# Appendix D

# Reactive Transport Modeling in Support of Barrier Design Analysis

This appendix contains results from a suit of reactive transport simulations that were conducted to support Frontier Hard Chrome in situ redox manipulation injection design analyses and development of the overall barrier emplacement strategy. A complete description of each simulation is provided in the figure legend.
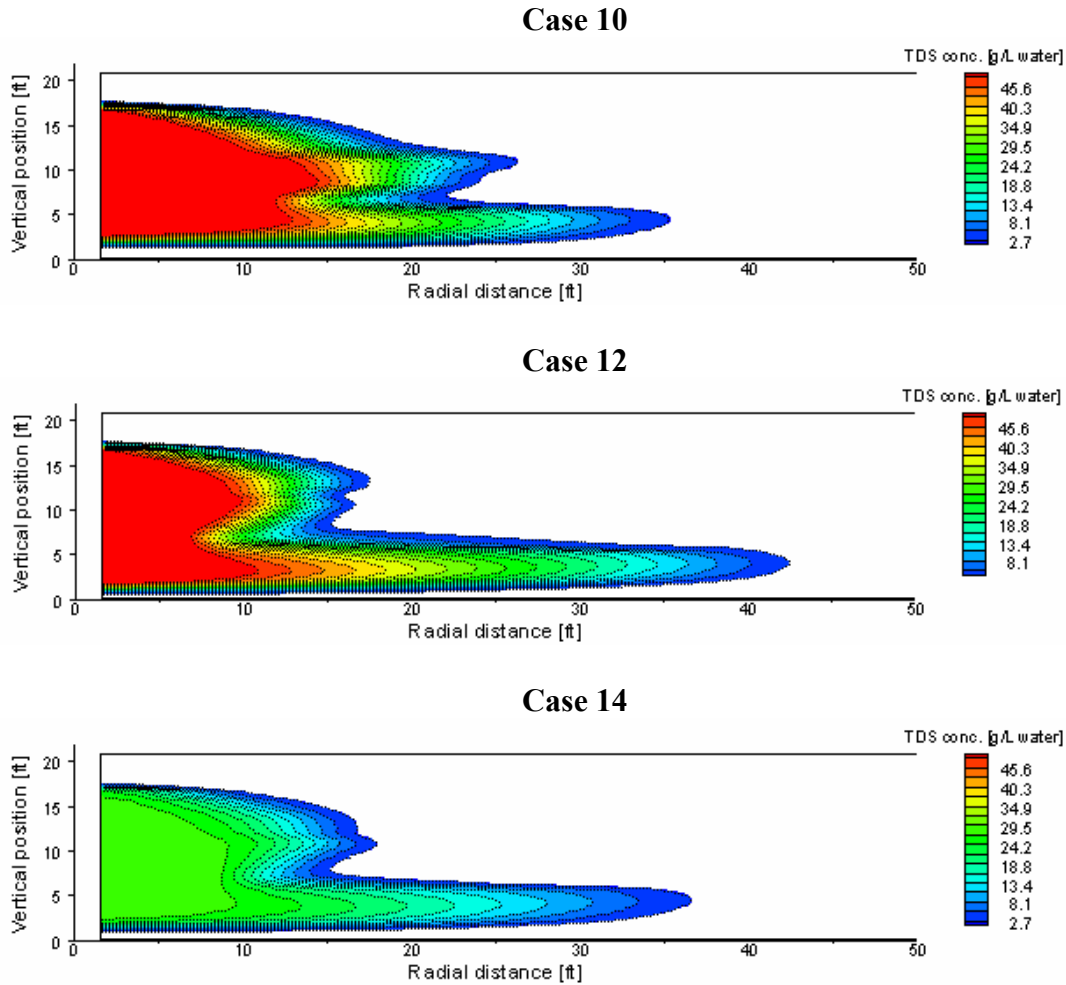
**Figure D.1**. Predicted TDS concentration distributions [g/L] around well PP016 at 2 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
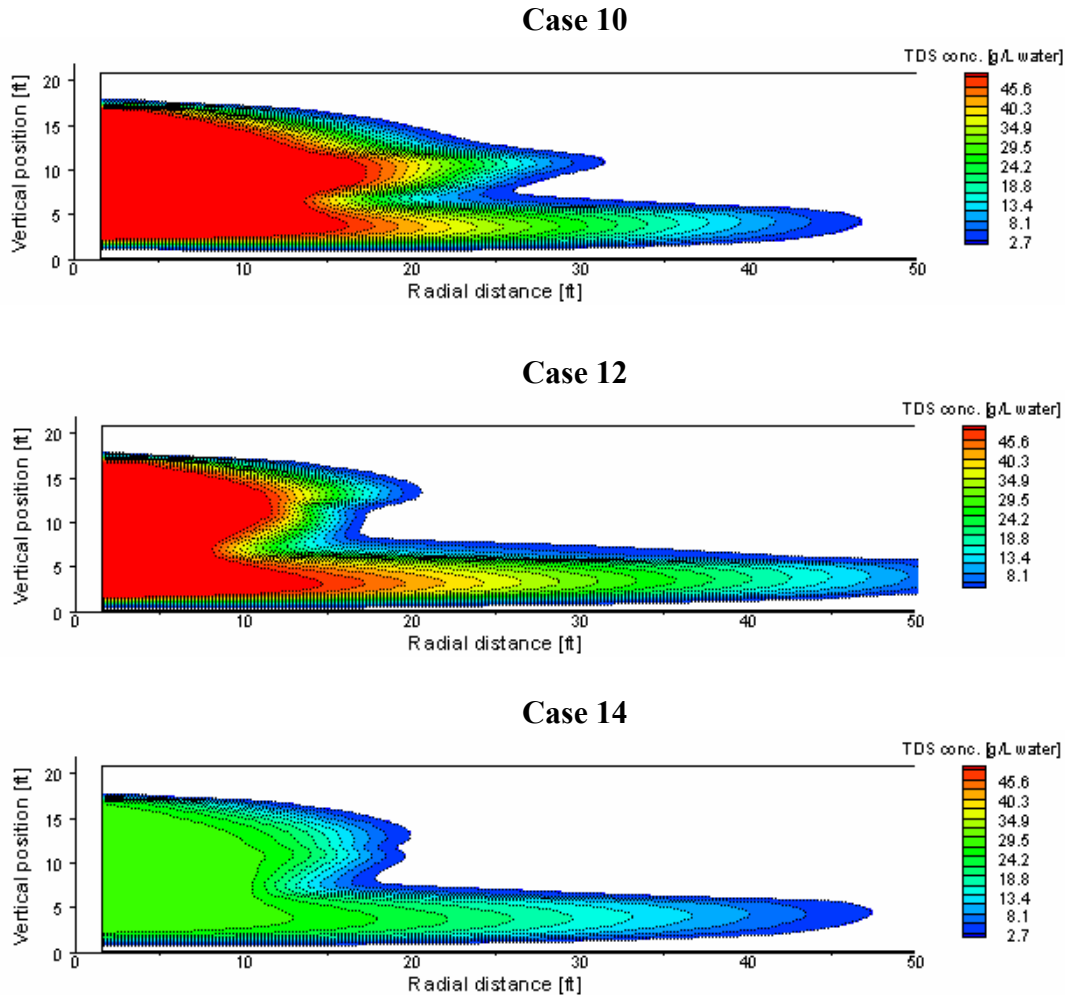
## Case 10



## Case 12



## Case 14
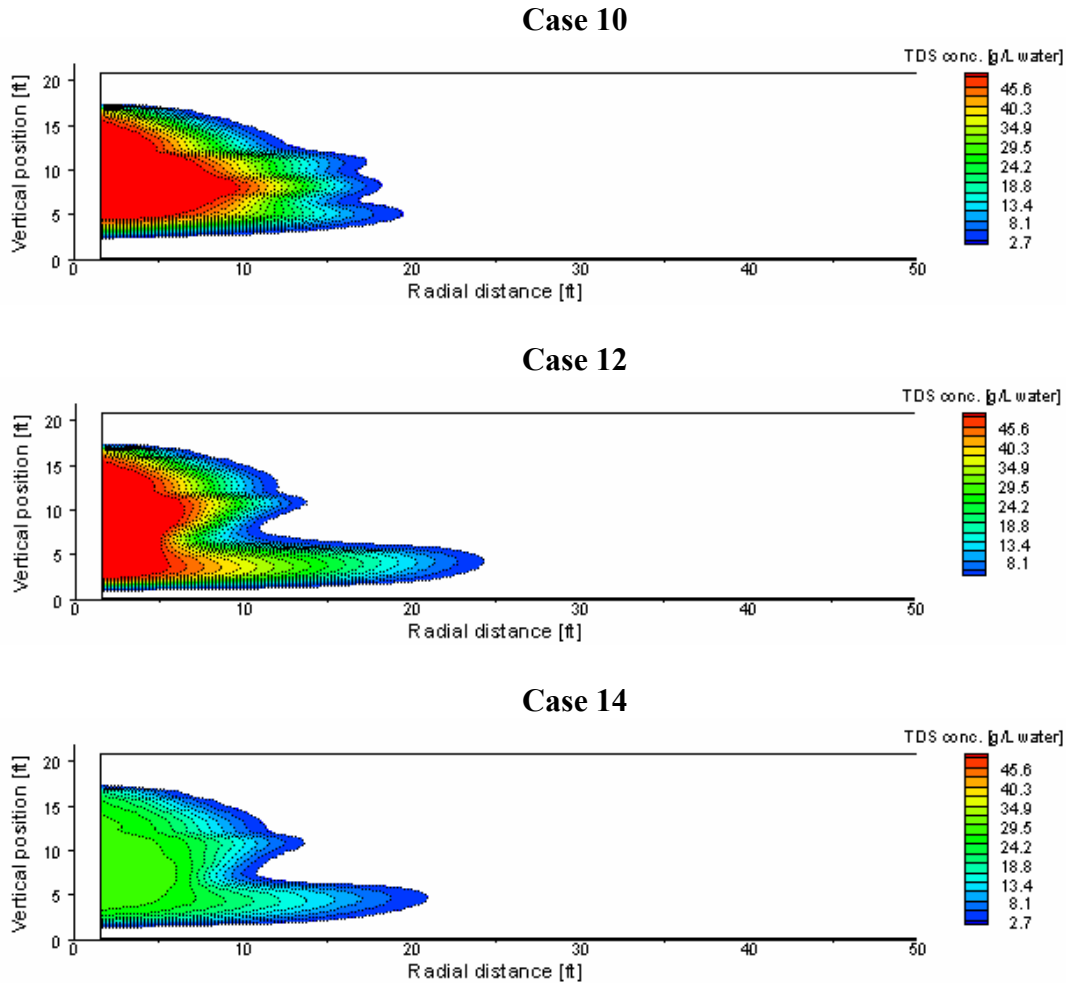
**Figure D.2**. Predicted TDS concentration distributions [g/L] around well PP016 at 6 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
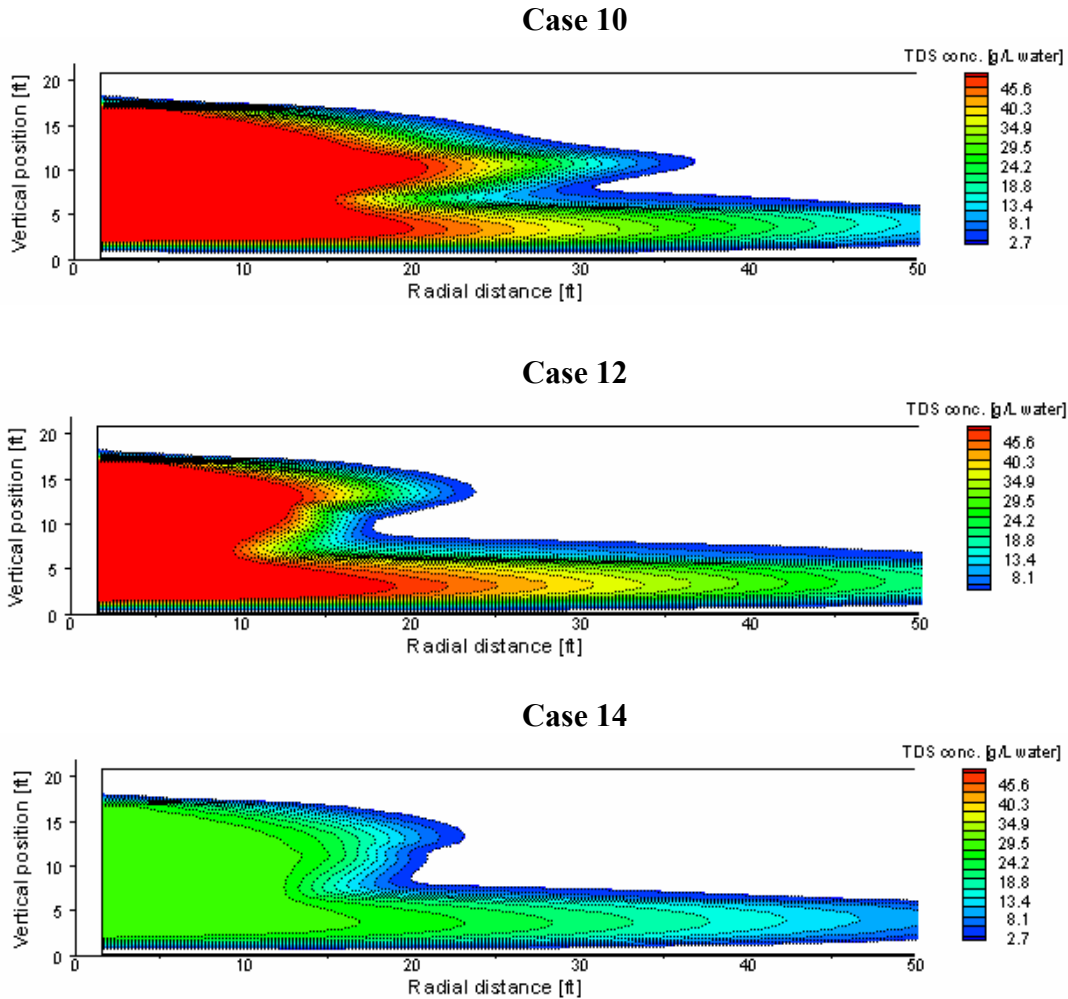
**Case 10**



**Case 12**



**Case 14**

**Figure D.3**. Predicted TDS concentration distributions [g/L] around well PP016 at 10 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
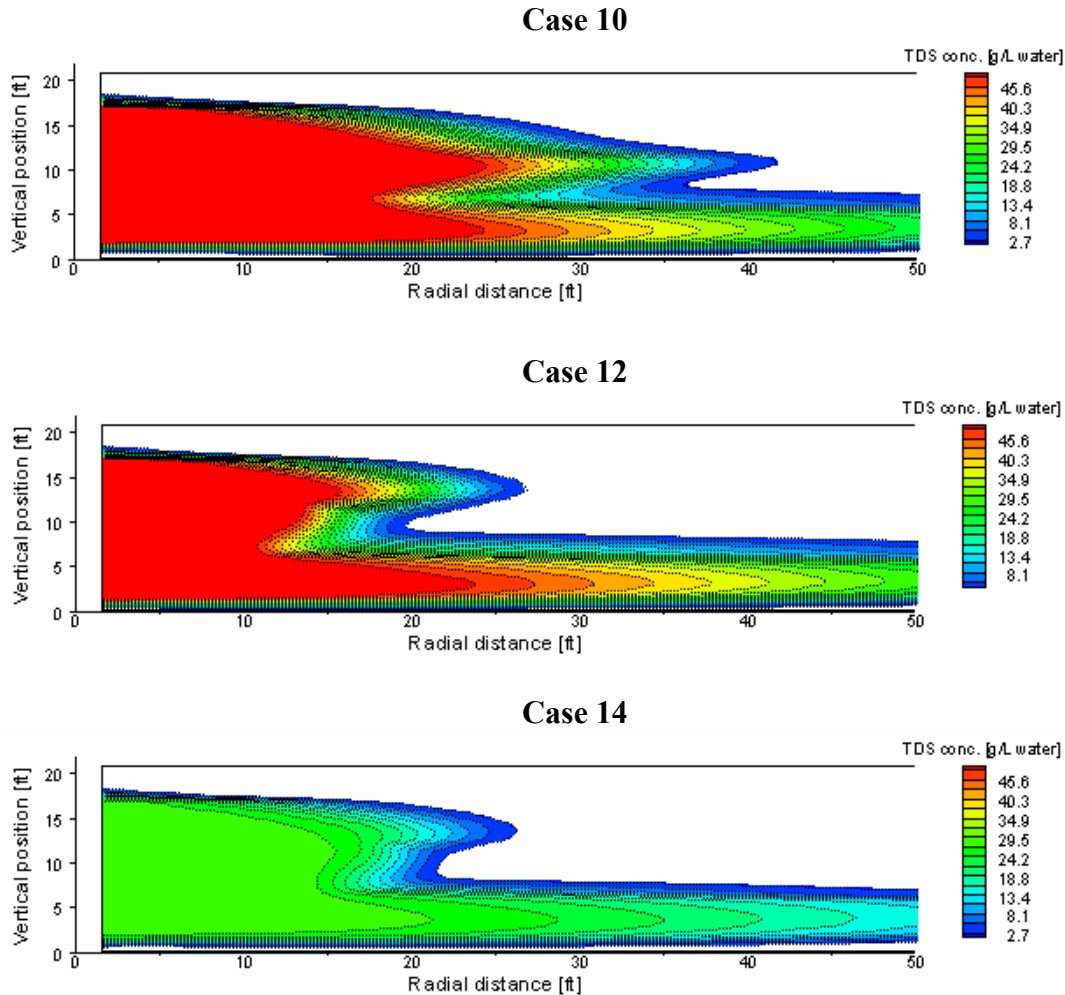
## Case 10



