

Guidance on Soil Performance Standards

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PURPOSE

This document discusses the use of soil performance standards and the application of soil performance standards to closure of contaminated sites. Soil performance standards offer an alternative to determining numerical soil cleanup standards for contaminated properties.

This guidance is not intended to be used as the sole reference for soil performance standards. Rather, it is intended to be used along with promulgated rules and published guidance. The material presented is based on available technical data along with the knowledge and experience of the authors and the peer reviewers.

Note: This guidance document does not specifically address cases closed under ch. NR 746, Wis. Adm. Code.

DISCLAIMER

This document is intended solely as guidance, and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. This guidance does not establish or affect legal rights or obligations, and is not finally determinative of any of the issues addressed. This guidance does not create any rights enforceable by any party in litigation with the State of Wisconsin or the Department of Natural Resources. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

This guidance is based on requirements found in chs. NR 140, 720, 722, 724, and 726, Wis. Adm. Code; the Hazardous Substance Spill Law, s. 292.11, Wis. Stats., the Environmental Repair Statute, s. 292.31, Wis. Stats., and the Groundwater Law, s. 160.23 and 160.25, Wis. Stats.

OTHER RELEVANT GUIDANCES

This guidance may be more complete when used in conjunction with the guidance documents listed below. These guidance documents contain examples of and requirements for applying soil performance standards.

Guidance for Cover Systems for Soil Performance Standard Remedies
Publication RR-709
<http://dnr.wi.gov/org/aw/rr/archives/pubs/RR709.pdf>

Case Closure and the Requirements for Managing Continuing Obligations, Publication RR-606
<http://dnr.wi.gov/org/aw/rr/archives/pubs/RR606.pdf>

GIS Registry Checklist, Form 4400-245,
<http://dnr.wi.gov/org/aw/rr/archives/pubs/4400-245.pdf>

Impacted Off-source Property Information, Form 4400-246,
<http://dnr.wi.gov/org/aw/rr/archives/pubs/4400-246.pdf>

Guidance On Natural Attenuation For Petroleum Releases, Publication RR-614
<http://dnr.wi.gov/org/aw/rr/archives/pubs/RR614.pdf>

Understanding Chlorinated Hydrocarbon Behavior in Groundwater: Investigation Assessment and Limitations of Monitored Natural Attenuation, Publication RR-699
<http://dnr.wi.gov/org/aw/rr/archives/pubs/RR699.pdf>

Determining Residual Contaminant Levels Using The EPA Soil Screening Level Web Site, Publication RR-682
<http://dnr.wi.gov/org/aw/rr/archives/pubs/RR682.pdf>

Interim Guidance on Soil Cleanup Levels for Polycyclic Aromatic Hydrocarbons (PAHs), Publication RR-519-97
<http://dnr.wi.gov/org/aw/rr/archives/pubs/RR519.pdf>

Interim Guidance on Use of Leaching Tests for Unsaturated Contaminated Soils to Determine Groundwater Contamination Potential, Publication RR-523-97
<http://dnr.wi.gov/org/aw/rr/archives/pubs/RR523.pdf>

This list will be expanded as additional guidance documents are developed.

These guidance documents may be obtained by:

- A. Sending a request to: Public Information Requests, Bureau for Remediation and Redevelopment, Department of Natural Resources, P.O. Box 7921, Madison, WI 53707.
- B. Downloading the files from the internet at
http://dnr.wi.gov/org/aw/rr/archives/pub_index.html

Questions regarding this guidance should be directed to Theresa Evanson – RR/5, WDNR, P.O. Box 7921, Madison, WI 53707, phone number 608-266-0941, email Theresa.Evanson@wisconsin.gov.

This guidance will be updated as needed. Comments and concerns may be sent to “Guidance Revisions”, Gary Edelstein, P.E. - RR/5, WDNR, P.O. Box 7921, Madison, WI 53707, phone number 608-267-7563, email Gary.Edelstein@wisconsin.gov.

1.0 INTRODUCTION

Chapter NR 720, Wis. Adm. Code outlines the requirements for soil performance standards, as follows: “If selected, a performance standard shall be established for a remedial action so that the remedial action is operated and maintained, in compliance with chs. NR 722 and 724 when those chapters are applicable to the site or facility, until the lowest concentration that is practicable is achieved or a permanent engineering control is maintained, or both, so that the residual contaminants left in the soil do not pose a threat to public health, safety and welfare or the environment”.

