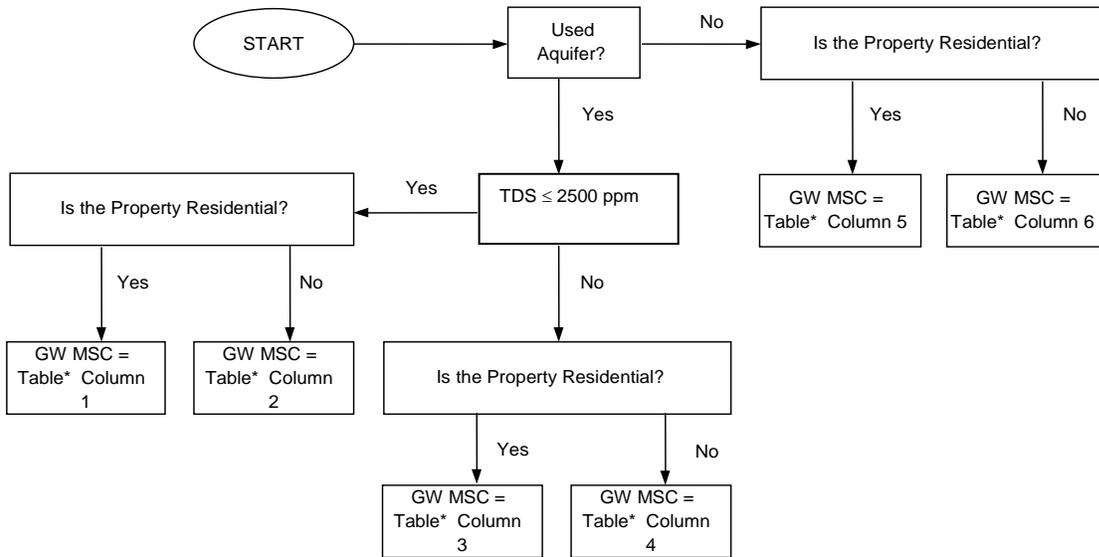
- Review the historical information and present use of regulated substances at the property.
- Begin the site investigation/ characterization and gathering information about the area on and around the property.
- As an option, begin using the completeness list (See Section VI.C) to help verify that all 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-submittal](#) for inclusion with the final report. Procedures for submittal of notifications are contained in Section II.A.3 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 III.B of this manual.
- Calculate the mass of contaminants remediated using the procedure in Section III.C of this manual.
- Complete the Final Report Summary [electronically as per the instructions on the web page](#).
- 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.2.f 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 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 post-remediation 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.

**c) 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 – ACT 2 REMEDIATION PROCESS**  
**B. Remediation Standards**

### **i) 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.

### **ii) 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 feet 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 feet, 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:

#### **(a) 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 periodically 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 intent of the one-tenth of the generic numeric value provision in the soil-to-groundwater numeric value calculation is to account for the dilution in contaminant concentrations that occurs in soils that are periodically saturated where dilution through unsaturated soil which does not occur in unsaturated soil. For permanently saturated soils, contamination becomes a groundwater contamination issue as the soil is in constant contact with the groundwater rather than being only periodically saturated.

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~~ have a passing SPLP ~~result~~ 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 all samples ~~result in~~ have a non-detect SPLP result, the alternative soil-to-groundwater standard will be the TC corresponding to the highest concentration of each contaminant. 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.

**(b) 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. The soil buffer approach ~~modeling~~ incorporates fate and transport considerations, therefore meeting the soil buffer requirements will not require any additional fate and transport analysis.

**(c) 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 III.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.2.c.ii.a established an alternative soil-to-groundwater value of 20 mg/kg.
- SPLP testing of site soil was established at 400 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 3,52300 µg/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 5,000 µg/L.