## Case 12



## Case 14

**Figure D.4** Predicted TDS concentration distributions [g/L] around well PP016 at 16 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
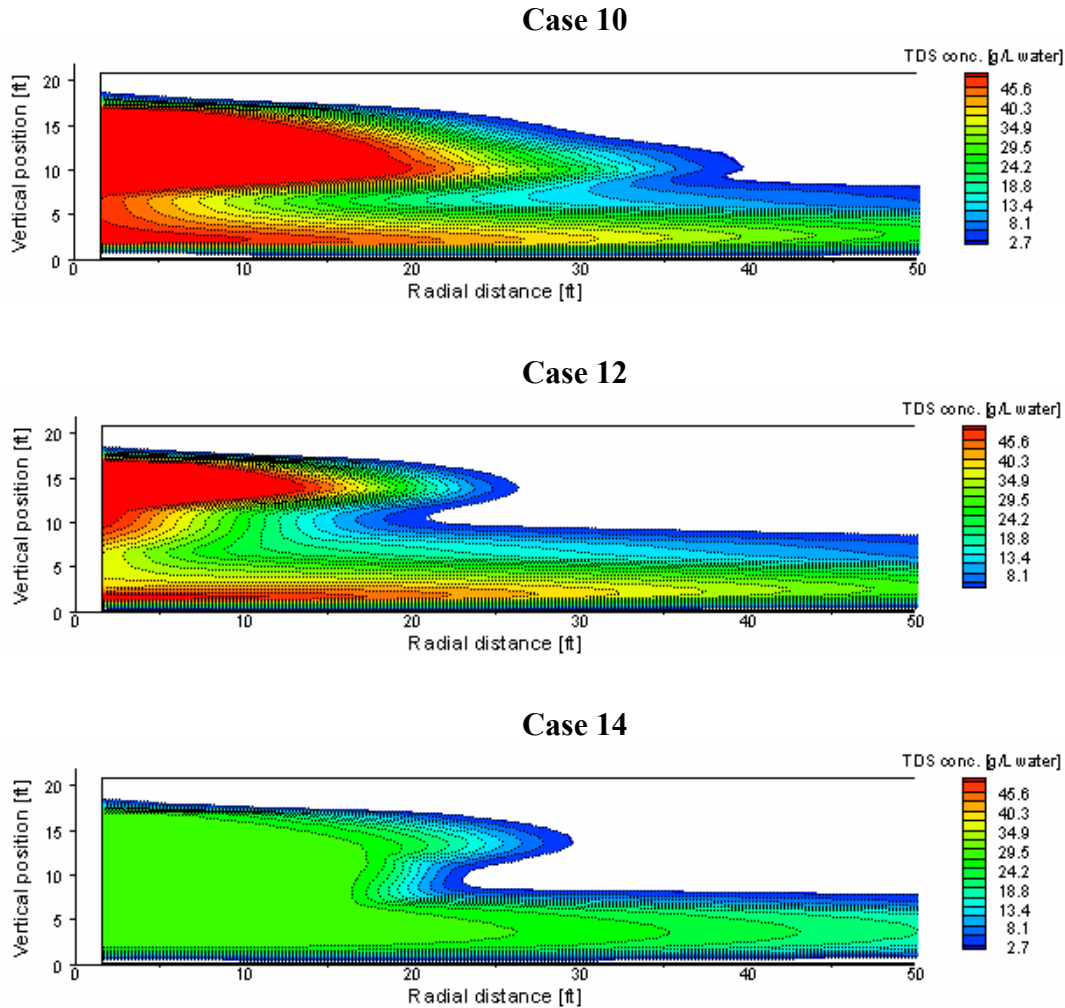
### Case 10



### Case 12



### Case 14

**Figure D.5**. Predicted TDS concentration distributions [g/L] around well PP016 at 24 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
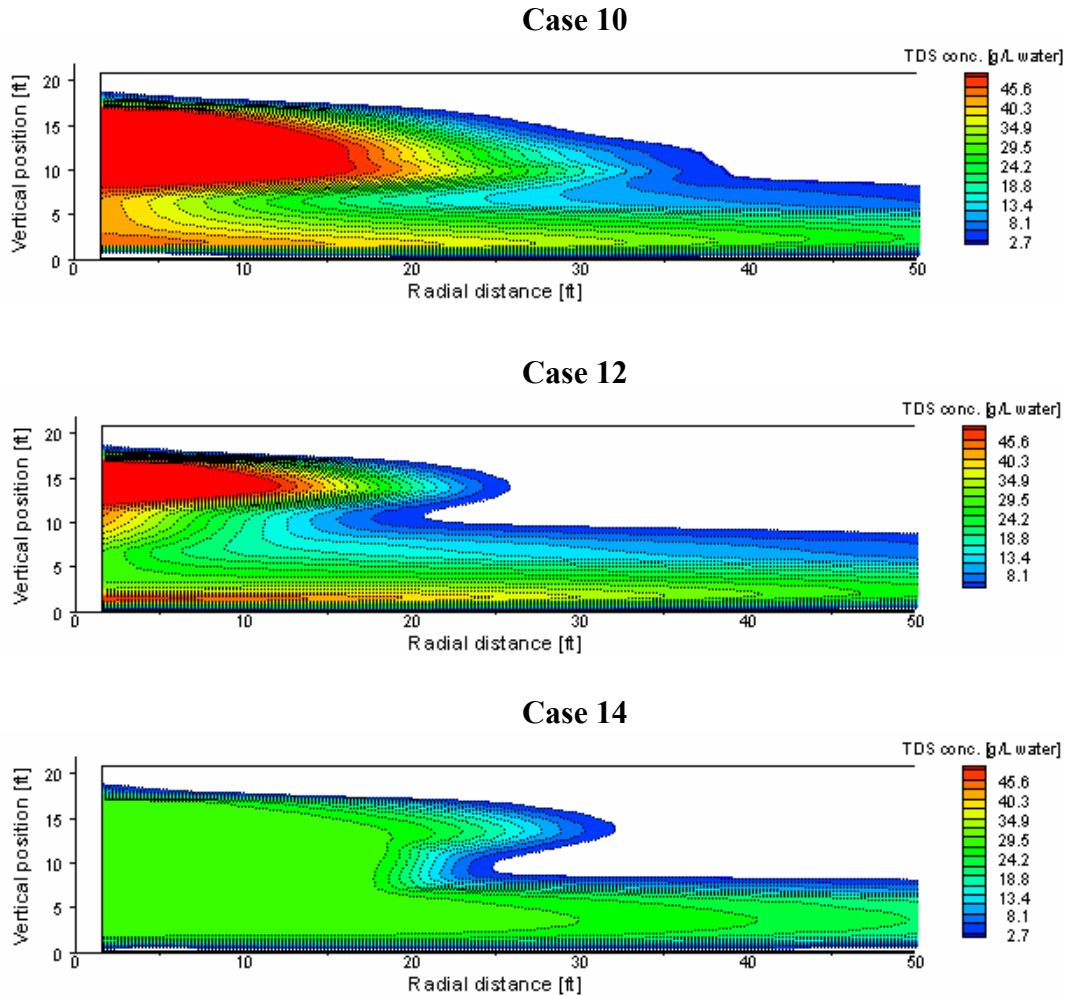
**Case 10**

**Case 12**

**Case 14**

**Figure D.6**. Predicted TDS concentration distributions [g/L] around well PP016 at 36 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
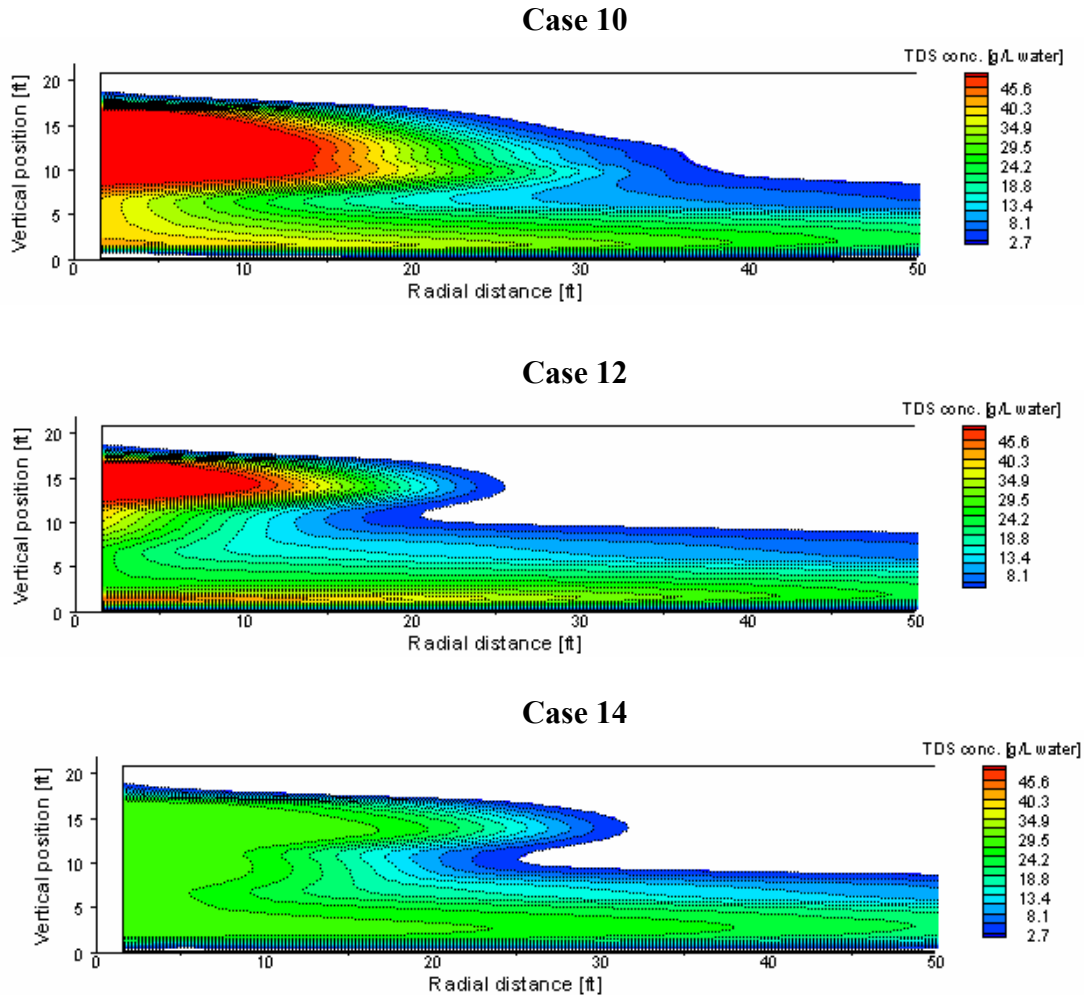
**Case 10**



**Case 12**



**Case 14**

**Figure D.7**. Predicted TDS concentration distributions [g/L] around well PP016 at 48 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
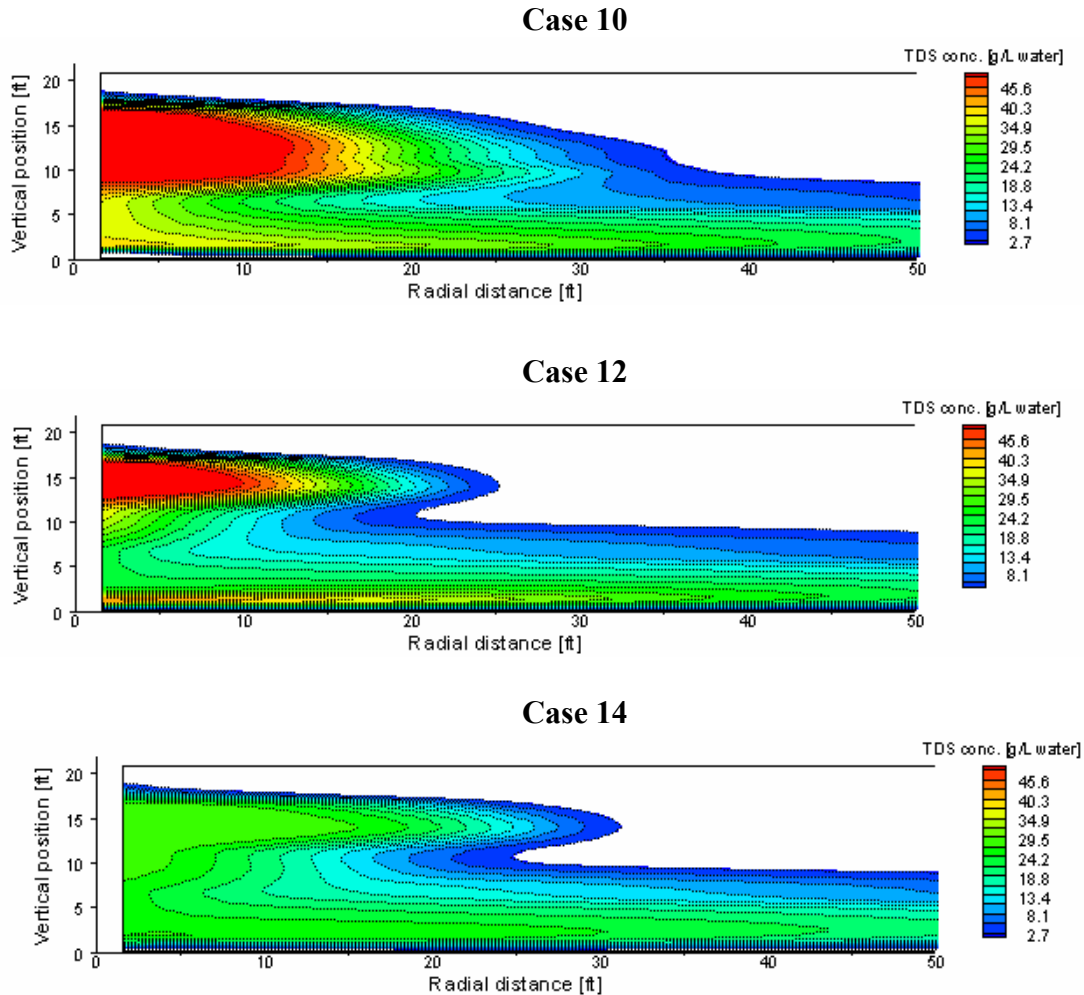
### Case 10



