



Wisconsin
Department of
Natural Resources

Bureau for
Remediation and
Redevelopment

PUB-RR-721
December, 2005
Revised October, 2013



Guidance for Determining Soil Contaminant Background Levels at Remediation Sites

Table of Contents

1.	Purpose, Disclaimer and Revisions	2
2.	Background Soil Determinations, Definitions and Rule Requirements	2
3.	Appropriate Contaminants of Concern for Background Determinations, Contaminants and Areas to Exclude as Representative of Background Conditions and Fill Areas	3
4.	Background Reference Site, Location and Number of Samples	4
5.	Sampling and Analysis Methods	6
6.	Determination of Background	6
	References	7

1. Purpose, Disclaimer and Revisions

- a) This document provides guidelines on how to determine the background concentrations of contaminants of concern in soil at hazardous substance discharge sites. It outlines how to select locations for sampling soil to determine background and site-related contaminant concentrations. It outlines how to evaluate the collected soil data for the background.
- b) 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 obligation, 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 149, NR 700 and NR 716, 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.

- c) Contact and revisions. This guidance will be updated as needed. Questions, comments and concerns may be sent to Gary Edelstein, P.E. - RR/5, WDNR, P.O. Box 7921, Madison, WI 53707, phone number 608-267-7563, email Gary.Edelstein@dnr.state.wi.us.

2. Background Soil Determinations, Definitions and Rule Requirements

- a) Need for Background Soil Determinations: Persons responsible for performing site investigations and determining the remedial approach will need to conduct soil sampling to determine if contaminants of concern are present in the soil at a hazardous substance discharge site. In some instances background levels for certain contaminants of concern may need to be established. This is because a residual soil contaminant (RCL) level for those contaminants could be determined to be below the background level.
- b) Definitions in the Rules Related to Background Determinations:

NR 700.03(58) "Soil" means unsaturated organic material, derived from vegetation and unsaturated, loose, incoherent rock material, of any origin, that rests on bedrock other than foundry sand, debris and any industrial waste.

NR 700.03(2) "Background soil quality" means:

(a) Soil quality that is attributable to the parent material from which the soil was derived and the natural processes which produce soil, or from contamination attributable to atmospheric deposition including but not limited to the following constituents: lead, polynuclear aromatic hydrocarbons or polychlorinated biphenyls, but not attributable to hazardous substance discharges or the discharge of pollutants, as that phrase is defined in s. 283.01, Stats.

(b) Soil quality that is found at or within reasonable proximity to the site or facility, at a depth comparable to that of the area to be remediated, in the same soil layer and in an area unaffected by hazardous substances discharges or the discharge of pollutants.

(Note: The requirements in both paragraphs (a) and (b) must be satisfied in the definition of "background soil quality," since the word "or" does not appear between the two paragraphs.)

c) Other Rule Requirements Related to Background Determinations:

Section NR 716.07(11) requires persons conducting site investigations to collect background soil samples, as appropriate.

Section NR 720.07(3) allows the background concentration to be used as the residual contaminant level (RCL) for the direct contact pathway for a substance if the background concentration (as determined using a Department-approved and appropriate method) is higher than the RCL determined in accordance with the requirements of that section.

3. Appropriate Contaminants of Concern for Background Determinations, Contaminants and Areas Not Representative of Background Conditions and Fill Areas

a) Appropriate Contaminants of Concern

Generally, only naturally occurring metals, lead and some ubiquitous organics, such as polynuclear aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) from widespread atmospheric deposition, are candidates for background soil determinations (that is, widespread, ubiquitous contamination that can't be traced to a specific source). Other contaminants found at a discharge site, such as volatile organic compounds (VOCs), are generally not candidates for such determinations.

The compounds selected for soil sampling at hazardous substance discharge sites should be limited to substances of concern based on the information gathered through the scoping process outlined in NR 716.07.

A contaminant detected in an area that may have been impacted by a discharge at a hazardous substance discharge site should be assumed to be above background unless it is determined, using Department-approved methods, that the background concentration of a substance is higher than the RCL determined under NR 720.

b) Contaminants and Areas Not Representative of Background Conditions

Where data or other information indicates that contaminants have migrated to a hazardous substance discharge site from another site that has an identifiable source of contaminants, the contaminants from that other source should not be considered background contaminants. Contaminants that should **not** be considered background include: contaminants from surface runoff from specific sources, such as runoff from parking lots and storage facilities where spills have occurred; railroad tie-related contaminants, such as creosote (PAHs, benzene, toluene, and ethylene (BTEX compounds) can be present in creosote), contaminants from spills at railroad facilities and in railroad rights-of-way; surface contamination adjacent to roads caused by vehicle emissions, and air emissions-related contamination from specific sources.

