Ohio EPA
Division of Emergency and Remedial Response

TECHNICAL DECISION COMPENDIUM
Remedial Response Program

Title: **Methodology for Evaluating Site-specific Background Concentrations of Chemicals**

Date: 14 April 2004

Key Words: Background, maximum concentration, screening

Purpose: To provide a methodology, applicable at all remedial response sites, for the determination of background concentrations and their use in risk assessment.

Background: Background concentrations refer to levels of naturally occurring or anthropogenic substances that are unaffected by any current or past site-related activities.

Background sampling is often conducted to help distinguish site-related contamination from naturally occurring or other non-site-related chemicals. This information is useful in evaluating whether a site has impacted various media and to help in the evaluation of remedial alternatives when necessary.

Background information can also assist in a screening step for chemicals during the human health and ecological risk assessments (see: Ohio EPA, 2003; U.S. EPA, 1989 *Chapter 5.7*). Background concentration levels of chemicals have also been used on a site-specific basis as an alternative to risk-based standards where risk-based standards are lower than background levels (U.S. EPA, 2002).

Even though the identification of background concentrations has not been required at all sites, it is beneficial to determine the background concentrations early in the remedial process.

To date, many methods have been developed to determine site-specific background concentrations. This TDC identifies one of the many options that are available for quantifying or evaluating background conditions.

Decision: Site-specific background concentrations of naturally occurring and anthropogenic chemicals may be used in the risk assessment process, as discussed below, at all remedial response sites.

Background sampling should be conducted at locations that have not been affected by the site or site-related anthropogenic activities, and in media of a similar type and horizon. See Section 2.3, in U.S. EPA-OERR 2002 for additional information on selecting appropriate background sample locations. Background levels can be determined for most media (*e.g.*, soil, ground water, surface water, and sediment). For mobile media such as surface water, ground water and sediment, the reference location(s) should be up-gradient and upstream in the same water body or saturated zone in areas not affected by site-related activities. Additional guidance may be provided by Ohio EPA on site-specific basis.

To calculate chemical-specific background levels, the methodology identified in the Background Calculation Methodology Guidance (see Ohio EPA Reference #2) is recommended. The calculated site-specific background levels should be compared to the maximum concentrations of chemicals of potential concern detected on-site in the screening step of risk assessment process. In contrast, site-related chemicals whose background concentrations are unknown have to be carried through the risk assessment process as chemicals of potential concern.

Naturally occurring chemicals may be eliminated from further consideration as chemicals of potential concern in the risk assessment, provided that on-site maximum concentrations of potentially site-related constituents are comparable to (equal to or less than) background levels.

Concentrations of anthropogenic chemicals that are non site-related (such as certain pesticides, polycyclic aromatic hydrocarbons, dioxins, etc.), may also be screened out by comparison to background levels on a site-specific basis.

The Ohio EPA site coordinator's concurrence that the chemicals in question are not attributable to the site should be obtained prior to screening out chemicals from the quantitative risk assessment. Chemicals that have been screened out in the quantitative risk assessment process should be qualitatively discussed in the risk characterization section (*e.g.*, as "chemicals not included", contributing significantly to uncertainty; U.S. EPA, 1989), to facilitate appropriate risk management and risk communication.

Additional guidance on the use of background in ecological risk assessments can be found in the Ohio EPA-DERR Ecological Risk Assessment Guidance document (Ohio EPA, 2003).

Rationale: The background evaluation methodology is not inconsistent with U.S. EPA guidelines and has precedence of usage by multiple Divisions in the Ohio EPA. Its application allows for the reduction of the number of chemicals carried through the quantitative risk assessment process, in an effort to simplify and focus the evaluation on site-related risk drivers. The Ohio EPA - DERR considers this methodology acceptable for use at all remedial sites. However, DERR would also accept the procedures recommended by U.S. EPA for CERCLA - Superfund sites (U.S. EPA, 1989; U.S. EPA, 2002; U.S. EPA-OERR, 2002) in evaluating and applying background concentrations in the risk assessment process.