### Case 12



### Case 14

**Figure D.8**. Predicted TDS concentration distributions [g/L] around well PP016 at 60 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
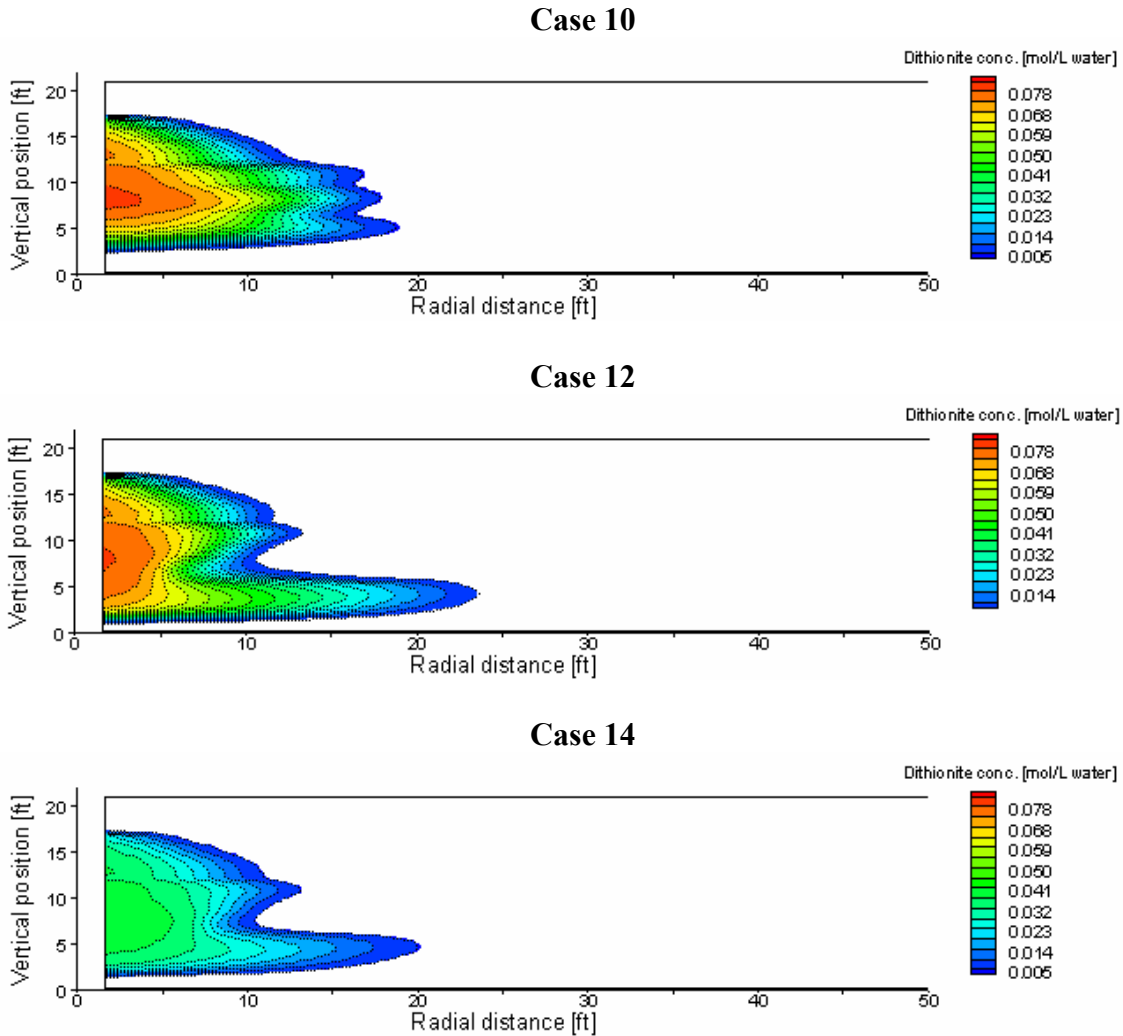
**Case 10**



**Case 12**



**Case 14**

**Figure D.9**. Predicted TDS concentration distributions [g/L] around well PP016 at 72 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
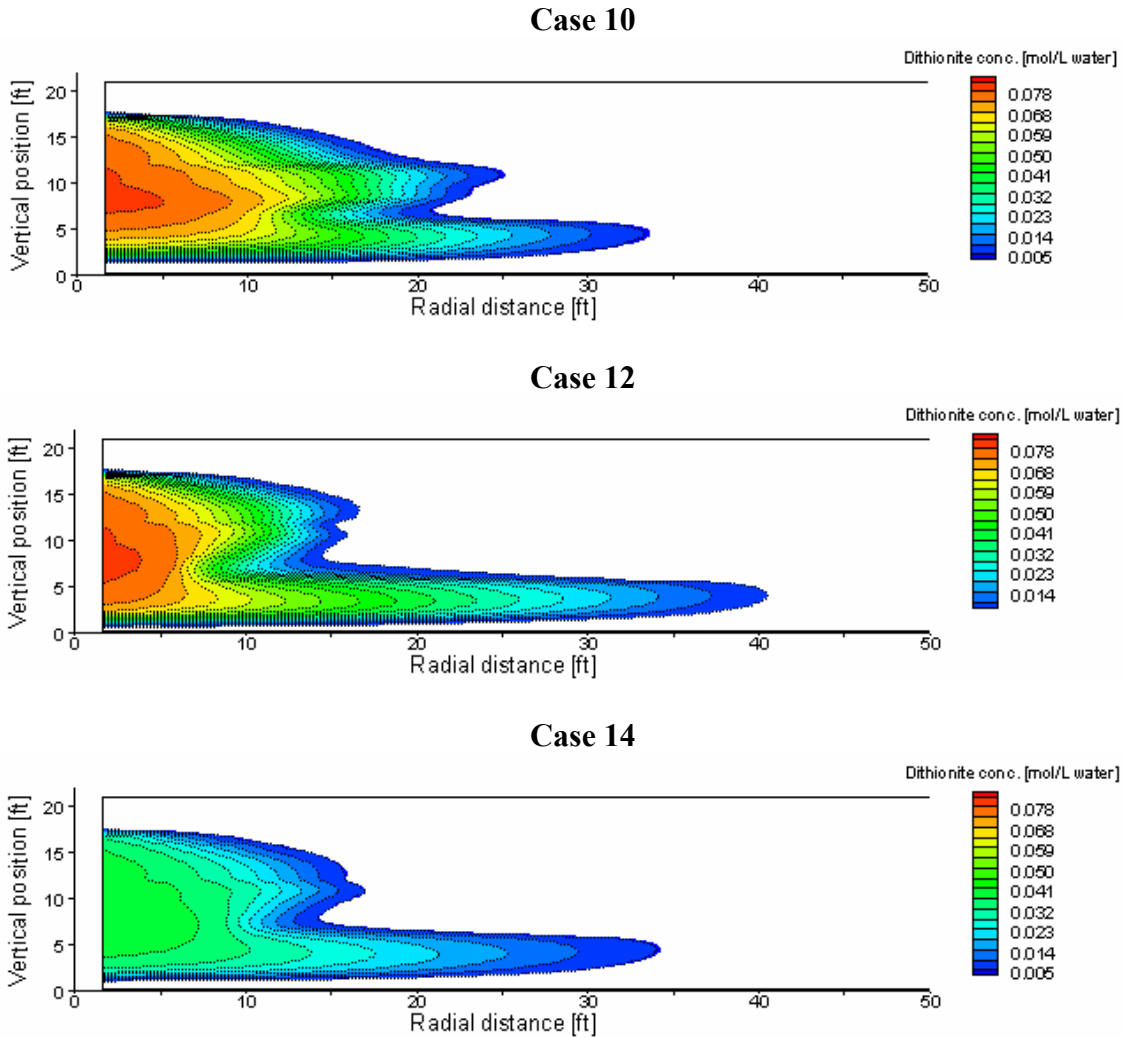
**Case 10**



**Case 12**



**Case 14**

**Figure D.10**.  Predicted dithionite concentration distributions [mol/L] around well PP016 at 2 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.



D.11

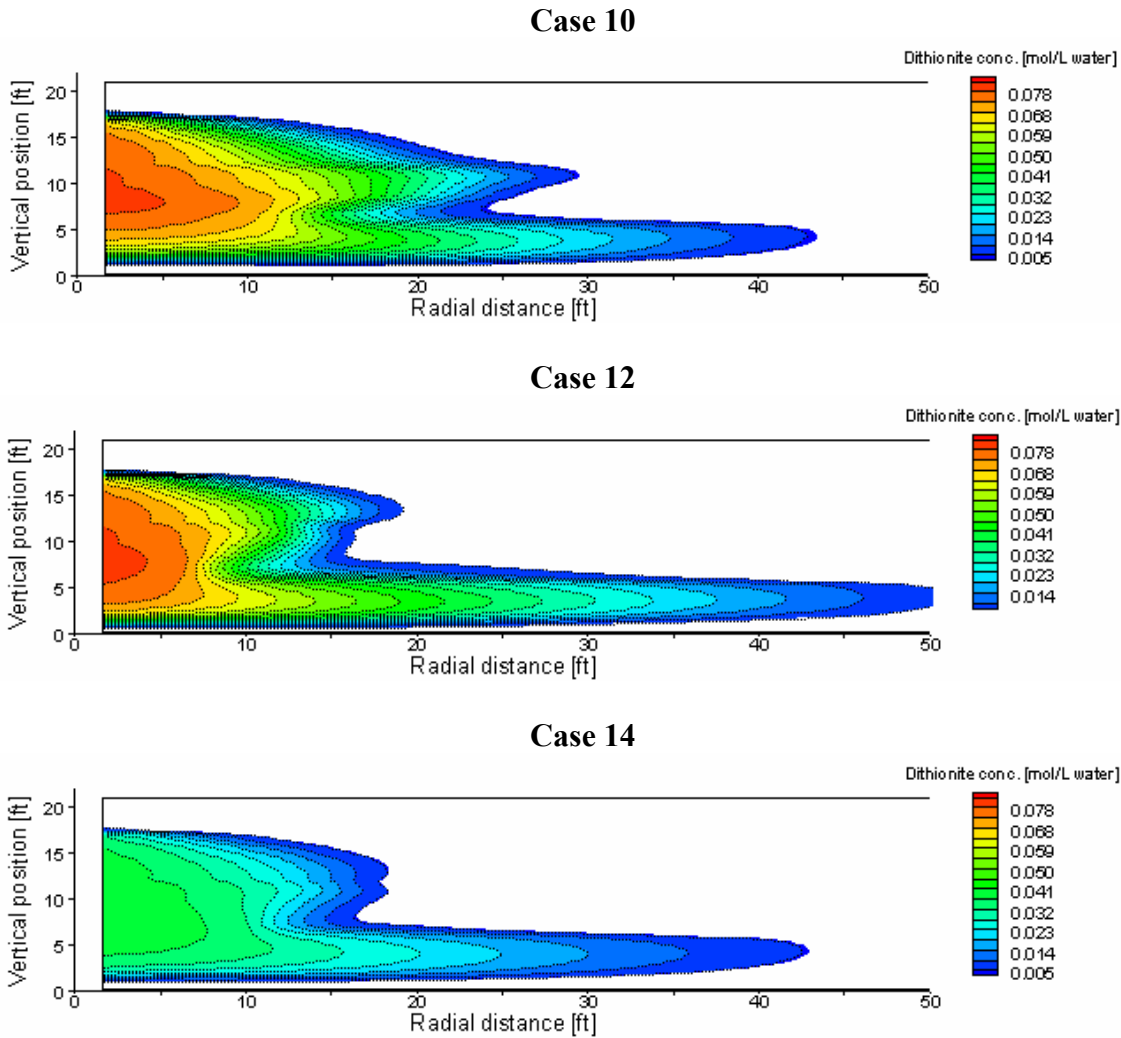**Figure D.11**.  Predicted dithionite concentration distributions [mol/L] around well PP016 at 6 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
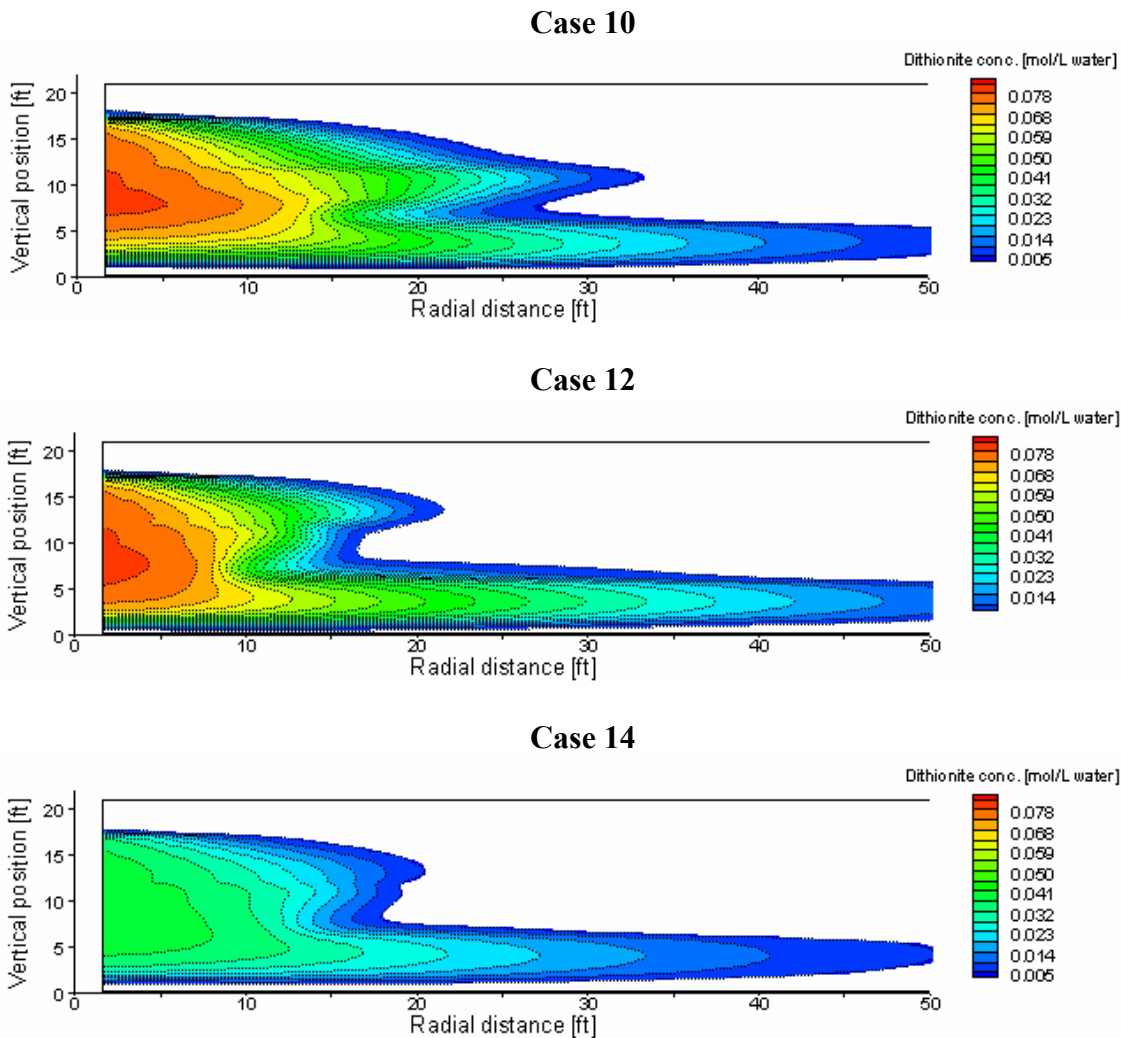