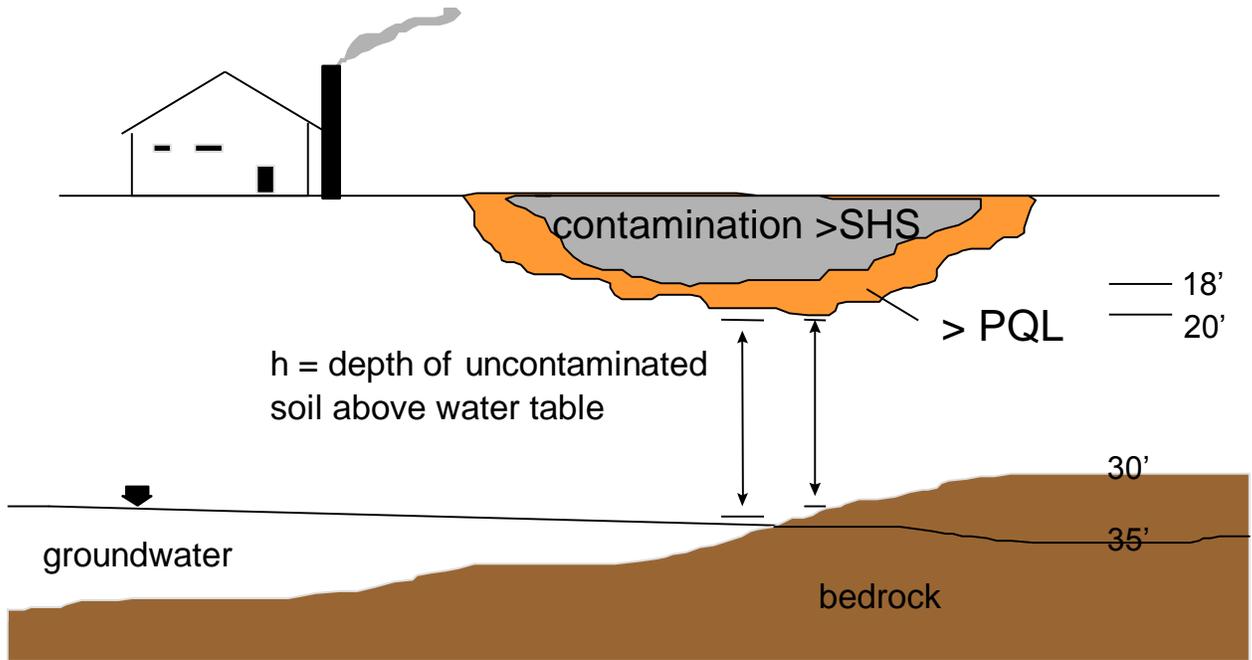
The remediator takes the following steps to determine appropriate MSCs for cumene at this site.

#### Groundwater MSC:

- 1) For scenario #1 AND scenario #2: 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≤2500 mg/L," "NR" (for Nonresidential). The groundwater MSC is 233,500 µg/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 ([233,500](#)  $\mu\text{g}/\text{L}$ ) and therefore no attainment demonstration is needed.

Under Scenario #2, the remediator concludes that the aquifer area exceeds the groundwater MSC ([233,500](#)  $\mu\text{g}/\text{L}$ ) and therefore attainment demonstration is needed.

Soil MSC:

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  $\leq$  2500 mg/L," "Nonresidential." The two values listed are:

- 100x GW MSC- [230350](#) mg/kg
- Generic Value - [16002,500](#) mg/kg

The 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/she has~~ three options exist under the regulations (Section 250.308).

- 100x GW MSC - ~~230~~350 mg/kg
- Generic Value -- ~~1600~~2,500 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~~2,500 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~~ The remediator ~~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.

Alternatively ~~he-the remediator~~ could have considered use of the groundwater equivalency option [Section 250.308(d)], but this includes the condition that ~~he/she~~ 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~~ ~~The remediator~~ concludes ~~that he/she~~ the site 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-the site~~ 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-the remediator~~ has to consider BOTH the s/gw numeric value and the direct contact (DC) value.

~~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 states 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.

