

APPENDIX E
BIOCHLOR TWO-DIMENSIONAL MODELING DATA

DRAFT REMEDIAL INVESTIGATION REPORT

Capital Industries, Inc.
5801 3rd Avenue South
Seattle, Washington
Agreed Order No. DE 5348

Farallon PN: 457-004

BIOCHLOR Model Inputs
 Water Table Zone
 "Source Area" 1 Near Wells CI-12-WT and CI-14-WT
 Approx. 550 feet from Duwamish (Slip 2)

BIOCHLOR Natural Attenuation Decision Support System

Capital Industries
 Water Table Zone

Data Input Instructions:

1. Enter value directly....or
 2. Calculate by filling in gray cells. Press Enter, then **C**
- (To restore formulas, hit "Restore Formulas" button)
 Variable* → Data used directly in model.

TYPE OF CHLORINATED SOLVENT: Ethenes Ethanes

1. ADVECTION

Seepage Velocity*	Vs	<input type="text" value="79.5"/>	(ft/yr)
Hydraulic Conductivity	K	<input type="text" value="1.1E-02"/>	(cm/sec)
Hydraulic Gradient	i	<input type="text" value="0.0017"/>	(ft/ft)
Effective Porosity	n	<input type="text" value="0.25"/>	(-)

2. DISPERSION

Alpha x*	<input type="text" value="31.2"/>	(ft)	Calc. Alpha x
(Alpha y) / (Alpha x)*	<input type="text" value="0.1"/>	(-)	
(Alpha z) / (Alpha x)*	<input type="text" value="1.E-99"/>	(-)	

3. ADSORPTION

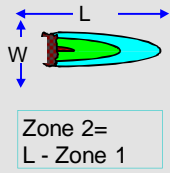
Retardation Factor*	→ R		
Soil Bulk Density, rho	<input type="text" value="1.51"/>	(kg/L)	
Fraction Organic Carbon, foc	<input type="text" value="2.0E-3"/>	(-)	
Partition Coefficient	Koc		
PCE	<input type="text" value="265"/>	(L/kg)	<input type="text" value="4.20"/> (-)
TCE	<input type="text" value="94"/>	(L/kg)	<input type="text" value="2.14"/> (-)
DCE	<input type="text" value="36"/>	(L/kg)	<input type="text" value="1.43"/> (-)
VC	<input type="text" value="19"/>	(L/kg)	<input type="text" value="1.23"/> (-)
ETH	<input type="text" value="302"/>	(L/kg)	<input type="text" value="4.65"/> (-)
Common R (used in model)* =			<input type="text" value="2.14"/>

4. BIOTRANSFORMATION

		-1st Order Decay Coefficient*		
		λ (1/yr)	half-life (yrs)	Yield
Zone 1				
PCE → TCE		<input type="text" value="0.578"/>	<input type="text" value="1.20"/>	0.79
TCE → DCE		<input type="text" value="0.385"/>	<input type="text" value="1.80"/>	0.74
DCE → VC		<input type="text" value="0.433"/>	<input type="text" value="1.60"/>	0.64
VC → ETH		<input type="text" value="0.408"/>	<input type="text" value="1.70"/>	0.45
Zone 2				
PCE → TCE		<input type="text" value="0.000"/>		
TCE → DCE		<input type="text" value="0.000"/>		
DCE → VC		<input type="text" value="0.000"/>		
VC → ETH		<input type="text" value="0.000"/>		

5. GENERAL

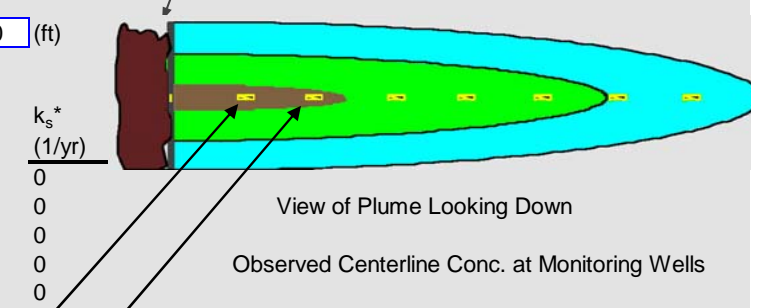
Simulation Time*	<input type="text" value="500"/>	(yr)
Modeled Area Width*	<input type="text" value="500"/>	(ft)
Modeled Area Length*	<input type="text" value="550"/>	(ft)
Zone 1 Length*	<input type="text" value="550"/>	(ft)
Zone 2 Length*	<input type="text" value="0"/>	(ft)



6. SOURCE DATA

Source Options	TYPE: Continuous Single Planar	
Source Thickness in Sat. Zone*	<input type="text" value="20"/>	(ft)
Width* (ft)	<input type="text" value="50"/>	
Conc. (ug/L)*	C1	
PCE	<input type="text" value=".0"/>	
TCE	<input type="text" value=".99"/>	
DCE	<input type="text" value="15.0"/>	
VC	<input type="text" value="10.0"/>	
ETH	<input type="text" value="0"/>	

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



7. FIELD DATA FOR COMPARISON

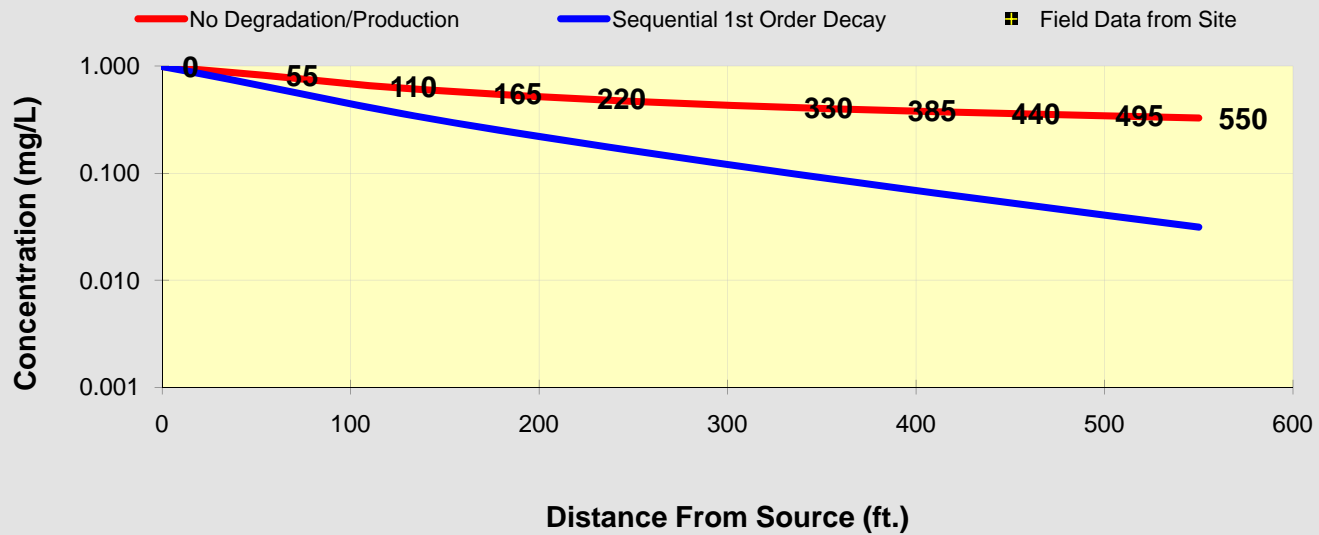
	PCE Conc. (mg/L)	TCE Conc. (mg/L)	DCE Conc. (mg/L)	VC Conc. (mg/L)	ETH Conc. (mg/L)	Distance from Source (ft)	Date	Data Collected

8. CHOOSE TYPE OF OUTPUT TO SEE:

Simulated TCE Concentrations - Water Table Zone
 "Source Area" 1: CI-12-WT and CI-14-WT; 550' from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)											
	0	55	110	165	220	275	330	385	440	495	550	
No Degradation	0.990	0.815	0.653	0.558	0.495	0.449	0.414	0.386	0.363	0.344	0.327	
Biotransformation	0.9900	0.644	0.408	0.276	0.193	0.139	0.101	0.075	0.055	0.041	0.031	
	Monitoring Well Locations (ft)											
Field Data from Site												



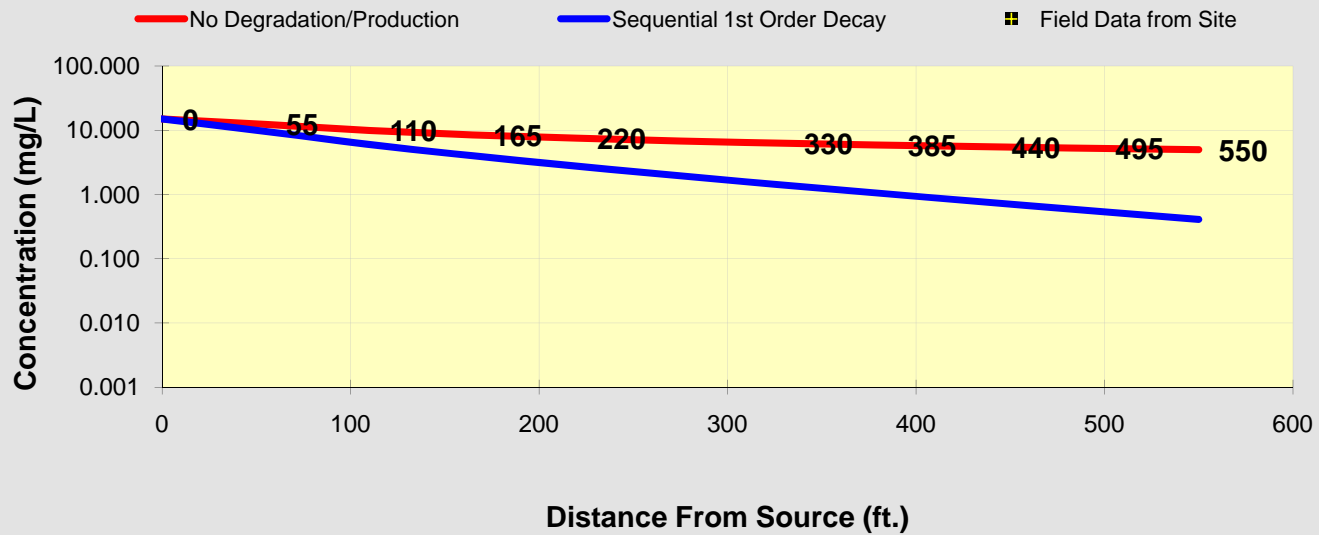
- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Time:

Simulated cis-1,2-DCE Concentrations - Water Table Zone
 "Source Area" 1: CI-12-WT and CI-14-WT; 550' from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

DCE	Distance from Source (ft)											
	0	55	110	165	220	275	330	385	440	495	550	
No Degradation	15.000	12.342	9.900	8.461	7.502	6.807	6.275	5.850	5.501	5.207	4.957	
Biotransformation	15.0000	9.604	5.996	3.989	2.754	1.946	1.397	1.014	0.743	0.548	0.407	
Monitoring Well Locations (ft)												
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time: hrs