**Case 12**



**Case 14**

**Figure D.12**. Predicted dithionite concentration distributions [mol/L] around well PP016 at 10 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
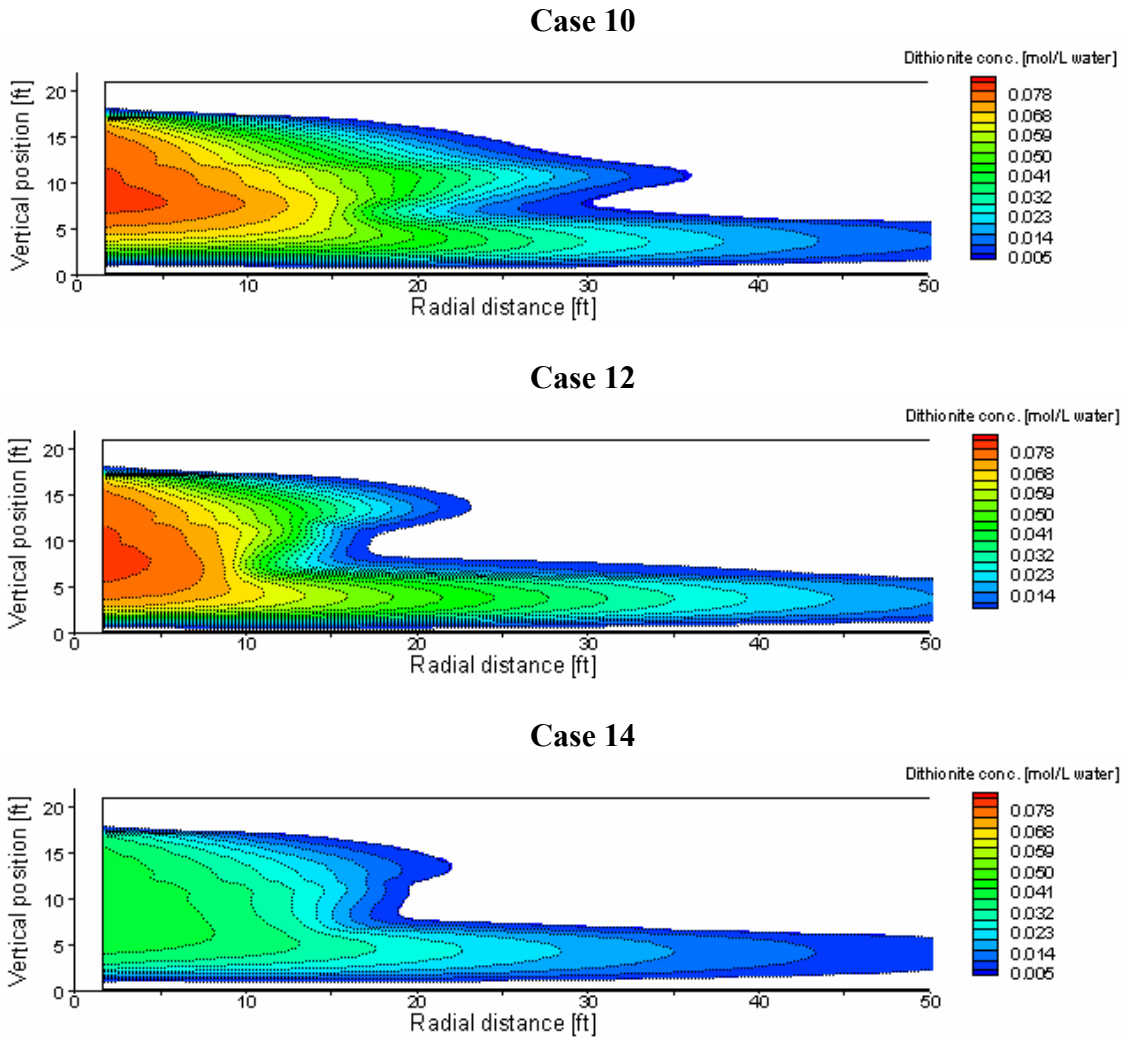
**Case 12**

**Case 14**

**Figure D.13**. Predicted dithionite concentration distributions [mol/L] around well PP016 at 16 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
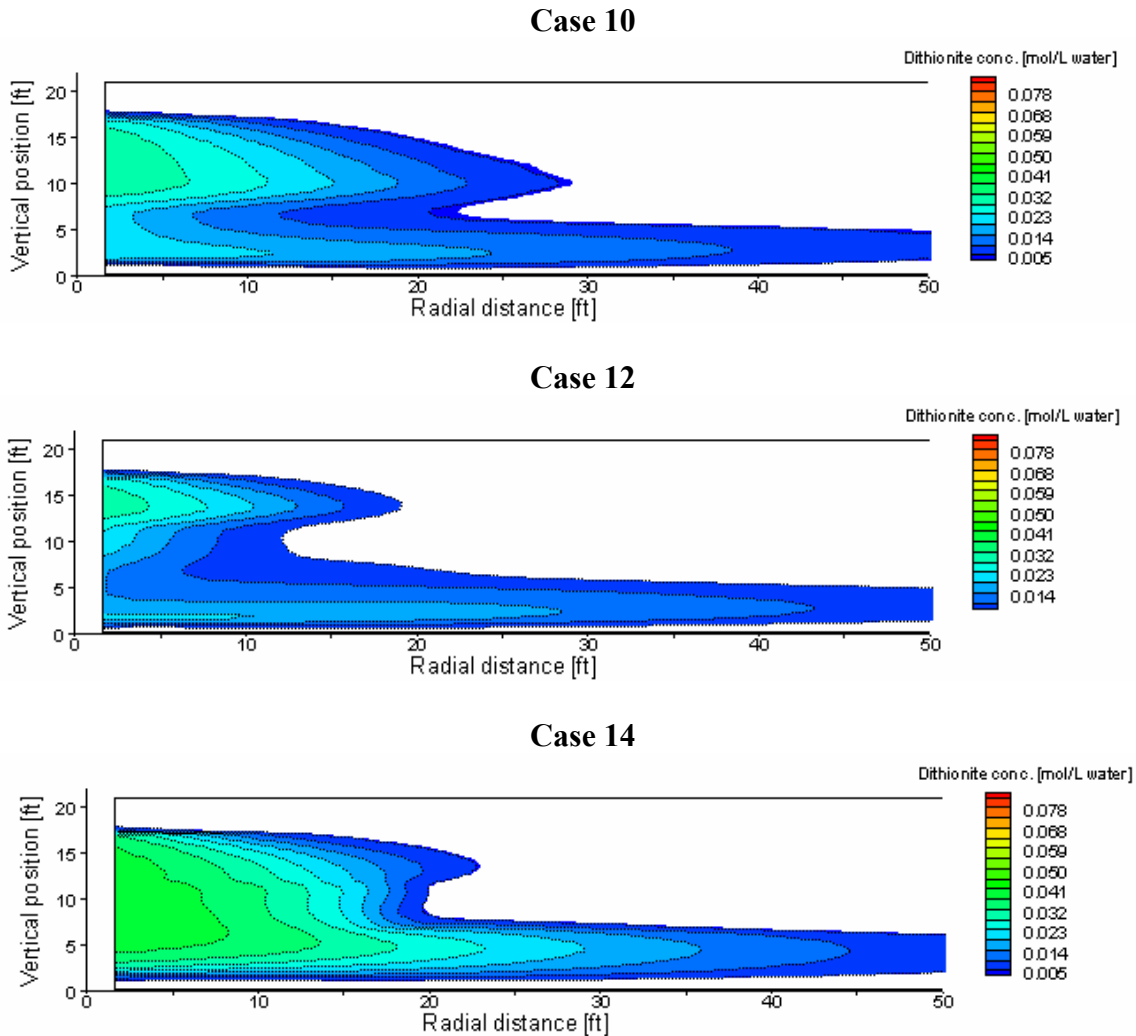


**Case 12**



**Case 14**

**Figure D.14**. Predicted dithionite concentration distributions [mol/L] around well PP016 at 24 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

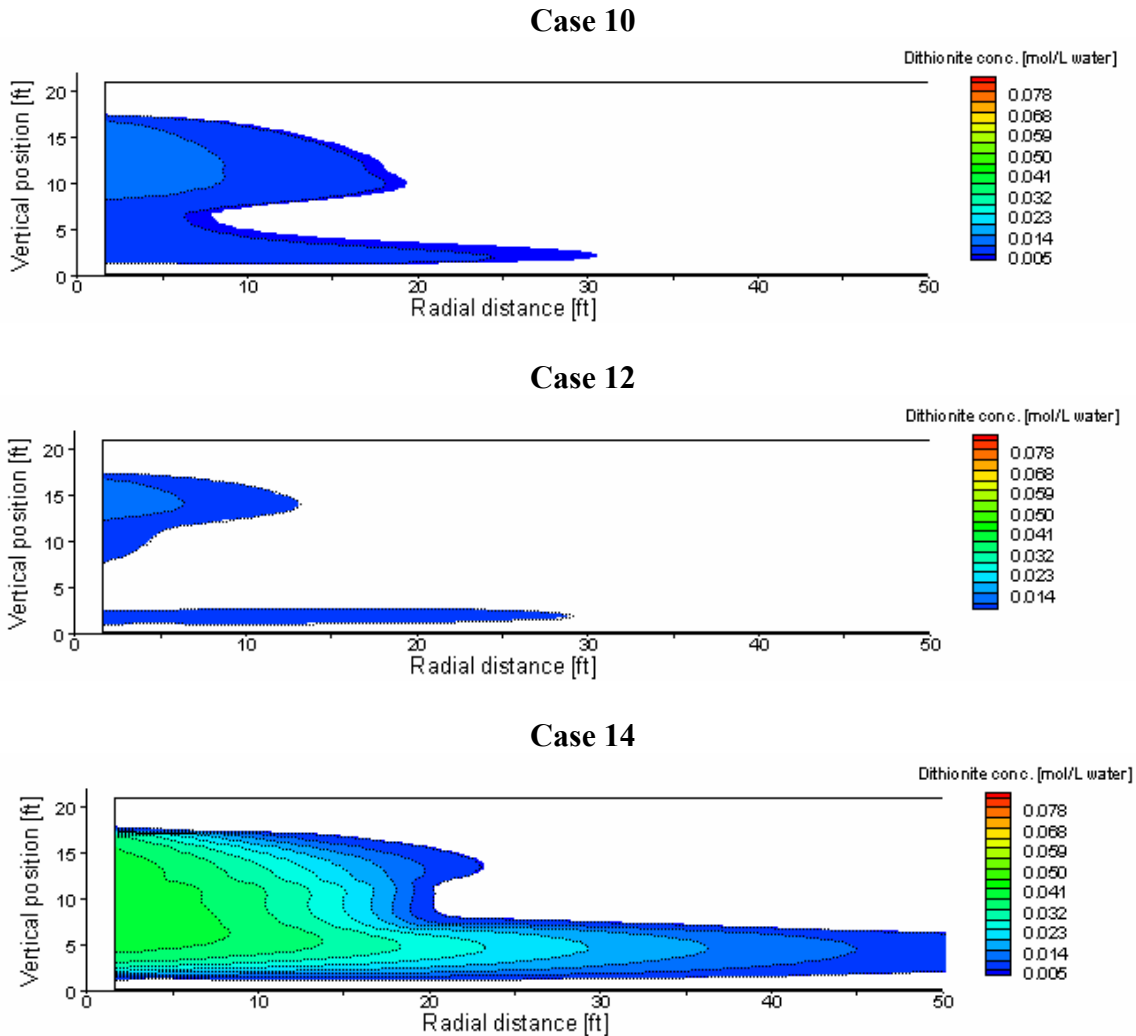**Figure D.15**. Predicted dithionite concentration distributions [mol/L] around well PP016 at 36 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
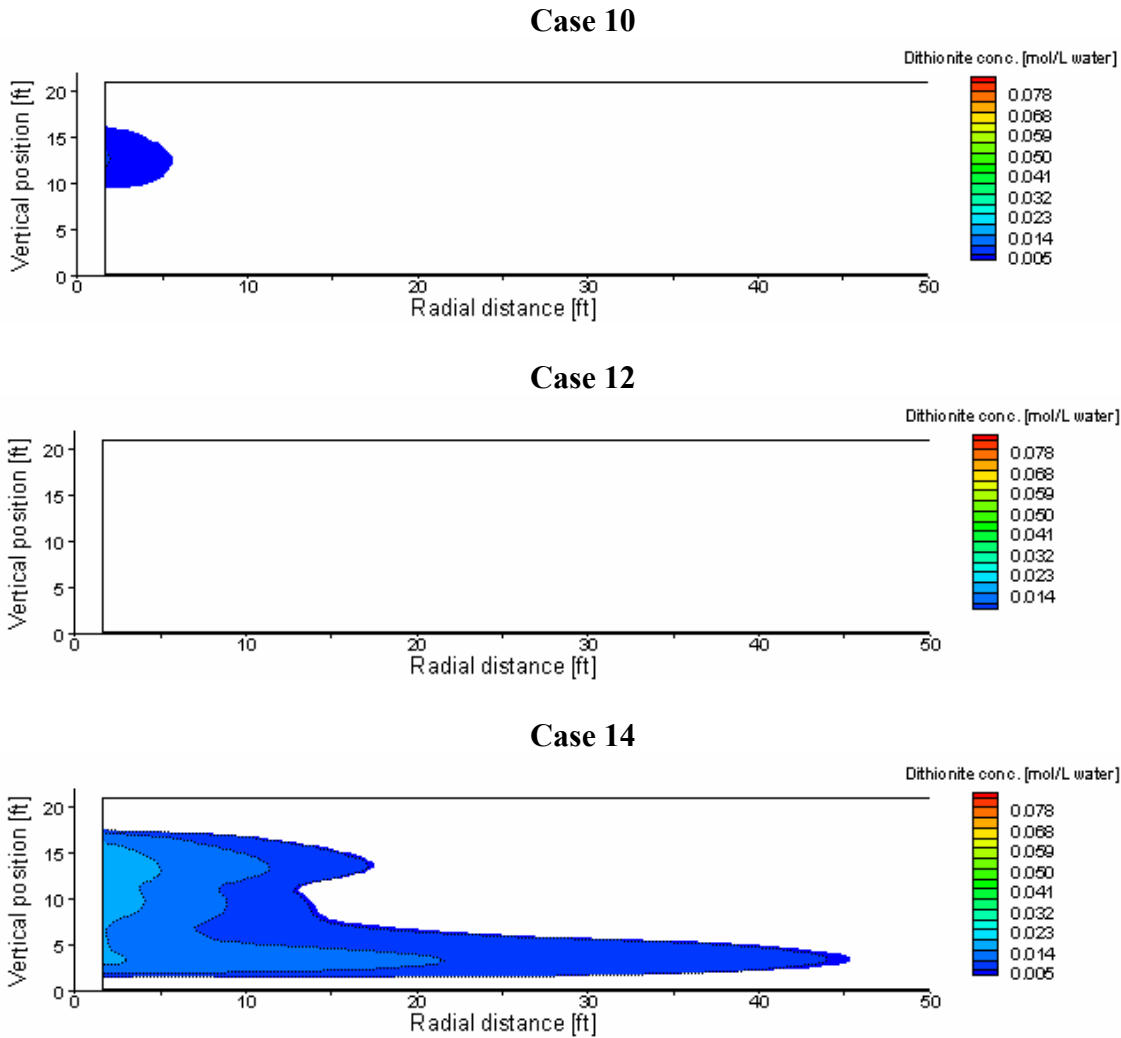


**Case 12**



**Case 14**

**Figure D.16**. Predicted dithionite concentration distributions [mol/L] around well PP016 at 48 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
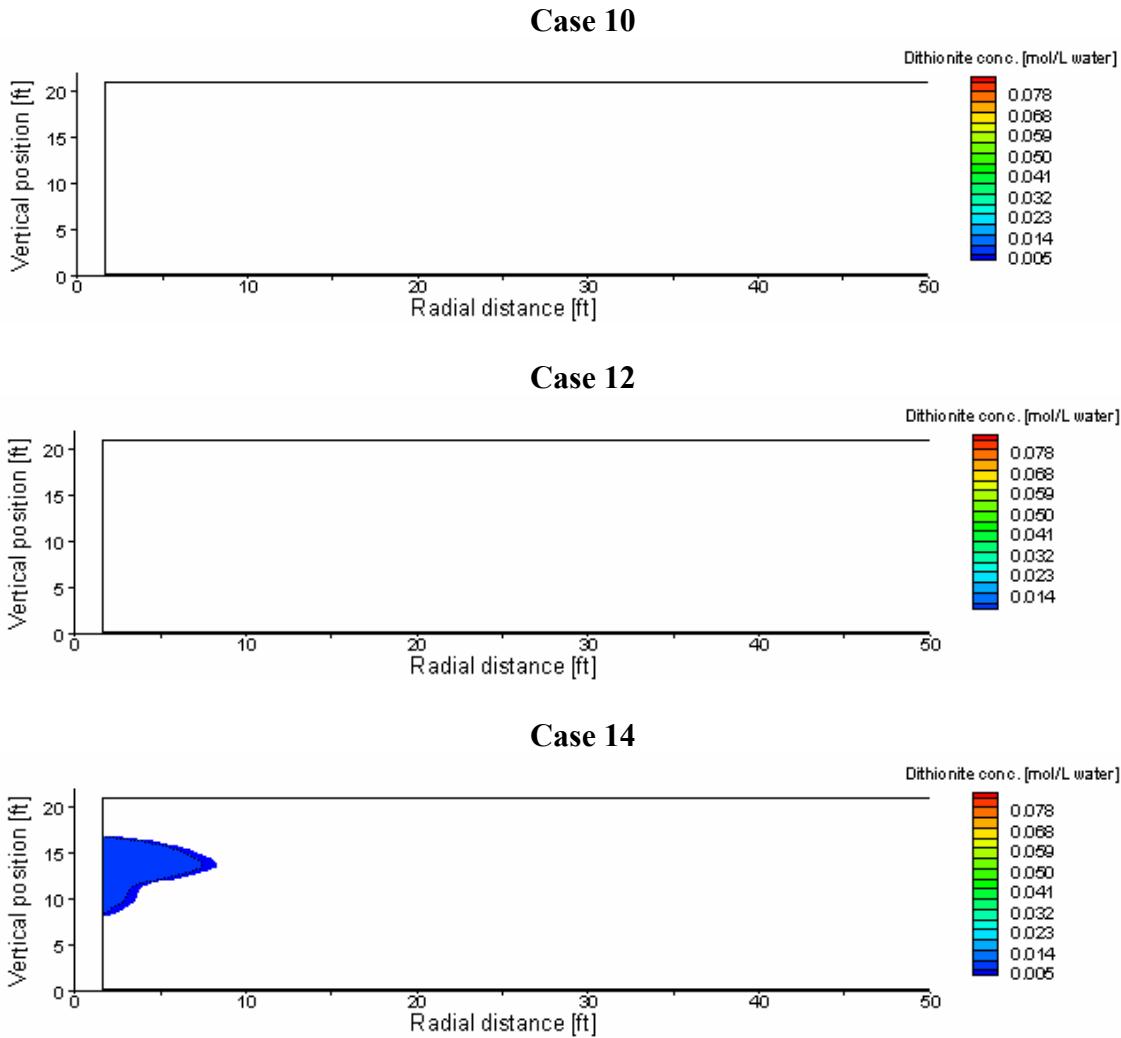