~~He-The remediator~~ chooses the s/gw numeric value based on the generic value of ~~1600-2,500~~ 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:

	Direct contact value	S/GW value	Resulting Soil MSC
Zone 0'-2'	10,000 mg/kg	<del>1600-2,500</del> mg/kg	<del>1600-2,500</del> mg/kg
Zone 2'-15'	10,000 mg/kg	<del>1600-2,500</del> mg/kg	<del>1600-2,500</del> mg/kg
Zone 15'-18'	NA	<del>1600-2,500</del> mg/kg	<del>1600-2,500</del> 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 230-350 mg/kg

Generic Value 160-250 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.2.f.vii 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]).

**d) Nonuse Aquifer Determinations**

**i) 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 III.D (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.

## **ii) 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/LR\\_WM0267.pdf](http://www.dep.state.pa.us/dep/deputate/airwaste/wm/landrecy/Forms/LR_WM0267.pdf) to be used by a remediator to expedite the Department's review of a nonuse aquifer demonstration. Use of this form is optional.

## **iii) 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 an environmental covenant should](#) 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.

**iv) Request for Certification of a Nonuse Aquifer Area Initiated by a Local Government<sup>4</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.

**v) 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

---

<sup>4</sup>This option will be available upon finalization of the proposed amendments to Chapter 250 published August 5, 2000 in the PA Bulletin.

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.

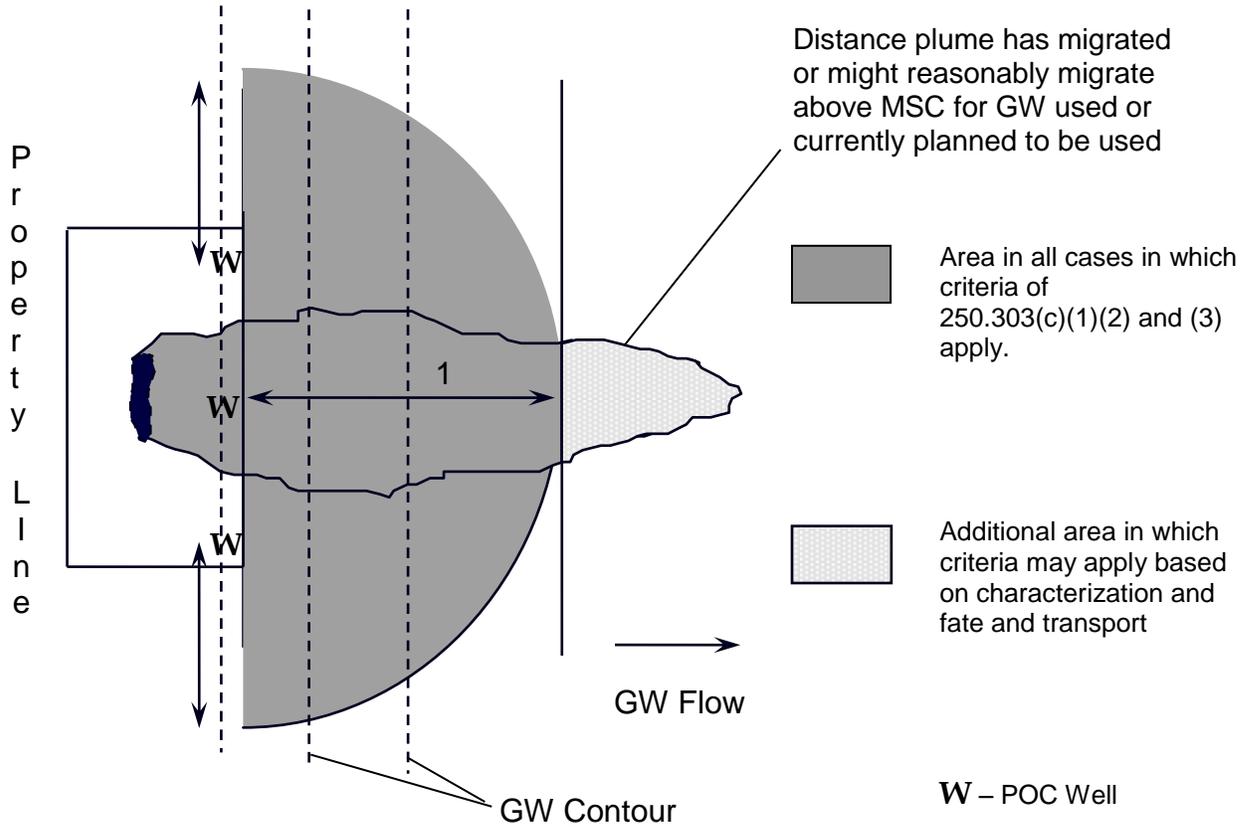
Figure II-9 shows the screening area for an idealized site where the site characterization has determined there is divergent groundwater flow. In this case the screening area is somewhat larger than the other figures because the area 1,000 feet downgradient (lower groundwater elevation) from the compliance 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.