The definition of "background soil quality" in NR 700.03(2) refers to "lead, polynuclear aromatic hydrocarbons or polychlorinated biphenyls attributable to atmospheric deposition." The Department interprets this reference to "atmospheric deposition" to only refer to the ubiquitous, widespread deposition of contaminants from the air that can't be traced to a specific source. Contaminants from known sources are excluded from the definition. Therefore, lead contamination that can be traced back to vehicle emissions along a highway (even though all the specific vehicle owners can't be identified), and chromium contamination that has condensed on the ground outside an electroplater air vent, are not

due to "atmospheric deposition" as that term is used in the definition. This is because they are discharges from specific sources, even though the contaminants were released into the air before they were deposited on the surface of the ground.

Besides the definition of "background soil quality" in s. NR 700.03(2), the Department has other authority to prohibit the use of soil samples that were collected near roads or railroads or other inappropriate locations for the purpose of determining background concentrations under s. NR 720.07(3).

Section NR 720.07(3) provides that the "background concentration for a substance in soil shall be determined using a department-approved and appropriate method." The Department has the authority to refuse to approve of the use of soil samples that were collected in areas that are known or suspected to have high concentrations of contaminants. Therefore, areas near roads, including terraces and boulevards contaminated by vehicle emissions and areas impacted by road runoff, areas near railroads affected by engine exhaust contaminants, and areas near buildings contaminated by paint chips should **not** be used for the collection of background soil samples, for the purpose of applying s. NR 720.07(3).

Of course, this does **not** mean that a soil sample collected at a location that is a considerable distance from roads and other areas of high contamination is considered unacceptable merely because lead or some other contaminant is found in the soil sample, even if it is assumed to be from vehicle emissions. If there is lead or some other fairly common contaminant found outside of the areas that are known or suspected to have high concentrations of contaminants from specific sources, that contamination is truly widespread, ubiquitous contamination that can't be traced to a specific source and would appropriately be considered to be background.

It also does **not** mean that contamination that is not considered to be background must always be investigated in compliance with ch. NR 716 or must be required to be treated or removed. The Department has the ability to use enforcement discretion in such situations. In situations such as lead contamination from paint chips near a building, the Department can require or suggest that the contaminated soil be covered with grassy turf or pavement or can otherwise exercise enforcement discretion. (Please refer to DNR guidance on performance standard remedies for more information on capping remedies.)

Fill Areas

Areas of widespread imported natural soil fill fall under the definition of "soil" in NR 700.03(58), and are discussed in this guidance. Areas of waste fill, including areas filled with foundry sand, industrial waste, ash and demolition debris are considered to be landfills, not soil fill. Determinations of soil RCLs are not allowed or appropriate for in place waste that isn't soil. For cleanup purposes, areas of waste fill should be managed as landfills. Regional Project Managers can use case by case judgment when considering areas of fill that are mixtures of soil and some waste. Regional Project Managers may determine that areas that are mostly soil with an extremely small percentage of relatively inert waste may be considered soil fills under this guidance. The burden is on the persons responsible for addressing the site to show Regional Project Managers that the area of fill meets these characteristics.

4. Background Reference Site, Location and Number of Samples

The location or locations to select for background soil sampling should be as similar as possible to the hazardous substance discharge site but without the presence of discharged contaminants. "Where pollution sources are being studied, the ideal background or control area would be a location that only differs from the study area by the absence of the pollution source. This is seldom possible, but every

attempt should be made to reduce the factors that are different between the control and the study area.” (Mason, pg 6-17)

The background soil sampling locations shouldn't include contaminants from other sites or discharges.

In urban areas, background soil sampling locations may include areas where widespread, ubiquitous contamination is present that can't be traced to a specific source for such substances as PAHs, lead and PCBs.

In light of the second part of the definition of "background soil quality" in s. NR 700.03 (2), background levels must be established for each soil type/horizon of direct contact concern at the discharge site that shows contamination from the discharge if the responsible party intends to try to determine background concentrations of the contaminants of concern.

Generally, published background levels don't exist for most areas in Wisconsin. If published levels are found, they may be considered, but the locations of the samples and soil types should be sufficiently similar to the discharge site to be used.