**Case 12**



**Case 14**

**Figure D.17**. Predicted dithionite concentration distributions [mol/L] around well PP016 at 60 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
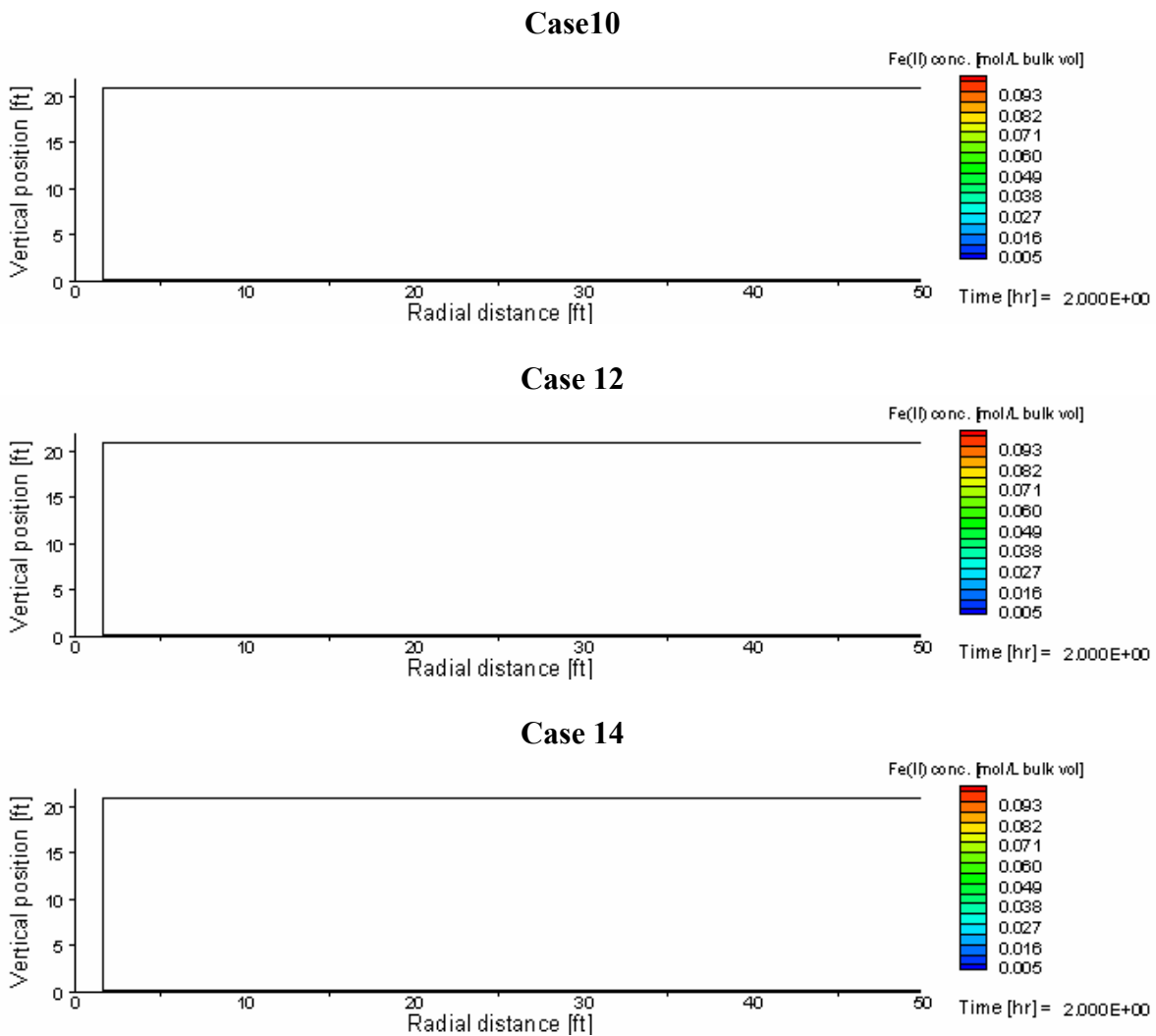


**Case 12**



**Case 14**

**Figure D.18**. Predicted dithionite concentration distributions [mol/L] around well PP016 at 72 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
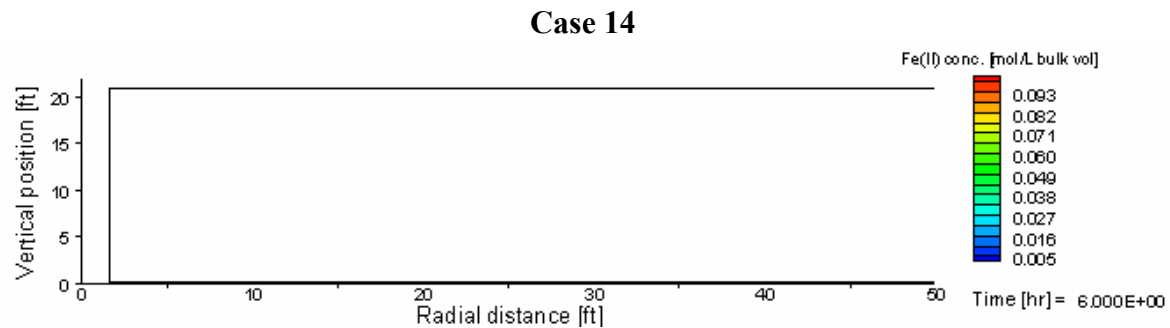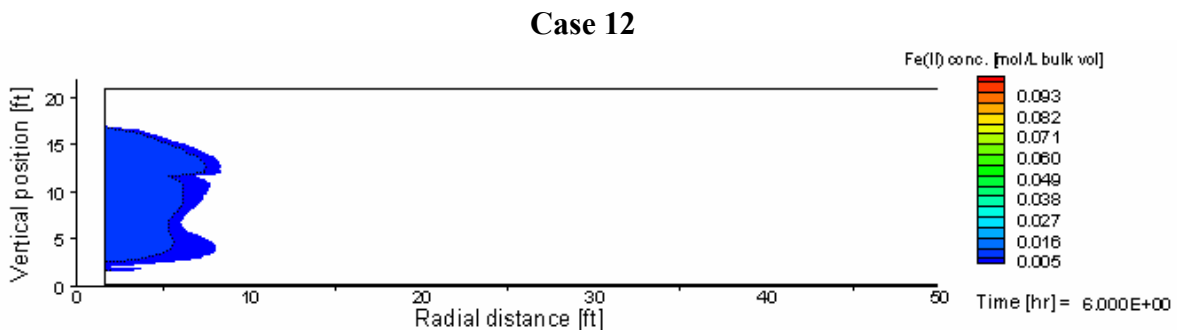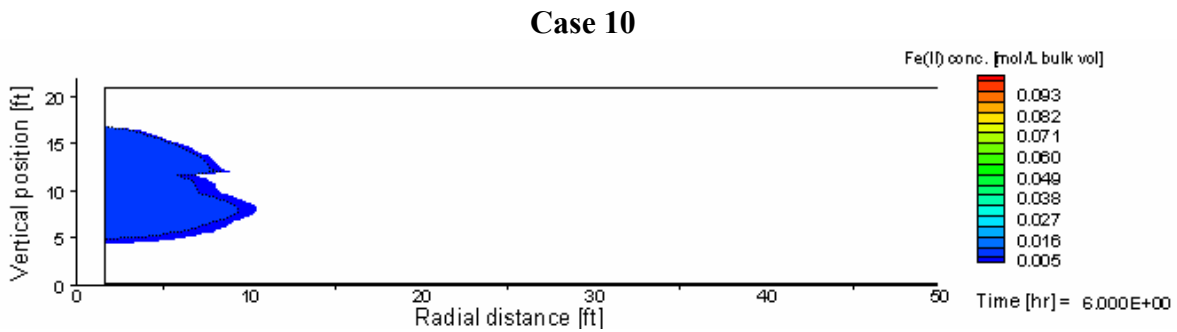


**Case 12**



**Case 14**

**Figure D.19**. Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 2 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case10**
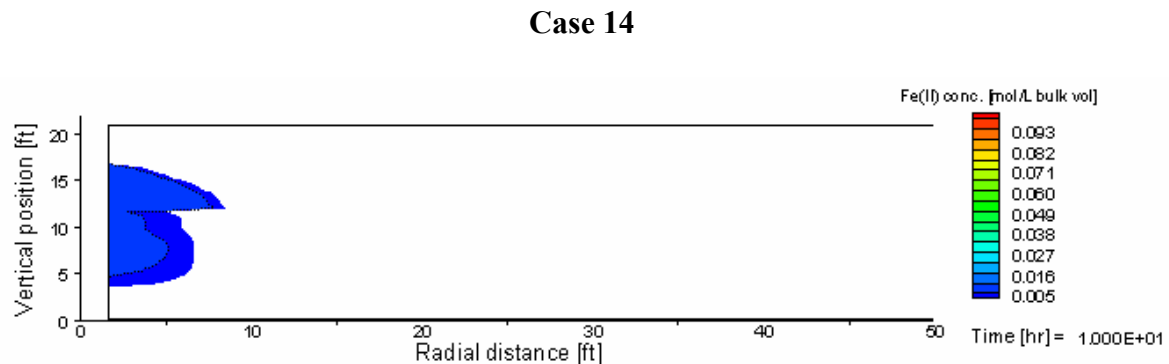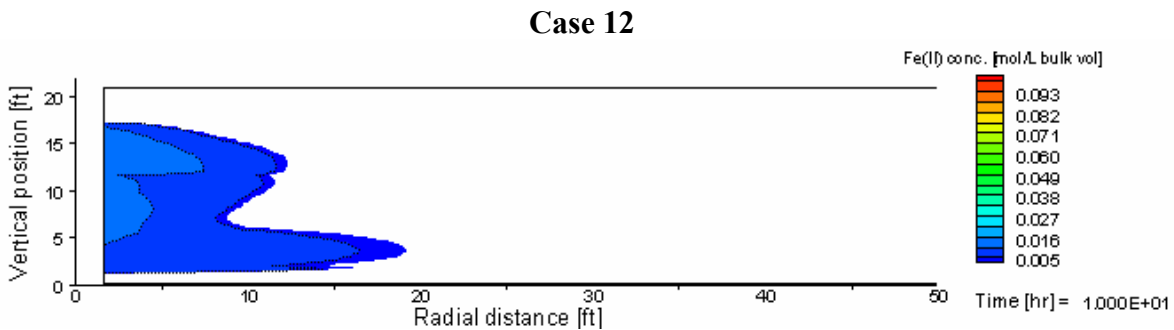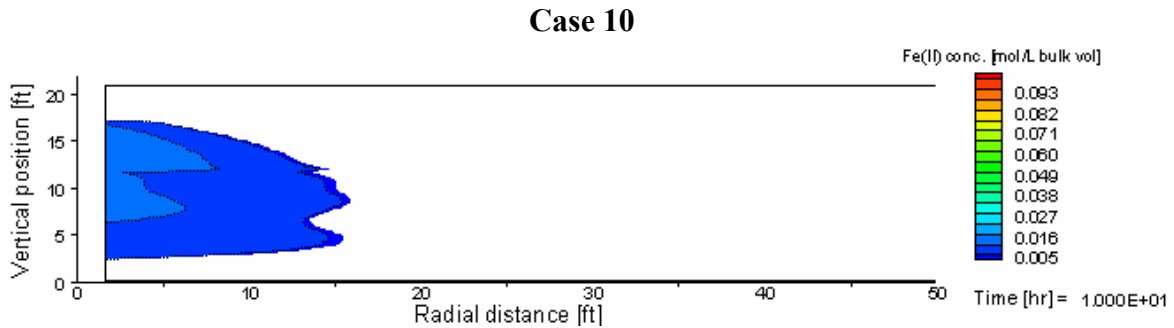


**Case 12**



**Case 14**

**Figure D.20**.  Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 6 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
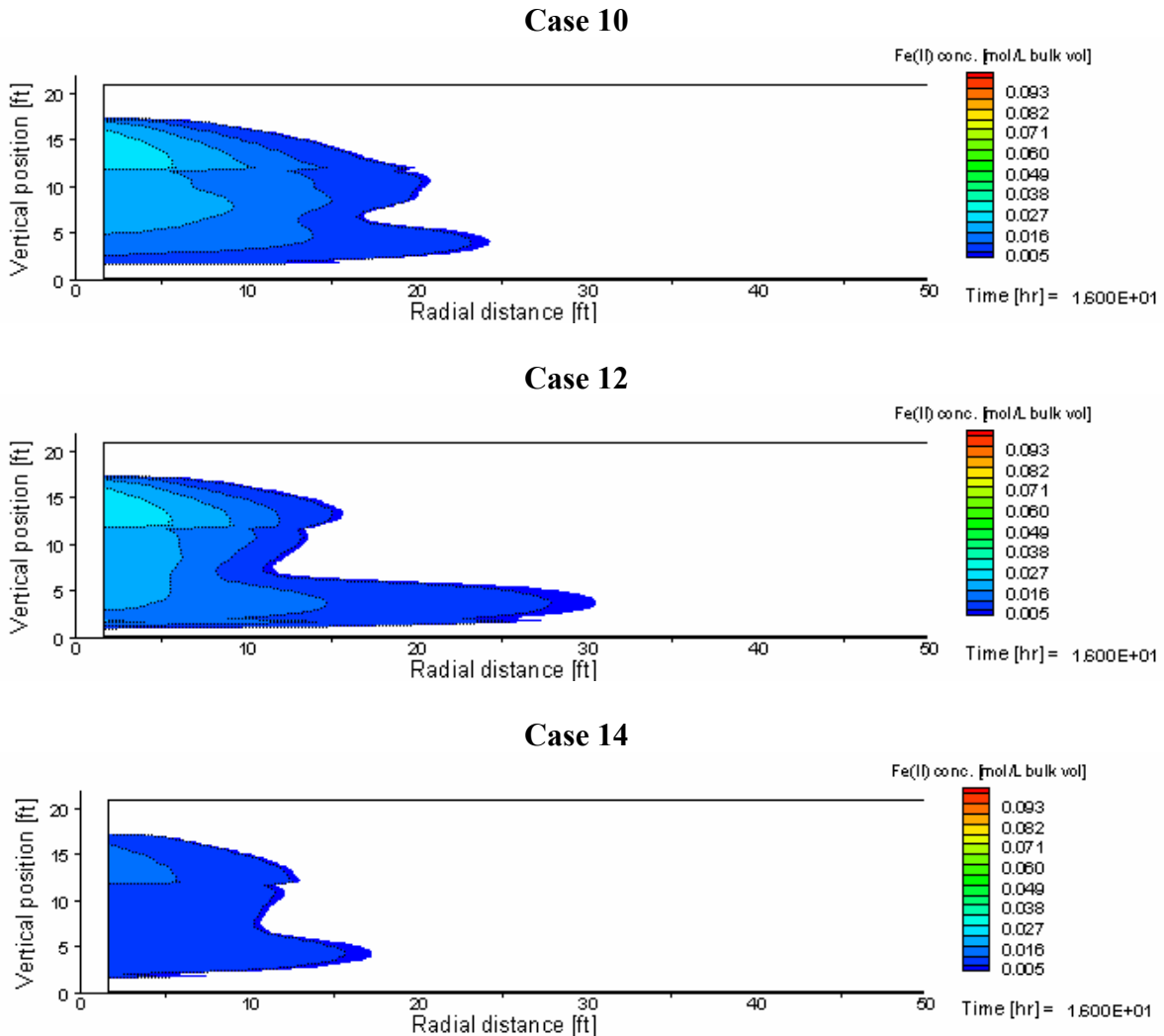
**Case 10**