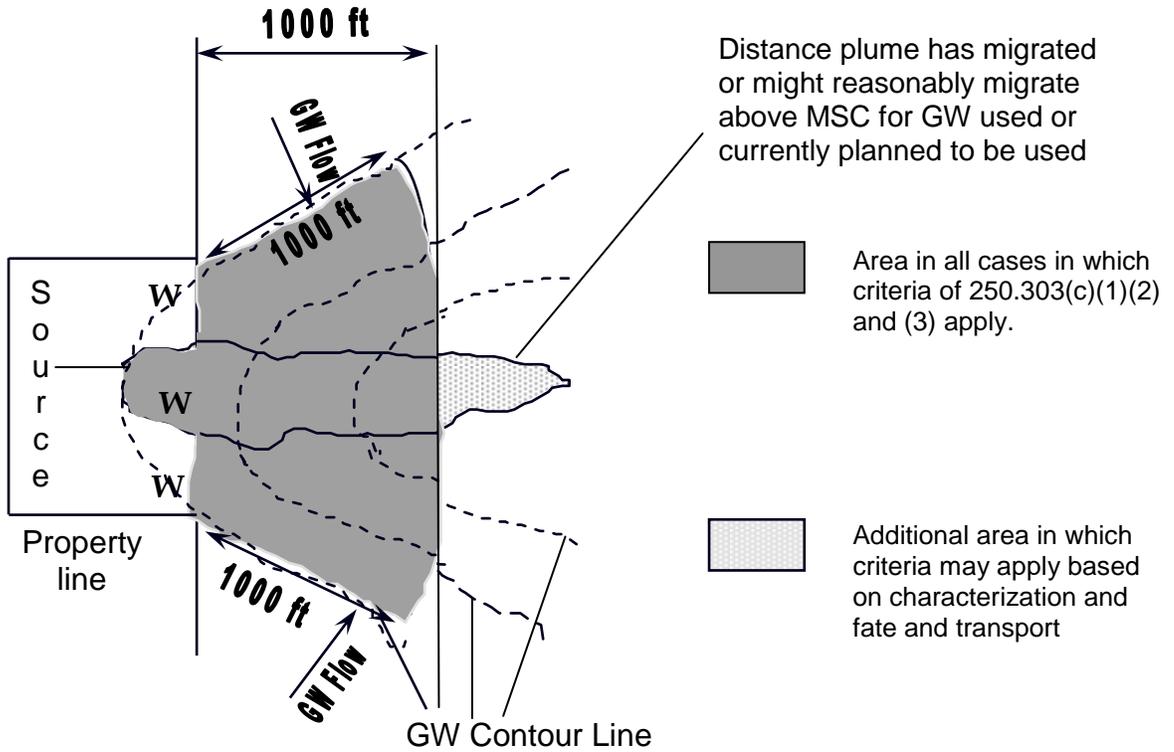
#### **e) Ecological Screening**

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 [Section 250](#), 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.