Log Linear

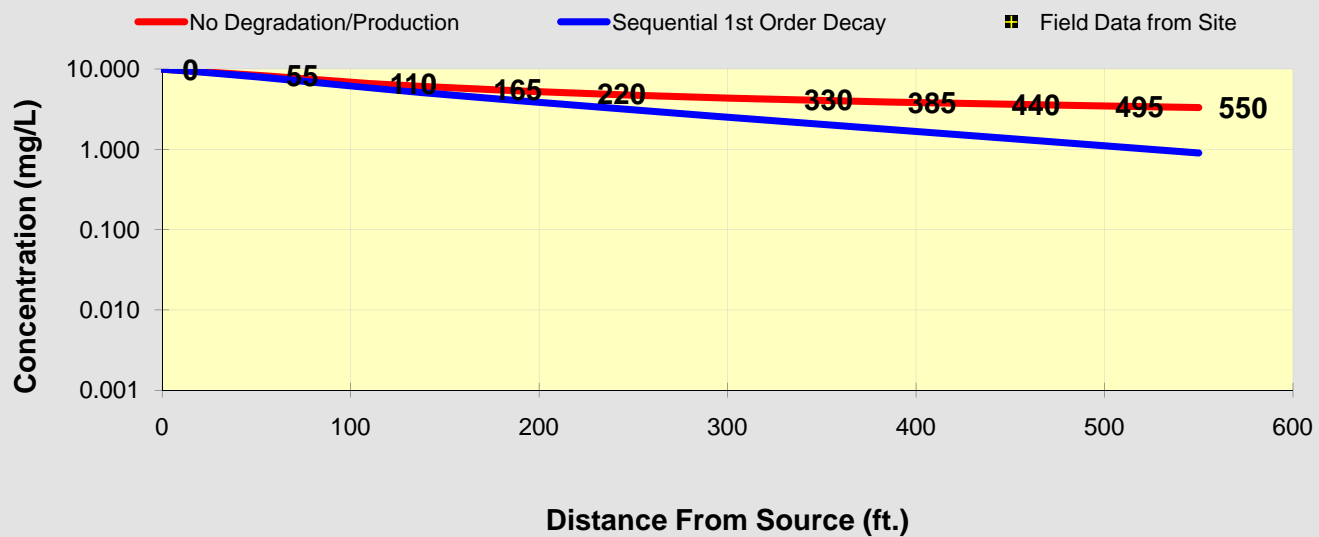
Return to Input To All To Array

Simulated Vinyl Chloride Concentrations - Water Table Zone
 "Source Area" 1: CI-12-WT and CI-14-WT; 550' from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)											
	0	55	110	165	220	275	330	385	440	495	550	
No Degradation	10.000	8.228	6.600	5.641	5.002	4.538	4.183	3.900	3.667	3.472	3.304	
Biotransformation	10.0000	7.875	5.838	4.498	3.530	2.795	2.223	1.771	1.413	1.127	0.899	

Monitoring Well Locations (ft)											
Field Data from Site											



- [See PCE](#)
- [See TCE](#)
- [See DCE](#)
- [See VC](#)
- [See ETH](#)

[Prepare Animation](#)

Time: hrs

Log Linear

[Return to Input](#)

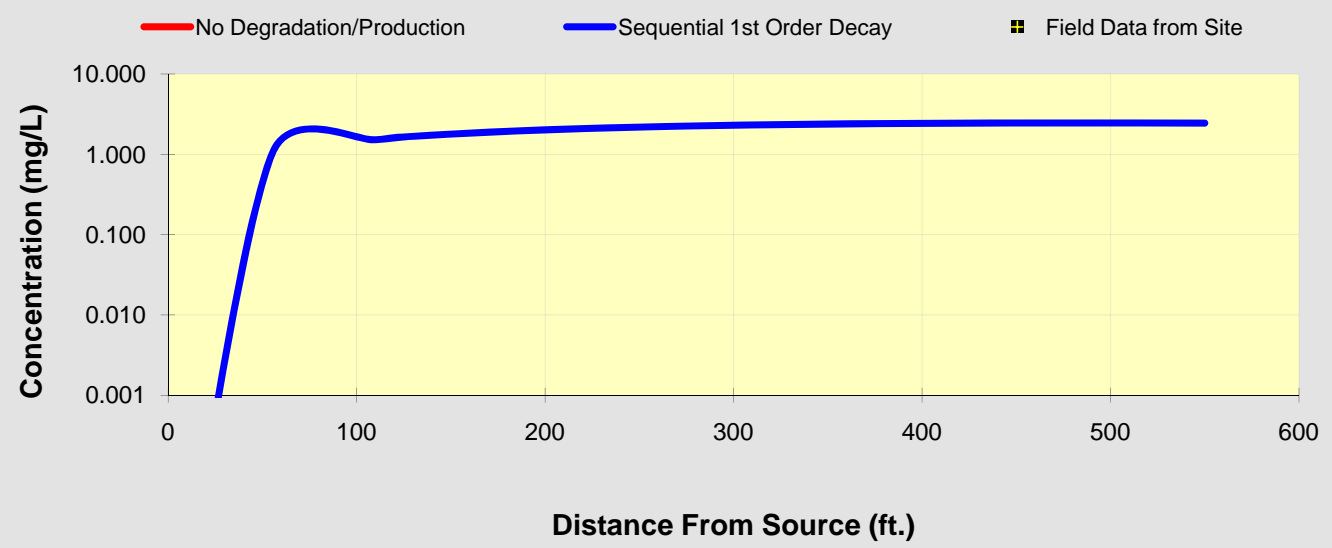
[To All](#)

[To Array](#)

Simulated Ethene Concentrations - Water Table Zone
 "Source Area" 1: CI-12-WT and CI-14-WT; 550' from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

		Distance from Source (ft)										
ETH		0	55	110	165	220	275	330	385	440	495	550
No Degradation		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation		0.0000	0.989	1.527	1.871	2.103	2.260	2.363	2.426	2.459	2.470	2.464
		Monitoring Well Locations (ft)										
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time:
 Log Linear

Return to Input

To All

To Array

BIOCHLOR Model Inputs
 Water Table Zone
 "Source Area" 2 Near Well CI-10-WT
 Approx. 850 feet from Duwamish (Slip 2)

BIOCHLOR Natural Attenuation Decision Support System

Capital Industries
 Water Table Zone

Data Input Instructions:

1. Enter value directly...or
 2. Calculate by filling in gray cells. Press Enter, then **C**
- (To restore formulas, hit "Restore Formulas" button)
 Variable* → Data used directly in model.

TYPE OF CHLORINATED SOLVENT: Ethenes Ethanes

Vrs
 Excel 2000

Source Area 2 (850' from Waterway)

1. ADVECTION

Seepage Velocity*	Vs	<input type="text" value="79.5"/>	(ft/yr)
Hydraulic Conductivity	K	<input type="text" value="1.1E-02"/>	(cm/sec)
Hydraulic Gradient	i	<input type="text" value="0.0017"/>	(ft/ft)
Effective Porosity	n	<input type="text" value="0.25"/>	(-)

2. DISPERSION

Alpha x*	<input type="text" value="31.2"/>	(ft)	Calc. Alpha x
(Alpha y) / (Alpha x)*	<input type="text" value="0.1"/>	(-)	
(Alpha z) / (Alpha x)*	<input type="text" value="1.E-99"/>	(-)	

3. ADSORPTION

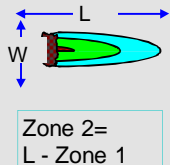
Retardation Factor*	R		
Soil Bulk Density, rho	<input type="text" value="1.51"/>	(kg/L)	
Fraction Organic Carbon, foc	<input type="text" value="2.0E-3"/>	(-)	
Partition Coefficient	Koc		
PCE	<input type="text" value="265"/>	(L/kg)	<input type="text" value="4.20"/> (-)
TCE	<input type="text" value="94"/>	(L/kg)	<input type="text" value="2.14"/> (-)
DCE	<input type="text" value="36"/>	(L/kg)	<input type="text" value="1.43"/> (-)
VC	<input type="text" value="19"/>	(L/kg)	<input type="text" value="1.23"/> (-)
ETH	<input type="text" value="302"/>	(L/kg)	<input type="text" value="4.65"/> (-)
Common R (used in model)* =	<input type="text" value="2.14"/>		

4. BIOTRANSFORMATION

		-1st Order Decay Coefficient*		
		λ (1/yr)	half-life (yrs)	Yield
Zone 1				
PCE → TCE	<input type="text" value="0.578"/>	<input type="text" value="1.20"/>	<input type="text" value="0.79"/>	
TCE → DCE	<input type="text" value="0.385"/>	<input type="text" value="1.80"/>	<input type="text" value="0.74"/>	
DCE → VC	<input type="text" value="0.433"/>	<input type="text" value="1.60"/>	<input type="text" value="0.64"/>	
VC → ETH	<input type="text" value="0.408"/>	<input type="text" value="1.70"/>	<input type="text" value="0.45"/>	
Zone 2				
PCE → TCE	<input type="text" value="0.000"/>	<input type="text" value=""/>	<input type="text" value=""/>	
TCE → DCE	<input type="text" value="0.000"/>	<input type="text" value=""/>	<input type="text" value=""/>	
DCE → VC	<input type="text" value="0.000"/>	<input type="text" value=""/>	<input type="text" value=""/>	
VC → ETH	<input type="text" value="0.000"/>	<input type="text" value=""/>	<input type="text" value=""/>	

5. GENERAL

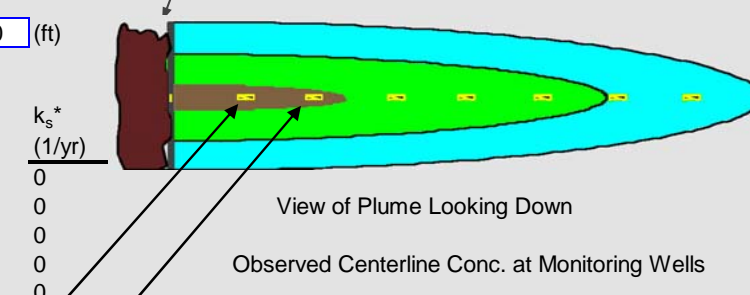
Simulation Time*	<input type="text" value="500"/>	(yr)
Modeled Area Width*	<input type="text" value="500"/>	(ft)
Modeled Area Length*	<input type="text" value="850"/>	(ft)
Zone 1 Length*	<input type="text" value="850"/>	(ft)
Zone 2 Length*	<input type="text" value="0"/>	(ft)



6. SOURCE DATA

Source Options	TYPE: Continuous Single Planar	
Source Thickness in Sat. Zone*	<input type="text" value="20"/>	(ft)
Width* (ft)	<input type="text" value="50"/>	
Conc. (ug/L)*	C1	
PCE	<input type="text" value="0"/>	
TCE	<input type="text" value="45.0"/>	
DCE	<input type="text" value="26.0"/>	
VC	<input type="text" value="0.21"/>	
ETH	<input type="text" value="0"/>	