**Case 12**



**Case 14**

**Figure D.21**. Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 10 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

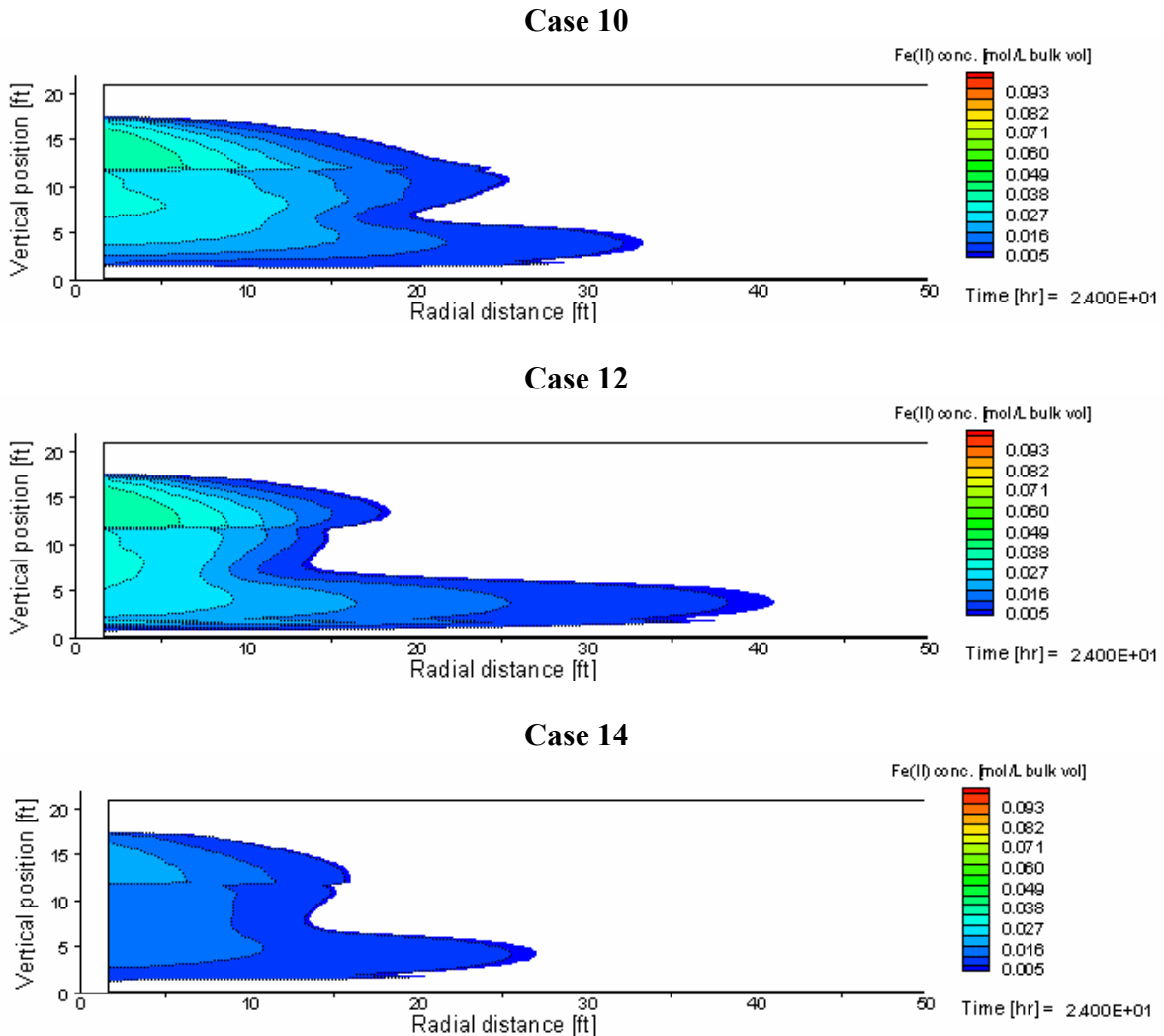### Case 10



### Case 12



### Case 14

**Time = 16 hr**

**Figure D.22**.  Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 16 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
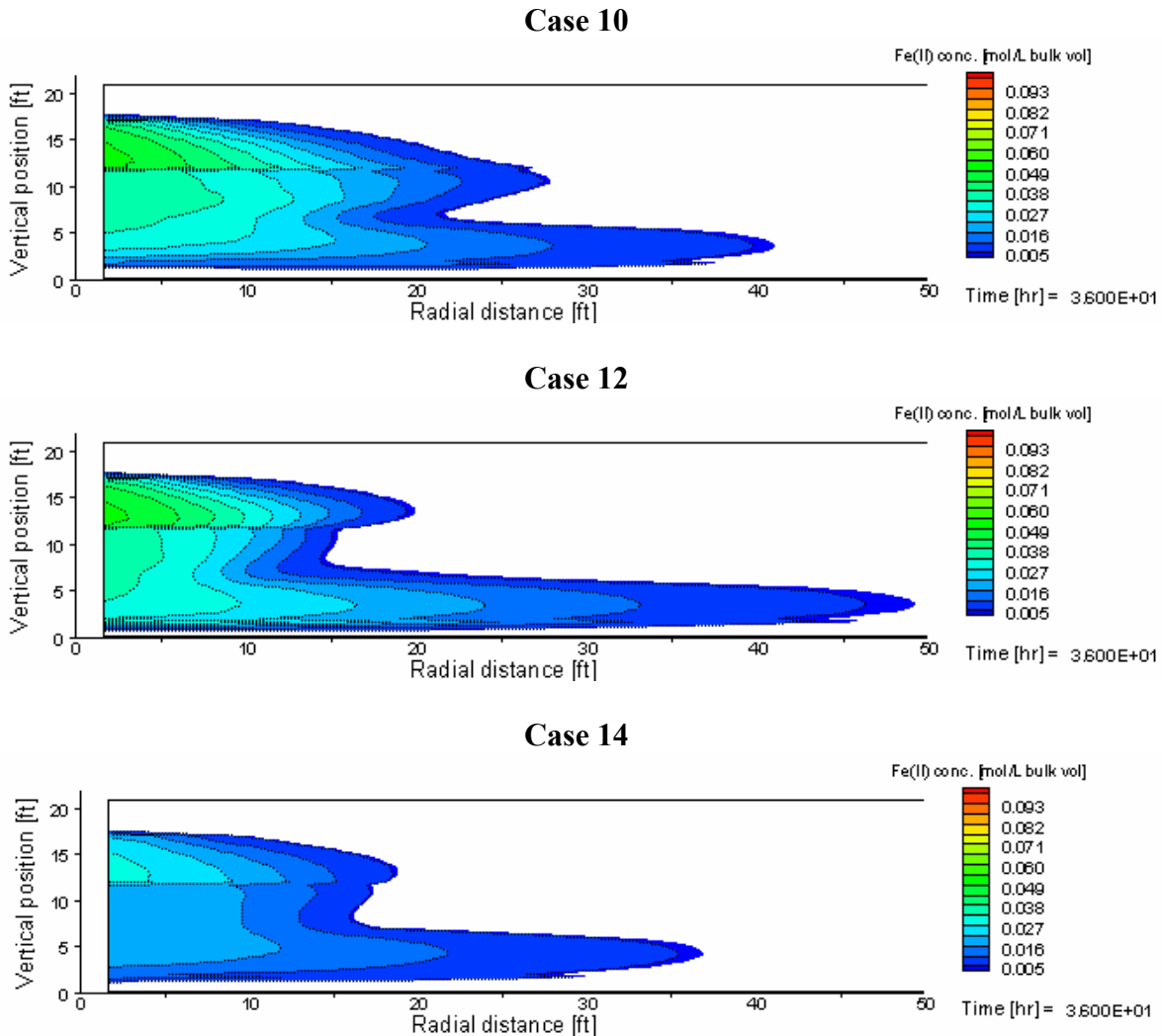


**Case 12**



**Case 14**



D.23

**Figure D.23**. Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 24 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
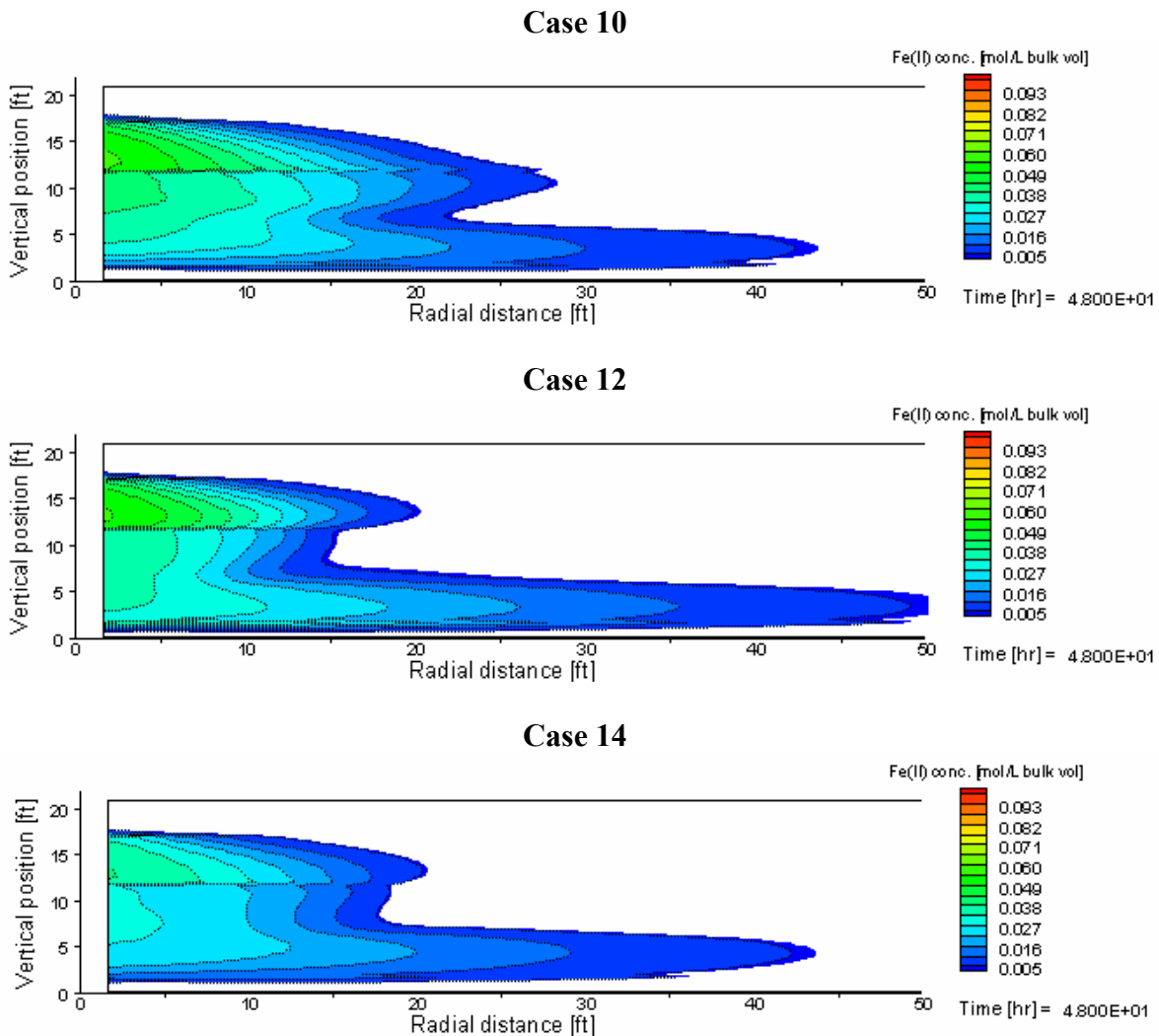


**Case 12**



**Case 14**

**Time = 36 hr**

**Figure D.24**.  Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 36 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.
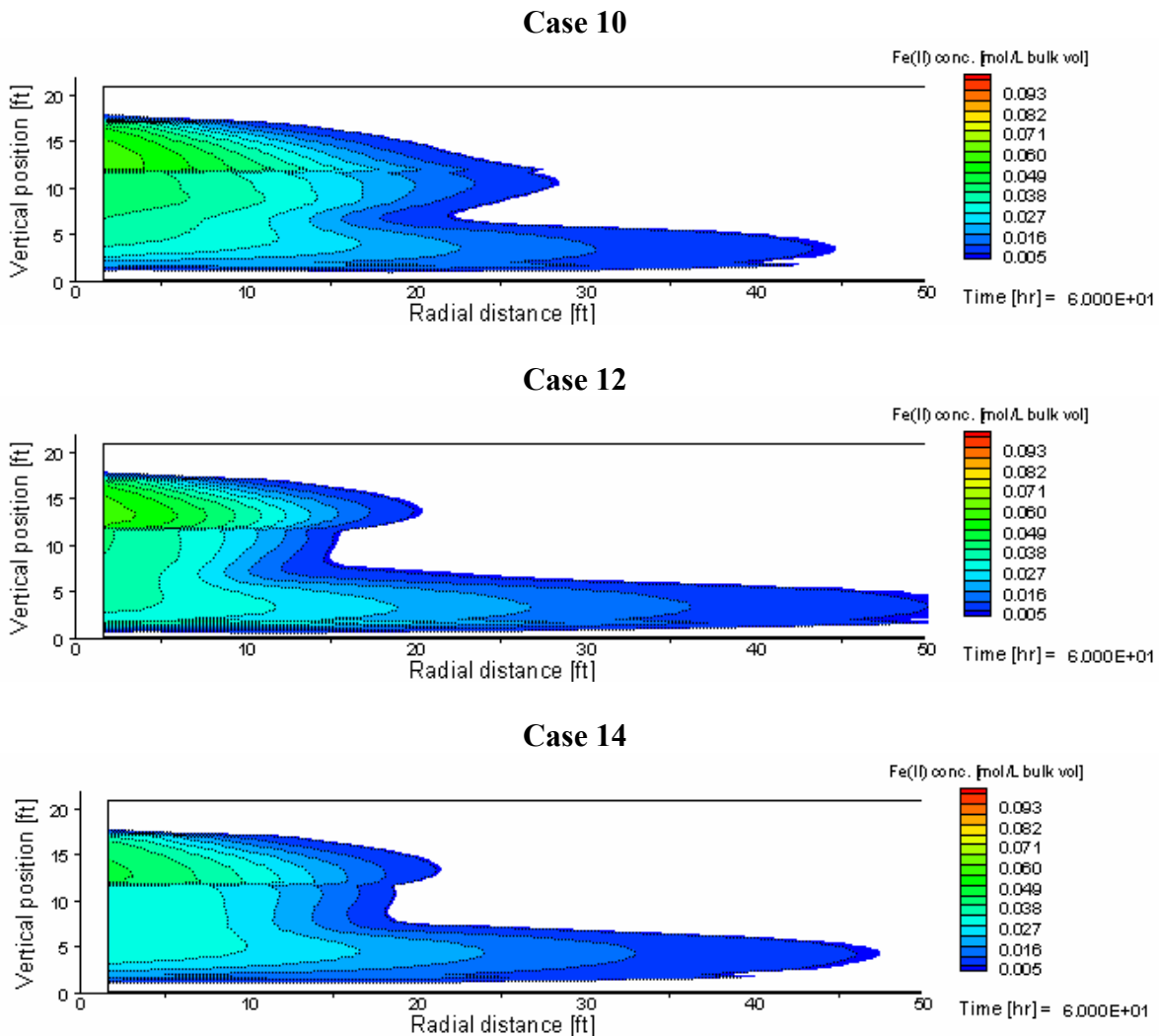
**Case 10**



**Case 12**



**Case 14**

**Time = 48 hr**

**Figure D.25**.  Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 48 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**



