ARCHIVE: **Archived due to the 2009 rule revision. Refer to VA30007.09.032 for the updated document.**

TITLE: **Use of RBCA Tool Kit ® and SAM to Evaluate Leaching**

DATE EFFECTIVE: August 2005

HISTORY: New addition to the Technical Guidance Compendium

KEYWORDS: Leaching, soil partitioning coefficient, Summer's dilution equation, mass distribution equation, modeling

RULE/ AUTHORITY: OAC 3745-300-07(D)(4)(a)(i) and (F); 3745-300-10(E) and (F)

QUESTION: Can the equilibrium partitioning, dilution, and sorptive mass redistribution equation in the Soil Attenuation Model (SAM)[1] and RBCA Tool Kit Model®[2] be used to evaluate leaching to ground water?

BACKGROUND: OAC 3745-300-10(E) states that remedial activities must ensure that when any ground water underlying the property complies with unrestricted potable use standards (UPUS), migration of hazardous substances or petroleum from source areas on the property will not result in UPUS being exceeded anywhere within the saturated zone. OAC 3745-300-07(D)(4) requires a volunteer to demonstrate continued compliance with the provisions to protect ground water meeting unrestricted potable use standards. An evaluation of leaching and migration to a compliance point may also be necessary in accordance with portions of OAC 3745-300-10(F).

ANSWER: RBCA Tool Kit® and SAM models have several equations that may be useful in evaluating the soil concentration of a chemical of concern

[1]Connor, J.A, R.L. Bowers, S.M. Paquette, and KNAWEL. Soil Attenuation Model (SAM) for Derivation of Risk-Based Soil Remediation Standards. 1997. Ground Water Services, Houston, Texas. http://www.gsi-net.com/publications/papers2.asp

[2]Ground Water Services Inc. 2000. RBCA Tool Kit Model for Chemical Releases. Houston, Texas.

(COC), the concentration that can be left in soil above the first ground water zone that would be protective of ground water of a target ground water concentration (i.e., unrestricted potable use standard). A leach-based soil value can be estimated by partitioning between the soil and pore water. The models also contain a dilution equation accounting for dilution as it enters the ground water zone. Both of these (partitioning equation and dilution equation) are also described in U.S. EPA Soil Screening Guidance Document (1996).

A third equation provided in the RBCA Tool Kit and Soil Attenuation Model (SAM) accounts for the relationship between the thickness of the contaminated soil and the thickness of the "clean" soil separating the lower most portion of soil contamination from the top of the water table (referred to as the mass distribution equation). This allows for a conservative method to account for the attenuation of a COC as it migrates through the lower portion of the previously uncontaminated soil. Application of the mass distribution equation provides an additional mechanism to demonstrate that leaching of contaminants is not of concern. Note that Ohio EPA does not consider it appropriate to apply the mass distribution equation to vadose soils with a saturated vertical hydraulic conductivity greater than 10E-3 cm/sec and/or COCs that are highly soluble (e.g., acetone, methyl ethyl ketone). This is based on a comparison of modeling results from both the SAM and SESOIL models.

The leaching of contaminants is an extremely property-specific phenomenon and one method may not be appropriate for all situations. Therefore, property-specific contaminant conditions, geology, climate and subsurface conditions should always be taken into account before using any method. In addition, there are many physical, chemical, and biological mechanisms that can impact the amount of contamination reaching a ground water zone. Major contaminant loss mechanisms may include volatilization of the contaminant, sorption of the contaminant to the soil particles, dissolution of the contaminant in the soil water, and natural degradation of the chemical compound. SAM accounts for several of these mechanisms but not all of them. Additional property-specific modeling may be appropriate depending on the specific circumstances at the property.

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