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



7. FIELD DATA FOR COMPARISON

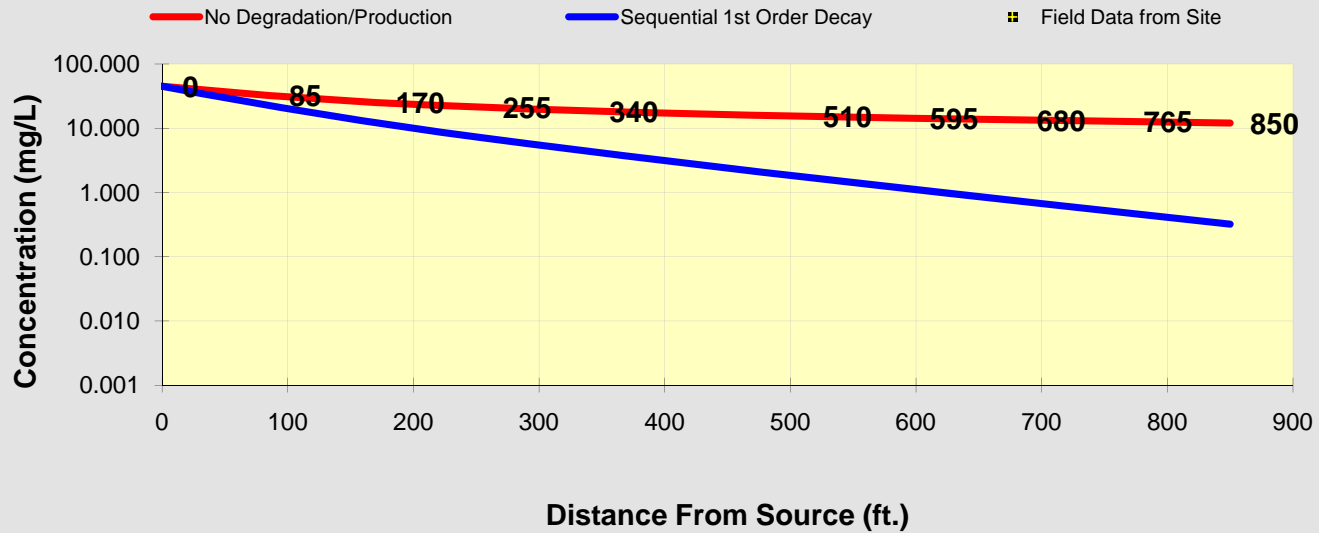
Conc. (mg/L)										
PCE Conc. (mg/L)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
TCE Conc. (mg/L)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
DCE Conc. (mg/L)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
VC Conc. (mg/L)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
ETH Conc. (mg/L)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Distance from Source (ft)	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Date Data Collected	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

8. CHOOSE TYPE OF OUTPUT TO SEE:

Simulated TCE Concentrations - Water Table Zone
 "Source Area" 2: CI-10-WT; 850 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)											
	0	85	170	255	340	425	510	595	680	765	850	
No Degradation	45.000	32.504	25.077	21.112	18.572	16.769	15.406	14.328	13.449	12.714	12.087	
Biotransformation	45.0000	22.605	12.128	7.101	4.344	2.728	1.743	1.127	0.736	0.484	0.320	
	Monitoring Well Locations (ft)											
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time:

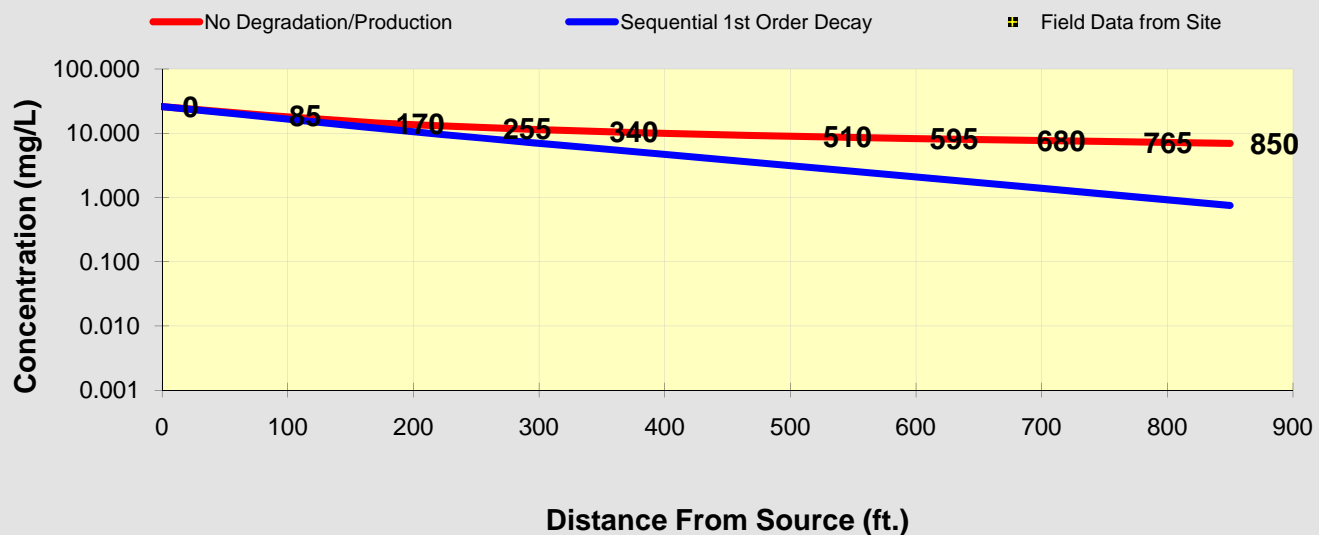
Log Linear

Return to Input To All To Array

Simulated cis-1,2-DCE Concentrations - Water Table Zone
 "Source Area" 2: CI-10-WT; 850 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

DCE	Distance from Source (ft)											
	0	85	170	255	340	425	510	595	680	765	850	
No Degradation	26.000	18.780	14.489	12.198	10.730	9.689	8.901	8.279	7.771	7.346	6.984	
Biotransformation	26.0000	17.795	11.988	8.392	5.940	4.217	2.993	2.121	1.501	1.060	0.748	
Monitoring Well Locations (ft)												
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time: hrs

Log Linear

Return to Input

To All

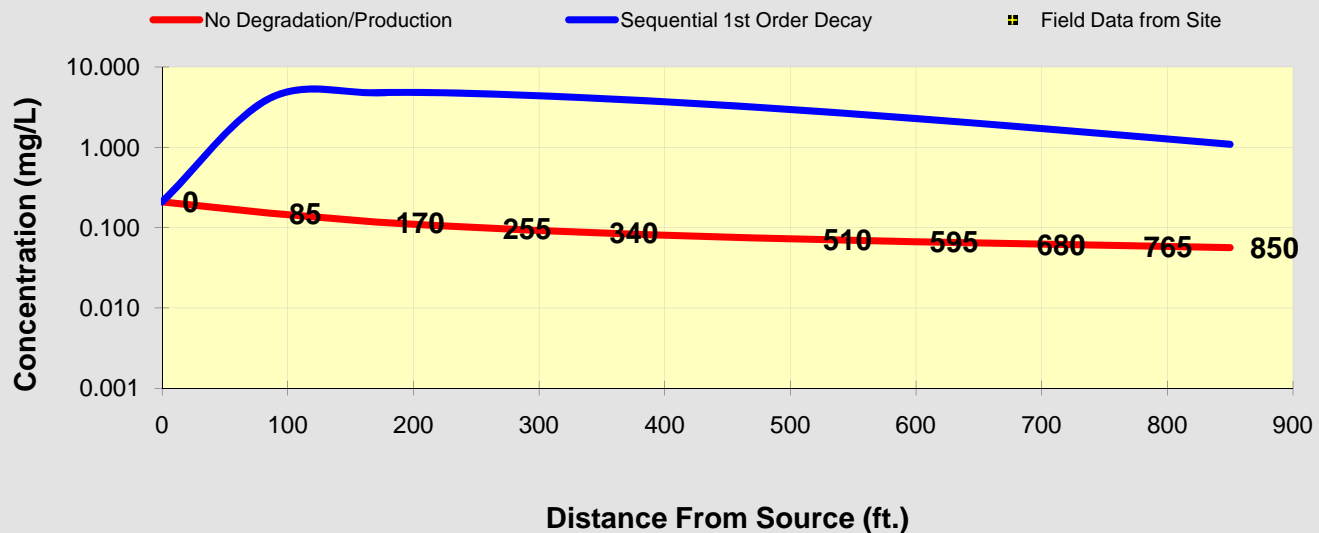
To Array

Simulated Vinyl Chloride Concentrations - Water Table Zone
 "Source Area" 2: CI-10-WT; 850 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)											
	0	85	170	255	340	425	510	595	680	765	850	
No Degradation	0.210	0.152	0.117	0.099	0.087	0.078	0.072	0.067	0.063	0.059	0.056	
Biotransformation	0.2100	4.006	4.775	4.625	4.117	3.492	2.870	2.305	1.819	1.416	1.090	

Monitoring Well Locations (ft)											
Field Data from Site											



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Time:

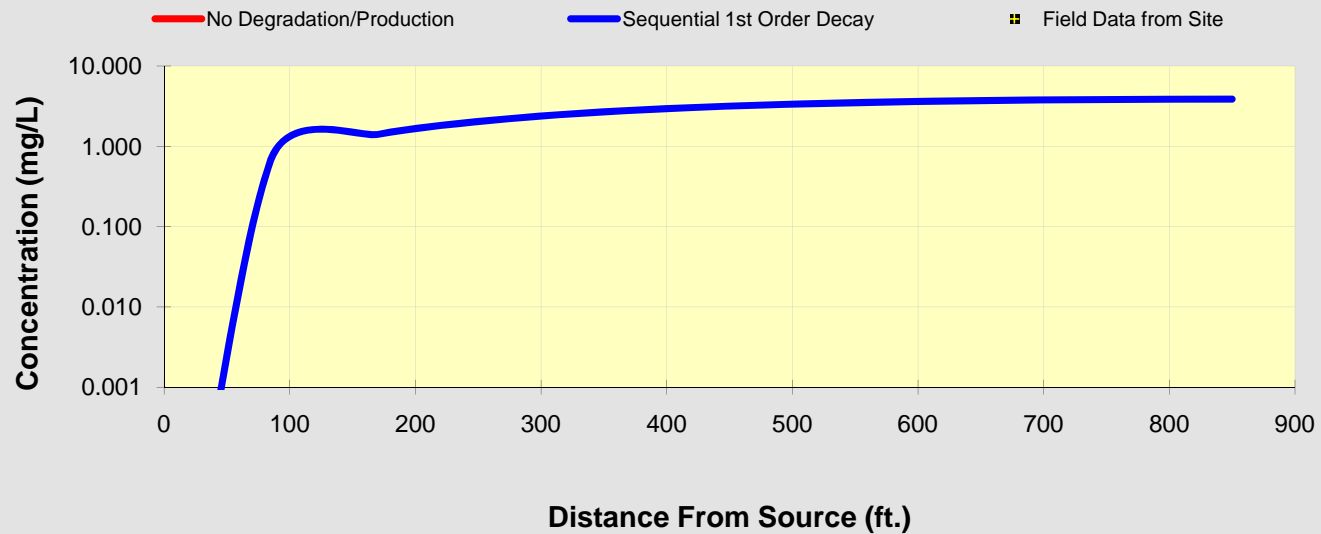
Log Linear

Prepare Animation Return to Input To All To Array

Simulated Ethene Concentrations - Water Table Zone
 "Source Area" 2: CI-10-WT; 850 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

ETH	Distance from Source (ft)											
	0	85	170	255	340	425	510	595	680	765	850	
No Degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.0000	0.670	1.400	2.065	2.620	3.055	3.377	3.602	3.747	3.828	3.860	
	Monitoring Well Locations (ft)											
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time:

Log Linear

Return to Input To All To Array

BIOCHLOR Natural Attenuation Decision Support System

Capital Industries
 Water Table Zone

Data Input Instructions:

1. Enter value directly....or
 2. Calculate by filling in gray cells. Press Enter, then **C**
- (To restore formulas, hit "Restore Formulas" button)
 Variable* → Data used directly in model.

