GW-2 METHODOLOGY

The DES revised GW-2 calculation methodology has been developed using a variation of the USEPA spreadsheets for the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings to determine a groundwater to indoor air chemical specific attenuation factor. The attenuation factor is used in combination with conservative risk assessment calculations to generate target groundwater concentrations, as described below.

The approach taken to develop the GW-2 guidelines is as follows:

1. **Threshold Non Cancer Risk ($\mu g/m^3$)**: A concentration in air equal to 20 percent of a reference concentration (RfC) published by the USEPA or an analogous allowable concentration is determined, if available.

2. **Cancer Risk ($\mu g/m^3$)**: A concentration in air associated with an excess lifetime cancer risk equal to one-in-one million (10^{-6}) is determined, if available.

3. **Odor Threshold ($\mu g/m^3$)**: A concentration in air at which 50% of the population can detect its odor is determined, if available.

4. **Lowest Risk-Based/Odor Value ($\mu g/m^3$)**: The lowest of the values from steps 1, 2 and 3, is carried through the process.

5. **Background Indoor Air Level ($\mu g/m^3$)**: Where a chemical was detected in at least 25% of homes sampled in the studies listed below, the lowest 75th percentile value is selected to represent the background indoor air level

    - "Study of Volatile Organic Chemicals in Air of Fuel Oil Heated Homes." New York State Department of Health, 1997-2003.

    - "Background Indoor Air Levels of Volatile Organic Compounds (VOCs) and Air-Phase Petroleum Hydrocarbons in Massachusetts Residences," completed by Rich Rago and Rose McCafferty, Haley & Aldrich, and Andy Rezendes, Alpha Analytical, presented to NHDES October 2005.

6. **Method Reporting Limit ($\mu g/m^3$)**: The method reporting limit for an appropriate EPA approved analytical method for indoor air.

7. **Target Indoor Air Level ($\mu g/m^3$)**: The higher of the values from steps 4, 5 and 6 is selected as the target indoor air level.

8. **Target Groundwater Value ($\mu g/L$)**: A target groundwater value is calculated using a groundwater to indoor air chemical specific attenuation factor generated by the vapor transport model (see model discussion below) and the target indoor air level established above in step 7 as follows:

$$[C]gw = [C]_T \div (\alpha_{gw} * d * H * CF)$$

[C]gw = Target groundwater value, µg/l (ppb).
$[C]_T$ = Target indoor air level, $\mu g/m^3$.
α_{gw} = Groundwater to indoor air chemical specific attenuation factor. Dimensionless.
d = Degradation factor of 0.1 for petroleum compounds, 1.0 for all other compounds.
H = The Henry's Law Constant for the chemical. Dimensionless.
CF = Units Conversion Factor of 1000 l/ m^3

9. **Ceiling Value:** 50,000 µg/L is the maximum GW-2 value for any volatile chemical.

10. **Solubility Value:** The solubility of the chemical if available.

11. **Lowest of Target, Ceiling, Solubility (µg/L)**: The lower of the values from steps 8, 9 and 10 is carried through the process.

12. **Method Reporting Limit:** The method reporting limit (MRL) for an appropriate EPA approved analytical method for groundwater.

13. **Ambient Groundwater Quality Standard (AGQS):** The current AGQS value for the chemical.

14. **Highest of Lowest, MRL, and AGQS (µg/L)**: The highest of the three values from steps 11, 12 and 13 is chosen as the GW-2 value.

15. **GW-2 Guideline:** The value from step 14 is rounded to one significant figure and selected as the GW-2 guideline.

MODEL INPUT PARAMETERS

The GW-2 guidelines are based on a variation of the USEPA spreadsheet for the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings where chemical specific partitioning coefficients, subsurface properties and building parameters are used to calculate a groundwater to indoor air chemical specific attenuation factor.

Model Input			
Parameter	Description	Value	Units
L_F	- Depth below grade to bottom of enclosed space floor	183	cm
L_{WT}	- Depth below grade to water table	300	cm
T_S	- Average soil/groundwater temperature	10	°C
h_A	- Thickness of Soil Stratum A	300	cm
h_B, h_C	- Thickness of Soil Strata B and C	0	cm
p_b^A	- Soil dry bulk density	1.3	g/cm^3
n^A	- Soil total porosity	0.3	unitless
θ_w^A	- Soil water-filled porosity	0.06	cm^3/cm^3
L_{crack}	- Enclosed space floor thickness	15	cm
ΔP	- Soil-bldg. pressure differential	40	$g/cm\text{-}s^2$
L_B	- Enclosed space floor length	961	cm
W_B	- Enclosed space floor width	961	cm
H_B	- Enclosed space floor height	488	cm
w	- Floor-wall seam crack width	0.1	cm
ER	- Indoor air exchange rate	0.45	1/h