

**BUREAU OF ENVIRONMENTAL REMEDIATION/REMEDIAL SECTION
POLICY
Determining Background Levels for Chemicals of Concern**

BER POLICY # BER-RS-038 (Revised)

DATE: June 15, 2010

PAGES: 4

Section Chief: 

Date: 6/30/10

Bureau Manager: 

Date: 6/30/10

ORIGINATOR

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Date: June 15, 2010

Original Policy: RESCINDED IN 1999**

**(KDHE's previous policy BER-RS-38 was rescinded in 1999 following the publication of the Risk-Based Standards for Kansas RSK Manual. This policy provides additional guidance to the proper use of the Tier I policy as outlined in the RSK Manual. The policy is primarily applicable to metals in soil media, but also has applicability to other chemicals of concern and groundwater in certain situations.)

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PURPOSE

This policy has been developed to establish a mechanism for consistency across BER programs in determining site-specific background values (Tier 1) for chemicals of concern (COCs). The term “Respondent” as used in this policy is the party responsible for carrying out environmental response at a contaminated property under the auspices of a KDHE environmental program. This policy replaces the previous version of this policy, dated 1993/updated 1996, that has been rescinded.

INTRODUCTION

The primary goal of KDHE/BER programs is to insure contaminated sites are remediated to the extent necessary to protect public health and the environment from unacceptable risks potentially caused by exposure to contaminated media. The Risk-Based Standards for Kansas RSK Manual (current version available on line at <https://www.kdhe.ks.gov/775/Risk-based-Standards-for-Kansas>) provides a tiered approach for establishing cleanup goals at contaminated sites in Kansas. The tiers are summarized as follows:

- Tier 1 is a comparison of the concentration of a naturally occurring contaminant to the background concentration of that contaminant in the affected medium, using methods approved by KDHE/BER to determine background.
- Tier 2 is a comparison of the concentration to the risk-based cleanup values in the Tier 2 Risk-Based Summary Table found in Appendix A of the aforementioned RSK Manual.
- Tier 3 involves collecting the necessary data, under KDHE/BER direction, to replace default values in the Tier 2 equations with site-specific information.

APPROACH

Tier 1 cleanup levels may be determined for COCs that are also naturally present in the environment. This class of contaminants includes metals (such as lead, arsenic, cadmium and chromium), radionuclides, nitrate, ammonia and chloride, among others. The COCs identified tend to be the most common, but other COCs may be present where there is a need to distinguish between naturally-occurring and anthropogenic effects for the sake of determining appropriate

cleanup levels. In addition, certain COCs that are endemically enriched in various environments such as industrial tracts or agricultural lands, as a result of their widespread employment by humans, may also be evaluated as a Tier 1 contaminant. For sites with naturally-occurring contaminants, KDHE/BER may allow the background concentration to be the cleanup goal in that medium.

To establish Tier 1 cleanup levels, background concentrations of naturally-occurring contaminants must be determined at or in the vicinity of the site. If current background environmental quality data are not available or are not representative of the site, then the collection and analysis of background samples will be required to determine background environmental quality.

Respondents and their consultants should discuss with the KDHE Project Manager prior to the submittal of a work plan for investigation, the scope of environmental information needed at a property to completely delineate contamination. If it is apparent that one or more COCs at the property are also naturally present in the contaminated media, a plan for background sampling should be included in the work plan for investigation and presented for review and approval by the KDHE/BER Project Manager prior to the collection of samples. The KDHE/BER Project Manager must be provided the opportunity to observe and collect split samples for the background investigation along with the other investigative activities. The portion of the work plan developed for background sampling should contain the following at a minimum:

- The rationale for determining background levels for COCs in lieu of using the Tier 2 Table.
- A description of the media impacted and targeted for sampling to determine background levels.
- The number and location of samples to be taken.
- Sampling and analytical protocols.
- The statistical program(s) to be used to process data and determine background levels.

The KDHE/BER Project Manager may request additional data be collected or suggest an alternate approach based on project-specific needs and site-specific circumstances. Standard Operating Procedures (SOPs) for sampling, lab analysis and statistical processing of samples for background determinations should be attached to the work plan.

Selecting Sample Locations

Selecting sample locations to yield acceptable background data requires an adequate understanding of the COCs, the contaminated media on-site, as well as, the distribution and location of comparable media in the vicinity of the site. Ideally, background samples should be taken from the same media in similar topographic and geologic positions as the contaminated media on-site. To properly determine natural background levels at a site, samples should be collected from areas hydraulically up-gradient (groundwater) and beyond the influence of airborne contamination from known or suspected contaminated area(s) (soil). The identified areas for background sampling must not have been affected by local anthropogenic activities.