The term “performance standard” refers to the manner in which remedial actions (or, in some cases, existing site conditions) prevent exposure to contaminants, or will result in a decrease in contaminant concentrations, or both. The remedial action must be implemented and maintained at a site or facility with soil contamination, such that any contamination that exceeds residual contaminant levels (if calculated)¹ is contained and/or remediated. To be effective as a soil performance standard, the selected remedial action must be maintained permanently, until applicable numeric standards are achieved or until the remedial action is replaced by another remedy. In all cases the soil performance standard must be designed, implemented and maintained in order to protect public health, safety, welfare and the environment. Soil performance standards can be applied only in cases where the soils are treated or managed in-situ at a site or facility. Contaminated soil that has been excavated must be managed as a solid or hazardous waste or managed in accordance with ch. NR 718, Wis. Adm. Code, which applies to excavated contaminated soil that is not a hazardous waste.

Soil performance standards may be developed during remedy selection under NR 722 and may provide the basis for case closure. One example of a soil performance standard is placing a barrier cap, cover or pavement over contaminated soil to limit infiltration or to prevent direct contact. The barrier must be maintained and repaired for as long as necessary to protect human health and the environment. Another example is demonstrating that natural attenuation of groundwater will contain and remediate the contaminants leached from soils (i.e. demonstrating that the contaminant plume is stable or receding due to natural attenuation). In these examples, reduced infiltration or the natural attenuation processes are “performing” to contain and remediate the environmental contaminants. Once a performance standard has been established, no further action with regard to the contaminated soil is necessary as long as the conditions that are required by or affect the performance standard are maintained. Cover, barrier or cap design and maintenance is discussed in greater detail in “Guidance for Cover Systems for Soil Performance Standard Remedies”, RR-709.

Existing conditions can create a “soil performance standard”: At many sites, a relatively impermeable seal, such as a parking lot or building, covers contaminated soil. The site investigation may indicate that the soils in their contained state do not present a threat for direct contact or leaching to groundwater. However, the contaminated soil may present a threat to

¹ It may not be necessary to determine numeric RCLs for contaminants as long as all contaminant pathways for all contaminants of concern are addressed by the remedial action, the extent of contamination is fully defined, the remedial action remains in place, is maintained as appropriate and remains effective. For example, if a cover is placed that addresses all pathways for the contaminated soil, then it isn't necessary to determine the numeric RCLs for as long as the cover adequately addresses the pathway and remains protective. It may be necessary to determine RCLs in the future if the remedy is changed or replaced.

one or both of these pathways if the surface seal were removed. In these instances, the existing surface seal acts as a soil performance standard and, like all soil performance standards, must be maintained after site closure.

2.0 SELECTION OF A REMEDIAL ACTION WITH A SOIL PERFORMANCE STANDARD

Selection of a soil performance standard requires knowledge of administrative code requirements as well as of the migration pathways being protected. At a minimum, establishing a soil performance standard requires evaluation during the remedy selection phase and verification during the implementation phase.

2.1 ADMINISTRATIVE CODE REQUIREMENTS

Before a remedial action that utilizes a soil performance standard may be selected, it must be demonstrated that:

1. The selected remedy has been evaluated in compliance with ch. NR 722. Standards for selecting remedial actions are specified in ch. NR 722, Wis. Adm. Code. To comply with ss. NR 722.07(4) and NR 722.09(2), soil performance standards for a proposed remedial action must ensure that there is no threat of adverse impact to groundwater, surface water, human health, safety or welfare or to sensitive environments, posed by the residual soil contamination. In other words, the analysis of the alternatives, including the selected alternative must document how all pathways of exposure will be addressed. Where the RP believes that some pathways are not of concern, that rationale should be documented as well.

Any number of considerations may affect the choice of remedial options including volume of contaminated soil, type of contamination, area available for soil treatment, alternative disposal options, and future land use. A Remedial Action Options Report (RAOR) should document the process used to select a soil performance standard. If a RAOR is not prepared for the site, then the closure report should document the process used to determine that the soil performance standard is protective of human health and the environment for all pathways of exposure.