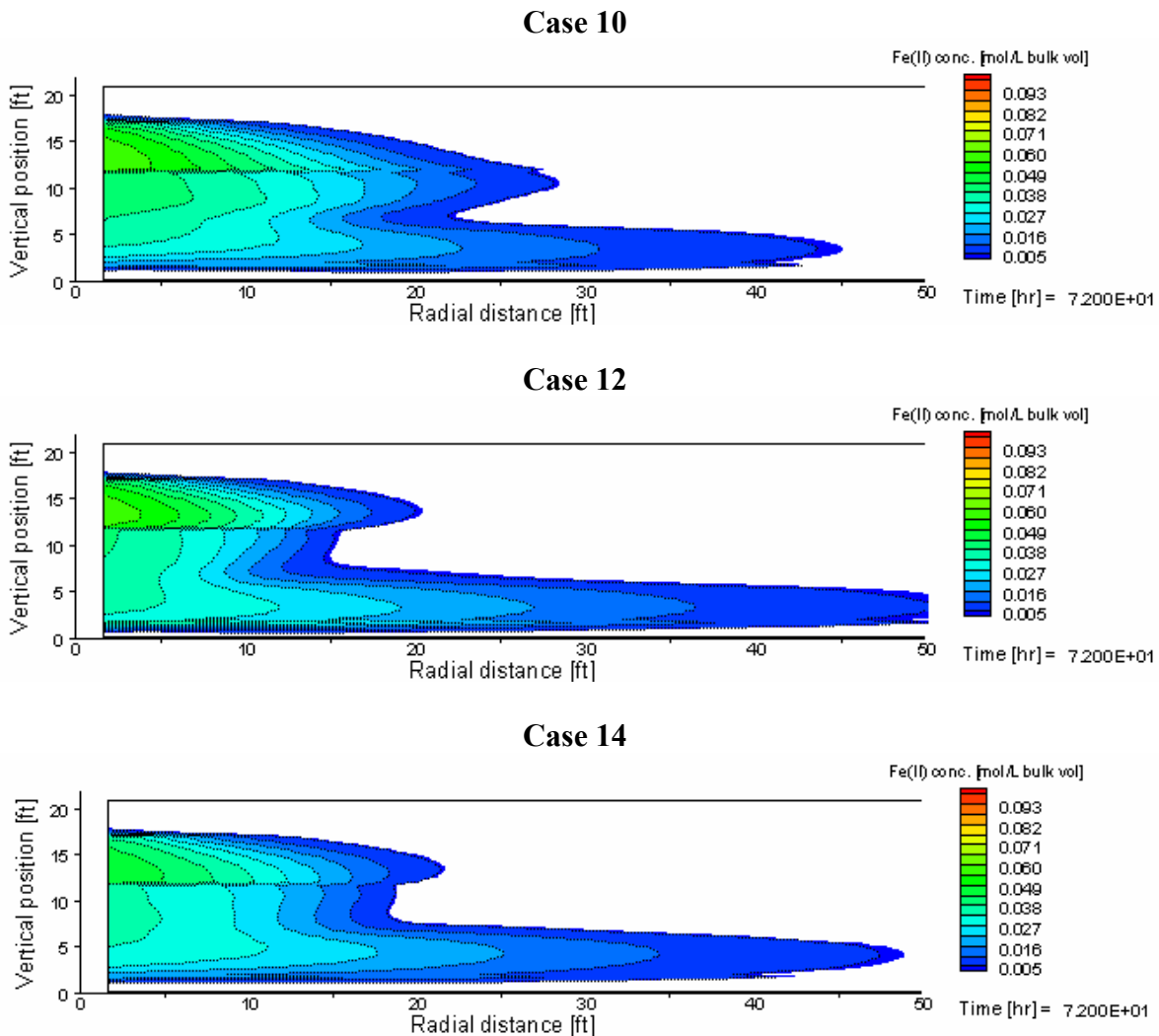**Case 12**



**Case 14**



D.26

**Time = 60 hr**

**Figure D.26**.  Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 60 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
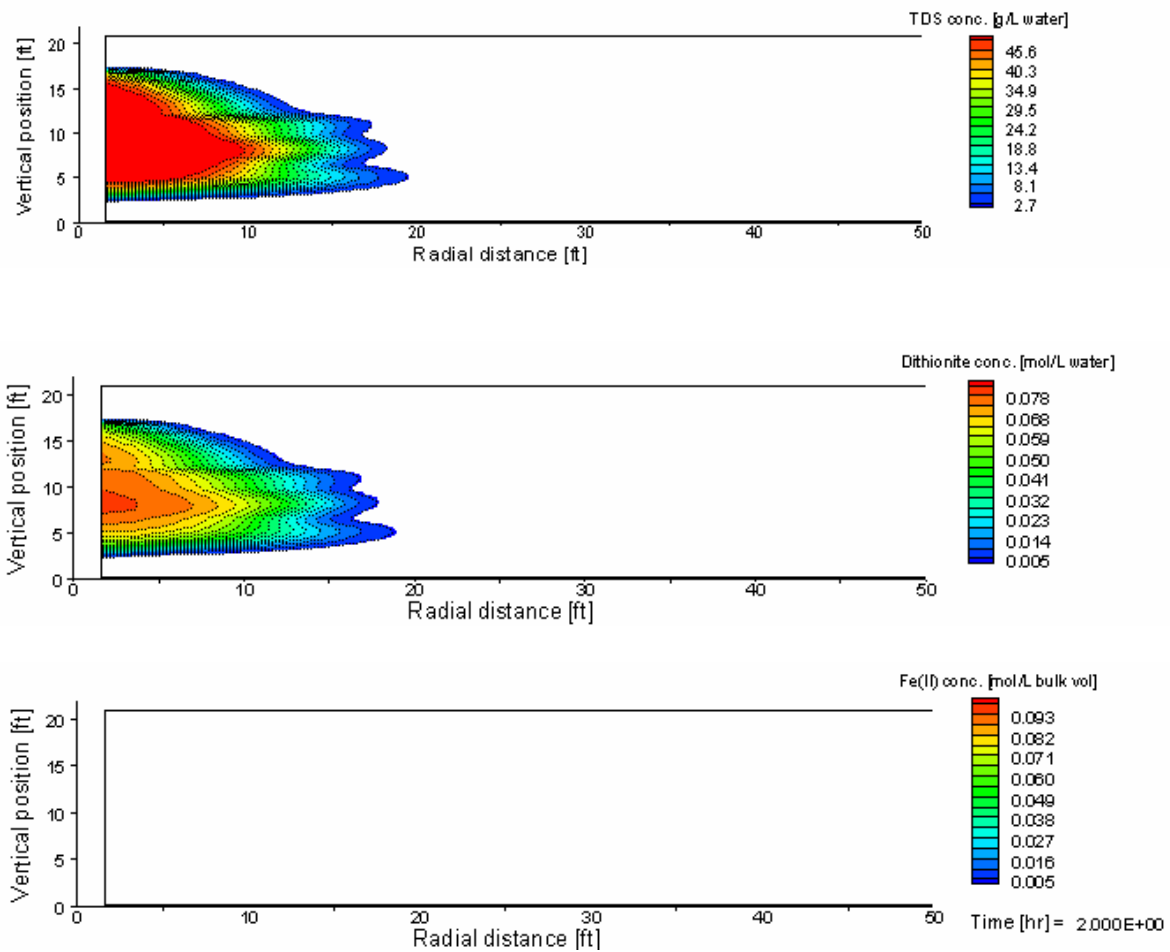
**Case 12**

**Case 14**

**Figure D.27**. Predicted Fe(II) concentration distributions [mol/L bulk vol] around well PP016 at 72 hr for simulation cases 10, 12, and 14 (top to bottom). Dithionite injectate concentrations are 0.08, 0.08, and 0.04 M for cases 10, 12, and 14, respectively. Flow rates are 6.94 gpm from 0-24 hr (~10,000 gal) in unit A1, and 27.75 gpm from 0-24 hr (~40,000 gal) in unit A2, for cases 10 and 12, and 6.94 gpm from 0-48 hr (~20,000 gal) in unit A1, and 27.77 gpm from 0-48 hr (~80,000 gal) in unit A2 for case 14. For case 10, units A1 and A2 are both layered with Kv=Kh/100. For cases 12 and 14, unit A1 is layered with Kv=Kh/100, and unit A2 is layered with Kv=Kh/10.

**Case 10**
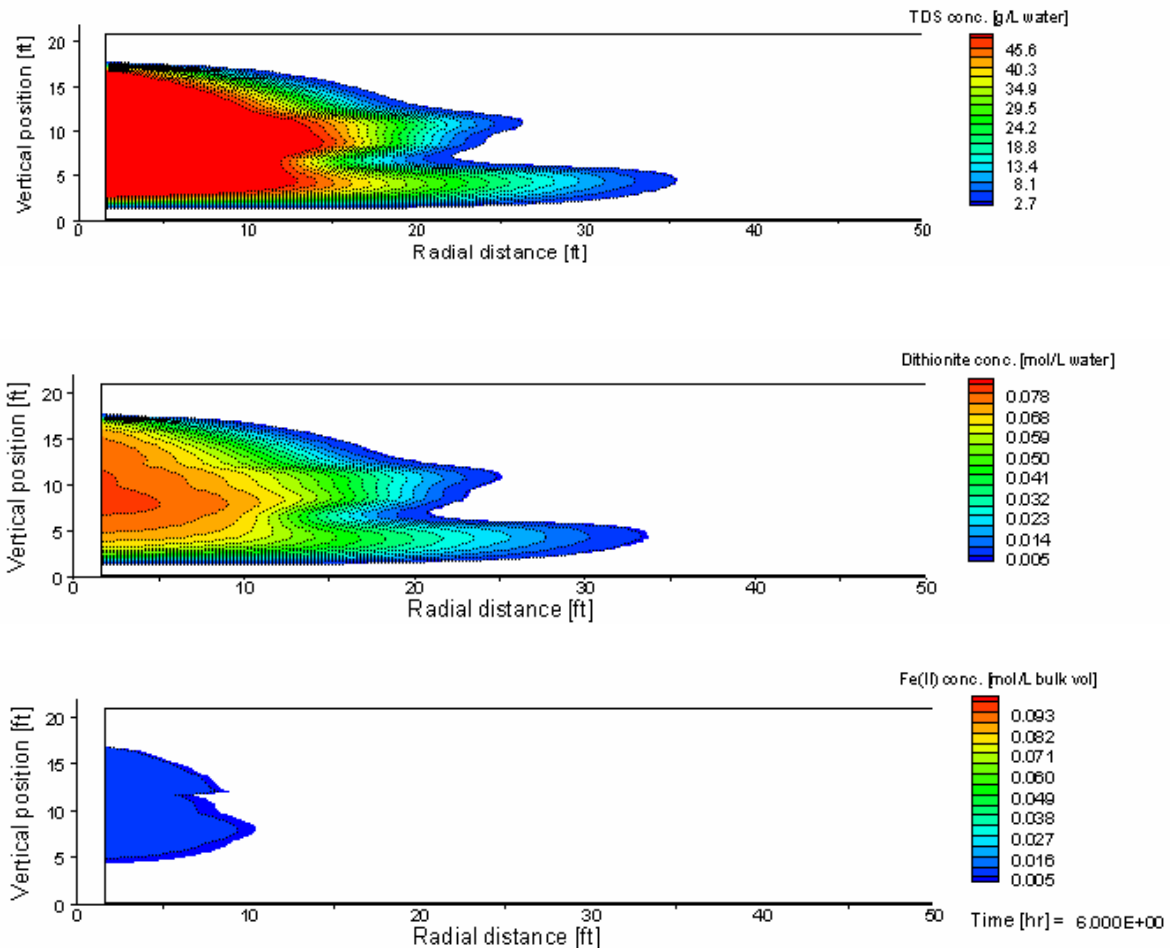


**Case 12**



**Case 14**

**Figure D.28**. Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 2 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2. Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.

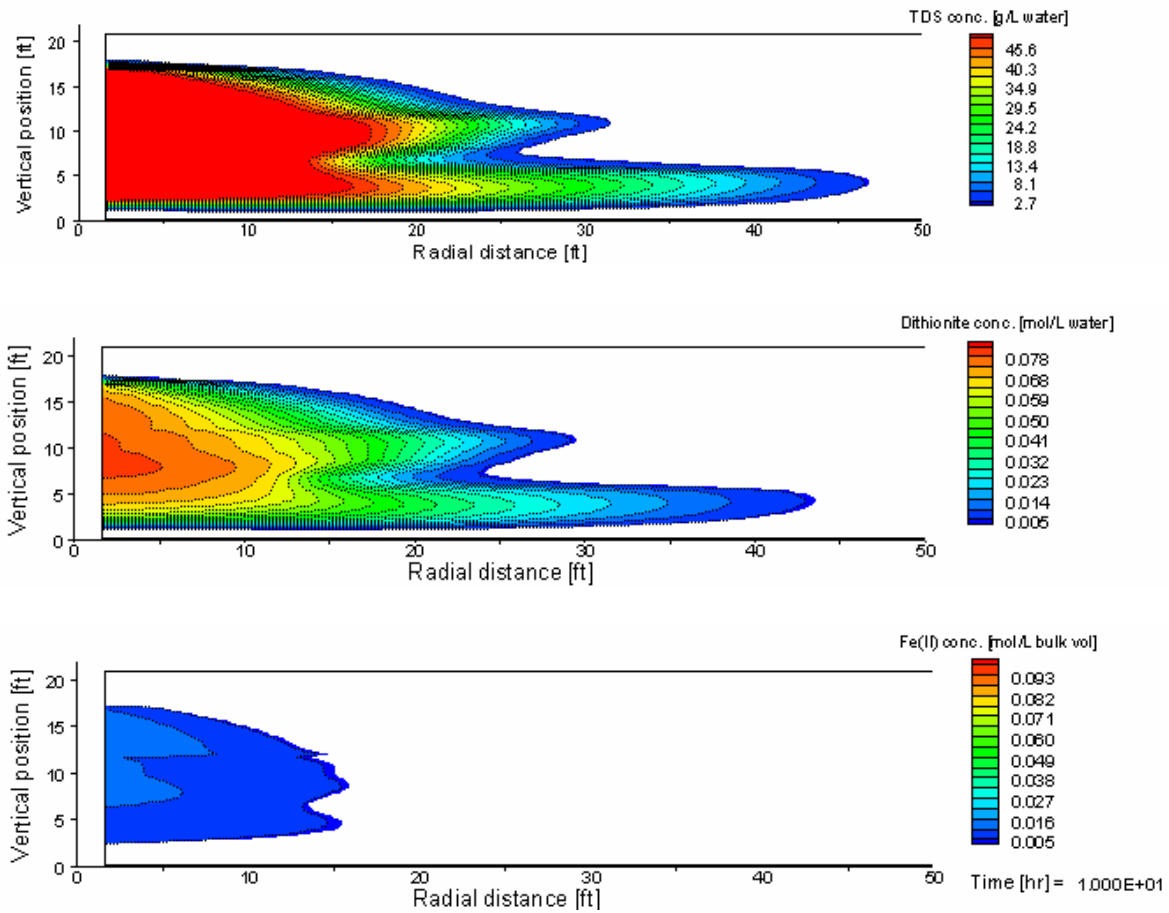**Figure D.29**.  Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 6 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2. Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.

