The Remediation Standards
N.J.A.C. 7:26D
Migration to Ground Water Pathway

External Stakeholder Meeting
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Purpose

- Intent of the current effort is to amend the 2008 remediation standards (N.J.A.C. 7:26D) which are scheduled to sunset June 2, 2015
- Describe the development of the Migration to Ground Water Pathway Remediation Standards
- Note: The Impact to Ground Water(IGW) pathway will now be named the Migration to Ground Water (MGW) Pathway (consistent with USEPA)

Agenda

- Describe the MGWRS proposal in a broad sense
- Detail the process of developing the MGWRS

2015 MGW Soil Standards Proposal

- Two sets of standards will be proposed

  1. Soil standards based on the soil water partition equation
  2. Leachate standards based on GWQS and DAF

- The pathway may be addressed using either the soil standards or the leachate standards

MGW Soil Standards

- Since the endpoint is GWQS, toxicity selection has not been a part of MGWSRS development (unlike Direct Contact)
- Like the Direct Contact pathways, PQLs are incorporated into the standards

First Set of MGW Remediation Standards

Soil Standards

- Directly applicable to measured soil concentrations
- Relies on USEPA methodology
  http://www.epa.gov/superfund/health/conmedia/soil/introtbd.htm
- Uses the soil water partition equation which is the equation used by USEPA to develop their MGW Regional Screening Levels listed in the USEPA mid Atlantic Risk Assessment table

Soil Water Partition Equation

- Back-calculates the soil standard from the GWQS using equilibrium partitioning and a dilution-attenuation factor representing dilution when contaminant enters ground water
- GW under an Area of Concern meets the GWQS
- Protective of ground water for cases with little or no site specific information

Soil Water Partition Equation continued

- Protective irrespective of location of contamination relative to water table.
- Contamination may be in contact with the top of the water table (no clean zone between contaminated soil and ground water).
- Protective even if entire unsaturated zone is contaminated

Key changes from and updates to current IGWSSLs

- The GWQS, not the health based GWQC, is the proposed endpoint. This differs from current IGWSSLs.
- If MGWSRS exceeds the contaminant's Csat value, the contaminant does not pose a risk to pathway
- Chemical properties will be updated

Soil Water Partition Equations

- Organic contaminants equation

$$MGWSRS = GWQS\left\{K_{oc}\rho_{oc} + \frac{\theta_w + \theta_a H'}{\rho_b}\right\} DAF$$

- Inorganic contaminants equation

$$MGWSRS = GWQS\left\{K_d + \frac{\theta_w + \theta_a H'}{\rho_b}\right\} DAF$$

Ground Water Quality Standards

- The endpoint for the pathway, the GWQS, are basically the same as in 2008
- The only change is where a contaminant with no previous GWQS now has an Interim Specific Standard that can be used to develop a MGWRS
- Generic Interim Standards have not been used

Soil Parameter Values

- Unchanged from 2008, also used in Inhalation Standards for volatile calculation
- Parameter values explained in 2008 Inhalation Basis and Background Document
  http://www.state.nj.us/dep/srp/regs/rs/bb_inhalation.pdf
- Sandy loam soil selected as default soil texture

Soil parameter values

- Soil bulk density (ρ_b)= 1.5 g/cc
- Soil water content (θ_w)= 0.23 (v/v)
- Soil air content (θ_a) = 0.18 (v/v)
- Sensitivity of partition equation standard to above parameters is low

(http://www.nj.gov/dep/srp/guidance/rs/partition_equation.pdf)

- Fraction organic carbon (f_{oc})= 0.002 (w/w)

Chemical Properties

- Primary source for 2008 chemical properties was 1996 USEPA soil screening guidance (Superfund Chemical Data Matrix)
- New source for chemical properties is the USEPA mid-Atlantic Risk Assessment tables

(http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm)

Chemical Properties-H', S, Koc

- Henry's law constant (H') – EPI Suite (experimental values)
- Water solubility (S) – EPI Suite (experimental values)
- Soil organic carbon-water partition coefficient (Koc) – EPI Suite (MCI-estimated)