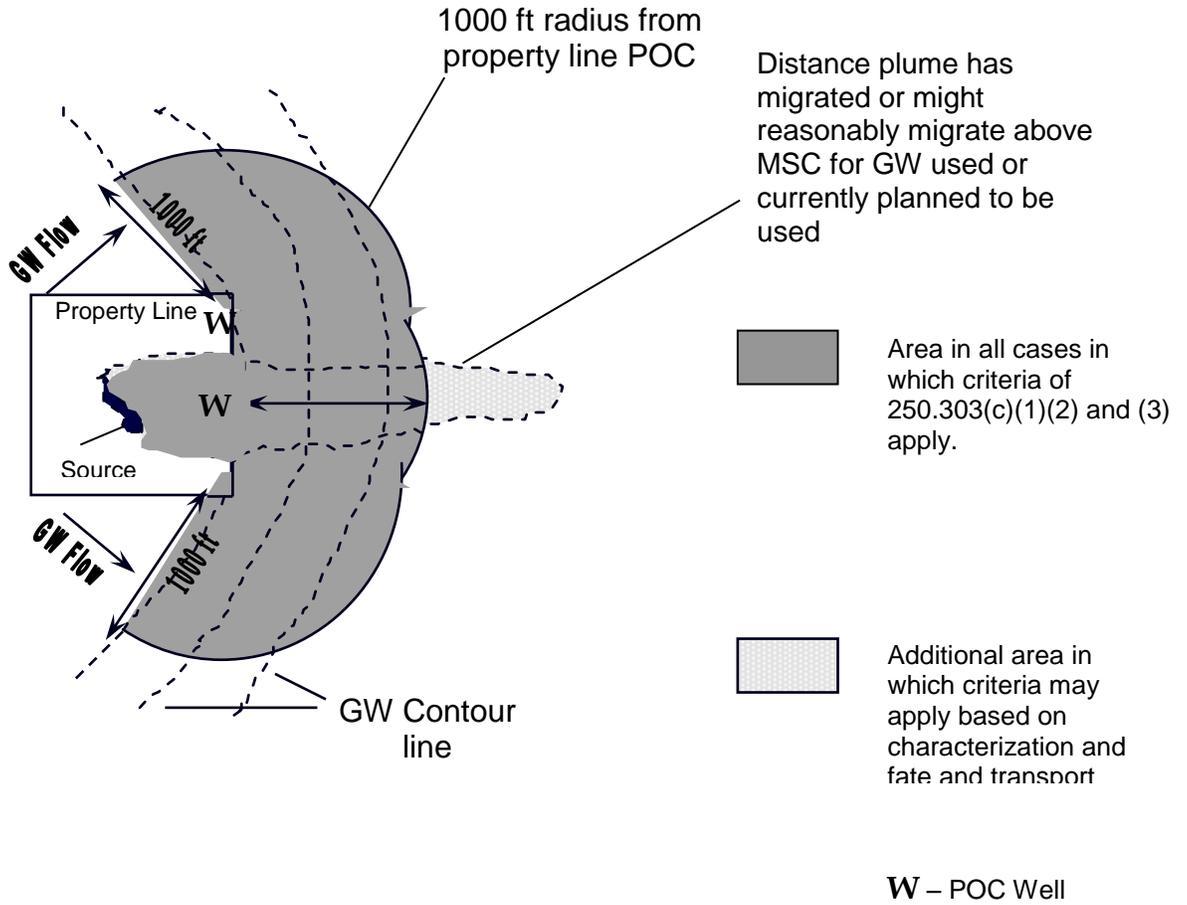
**Figure II-7**  
**Nonuse Aquifer Screening Area**  
**(Parallel Flow)**