TYPE OF CHLORINATED SOLVENT: Ethenes Ethanes

1. ADVECTION

Seepage Velocity*	Vs	79.5	(ft/yr)
Hydraulic Conductivity	K	1.1E-02	(cm/sec)
Hydraulic Gradient	i	0.0017	(ft/ft)
Effective Porosity	n	0.25	(-)

2. DISPERSION

Alpha x*	31.2	(ft)	Calc. Alpha x
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	1.E-99	(-)	

3. ADSORPTION

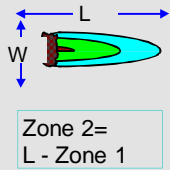
Retardation Factor*	R		
Soil Bulk Density, rho	1.51	(kg/L)	
Fraction Organic Carbon, foc	2.0E-3	(-)	
Partition Coefficient	Koc		
PCE	265	(L/kg)	4.20 (-)
TCE	94	(L/kg)	2.14 (-)
DCE	36	(L/kg)	1.43 (-)
VC	19	(L/kg)	1.23 (-)
ETH	302	(L/kg)	4.65 (-)
Common R (used in model)* =	2.14		

4. BIOTRANSFORMATION

Zone	Reaction	-1st Order Decay Coefficient* λ (1/yr)	half-life (yrs)	Yield
Zone 1	PCE → TCE	0.578	1.20	0.79
	TCE → DCE	0.385	1.80	0.74
	DCE → VC	0.433	1.60	0.64
	VC → ETH	0.408	1.70	0.45
Zone 2	PCE → TCE	0.000		
	TCE → DCE	0.000		
	DCE → VC	0.000		
	VC → ETH	0.000		

5. GENERAL

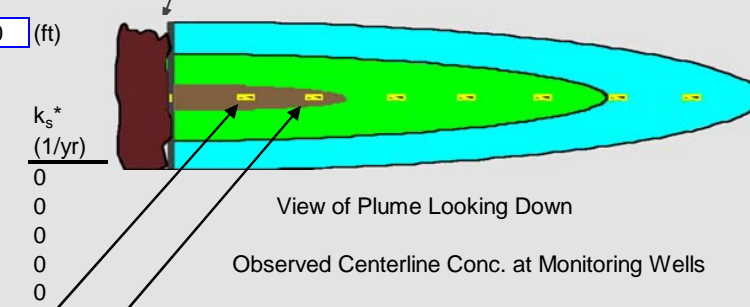
Simulation Time*	500	(yr)
Modeled Area Width*	500	(ft)
Modeled Area Length*	1500	(ft)
Zone 1 Length*	1500	(ft)
Zone 2 Length*	0	(ft)



6. SOURCE DATA

Source Options	TYPE: Continuous Single Planar
Source Thickness in Sat. Zone*	20 (ft)
Width* (ft)	50
Conc. (ug/L)*	C1
PCE	6.2
TCE	170.0
DCE	120.0
VC	4.6
ETH	

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



7. FIELD DATA FOR COMPARISON

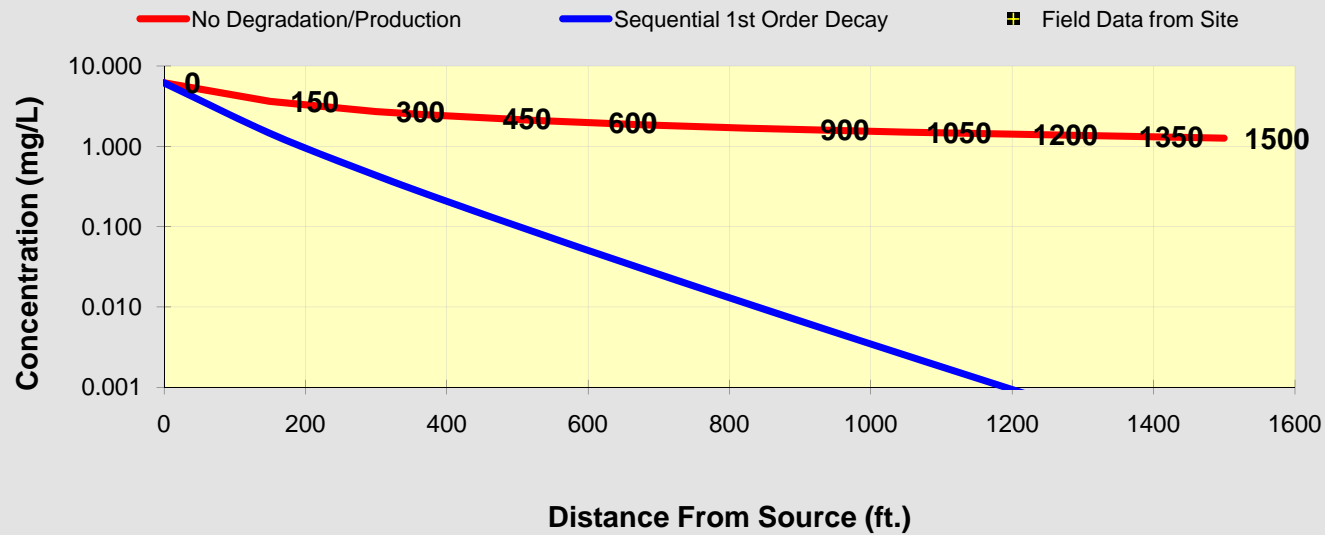
Conc. (mg/L)										
PCE Conc. (mg/L)										
TCE Conc. (mg/L)										
DCE Conc. (mg/L)										
VC Conc. (mg/L)										
ETH Conc. (mg/L)										
Distance from Source (ft)										
Date Data Collected										

8. CHOOSE TYPE OF OUTPUT TO SEE:

Simulated PCE Concentrations
 "Source Area" 3: MW-5, MW-6, BDC-6-WT; 1500 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

PCE	Distance from Source (ft)											
	0	150	300	450	600	750	900	1050	1200	1350	1500	
No Degradation	6.200	3.634	2.707	2.250	1.966	1.768	1.620	1.504	1.410	1.331	1.264	
Biotransformation	6.2000	1.455	0.434	0.144	0.051	0.018	0.007	0.002	0.001	0.000	0.000	
	Monitoring Well Locations (ft)											
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time: hrs

Log Linear

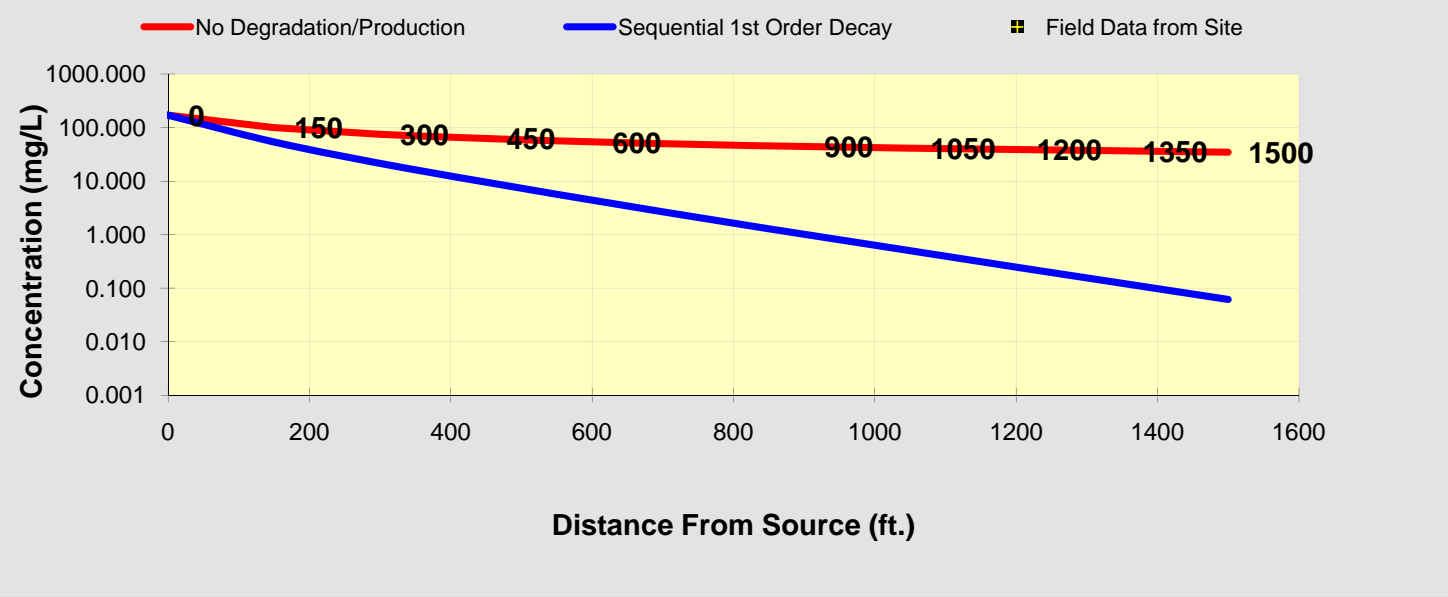
Return to Input To All To Array

Simulated TCE Concentrations
 "Source Area" 3: MW-5, MW-6, BDC-6-WT; 1500 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)											
	0	150	300	450	600	750	900	1050	1200	1350	1500	
No Degradation	170.000	99.647	74.224	61.696	53.915	48.487	44.424	41.236	38.649	36.494	34.664	
Biotransformation	170.0000	53.589	21.355	9.459	4.393	2.095	1.016	0.499	0.247	0.123	0.062	

Monitoring Well Locations (ft)											
Field Data from Site											



- [See PCE](#)
- [See TCE](#)
- [See DCE](#)
- [See VC](#)
- [See ETH](#)

[Prepare Animation](#)

Time:
 Log Linear

[Return to Input](#)

[To All](#)

