Domenico Analytical Solute Transport Model					**Management Option 1**			
LDEQ Risk Evaluation/Corrective Action Program								
Revision date: 07/10/2002								
Run date:	10/16/2003							
General assumptions:								
1. A single continuous source of one chemical compound dissolved								
in the groundwater. No NAPL.								
2. No initial groundwater contamination.								
3. Chemical compound is non-reactive.								
4. No biodegradation or retardation occuring.								
5. Groundwater flow is in one direction.								
6. Saturated zone is homogeneous and isotropic.								
7. Contaminant plume is a planar source spreading infinitely								
laterally in two directions and vertically in one direction.								
8. The point "X" is behind the point where "X = v * time since spill".								
9. Longitudinal, transverse, and vertical groundwater dispersivities								
are based on ASTM E 1739-95 example.								
10. The DAF is based on the estimated contaminant concentration (Cxi)								
at the center line of the plume.								
Example Calculation of the Groundwater Dilution Attenuation Factor								
Site-specific inputs:								
2000	(ft) = X = distance downgradient from source.							
5	(ft) = Sd = vertical depth of plume (measured vertical extent							
	of affected groundwater plume or the full							
	thickness of the groundwater stratum).							
Defaults:								
148	(ft) = Sw = groundwater plume width perpendicular to							
	groundwater flow.							
30	(ft/yr) = Dv = K*i = Darcy groundwater velocity.							
0.36	(dimensionless) = O = soil porosity.							
83.33333	(ft/yr) = Dv / O = v = linear Darcy groundwater transport velocity.							
200	(ft) = X * 0.1 = Ax = longitudinal groundwater dispersivity.							
66.66667	(ft) = Ax / 3 = Ay = transverse groundwater dispersivity.							
10	(ft) = Ax / 20 = Az = vertical groundwater dispersivity.							
1	(dimensionless) = Ri = retardation factor for constituent i.							
0	(yr-1) = Yi = first-order degradation constant for constituent i.							
Model equation:								
(Csi/Cxi)= DAF =	1/[EXP(X/(2*Ax) * (1-SQRT(1+(4*Yi*Ax*Ri/v))))							
	* Erf(Sw/(4*SQRT(Ay*X))) * Erf(Sd/(2*SQRT(Az*X)))]							
=	440.0095	(dimensionless)						

LDEQ RECAP
WORKSHEET 7
DF

			Management Option 1 DF for 0.5 acre					
X (ft) = distance				(dimensionless)				
downgradient from								
source =		Sd =	5 ft	10 ft	15 ft	20 ft		
0 - 50			1.5	1	1	1		
50 - 100			2.6	1.5	1.2	1.1		
100 - 150			4.1	2.1	1.6	1.3		
150 - 250			8.4	4.3	3	2.3		
250 - 500			29	15	9.8	7.4		
500 - 750			63	32	21	16		
750 - 1000			111	57	37	28		
1000 - 1250			173	86	58	43		
1250 - 1500			248	124	83	62		
1500 - 1750			337	169	113	84		
1750 - 2000			440	220	147	110		

Domenico Analytical Solute Transport Model	**Management Option 2**	
LDEQ Risk Evaluation/Corrective Action Program		
Revision date: 07/10/2002		
Run date: 10/16/2003		
General assumptions:		
1. A single continuous source of one chemical compound dissolved in the groundwater. No NAPL.		
2. No initial groundwater contamination.		
3. Chemical compound is non-reactive.		
4. Groundwater flow is in one direction.		
5. Saturated zone is homogeneous and isotropic.		
6. Contaminant plume is a planar source spreading laterally infinitely in two directions and vertically finitely in one direction.		
7. The point "X" is behind the point where "X = v * time since spill".		
8. The DAF is based on the estimated contaminant concentration (Cxi) at the center line of the plume.		
Two possible model cases exist:		
(1) The plume's vertical depth is or is assumed to be the full thickness of the groundwater stratum.		
(2) The plume's vertical depth is less than the full thickness of the groundwater stratum.		
Example Calculations of the Groundwater Dilution Attenuation Factor		
Site-specific inputs (Default value)		
148	(ft) = Sw = groundwater plume width perpendicular to groundwater flow.	
5	(ft) = Sd = vertical depth of plume (measured vertical extent of affected groundwater plume or the full thickness of the groundwater stratum).	
10	(ft) = H = thickness of groundwater stratum.	
2000	(ft) = X = distance downgradient from source.	
30	(ft/yr) = Dv = K*i = Darcy groundwater velocity.	
0.36	(dimensionless) = O = soil porosity.	
83.3333333	(ft/yr) = Dv / O = v = linear Darcy groundwater transport velocity.	
200	(ft) = Ax = longitudinal groundwater dispersivity.	
66.6666667	(ft) = Ay = transverse groundwater dispersivity.	
10	(ft) = Az = vertical groundwater dispersivity.	
1	(dimensionless) = Ri = retardation factor of constituent i.	
0	(yr-1) = Yi = first-order degradation constant for constituent i.	

LDEQ RECAP
WORKSHEET 8
DAF

(1) The plume's vertical depth is or is assumed to be								
the full thickness of the groundwater stratum. Therefore,								
spreading in the vertical direction is ignored and the Erf term								
containing Sd is removed from the Domenico model.								
Model equation when Sd = H:								
(Csi/Cxi)= DAF =		1/[EXP(X/(2*Ax) * (1-SQRT(1+(4*Yi*Ax*Ri/v))))						
		* Erf(Sw/(4*SQRT(Ay*X)))]						
	=	8.776006	(dimensionless)					
(2) The plume's vertical depth is less than the full								
thickness of the groundwater stratum. The distance over which								
vertical spreading can occur is limited to the thickness of the								
groundwater stratum. The horizontal distance over which vertical								
spreading can occur is approximated by Xp = ((H-Sd)^2)/Az.								
Xp equation:								
2.5	(ft) = Xp = (H-Sd)^2/Az							
2000	(ft) = X = distance downgradient from source							
Model equation when X < or = Xp:								
(Csi/Cxi)= DAF =		1/[EXP(X/(2*Ax) * (1-SQRT(1+(4*Yi*Ax*Ri/v))))						
		* Erf(Sw/(4*SQRT(Ay*X))) * Erf(Sd/(2*SQRT(Az*X)))]						
	=	440.0095	(dimensionless)					
Model equation when X > Xp:								
(Csi/Cxi)= DAF =		1/[EXP(X/(2*Ax) * (1-SQRT(1+(4*Yi*Ax*Ri/v))))						
		* Erf(Sw/(4*SQRT(Ay*X))) * Erf(Sd/(2*SQRT(Az*Xp)))]						
	=	16.86073	(dimensionless)					