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



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

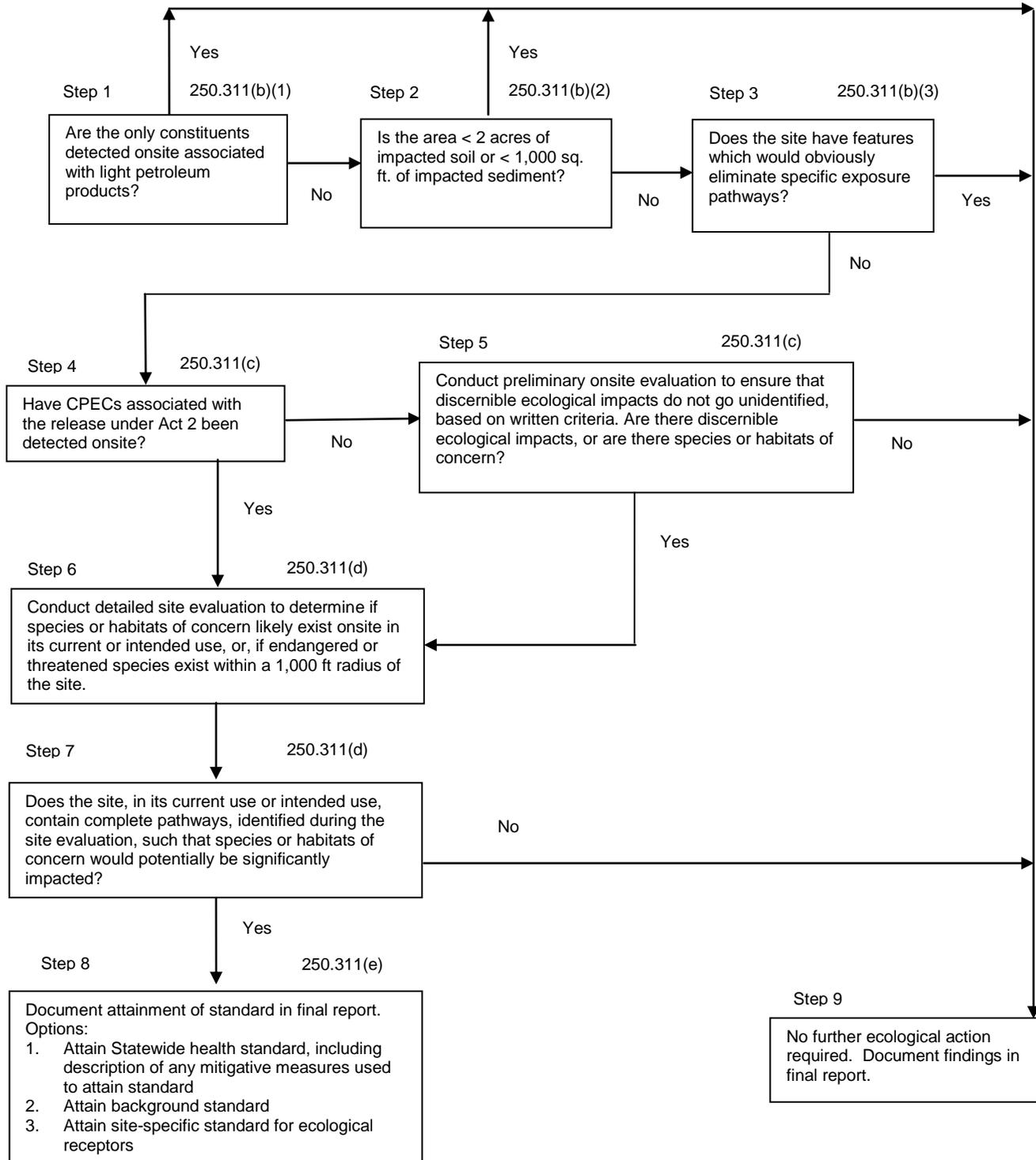


The objective of the ecological screening procedure is to quickly evaluate whether surface soils or sediments at a site have the potential to pose substantial ecological impact or impacts requiring further evaluation. The site screening procedure defines substantial impact as the potential for constituents 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**



**3.**

**SECTION II – ACT 2 REMEDIATION PROCESS  
B. Remediation Standards**

## **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 2,500 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 2,500 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	<u>Dichloroethane</u> <u>Dichlorobenzene</u> ,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 VI.E 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 PA DEP 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 VI.E.