Chemical Properties-Kd

- Soil adsorption coefficients for metals (Kd) – no change from 2008
- Explained in 2008 Inhalation Basis and Background document
- Uses values presented on USEPA mid-Atlantic Risk Assessment web pages (USEPA 1996 Soil Screening document values)
- For pH dependent Kd values, used pH 5.3 value

Dilution-Attenuation Factor (DAF)

- May 1996 Soil Screening Guidance published 2 sets of numbers using DAF of 1 and DAF of 20
- Current Regional Screening Level table uses only a DAF of 1 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/docs/master_sl_table_run_NOV2013.pdf)
- NJDEP previously had DAF of 13; it was updated to DAF of 20 in December 2013

Dilution-Attenuation Factor

When infiltrating soil water reaches the water table, it mixes with GW and contaminants are diluted. The resulting concentration in GW is therefore lower than that in the infiltrating water. A DAF factor is used to account for this process.

$$DAF = 1 + \frac{Kid}{IL}$$

i = gradient

d = mixing zone depth

I = infiltration rate

L = length of AOC parallel to GW flow

K = hydraulic conductivity

DAF- Default Input Parameters

- Length of AOC Parallel to GW Flow (L) = 100 ft
- Mixing zone depth, d = 3.4 m
- K = 142 ft/day
- i = 0.003
- I= 0.28 m/yr

DAF – Recharge rate (I)

- Unchanged from 2008, explained in Inhalation Basis and Background document
- Calculated from New Jersey Geological Survey calculator for representative soil textures in their respective municipalities
- Looked at landscaped open space, unvegetated and general agricultural land uses
- 11"/year is a representative recharge rate for most soil textures

DAF – Hydraulic conductivity (K) and gradient (i)

- Primary source of information for K and i is most recent data on the Kirkwood-Cohansey aquifer
- A representative gradient was determined from 235 actual measurements of gradient on water table elevation map. Median i=0.003
- Results of 67 aquifer stress tests from NJGS and USGS were compiled. Median K=142 ft/day
- Using these values in the DAF Equation, along with the other parameters results in a DAF of 20

DAF of 20 as a statewide value

- Inner coastal plain aquifers judged to be similar to outer coastal plain (Kirkwood-Cohansey), at least in terms of the surface aquifers and the product of K and i.
- For the rest of the state, two USEPA DAF databases presented in the 1996 USEPA Soil Screening Guidance were used to evaluate DAF values for 0.5 acre site size.
- HGDB database, northern NJ (uplands and glaciated): Mean, 37; Geo Mean, 18, Median: 21.
- DNAPL database: median of 22 (uplands), median of 20 (coastal plain). These data not from NJ sites.
- DAF Guidance: http://www.nj.gov/dep/srp/guidance/rs/daf.pdf

Parameters which may be varied site specifically in the soil water partition equation

- Fraction organic carbon (f_{oc})

(http://www.nj.gov/dep/srp/guidance/rs/partition_equation.pdf)

- Dilution-Attenuation factor (DAF)

(http://www.nj.gov/dep/srp/guidance/rs/daf.pdf)

- Site specific Kd (derived using SPLP)

(http://www.nj.gov/dep/srp/guidance/rs/splp_guidance.pdf)

Second Set of MGW Remediation Standards

Leachate Standards

Equation:

LS= GWQS x DAF (20) or PQL, whichever is higher

Note: PQL will be the same as for the GWQS

Leachate standards may be used in two ways

1. SPLP test can be used to determine leachate concentrations under field conditions, which may be compared to the Leachate Standards
http://www.nj.gov/dep/srp/guidance/rs/splp_guidance.pdf

2. SESOIL model- compare the leachate predicted by the model to Leachate Standards
http://www.nj.gov/dep/srp/guidance/rs/sesoil.pdf

Migration to Ground Water Pathway ARS

Alternative/Site Specific Remediation Standards

See guidance documents found at:

http://www.nj.gov/dep/srp/guidance/rs/

Questions

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