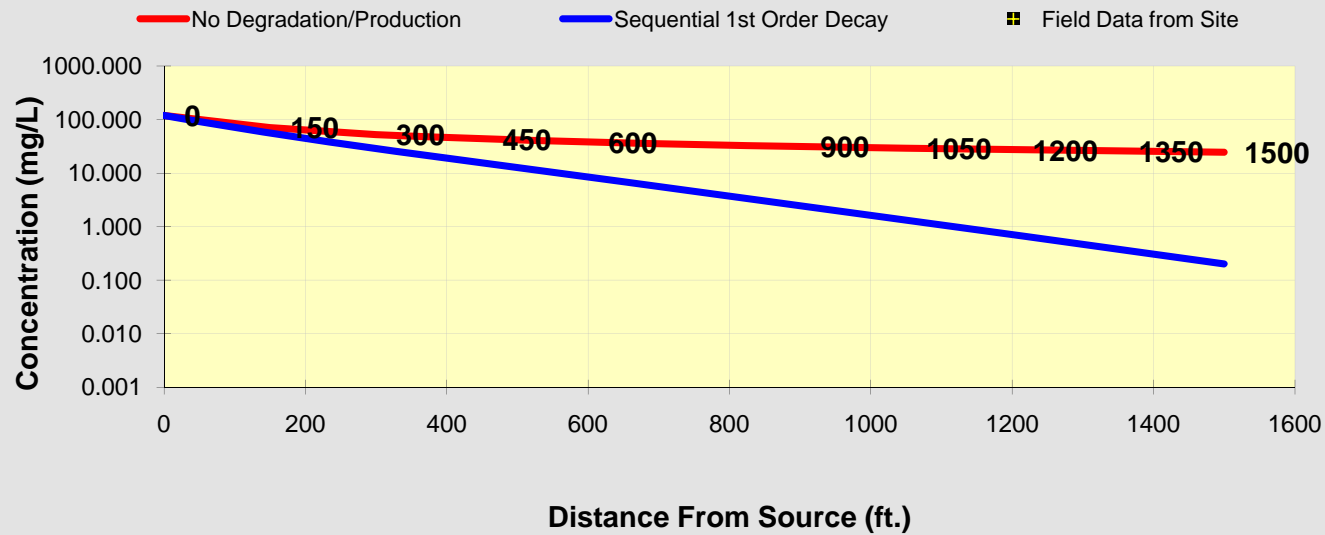
[To Array](#)

Simulated cis-1,2-DCE Concentrations
 "Source Area" 3: MW-5, MW-6, BDC-6-WT; 1500 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

DCE	Distance from Source (ft)											
	0	150	300	450	600	750	900	1050	1200	1350	1500	
No Degradation	120.000	70.339	52.393	43.550	38.058	34.226	31.358	29.108	27.282	25.761	24.469	
Biotransformation	120.0000	56.007	29.050	15.654	8.481	4.587	2.472	1.327	0.710	0.379	0.201	

Monitoring Well Locations (ft)											
Field Data from Site											



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time:
 Log Linear

Return to Input

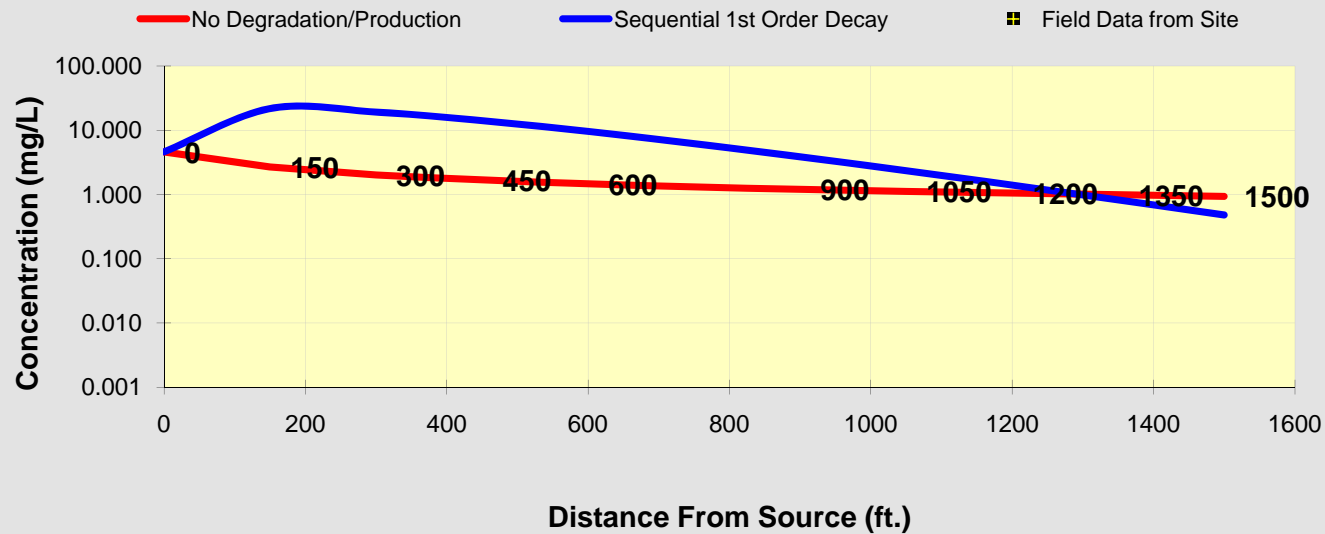
To All

To Array

Simulated Vinyl Chloride Concentrations
 "Source Area" 3: MW-5, MW-6, BDC-6-WT; 1500 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)										
	0	150	300	450	600	750	900	1050	1200	1350	1500
No Degradation	4.600	2.696	2.008	1.669	1.459	1.312	1.202	1.116	1.046	0.987	0.938
Biotransformation	4.6000	21.613	19.071	14.051	9.536	6.159	3.846	2.343	1.400	0.824	0.479
Monitoring Well Locations (ft)											
Field Data from Site											



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time: hrs
 Log Linear

Return to Input

To All

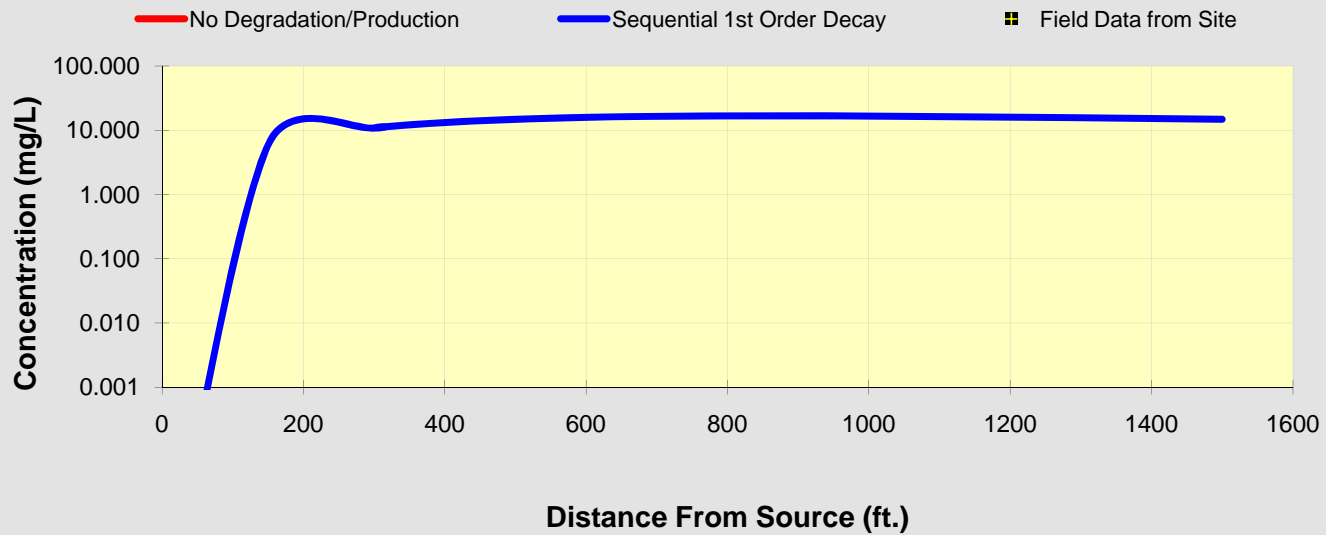
To Array

Simulated Ethene Concentrations
 "Source Area" 3: MW-5, MW-6, BDC-6-WT; 1500 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

ETH	Distance from Source (ft)										
	0	150	300	450	600	750	900	1050	1200	1350	1500
No Degradation	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation	0.0000	5.871	10.790	14.051	15.862	16.634	16.745	16.472	15.998	15.438	14.858

Monitoring Well Locations (ft)										
Field Data from Site										



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Time:

BIOCHLOR Model Inputs
Shallow Zone
"Source Area" 1 Near Wells CI-12-30 and CI-14-35
Approx. 550 feet from Duwamish (Slip 2)

BIOCHLOR Natural Attenuation Decision Support System

Capital Industries
Shallow Zone

Data Input Instructions:

1. Enter value directly....or
 2. Calculate by filling in gray cells. Press Enter, then **C**
- (To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

TYPE OF CHLORINATED SOLVENT: Ethenes Ethanes

1. ADVECTION

Seepage Velocity*	Vs	66.2	(ft/yr)
Hydraulic Conductivity	K	9.99E-03	(cm/sec)
Hydraulic Gradient	i	0.0016	(ft/ft)
Effective Porosity	n	0.25	(-)

2. DISPERSION

Alpha x*	31.2	(ft)	Calc. Alpha x
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	1.E-99	(-)	

3. ADSORPTION

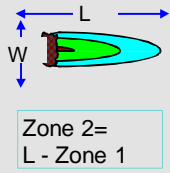
Retardation Factor*	R		
Soil Bulk Density, rho	1.51	(kg/L)	
Fraction Organic Carbon, foc	2.2E-3	(-)	
Partition Coefficient	Koc		
PCE	265	(L/kg)	4.52 (-)
TCE	94	(L/kg)	2.25 (-)
DCE	36	(L/kg)	1.47 (-)
VC	19	(L/kg)	1.25 (-)
ETH	302	(L/kg)	5.01 (-)
Common R (used in model)* =	2.25		

4. BIOTRANSFORMATION

Zone 1		-1st Order Decay Coefficient*		
		λ (1/yr)	half-life (yrs)	Yield
PCE → TCE	<input type="checkbox"/>	0.578	1.20	0.79
TCE → DCE	<input type="checkbox"/>	0.385	1.80	0.74
DCE → VC	<input type="checkbox"/>	0.433	1.60	0.64
VC → ETH	<input type="checkbox"/>	0.408	1.70	0.45
Zone 2		λ (1/yr)	half-life (yrs)	
PCE → TCE	<input type="checkbox"/>	0.000		
TCE → DCE	<input type="checkbox"/>	0.000		
DCE → VC	<input type="checkbox"/>	0.000		
VC → ETH	<input type="checkbox"/>	0.000		

5. GENERAL

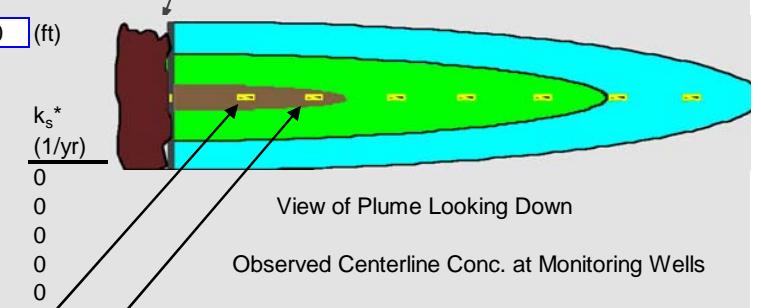
Simulation Time*	500	(yr)
Modeled Area Width*	500	(ft)
Modeled Area Length*	550	(ft)
Zone 1 Length*	550	(ft)
Zone 2 Length*	0	(ft)



6. SOURCE DATA

Source Options	TYPE: Continuous Single Planar
Source Thickness in Sat. Zone*	20 (ft)
Width* (ft)	50
Conc. (ug/L)*	C1
PCE	.0
TCE	68.0
DCE	24.0
VC	10.0
ETH	0

