

DETERMINING SEDIMENT BACKGROUND CONCENTRATIONS

Contaminated Sediments External Advisory Group
Work Group Meeting
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Background: Naturally Occurring

- Ambient concentrations of substances or agents present in the environment without any human influence
- Concentration is not due to a release of a chemical from human activities
- Present in the environment in forms that have not been influenced by human activity
- Dependent upon topography, geology, geography, and physical, biological, and chemical properties
- Source is geomorphological processes such as erosion, weathering, and dissolution of mineral deposits

Background: Anthropogenic

- Chemicals present in the environment that are not clearly attributable to a specific source
- Concentrations of substances or agents present in the environment due to human-made, non-site sources
- Presence of a chemical in the environment is due to human activities, but is not the result of site-specific use, or release of waste or products, or industrial activity
- Chemicals have typically resulted from the use of a product in its intended manner and may be present at generally low levels over large areas

Goals of a background assessment

- Identify contaminants of potential concern (COPCs)
- To compare background data to site data
- Assess risks to human and ecological receptors

Proposed assumptions for determining background concentrations

- Site contamination cannot exist if the chemical substances have not, at least in part, been introduced as a result of an activity at the site or elsewhere
- Background concentrations are often used to delineate the area where liability for clean-up begins and ends
- Suitable background values may be derived through sediment profiles by examining concentrations at depth with the assumption that the lowest concentration at depth represents the pre-industrial or pre-development sediment horizon
- Dependence on site-specific sampling as opposed to data from other unrelated sites
- Data sets with fewer than 10 samples generally provide poor estimates of mean concentrations

Proposed assumptions for determining background concentrations (cont.)

- In areas and sites where the background/reference site concentrations are greater than the CBSQG TEC values, the local background/reference site concentration should be used as the practical lower limit for doing sediment evaluations and making management decisions for additional sediment assessments
- Chemicals detected at concentrations below the upper bound of the background range can be excluded from the full baseline risk assessment
- The particle size fractions (for metals) and TOC content (for nonpolar organic compounds) of all samples should be used to normalize concentrations in order to do relevant and appropriate site-to-site comparisons

Data collection and evaluation

- Upper bounds of background concentration range must be identified to:
 - Evaluate and/or delineate the extent of a site-related chemical release
 - Calculate residual risks caused by a site-related release
 - Determine the scope of required cleanup, should it become necessary
- Considerations
 - Scientifically defensible
 - Technically feasible
 - Risk-based
 - Cost effective

Data collection and evaluation (cont.)

- Methods
 - Statistical and graphical techniques
 - Chemical fingerprinting
 - Can't use statistics alone, need an understanding of the geological, geochemical, and hydrological processes that control the occurrence and concentrations of naturally occurring chemicals

Difficulties in determining background concentrations

- Replication of data is difficult due to the natural environment being heterogeneous and part of a dynamic system (e.g. redistribution of contamination due to current and wave action as well as deposition of new sediments)
- Background concentrations greater than target cleanup levels
 - Clean-up to background levels or risk-based levels to protect human health and the environment?
- PAHs are widespread
- Background chemicals, particularly metals, can occur naturally in all sediments and may be present at concentrations high enough to represent unacceptable risks to human and ecological receptors and exceed standards
- Determining the quality and quantity of samples that are needed
- Interpretation of total organic carbon (TOC)
- Normalizing data
- Chemical fingerprinting

Proposed requirements for valid background samples

- Samples collected from areas that are not affected by the same activities as the site being assessed
- Background/reference site has all the characteristics of the study site sediments as close as practicable, which includes:
 - Sites should be reflective of the land uses and land cover of the watershed that the study is in
 - Similar particle size fractions
 - Total organic carbon content
 - Depositional attributes
 - Relative partitioning (e.g. water depth and stream cross-section) in the same water body as the study site location but needs to be out of the study site and the factors responsible for contaminating the study site

Proposed requirements for valid background samples (cont.)

- Samples collected up-gradient, upstream, and upwind from site
- Use same sample techniques, laboratory methods, and laboratory as those used for the site
- Samples are analyzed for the appropriate parameters
- Metals must be characterized in order to accurately evaluate the nature and extent of site-related metal contamination and assess the associated risks

Resources

- Brownfields Study Group, 2015 Report, Investing in Wisconsin, Reducing Risk, Maximizing Return.
<http://dnr.wi.gov/topic/Brownfields/documents/bsg/BSG2015report.pdf>
- EPA, South Australia, December 2008, EPA Guidelines, Site Contamination, Determination of Background Concentrations.
[www.epa.sa.gov.au/.../8369 **background concentrations** 27nov08.pdf](http://www.epa.sa.gov.au/.../8369_background_concentrations_27nov08.pdf)
- Green Facts, Facts on Health and the Environment, Background level(s). <http://www.greenfacts.org/glossary/abc/background-level.htm>
- ITRC, August 2014, Guidance Document, Contaminated Sediments Remediation, Remedy Selection for Contaminated Sediments. http://www.itrcweb.org/contseds_remedy-selection/Content/Resources/CSRPDF.pdf
- Missouri Department of Natural Resources, Draft – May 5, 2005, Site-specific Background Concentrations.
<http://dnr.mo.gov/env/hwp/mrbca/ref/site-specific-background-concentrations-draft-050505.pdf>
- Naval Facilities Engineering Command, April 2003, Guidance for Environmental Background Analysis, Volume II: Sediment, NFESC User's Guide, UG-2054-ENV.
http://www.navfac.navy.mil/content/dam/navfac/Specialty%20Centers/Engineering%20and%20Expeditionary%20Warfare%20Center/Environmental/Restoration/er_pdfs/gpr/navfacesc-ev-ug-2054-env-bkgrd-seds-200304.pdf
- U.S. EPA, September 2002, Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites, EPA 540-R-01-003. https://dec.alaska.gov/spar/csp/guidance_forms/docs/background.pdf
- Wisconsin Department of Natural Resources, December 2003, Consensus-Based Sediment Quality Guidelines, Recommendations for Use & Application, Interim Guidance, WT-732 2003.
http://dnr.wi.gov/topic/brownfields/documents/cbsqg_interim_final.pdf