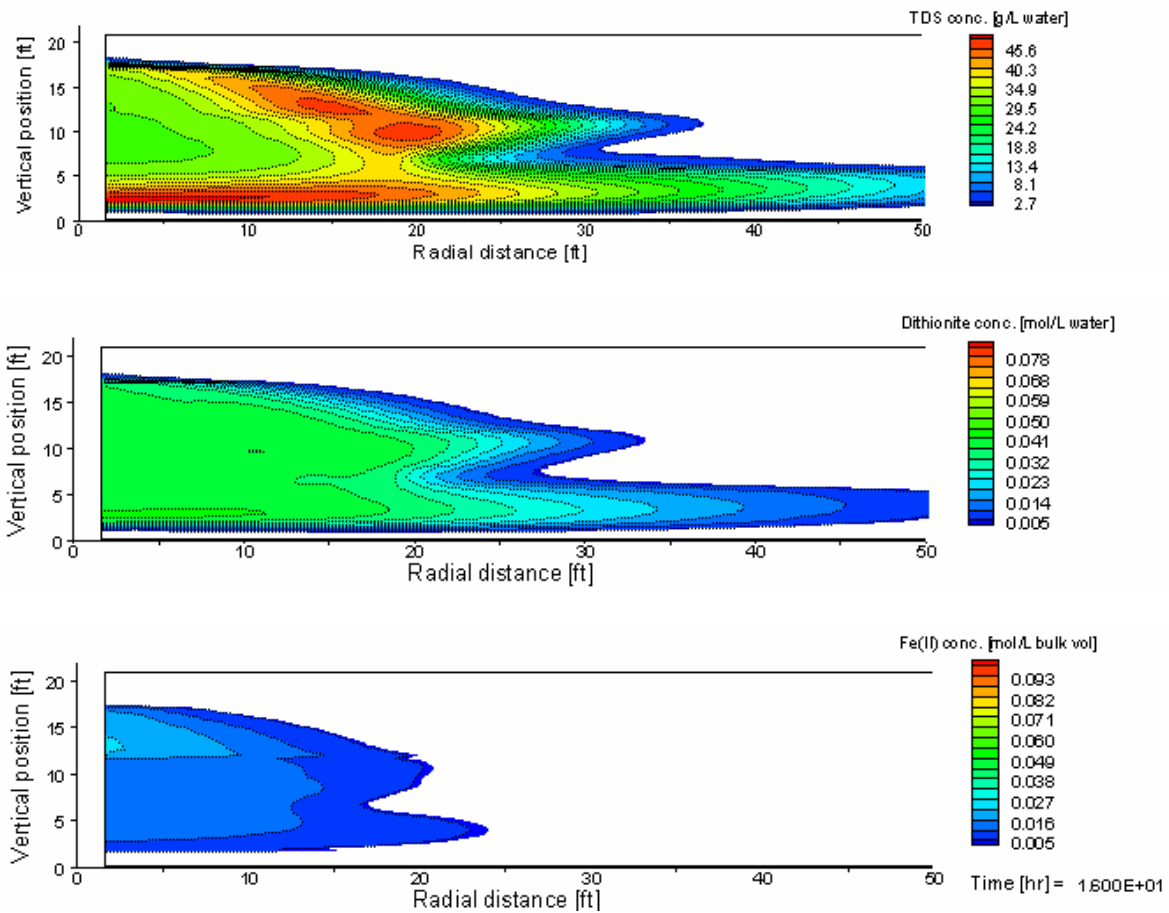**Figure D.30**. Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 10 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2. Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.

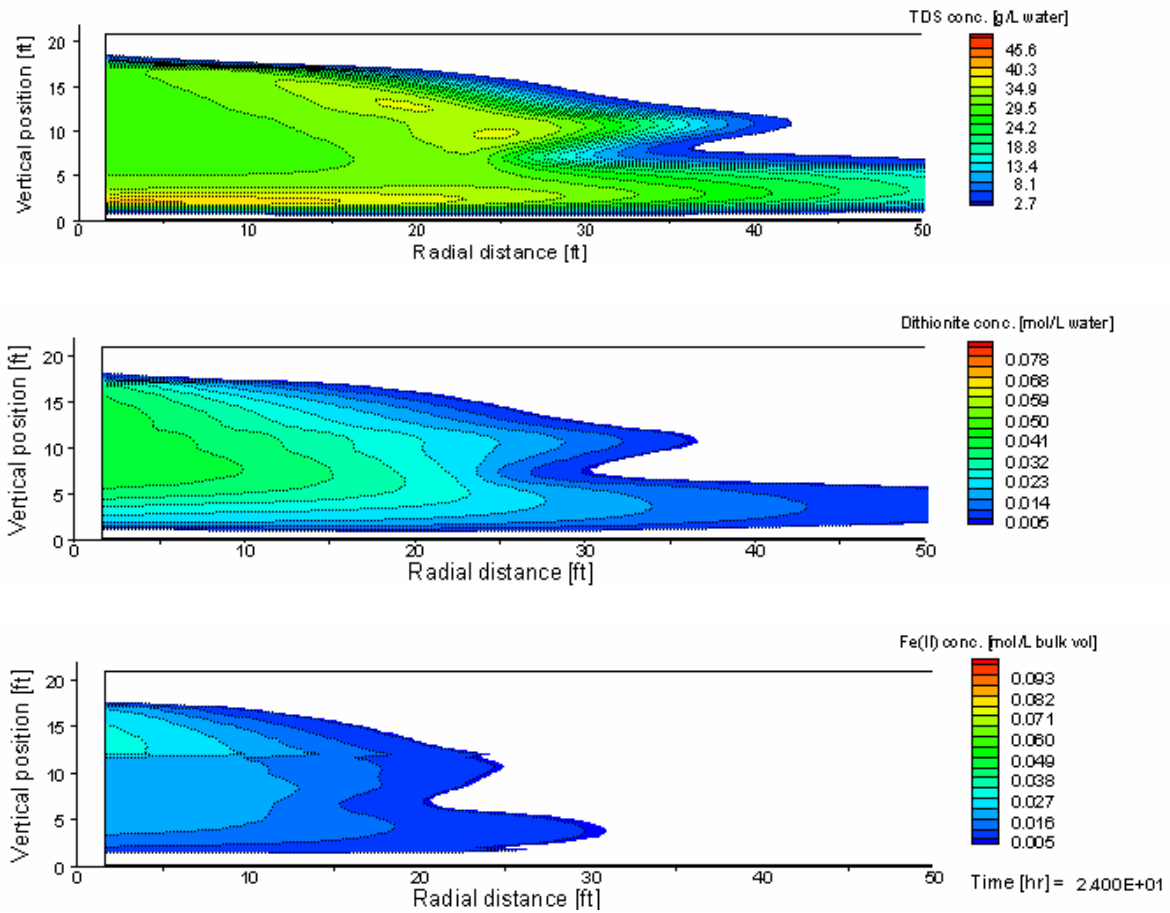**Figure D.31**. Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 16 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2. Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.
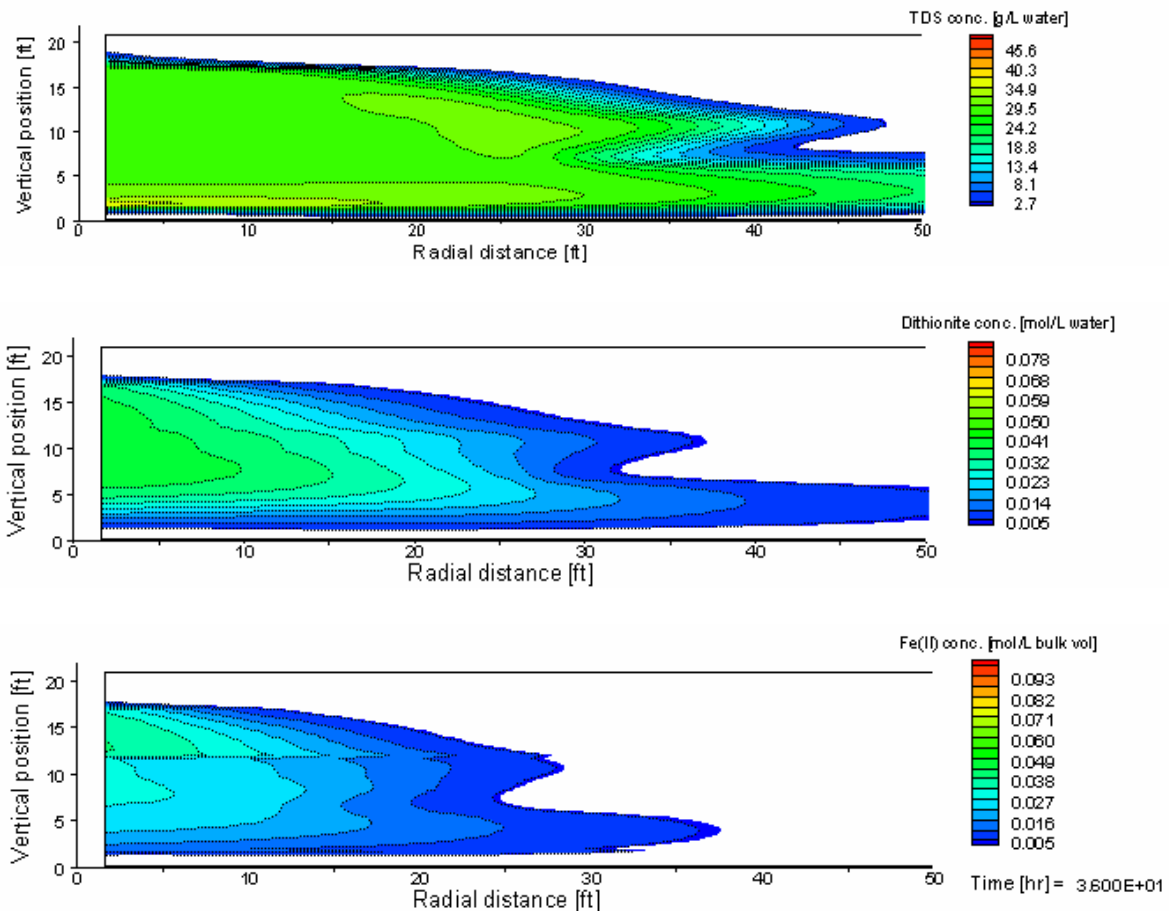
**Figure D.32**.  Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 24 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2. Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.

**Figure D.33**. Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 36 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2. Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.

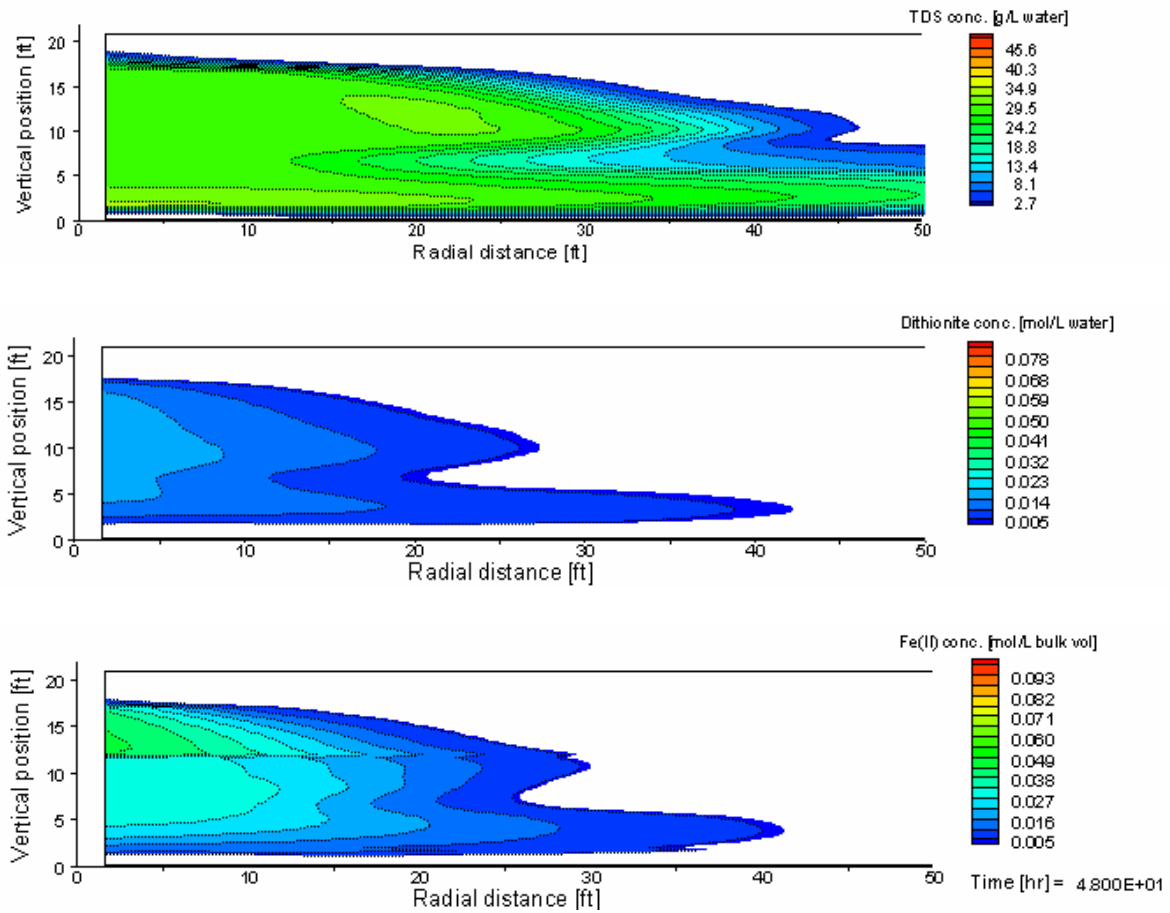**Figure D.34**.  Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 48 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2. Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.
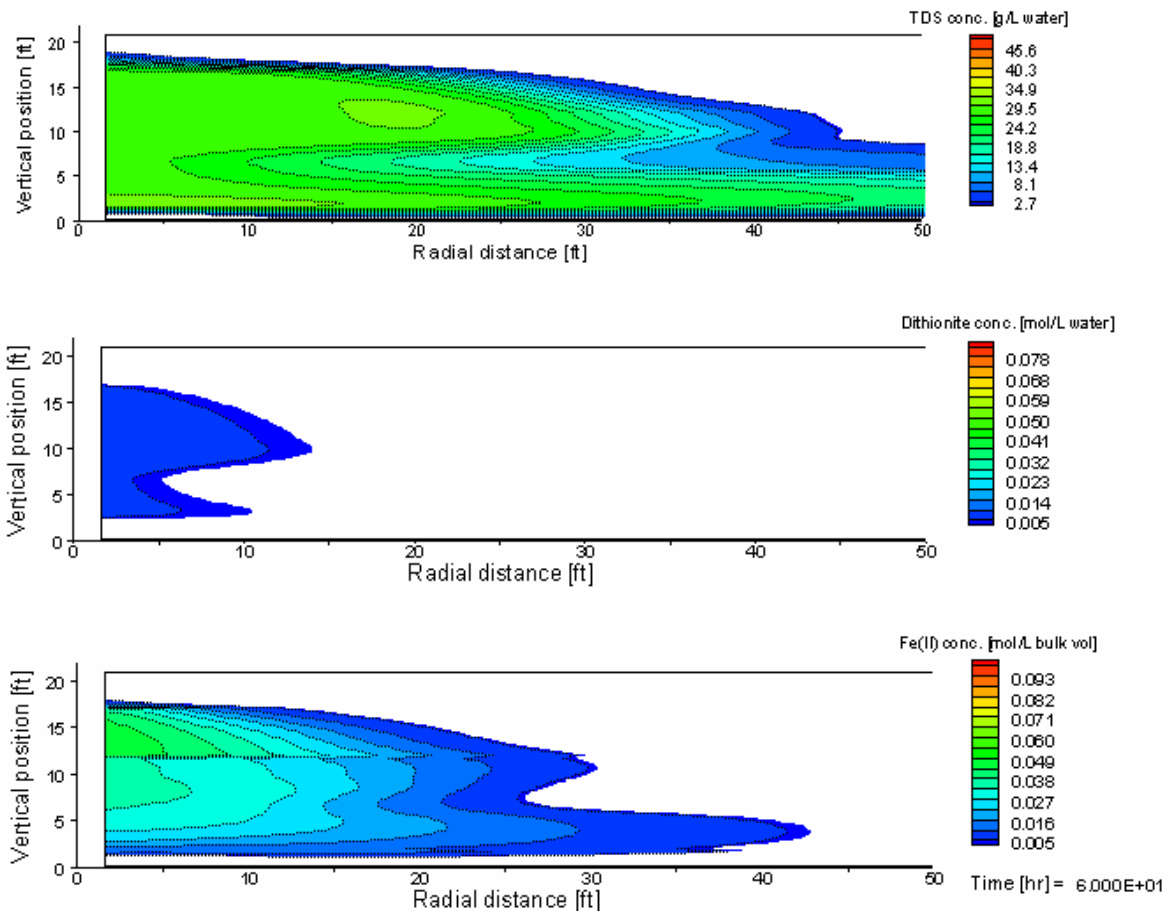
**Figure D.35**.  Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 60 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2. Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.

**Figure D.36**.  Predicted TDS [g/L], dithionite [mol/L], and Fe(II) [mol/L bulk vol] concentration distributions (top to bottom) around well PP016 at 72 hr for simulation case 15. Dithionite injectate concentrations are 0.08 M from 0-12 hr, and 0.04 M from 12-36 hr, in both units A1 and A2.  Flow rates are 6.94 gpm (~15,000 gal) and 27.75 gpm (~60,000 gal) in units A1 and A2, respectively. Units A1 and A2 are both assigned Kv=Kh/100.