2. The selected remedy will be operated and maintained in compliance with ch. NR 724, where applicable, until applicable standards are achieved.
3. The selected remedy will be implemented and maintained such that there is:
 - a. *Protection of groundwater.* See detailed discussion of this topic under section 2.4.
 - b. *No adverse impact on surface water or sensitive environments.* Discharges to surface water, wetlands, and other sensitive environments may not result in standard exceedances, in accordance with s. NR 722.09(2)(c). A soil performance standard must minimize migration of contaminants, be in compliance with NR 102 to 106, and must be evaluated to determine effectiveness.
 - c. *No adverse impact on human health, safety or welfare.* No adverse impact on human health includes dermal contact, ingestion, or inhalation of soil contaminants. Vapor migration through soils into enclosed spaces, such as basements, are also a potential risk to health or safety. Under some conditions, impermeable surface covers will

exacerbate lateral vapor migration in the subsurface. Therefore installation of a soil performance standard has the potential to create new contaminant migration pathways. All contaminant pathways must be evaluated and addressed when proposing use of a soil performance standard.

- d. *Field verification.* Documentation is required to demonstrate that the selected remedy performs to the standard established for the site or facility. For example, after installing a barrier cap to protect against contaminant infiltration to groundwater, monitoring must be used to establish that groundwater quality is protected at the present time and to support projections that the barrier will protect groundwater quality in the future.

2.2 EXPOSURE OR MIGRATION PATHWAYS

When choosing a remedial action for soil cleanup, all exposure or migration pathways must be addressed. While there are several pathways not addressed in this guidance (including vapor migration and utility trenches), they need to be evaluated as potential exposure or migration pathways for each site. Where it is determined that a potential pathway for exposure or migration does not exist, the site-specific reasoning for this determination should be included in the remedial action options report and the closure submittal. Each site is unique and the specific pathways of concern must be determined for each site. Development of a site conceptual model is recommended for evaluating the potential pathways and demonstrating the effectiveness of a soil performance standard.

The most common pathways for soil contamination that may be of concern at a specific site or facility are direct contact with soil contaminants through inhalation or ingestion and contaminant leaching to groundwater. These pathways are addressed in the following sections.

2.3 PROTECTION FROM DIRECT CONTACT WITH SOIL CONTAMINANTS

A soil performance standard implemented to protect human health from direct contact would typically involve capping the contaminated soil with an appropriate barrier and ensuring that the barrier is maintained until the direct contact threat no longer exists (i.e., residual contaminant level soil standards are met). Appropriate barriers may consist of compacted clay, geomembranes, asphalt or concrete roadways, parking lots, and building foundations. If the contaminants are not likely to leach from the soil (e.g., PCBs), permeable barriers may be acceptable for limiting direct contact exposure. Permeable barrier design and maintenance is discussed in greater detail in "Guidance for Cover Systems for Soil Performance Standard Remedies", RR-709.

When a soil cover, cap or engineered structure is used to prevent direct contact with soil contaminants within four feet of the ground surface, conditions requiring inspection and maintenance of the cover, cap or structure will be required. A condition requiring prior written Department approval of any activity that could change the condition of or disturb the cover, cap or structure will also be required. For case closure situations, listing of the site on the Department's database will be required. See Section 3.0 of this guidance for information on closure conditions.

Direct contact with contaminated soils at depth is also possible if subsurface excavation of the contaminated soil occurs. Therefore, even if soils exceeding direct contact limits are not within four feet of the surface, a performance standard to limit direct contact exposure to subsurface contamination needs to be imposed by listing the site on the Department's database and

including a condition in the closure letter that requires proper management of the soil, if excavated.

2.4 PROTECTION OF GROUNDWATER FROM INFILTRATION OF CONTAMINANTS

Chapter NR 140 specifies that “activities affecting groundwater must be regulated to minimize the level of substances to the extent technically and economically feasible, and to maintain compliance with the PAL’s unless compliance with the PAL’s is not technically or economically feasible”. The following section provides direction for those situations where soil contamination has caused groundwater impacts less than the enforcement standards and where soil contamination has resulted in the attainment or exceedance of the enforcement standards.