Soil Sampling

Soil samples collected for the purpose of determining background levels at a site must be obtained from the same soil type/horizon/stratum from which on-site COC impacted samples are taken. If site characterization includes collection of soil samples at predefined depths, then background samples should be collected at the same depth intervals. If site samples are from bedrock formations, then off-site samples should be taken from the same formation. Samples taken from contaminated natural surface soils at a site should be compared to the same soil types beyond the area of contamination. Reference to U.S. Department of Agriculture, Soil Conservation Service county soil maps can help determine soil types at sites. Both on- and off-site samples should be taken following the same sampling protocols.

Locating soil samples can be judgmental, random, or systematic and the decision to use one particular method over another is a professional judgment which **must be** approved by the KDHE Project Manager in the work plan and prior to actual sampling. Likewise, both discrete and composite sampling have been used in background studies with success; however, because composite sampling does not allow variance or precision to be estimated, discrete sampling will be required unless given specific approval from the KDHE Project Manager.

The Respondent and their consultant should use the data collected to derive a defensible statistically-based background soil value for the relevant COCs. Statistical tools for determining background levels in soil can be found in the comprehensive EPA publication “*Guidance for Comparing Background and Chemical Concentrations in Soil at CERCLIS Sites:*” EPA 540-R-01-003 (2002). That publication states that data sets with less than ten measurements may create t-values which are too large and produce background concentrations that are not considered statistically representative at a 90 percent confidence level. KDHE considers that at least ten background soil samples are necessary for a statistically defensible determination unless specific approval has been given by the KDHE Project Manager.

For sites greater than five acres or sites with a large amount of variation and complexity, the number of samples needed may be larger and can be determined by a pre-approved statistical methodology. The EPA Publication “*Data Quality Assessment: Statistical Methods for Practitioners (QA/G-9S)*: EPA/240/B-06/003 (2006) is available on-line at <https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=900B0D00.txt>, and elsewhere, may prove helpful in determining statistically reliable numbers of background samples for COCs.

KDHE understands that obtaining ten samples may be burdensome for small sites or to complete a preliminary investigation. At such sites, fewer background samples (generally no less than three) may be taken **with the approval** of the KDHE Project Manager. However, it must be recognized by all parties that remedial decisions based on a few samples are judgmental decisions and may not be statistically defensible. KDHE reserves the right to request additional background sampling if those samples collected are not sufficient to support decisions regarding cleanup criteria and/or remedial action objectives.

Please Note: Tier 1 background determinations are not appropriate for soil samples collected from fill material or disturbed soils at a site. These values will be compared to the Tier 2 Table to determine if cleanup is required.

Please Note: Refer to Policy BER-ARS-045 when sampling unconsolidated materials that meet the definition of “sediment.” (Nevertheless, determination of background levels for sediment may follow applicable portions of this guidance as determined by the KDHE Project Manager.)

Applicability of this Policy to Other Media

The forgoing policy for determining background levels for COCs in soil media has limited applicability to groundwater. Natural or non-point source anthropogenic COCs (such as metals, nitrate, radionuclides, chlorides and others) may be present in groundwater and may exceed the Tier 2 cleanup values. Determining local background levels in groundwater may require installation of upgradient or side gradient monitoring wells or groundwater probes and obtaining samples or data from nearby monitoring or water-supply wells. Obtaining sufficient samples to support statistically reliable background values may be too expensive to be practical. In sparsely populated areas, data availability may be limited. Nevertheless, obtaining background data from even a few existing wells may reduce uncertainty regarding background levels of COCs and support judgmental decisions on the number of additional monitoring wells that may be needed, especially in areas where the water table is deep.

Determining background levels in groundwater should follow the same general procedures as those for soils, recognizing that the number of sample points may be limited. Where determining background levels is a necessary goal for completing site investigation objectives, the Respondent should have their consultant include an appropriate sampling plan in the work plan for review and approval of the KDHE Project Manager.

References

- EPA, 2002, Guidance for Comparing Background and Chemical Concentrations in Soil at CERCLIS Sites: EPA 540-R-01-003, U.S. Environmental Protection Agency, Washington, D.C.
- EPA, 2006, Data Quality Assessment: Statistical Methods for Practitioners (QA/G-9S): EPA/240/B-06/003, U.S. Environmental Protection Agency, Washington, D.C.
- KDHE, 2007, Risk-Based Standards for Kansas RSK Manual – 4th Version: Kansas Department of Health and Environment, Bureau of Environmental Remediation, Topeka, Kansas.