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



7. FIELD DATA FOR COMPARISON

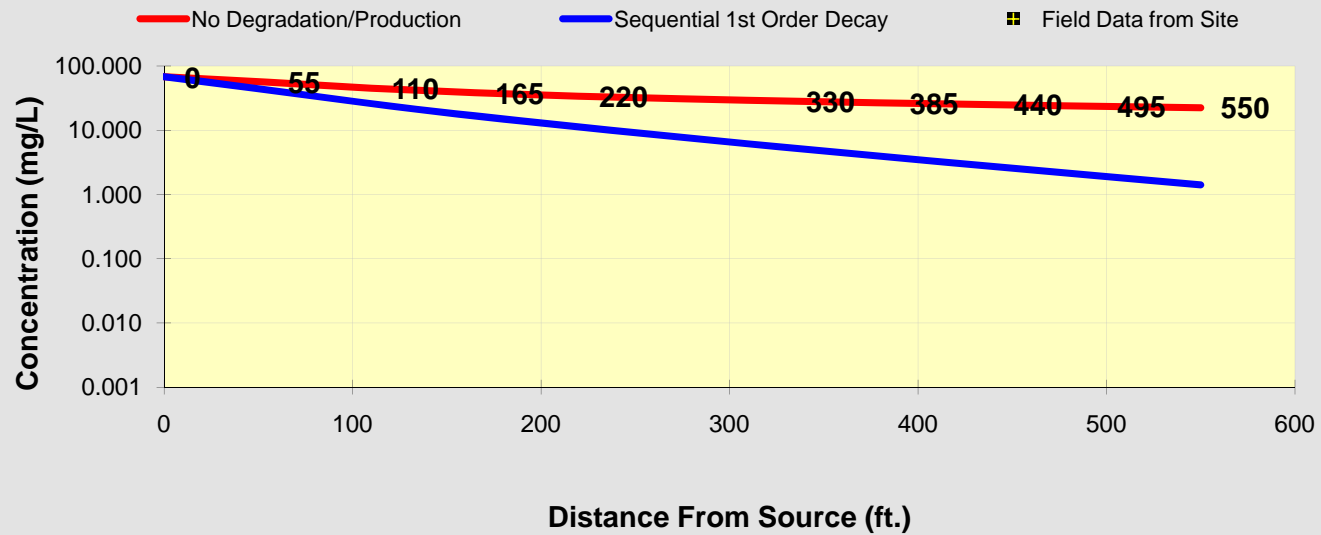
Conc. (mg/L)										
PCE Conc. (mg/L)										
TCE Conc. (mg/L)										
DCE Conc. (mg/L)										
VC Conc. (mg/L)										
ETH Conc. (mg/L)										
Distance from Source (ft)										
Date Data Collected										

8. CHOOSE TYPE OF OUTPUT TO SEE:

Simulated TCE Concentrations - Shallow Zone
 "Source Area" 1: CI-14-35 and CI-12-30; 550 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

TCE	Distance from Source (ft)											
	0	55	110	165	220	275	330	385	440	495	550	
No Degradation	68.000	55.952	44.882	38.358	34.011	30.860	28.445	26.519	24.937	23.607	22.469	
Biotransformation	68.0000	42.428	25.808	16.726	11.246	7.738	5.408	3.823	2.726	1.957	1.413	
	Monitoring Well Locations (ft)											
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time: hrs

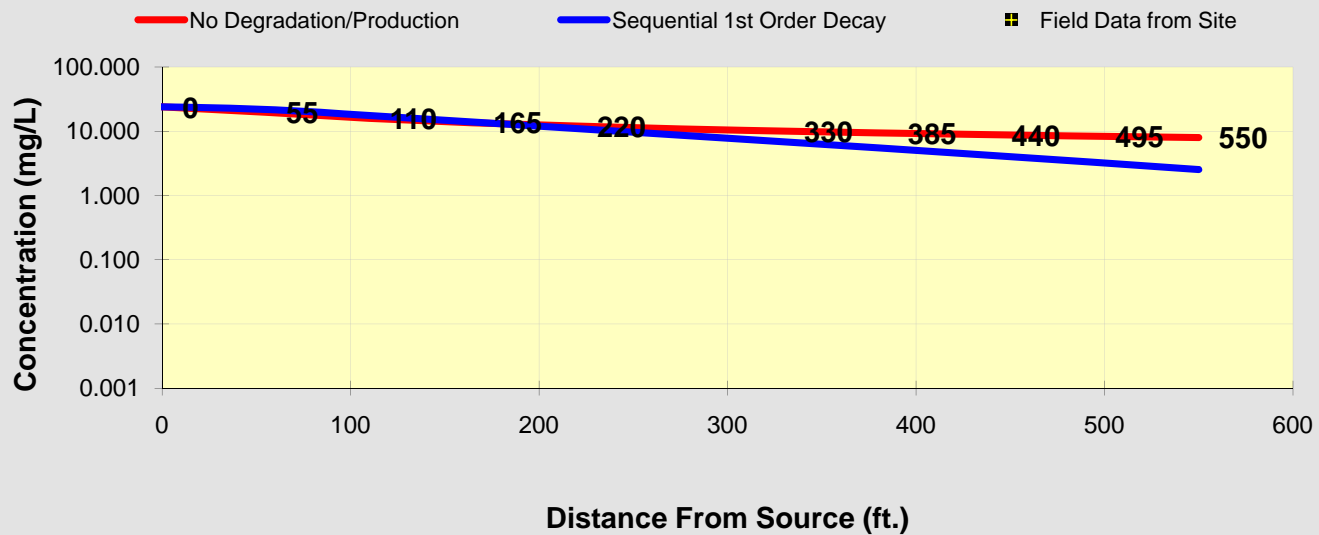
Log Linear

Return to Input To All To Array

Simulated cis-1,2-DCE Concentrations - Shallow Zone
 "Source Area" 1: CI-14-35 and CI-12-30; 550 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

DCE	Distance from Source (ft)											
	0	55	110	165	220	275	330	385	440	495	550	
No Degradation	24.000	19.748	15.841	13.538	12.004	10.892	10.040	9.360	8.801	8.332	7.930	
Biotransformation	24.0000	21.944	17.462	13.904	11.036	8.721	6.860	5.374	4.195	3.264	2.533	
Monitoring Well Locations (ft)												
Field Data from Site												



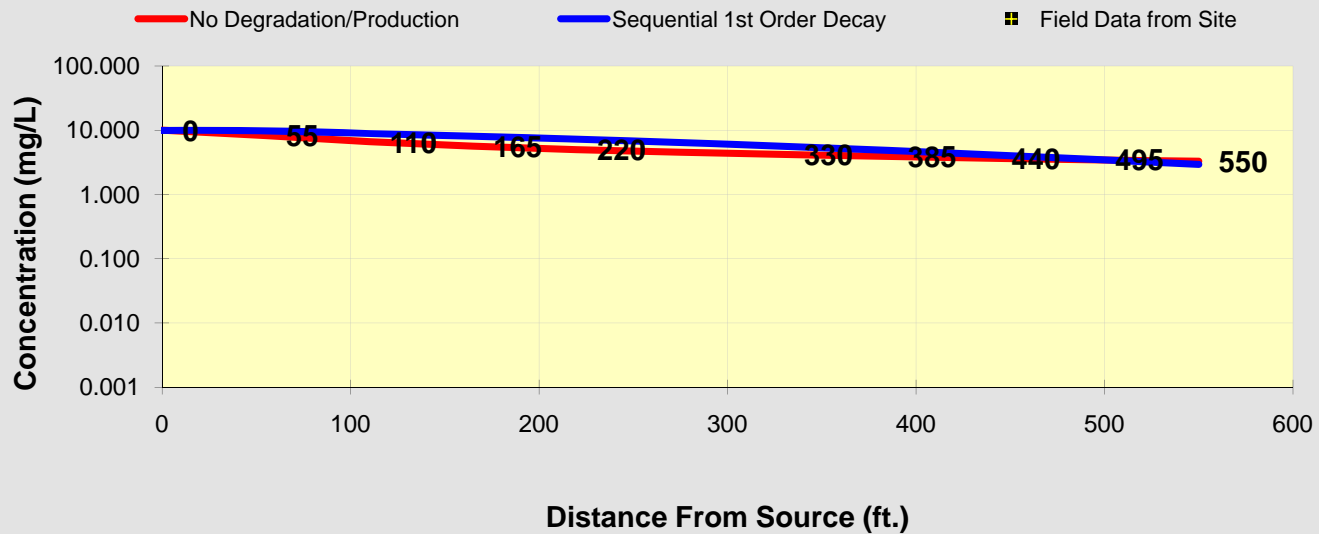
- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Time:

Simulated Vinyl Chloride Concentrations - Shallow Zone
 "Source Area" 1: CI-14-35 and CI-12-30; 550 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)											
	0	55	110	165	220	275	330	385	440	495	550	
No Degradation	10.000	8.228	6.600	5.641	5.002	4.538	4.183	3.900	3.667	3.472	3.304	
Biotransformation	10.0000	9.891	8.926	8.095	7.270	6.438	5.624	4.850	4.137	3.494	2.926	
Monitoring Well Locations (ft)												
Field Data from Site												



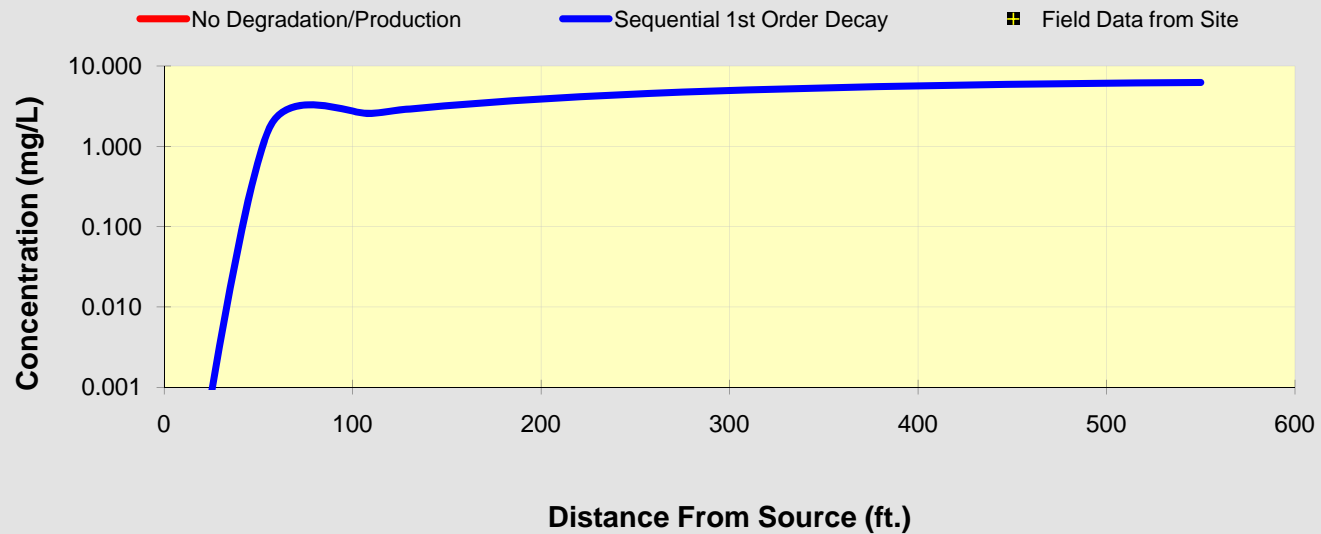
- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Time: hrs

Simulated Ethene Concentrations - Shallow Zone
 "Source Area" 1: CI-14-35 and CI-12-30; 550 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

		Distance from Source (ft)										
ETH		0	55	110	165	220	275	330	385	440	495	550
No Degradation		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation		0.0000	1.507	2.563	3.417	4.129	4.720	5.201	5.582	5.874	6.090	6.239
		Monitoring Well Locations (ft)										
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Time:

BIOCHLOR Natural Attenuation Decision Support System

Capital Industries
 Shallow Zone

Data Input Instructions:

1. Enter value directly....or
 2. Calculate by filling in gray cells. Press Enter, then **C**
- (To restore formulas, hit "Restore Formulas" button)
 Variable* → Data used directly in model.