Attachments: References; Glossary of Terms and Definitions

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References:

1. Ohio EPA, Division of Emergency and Remedial Response: 'Technical Decision Compendium, Use of U.S. EPA Region 9 PRGs as Screening Values in Human Health Risk Assessments', June 2002. Available on World Wide Web: http://www.epa.state.oh.us/derr/policies/technical/riskassem/screening.pdf

2. Ohio EPA, Division of Emergency and Remedial Response: 'Background Calculation Methodology Guidance' *(under development)*

3. Ohio EPA, Division of Emergency and Remedial Response: 'Guidance for Conducting Ecological Risk Assessments', February 2003, DERR-00-RR-031. Available on World Wide Web: http://www.epa.state.oh.us/derr/rules/RR-031.pdf

4. U.S. EPA, Office of Emergency and Remedial Response: 'Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A)', December 1989, EPA/540/1-89/002. Available on World Wide Web: http://www.epa.gov/superfund/programs/risk/ragsa/index.htm

5. U.S. EPA, Office of Solid Waste and Emergency Response and Office of Emergency and Remedial Response: 'Role of Background in the CERCLA Cleanup

Program'. April 26, 2002. OSWER 9285.6-07P. Available on World Wide Web: http://www.epa.gov/superfund/programs/risk/bkgpol_jan01.pdf

6. U.S. EPA-OERR, Office of Emergency and Remedial Response: 'Guidance for Comparing Background and Chemical Concentrations in Soil for CERCLA Sites', EPA 540-R-01-003, OSWER 9285.7-41 September 2002. Available on World Wide Web: http://www.epa.gov/superfund/programs/risk/background.pdf

ATTACHMENT:

Glossary of terms and definitions:

Background refers to concentrations of chemicals at locations that are unaffected by any current or past site activities involving the management, handling, treatment, storage or disposal of hazardous substances. Background includes concentrations of both anthropogenic and naturally occurring chemicals:

> 1) *Anthropogenic* – natural and human-made substances present in the environment as a result of human activities (not specifically related to the site in question); and,
>
> 2) *Naturally occurring* – substances present in their unaltered form or altered solely through naturally occurring processes or phenomena, in a location where they are naturally found.

Background levels include only substances, sampled from unaffected portions of the site and areas surrounding the site ("background reference locations"), whose upper boundaries (upper cutoff values) have been evaluated.

Background concentration is the concentration of constituents found in media such as air, water, soil or sediments at or surrounding a waste site, but which are not influenced by site activities or releases. [Note: The distinction between background concentrations and background levels in this TDC is that the former refers to actual measured data, while the latter refers to the upper limit of the population of background concentration values.]

A "*background reference location*" should be a site that is geologically similar and has similar biological, physical, and chemical characteristics (*e.g.*, particle size, percent organic carbon, pH) as the contaminated site but also should be upstream, upgradient, or upwind of the site. Samples taken from a site to determine background concentrations are referred to as *background samples*.

Screening is a common approach used by risk assessors to refine the list of potential chemicals of concern to those hazardous substances, pollutants, and contaminants that may pose substantial risks to health and the environment (risk drivers). Screening involves

a comparison of site media concentrations with *background* and *risk-based* values.

Site refers to the aerial extent of contamination and all suitable areas in very close proximity to the contamination necessary for the implementation of the response action, as defined in the National Contingency Plan (NCP: 40 CFR, Ch. I (7/1/03 Edition), § 300.5; Available on World Wide Web: http://www.epa.gov/oilspill/pdfs/40cfr300.pdf).

Upgradient refers to areas that are topographically and/ or hydraulically upgradient of the site, and thus could not be impacted by site-related contamination. Upgradient concentrations are generally necessary to determine whether contamination in mobile media such as surface water, sediment or groundwater are attributable to the site.