

APPENDIX I

APPENDIX I
GROUNDWATER COC MIGRATION
CALCULATIONS

PLUME LENGTH AND DURATION CALCULATIONS FOR ATLAS PARK

1. Hydraulic Conductivity, K (ft/d) (Franke and McClymonds, USGS 1972)		270.00
2. Hydraulic Gradient, i (ft/ft) (Average gradient between MW-13 and MW-38 from RI Table 16)		0.0014
3. Effective Porosity, n_e (Freeze and Cherry, 1979)		0.3
4. Bulk Density of Formation, r_b (g/cm ³) (EPA, 1998)		1.5
5. Soil Sorption Coefficient, K_{oc} (ml/g) (Domenico, 1987)	PCE	300
6. Fraction of Organic Carbon, f_{oc} (EPA, 1998)		0.0017
7. Seepage Velocity, v_s (ft/d) $[v_s = K * i / n_e]$ ft/yr		1.26 460
8. Retardation Factor, R_d $[R_d = 1 + (K_{oc} * f_{oc} * r_b / n_e)]$	PCE	3.6
9. Contaminant Transport Rate, V_{pt} (ft/d) $[V_{pt} = v_s / R_d]$	PCE	0.35

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10. Contaminant Data

PCE
(MW-38)
90
5
720
360
0.0010
0.0019

Initial Concentration of Compound, C_o (ug/l)
Target Compound Concentration (GWQS), C (ug/l)
Half-Life for Compound - High (days)
Half-Life for Compound - Low (days)
Degradation Constant, k - High (1/day)
Degradation Constant, k - Low (1/day)

1. Initial concentrations are based on RI groundwater data (Table 17).
2. Half-life equation (NJDEP 1998).

$$t_{1/2} = 0.693 / k$$

where k is the degradation constant

3. Half-lives from Handbook of Environmental Degradation Rates (Howard et al., 1991).

11. Plume Duration

First-order decay equation to calculate plume duration (NJDEP 1998):

$$[C = C_o e^{-kt}]$$

Therefore,

$$[t = -\ln (C / C_o) / k]$$

Contaminant	Decay Duration		
	Minimum	Maximum	Years
PCE	1,501	4.11	3,003
			8.2

12. Length of Plume, d (ft)

(NJDEP 1998) $[d = V_{pt} * t]$

Contaminant	Plume Length (ft)	
	Minimum	Maximum
PCE	532.9	1,066

PLUME LENGTH AND DURATION CALCULATIONS FOR ATLAS PARK

References:

- Domenico, P.A. "An Analytical Model For Multidimensional Transport of a Decaying Contaminant Species." Journal of Hydrology 91 (1987): 49-58.
- Freeze, R. Allan and Cherry, John A. Groundwater. Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1979.
- Howard, P.H., et al. Handbook of Environmental Degradation Rates. CRC Press LLC, 1991.
- NJDEP. Final Guidance on Designation of Classification Exception Areas. 1998.
- USEPA, 1998, Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water, EPA/600/R-98/128.