TYPE OF CHLORINATED SOLVENT: Ethenes Ethanes

1. ADVECTION

Seepage Velocity*	Vs	66.2	(ft/yr)
Hydraulic Conductivity	K	9.99E-03	(cm/sec)
Hydraulic Gradient	i	0.0016	(ft/ft)
Effective Porosity	n	0.25	(-)

2. DISPERSION

Alpha x*	31.2	(ft)	Calc. Alpha x
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	1.E-99	(-)	

3. ADSORPTION

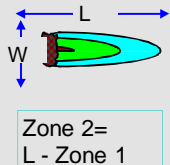
Retardation Factor*	R		
Soil Bulk Density, rho	1.51	(kg/L)	
Fraction Organic Carbon, foc	2.2E-3	(-)	
Partition Coefficient	Koc		
PCE	265	(L/kg)	4.52 (-)
TCE	94	(L/kg)	2.25 (-)
DCE	36	(L/kg)	1.47 (-)
VC	19	(L/kg)	1.25 (-)
ETH	302	(L/kg)	5.01 (-)
Common R (used in model)* =			2.25

4. BIOTRANSFORMATION

Zone 1		-1st Order Decay Coefficient*		
		λ (1/yr)	half-life (yrs)	Yield
PCE → TCE		0.578	1.20	0.79
TCE → DCE		0.385	1.80	0.74
DCE → VC		0.433	1.60	0.64
VC → ETH		0.408	1.70	0.45
Zone 2		λ (1/yr)	half-life (yrs)	
PCE → TCE		0.000		
TCE → DCE		0.000		
DCE → VC		0.000		
VC → ETH		0.000		

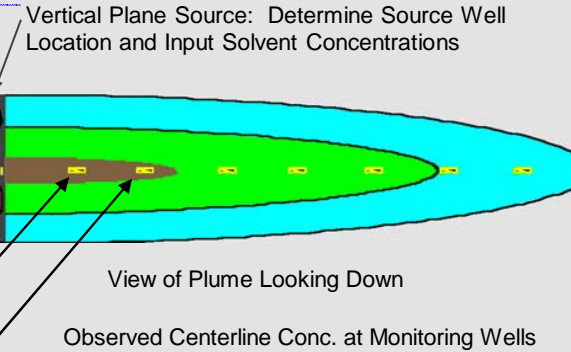
5. GENERAL

Simulation Time*	500	(yr)
Modeled Area Width*	500	(ft)
Modeled Area Length*	1050	(ft)
Zone 1 Length*	1050	(ft)
Zone 2 Length*	0	(ft)



6. SOURCE DATA

Source Options	TYPE: Continuous Single Planar
Source Thickness in Sat. Zone*	20 (ft)
Width* (ft)	50
Conc. (ug/L)*	C1
PCE	.0
TCE	.0
DCE	.0
VC	210.0
ETH	0



7. FIELD DATA FOR COMPARISON

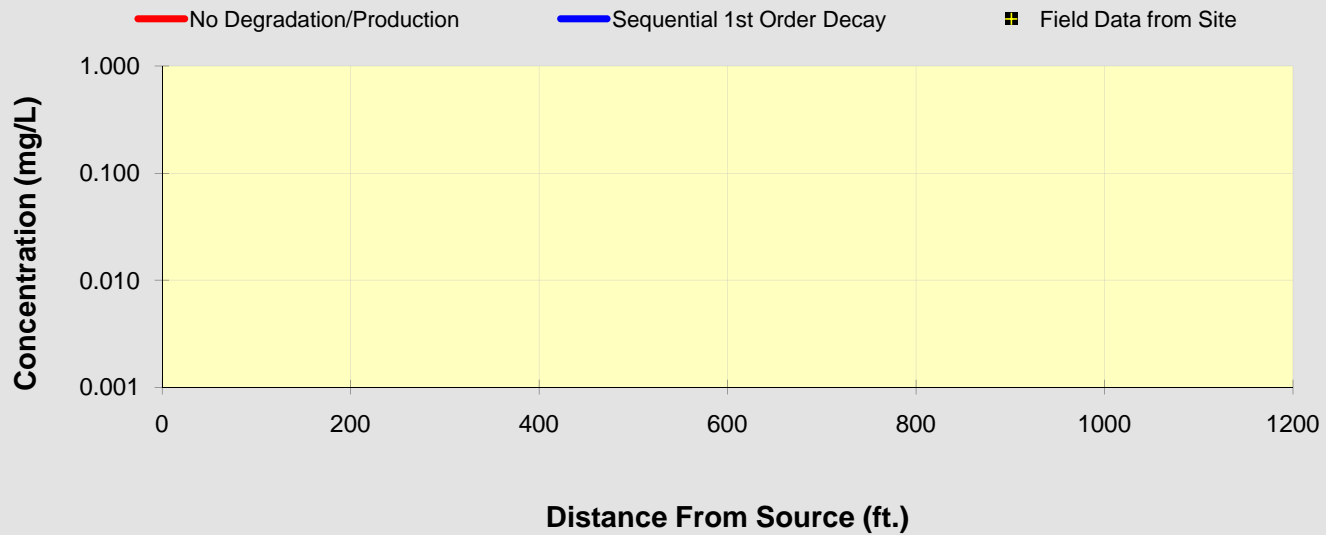
Conc. (mg/L)										
PCE Conc. (mg/L)										
TCE Conc. (mg/L)										
DCE Conc. (mg/L)										
VC Conc. (mg/L)										
ETH Conc. (mg/L)										
Distance from Source (ft)										
Date Data Collected										

8. CHOOSE TYPE OF OUTPUT TO SEE:

Simulated cis-1,2-DCE Concentrations - Shallow Zone
 "Source Area" 2: CG-141-40; 1050 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

		Distance from Source (ft)										
DCE		0	105	210	315	420	525	630	735	840	945	1050
No Degradation		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation		0.0001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Monitoring Well Locations (ft)										
Field Data from Site												



- [See PCE](#)
- [See TCE](#)
- [See DCE](#)
- [See VC](#)
- [See ETH](#)

Prepare Animation

Time:
 Log Linear

Return to Input

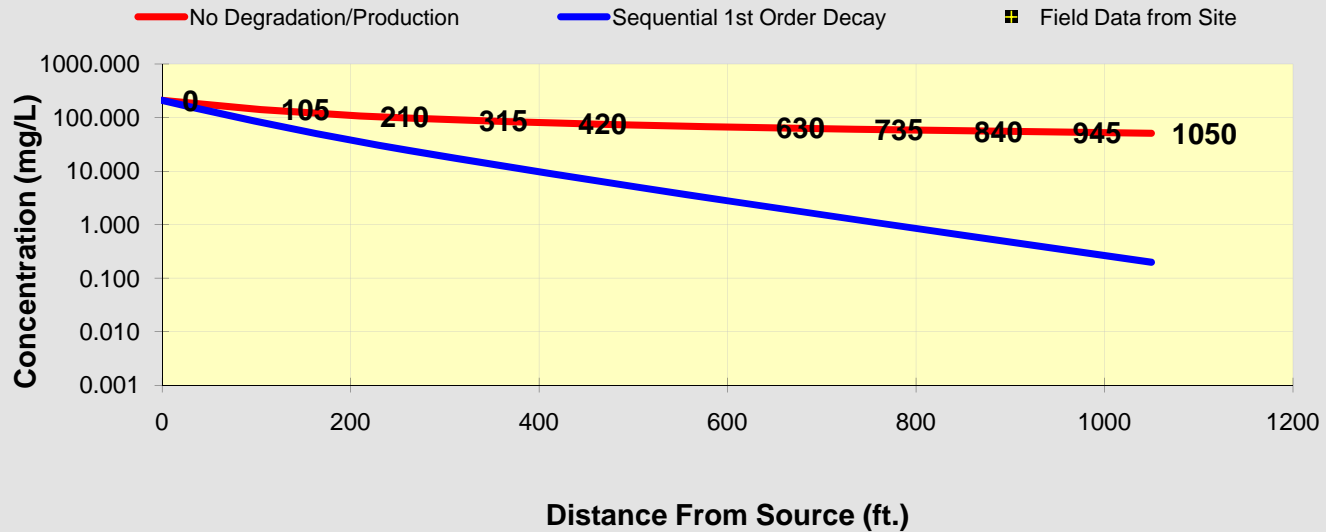
To All

To Array

Simulated Vinyl Chloride Concentrations - Shallow Zone
 "Source Area" 2: CG-141-40; 1050 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)											
	0	105	210	315	420	525	630	735	840	945	1050	
No Degradation	210.000	140.967	107.141	89.706	78.685	70.924	65.080	60.477	56.729	53.601	50.939	
Biotransformation	210.0000	80.894	35.282	16.952	8.533	4.413	2.324	1.239	0.667	0.362	0.197	
	Monitoring Well Locations (ft)											
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation

Time:
 Log Linear

Return to Input

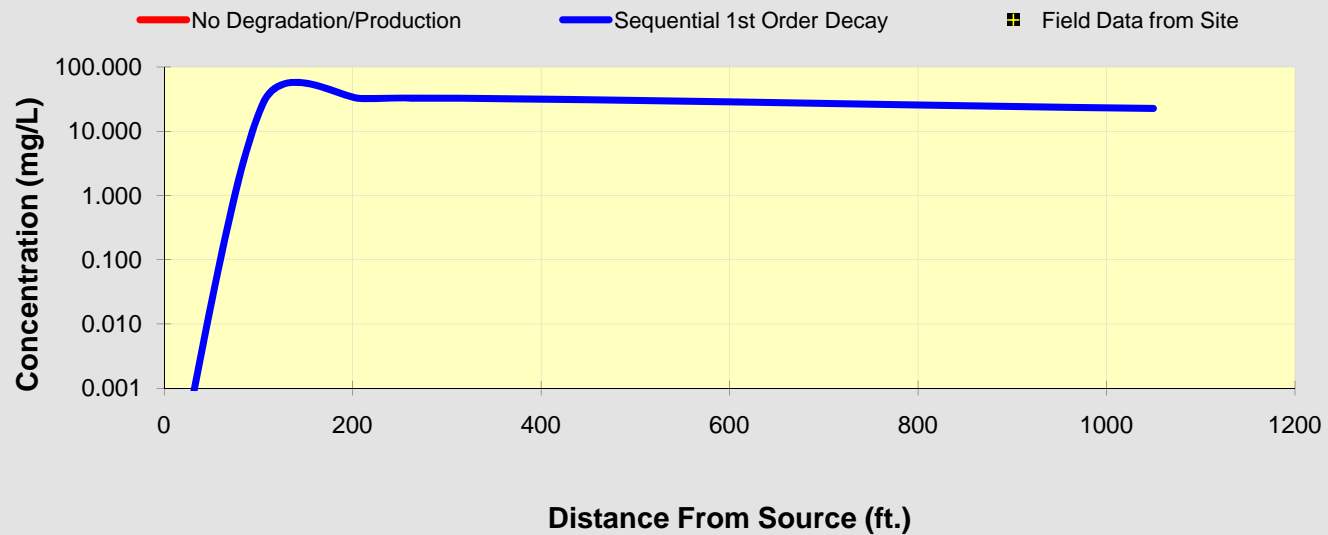
To All

To Array

Simulated Ethene Concentrations - Shallow Zone
 "Source Area" 2: CG-141-40; 1050 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

		Distance from Source (ft)										
ETH		0	105	210	315	420	525	630	735	840	945	1050
No Degradation		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation		0.0000	27.009	32.308	32.710	31.541	29.903	28.215	26.633	25.205	23.936	22.814
		Monitoring Well Locations (ft)										
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Time:

BIOCHLOR Model Inputs
Intermediate Zone
"Source Area" Near Well CI-15-60
Approx. 850 feet from Duwamish (Slip 2)

BIOCHLOR Natural Attenuation Decision Support System

Capital Industries
Intermediate Zone

Data Input Instructions:

1. Enter value directly....or
 2. Calculate by filling in gray cells. Press Enter, then **C**
- (To restore formulas, hit "Restore Formulas" button)
Variable* → Data used directly in model.