1. Soil contamination with groundwater contamination less than NR 140 ES levels.

- a. If soil contaminants have impacted the groundwater quality such that a PAL is exceeded, a soil performance standard must be designed to minimize the level of substances in groundwater and to comply with the PAL, unless compliance with the PAL is not technically or economically feasible. The Department may grant an exemption to compliance with the PAL if the criteria under s. NR 140.28, including compliance with the enforcement standard, are met.

In addition, contaminants that currently have no groundwater standard (e.g., TBA) but may pose a threat to groundwater must also be addressed. Empirical evidence (e.g., monitoring well data) may be necessary to demonstrate that the soil performance standard will protect groundwater from contamination. An example of a performance standard to protect groundwater from leaching of soil contaminants could include the allowable rate of leaching of soil contaminants into the groundwater after an impermeable barrier has been installed.

- b. If there is no threat to groundwater from soil contamination, a soil remedy for the groundwater pathway is not needed. However, the lack of groundwater contamination, by itself, may not be sufficient to establish that there is no threat to the groundwater pathway. For example, factors such as the age of the contaminant release, type of contaminants, geologic setting, depth to groundwater, proximity of monitoring wells to the source of contamination and other related characteristics will affect whether sufficient time has passed for the contaminants to have reached the groundwater.

If groundwater contamination does not exist or exists below ch. NR 140, Wis. Adm. Code, PALs, the following approaches can be used to screen sites to determine if a threat exists to the groundwater pathway:

- i..An analysis that accounts for the factors listed above, or
- ii. Calculating residual contaminant levels in soil that would be protective of the groundwater pathway using the process set out in ch. NR 720 and the Department’s guidance document entitled: “Determining Residual Contaminant Levels Using the EPA Soil Screening Level Web Site – Publication RR 682.

2. Soil contamination with groundwater contamination above NR 140 ES levels.

Where soil and groundwater contamination exist together, the proposed remedy should explicitly address cleanup actions for both media. An action taken to address contaminated groundwater may provide a basis for establishing a performance standard for leaching of soil contaminants to groundwater, if the remedy will contain and remediate groundwater contamination that exceeds enforcement standards. Any groundwater remedy (passive or active) that is designed to meet enforcement standards can qualify as a soil performance standard. There are a number of active groundwater remedies that can control and remediate groundwater contaminants. Therefore, it can be established that those remedies meet a soil performance standard for the groundwater pathway by containing and remediating contaminants leaching from soils.

An impermeable barrier may be an effective remedy to reduce contaminant leaching through soil into groundwater and may help reduce contaminant concentrations in groundwater to below enforcement standards. Design and maintenance of impermeable barriers is discussed in greater detail in "Guidance for Cover Systems for Soil Performance Standard Remedies", RR-709.

Natural attenuation of groundwater contaminants can also serve as the basis for establishing a soil performance standard. Demonstrating that natural attenuation contains and remediates groundwater contaminants may serve as a soil performance standard at a site or facility if:

- a. It can be documented that naturally occurring processes are containing and reducing the mass and concentration of groundwater contaminants.
- b. Groundwater contaminant concentrations will be reduced below NR 140 ES levels within a reasonable period of time.
- c. Human health and the environment are protected.

If there are conditions that may adversely impact the natural processes being relied on to control the plume, sufficient documentation must be provided at the time closure is requested in order to justify that natural attenuation will continue to occur. An example of this type of situation would be an upgradient contaminant source that potentially affects the concentration of electron acceptors/nutrients entering the site of facility.

When a soil cover, cap or engineered structure is used to protect the groundwater pathway, closure conditions for land use limitations or conditions, and inspection and maintenance of the cover, cap or structure are required at the time of closure. A condition for listing the site on the Department's database is also required. See Section 3.0 for information on closure conditions.