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).

---

<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.B.3 and III.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 III.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.

**f) 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~~ remediator 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.2.f.ii)

**III. Site Characterization**

Document current conditions at the site (Section 250.204 of the regulations and Section II.B.2.f.iii)

**IV. Statewide Health Standard**

How the Statewide health standard was established (Section II.B.2.f.iv)

**V. Ecological Screening**

Provide the results of the Ecological Screen described in Section 250.311 of the regulations and Section II.B.2.e.

**VI. Remediation**

Description of the remedial methodologies used to attain the selected standard (Section II.B.2.f.vi)

**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.2.f.vii)

**VIII. Fate and Transport Analysis**

Description of Fate and Transport analyses used and results and conclusions. (Section II.B.2.f.viii)

**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.2.f.ix)

**X. References**

(Section II.B.2.f.x)

**XI. Attachments**

(Section II.B.2.f.xi)

**XII. Signatures**

(Section II.B.2.f.xii)

### **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 completed form.

### **ii) 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).

### **iii) 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.

#### **iv) 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.2.c of this manual [should be included in this section of the final report.](#)

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.2.d 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.

**v) Ecological Screening**

Provide documentation of the implementation of the ecological screen described in Section 250.311 of the regulations, and Section II.B.2.e of this manual.

**vi) 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 III.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.

**vii) 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.

**(a) Point of compliance**

**(i) 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.

**(ii) 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 foot interval, another for the 2-15 foot interval, and a third for the soil at depths greater than 15 feet. 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.2.c.ii.a). For the purpose of demonstrating attainment, the saturated zone is considered to extend below the seasonal high water table level.

**(iii) 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 April 2008. 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.

**(b) Statistical tests**

Attainment tests appropriate for the Statewide health standard are described in Section 250.707(b) of the regulations, and in Section III.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 III.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 III.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 1,000 feet downgradient from the property boundary within 30 years. This fate and transport analysis should meet the requirements specified in Section III.A of this manual.

**(i) 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 feet and greater than 15 feet). For purposes of demonstrating attainment, the analysis of samples, based on their physical location by the systematic random sampling method (Section III.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 ~~to~~hen be used, there must be preapproval from the Department and 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.

**(ii) 95% UCL rule**

The minimum number of samples is as specified in Section III.B of this manual.

**(iii) 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 III.B.5.b.i.c of this Manual.

### **viii) Fate and Transport Analysis**

The Fate and Transport Section (Section III.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 [simple](#) 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-utilize](#) 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 feet 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.

### **ix) 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~~ [plan \(PRCP\)](#), 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.XX 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 post remediation care program.

Some remediators choose to use soil management plans (SMPs) and groundwater management plans (GWMPs) in place of PRCPs. This practice can be problematic because PRCPs are intended to be a plan to care for and maintain a remedy which utilizes engineering or institutional controls, while SMPs/GWMPs are often intended to address changes to a remedy that may occur at some point in the future. These plans are based on current waste management or water quality regulations or guidance. The Department cannot grant pre-approval of future soil or groundwater management plans since those guidances or regulations may change at some point in the future therefore invalidating the SMP or GWMP.

Remediators should avoid using SMPs and GWMPs in place of PRCPs. They should instead have the PRCP and the environmental covenant address how to handle potential changes to a remedy. Any planned change to a remedy would require the approval of the Department at the time of the proposed change.

#### **x) References**

Any references cited in the final report.

#### **xi) Attachments**

Attachments should include but not limited to:

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

## **xii) Signatures**

All those who participated in the remediation who are seeking relief from liability. If any portions of the submitted report were prepared or reviewed by or under the responsible charge of a registered professional geologist or engineer, the professional geologist or engineer in charge must sign the report.

## **g) 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