TYPE OF CHLORINATED SOLVENT: Ethenes Ethanes

1. ADVECTION

Seepage Velocity*	Vs	13.9	(ft/yr)
Hydraulic Conductivity	K	2.10E-03	(cm/sec)
Hydraulic Gradient	i	0.0016	(ft/ft)
Effective Porosity	n	0.25	(-)

2. DISPERSION

Alpha x*	31.2	(ft)	Calc. Alpha x
(Alpha y) / (Alpha x)*	0.1	(-)	
(Alpha z) / (Alpha x)*	1.E-99	(-)	

3. ADSORPTION

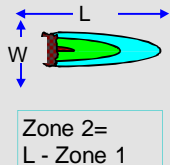
Retardation Factor*	R		
Soil Bulk Density, rho	1.51	(kg/L)	
Fraction Organic Carbon, foc	2.5E-3	(-)	
Partition Coefficient	Koc		
PCE	265	(L/kg)	5.00 (-)
TCE	94	(L/kg)	2.42 (-)
DCE	36	(L/kg)	1.54 (-)
VC	19	(L/kg)	1.29 (-)
ETH	302	(L/kg)	5.56 (-)
Common R (used in model)* =	2.42		

4. BIOTRANSFORMATION

Zone 1		-1st Order Decay Coefficient*		
		λ (1/yr)	half-life (yrs)	Yield
PCE → TCE		0.578	1.20	0.79
TCE → DCE		0.385	1.80	0.74
DCE → VC		0.433	1.60	0.64
VC → ETH		0.408	1.70	0.45
Zone 2		λ (1/yr)	half-life (yrs)	
PCE → TCE		0.000		
TCE → DCE		0.000		
DCE → VC		0.000		
VC → ETH		0.000		

5. GENERAL

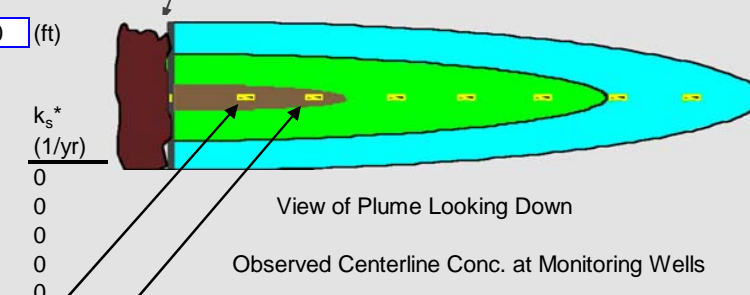
Simulation Time*	500	(yr)
Modeled Area Width*	500	(ft)
Modeled Area Length*	850	(ft)
Zone 1 Length*	850	(ft)
Zone 2 Length*	0	(ft)



6. SOURCE DATA

Source Options	TYPE: Continuous Single Planar	
Source Thickness in Sat. Zone*	20	(ft)
Width* (ft)	50	
Conc. (ug/L)*	C1	
PCE	.0	
TCE	.0	
DCE	.0	
VC	83.0	
ETH		

Vertical Plane Source: Determine Source Well Location and Input Solvent Concentrations



7. FIELD DATA FOR COMPARISON

Conc. (mg/L)											
PCE Conc. (mg/L)											
TCE Conc. (mg/L)											
DCE Conc. (mg/L)											
VC Conc. (mg/L)											
ETH Conc. (mg/L)											
Distance from Source (ft)											
Date Data Collected											

8. CHOOSE TYPE OF OUTPUT TO SEE:

RUN CENTERLINE

RUN ARRAY

Help

Restore Formulas

RESET

SEE OUTPUT

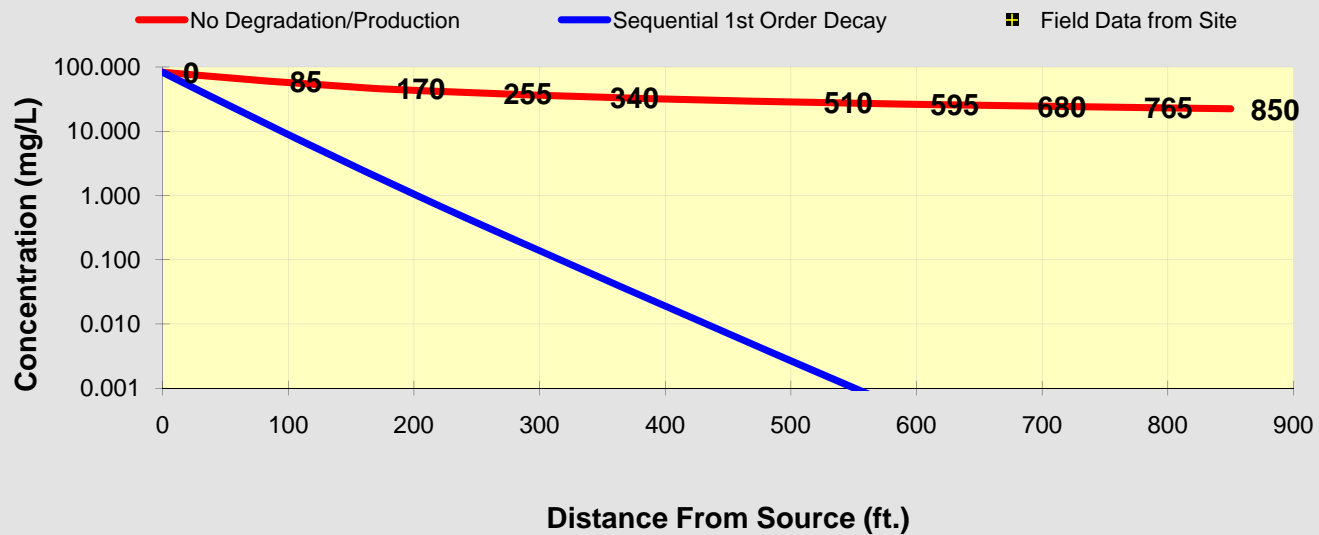
Paste Example

λ HELP

Simulated Vinyl Chloride Concentrations - Intermediate Zone
 "Source Area": CI-15-60; 850 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

VC	Distance from Source (ft)											
	0	85	170	255	340	425	510	595	680	765	850	
No Degradation	83.000	59.952	46.253	38.940	34.255	30.930	28.415	26.428	24.806	23.450	22.294	
Biotransformation	83.0000	12.374	1.971	0.342	0.062	0.012	0.002	0.000	0.000	0.000	0.000	
	Monitoring Well Locations (ft)											
Field Data from Site												



- [See PCE](#)
- [See TCE](#)
- [See DCE](#)
- [See VC](#)
- [See ETH](#)

[Prepare Animation](#)

Time:
 Log Linear

[Return to Input](#)

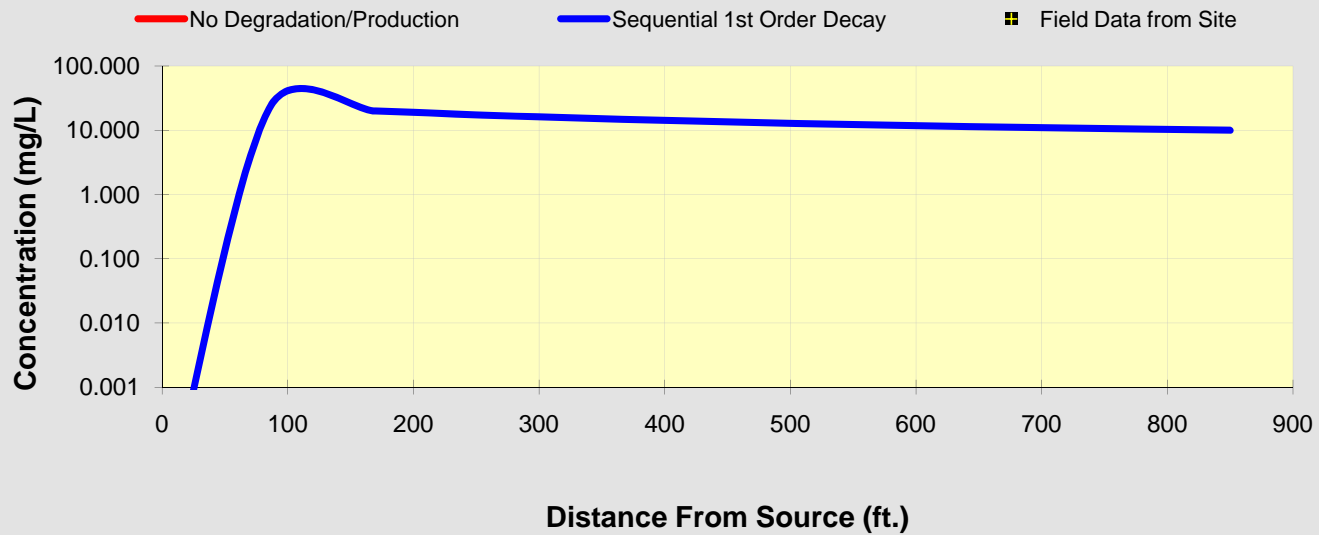
[To All](#)

[To Array](#)

Simulated Ethene Concentrations - Intermediate Zone
 "Source Area": CI-15-60; 850 feet from Slip 2

DISSOLVED CHLORINATED SOLVENT CONCENTRATIONS ALONG PLUME CENTERLINE (mg/L) at Z=0

		Distance from Source (ft)										
ETH		0	85	170	255	340	425	510	595	680	765	850
No Degradation		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Biotransformation		0.0000	21.391	19.909	17.354	15.373	13.901	12.774	11.882	11.153	10.543	10.024
		Monitoring Well Locations (ft)										
Field Data from Site												



- See PCE
- See TCE
- See DCE
- See VC
- See ETH

Prepare Animation Time: Return to Input To All To Array

Log Linear