3.0 REQUIREMENTS FOR CASE CLOSURE USING SOIL PERFORMANCE STANDARDS

3.1 VERIFICATION AND MAINTENANCE OF SITES USING A SOIL PERFORMANCE STANDARD AND REQUESTING CASE CLOSURE

When closure is requested for a site where a soil performance standard has been established, the effectiveness and adequacy of the remedial action and long-term maintenance of the remedy must be verified. Verification of the effectiveness and adequacy of the remedial action must be conducted by the responsible party prior to requesting closure. Capping actions to limit direct contact can be easily verified by establishing that a direct contact route of exposure no longer exists. It is more difficult to verify reduced leaching of soil contaminants to groundwater. If fate and transport modeling has been performed to evaluate contaminant leaching to

groundwater, a method to verify the results of the modeling in the field should be submitted to the Department. If natural attenuation is proposed as the mechanism containing and remediating a groundwater plume, the natural attenuation processes must be verified in the field before this remedy can qualify as a soil performance standard and case closure requested.

When a case is closed after verifying the effectiveness and acceptability of the remedial action at the site or facility, all components of the remedy (e.g., a barrier cap, natural attenuation) must be maintained permanently or until the contamination is reduced to the point where applicable standards are met and the pathways of concern no longer present a risk to human health or the environment. Barrier caps will require regular (typically annual) inspections and a maintenance program, including the regular repair and/or replacement of any cracked or deteriorated areas, to ensure the long-term effectiveness of the soil performance standard.

The closure request must identify who will be responsible for long term care and maintenance (if that responsibility rests with someone other than the property owner). Verification of notification of affected parties must be included. The Department may require maintenance agreements prior to granting final case closure. Activities that may disturb the barrier or change the condition of the barrier are specifically prohibited without prior written Department approval. If the soil performance standard is not maintained, the Department can reopen the closed site or facility under either of the following circumstances:

- a. the conditions in the case closure decision have not been complied with, or
- b. the Department can prove that "contamination on or from the site or facility poses a threat to public health, safety or welfare or the environment".

3.2 CONTINUING OBLIGATIONS

1. *General.* In accordance with the requirements of s. 292.12, Stats., which became effective on June 3, 2006, land use limitations and maintenance requirements can be imposed at a site or facility through enforceable conditions in local government exemption approvals, remedial action approvals or closure letters. Specific conditions may include any of the following:

- a. Require maintenance of an engineering control on the site.
- b. Require an investigation of the extent of residual contamination and the performance of any necessary remedial action if a building or other structural impediment is removed that had prevented a complete investigation or remedial action at the site.
- c. Impose limitations or other conditions related to property, in accordance with rules promulgated by the department, to ensure that conditions at the site remain protective of public health, safety, welfare and the environment, and, as applicable to promote economic development.

2. *Site specific requirements.* The type of site-specific situations that would meet one or more of the conditions mentioned above could include:

- a. Where a site is to be closed based on industrial RCL's.
- b. Where a building or other structural impediment prevents completion of a site investigation or remedial action at the site.
- c. Where some type of soil cover, cap or other engineered structure is used to contain soil contamination based on protection of groundwater.

- d. Where maintenance of a cover or cap is necessary to prevent direct exposure to residual soil contamination.
- e. Where a system is installed and maintained to prevent the migration of vapors.
- f. Where vapor migration was documented and the specific exposure assumptions utilized were based on the non-residential scenario.

3. *Deed notices.* The legislature, in enacting s. 292.12, Stats., did not change the Department's ability to place deed notices on property, when necessary. The Department uses deed notices to advise the public that previously applied deed restrictions have been satisfied, or where a person fails to adequately define or remediate contamination, and a deed notice is filed in accordance with ch. NR 728.

4. *Removal of continuing obligations.* Sites closed with continuing obligations (including groundwater use restrictions that were previously required) have the option of later requesting that the listing of the site on the Department's database be modified or removed if the previously imposed requirements have been satisfied.

More information can be found in the Case Closure and the Requirements for Managing Continuing Obligations, Publication RR-606, <http://dnr.wi.gov/org/aw/rr/archives/pubs/RR606.pdf>.

3.3 DNR DATABASE

When a continuing obligation is necessary in order for the Department to approve a local government exemption, remedial action or case closure request at a site with residual contamination, these sites are included on the Department's database. The Department has detailed guidance on when a site is required to be listed on the database. For a more information, please refer to the guidance document Case Closure and the Requirements for Managing Continuing Obligations, Publication RR-606, <http://dnr.wi.gov/org/aw/rr/archives/pubs/RR606.pdf>, and the web pages related to the database starting at: <http://dnr.wi.gov/org/aw/rr/cleanup/residual.htm>