At least 4 samples for each soil type/horizon of direct contact concern should be taken.

The background reference site should closely match (i.e. be substantively similar to) the contaminated site in question in respect to:

- a) geographical characteristics (e.g. location, topography, size/area, etc.),
- b) soil physical/chemical characteristics (see soil maps, etc.),
- c) hydrology, and
- d) soil sampling depth.

Additionally:

- e) within cities, preference should be given to vacant land (and it should be land which has not received imported fill, unless the site itself consists of mainly imported soil fill), naturally wooded areas, parks or large residential lots,
- f) reference sites should not be located immediately next to or within the area of contaminant point sources,
- g) reference sites with any obvious vegetation damage should be avoided, and
- h) the history of the reference site and adjacent land, including current and previous activities should be considered and documented.

The background reference site should not have the following characteristics:

- a) Areas of added or imported fill, including soil and waste filling (exception: if the discharge site consists mainly of imported soil fill, then a reference site could be an area of very similar soil fill that meets the other characteristics listed in this guidance),
- b) Road terraces or boulevards,

- c) Locations near buildings, especially where paint chips may be present,
- d) Locations where industrial or other contaminant generating activities are known to have taken place, including open garbage burning areas, vehicle parking and storage and material storage areas, or
- e) Locations near known air deposition sources, like foundries, coal fired power plants and other air pollution sources that may have deposited metals or other contaminants on the soil in the area.

5. Sampling and Analysis Methods

- a) Sampling methods for background soil samples should be the same as the methods used for contamination site characterization and follow the requirements of s. NR 716.13. Unless otherwise justified, discrete soil sampling is required in each soil horizon, in accordance with s. NR 716.13(4).
- b) Where appropriate, analysis methods for background soil samples should be the same as the methods used for contamination site characterization and follow the requirements of s. NR 716.13, however adjustments in the methods may be necessary. For example, the laboratory may use low concentration calibration standards to accommodate the low concentrations of the background soil samples and use calibration standards of higher concentration to accommodate the site characterization samples, especially if the site contaminant levels are orders of magnitude higher than background.

6. Determination of Background

- a) It's expected at most sites that there will not be enough background samples taken to perform normal statistics on the results. Therefore, in many situations, the mean level of the concentrations of the samples for each soil type/horizon may be used, provided that, using professional judgment; the levels from each sample are sufficiently similar to average together. Should the results not be sufficiently similar, it may be necessary to discard the outliers and collect more samples. Generally, it's expected that samples taken at an acceptable background reference site should show similar results across all the samples for each soil type/horizon.
- b) A responsible person or consultant may propose a normal statistics approach at sites where it is believed enough background samples have been taken after outliers are discarded. If this option is selected, prior DNR review and approval is strongly encouraged. One such approach would be to use the upper 95% confidence limit on the arithmetic mean of the individual sample concentrations. Utilization of this approach first requires a determination of the distribution of the data (i.e. normal, log normal or distribution free). More detail on this option, along with the method for calculating the upper 95% confidence limit can be found in several EPA guidance documents that are referenced in the guidance document "Soil Cleanup Levels for Polycyclic Aromatic Hydrocarbons (PAHs) Interim Guidance", Publication RR-519-97 (April, 1997).

References

Michigan guidance:

<http://www.deq.state.mi.us/documents/deq-erd-vsr.pdf>

Note: The Michigan guidance has now been replaced by the following:

<http://www.deq.state.mi.us/documents/deq-erd-stats-s3tm.pdf>

British Columbia regulatory protocol:

http://www.env.gov.bc.ca/epd/epdpa/contam_sites/policy_procedure_protocol/protocols/background_soil.html

Illinois Title 35 Part 742 Reg (TACO):

<http://www.ipcb.state.il.us/documents/dsweb/Get/Document-38408/>

Illinois TACO Background Soil fact sheet:

<http://www.epa.state.il.us/land/taco/9-background-determination.html>

Minnesota Guidance Documents:

Pubs page:

<http://www.pca.state.mn.us/cleanup/riskbasedoc.html>

Documents that discuss background soil issues:

Risk-Based Guidance for the Soil - Human Health Pathway
Site Screening and Evaluation Document
Site Characterization and Sampling Document

PREPARATION OF SOIL SAMPLING PROTOCOLS: SAMPLING TECHNIQUES AND STRATEGIES by Benjamin J. Mason, Ph.D. U.S EPA Publication number EPA/600/R-92/128, July 1992