

Figure 5. PHREEQC simulation of mixing anoxic water (41%) and oxic water (59%) combined with sequential kinetic and equilibrium speciation reactions in gravel pack, water column, and pump+riser pipe of geothermal loop extraction well. Dissolved  $\text{Fe}^{\text{II}}$  and  $\text{Mn}^{\text{II}}$  concentrations and associated solids accumulated considering previously accumulated sorbent of varied mass (thickness  $0.01\ \mu\text{m}$  in gravel pack and  $1.0\ \mu\text{m}$  in well and pump+riser) and composition (100% HFO in gravel pack and well and 97% HFO, 2.9% HMO, and 0.1% HAO in pump+riser) plus autocatalytic sorbent: A-B, default (1X) FeOB rate; and C-D, enhanced (10X) FeOB rate. [Oxidation rates of  $\text{Fe}^{\text{II}}$  and  $\text{Mn}^{\text{II}}$  consider homogeneous and heterogeneous contributions, plus that for  $\text{Fe}^{\text{II}}$  also considers microbial catalysis of the heterogeneous process. Homogeneous rates depend on the aqueous metal concentration; heterogeneous rates depend on the adsorbed metal concentration. Vertical dashed lines delineate zones with different detention times, aeration coefficients, and sorbent characteristics (mass and composition). The volume of accumulated solids was computed assuming a density of  $1.25\ \text{cm}^3/\text{g}$  for metals attenuated within the relevant zone expressed as  $\text{Fe}(\text{OH})_3$ ,  $\text{MnOOH}$ , and  $\text{Al}(\text{OH})_3$ .]

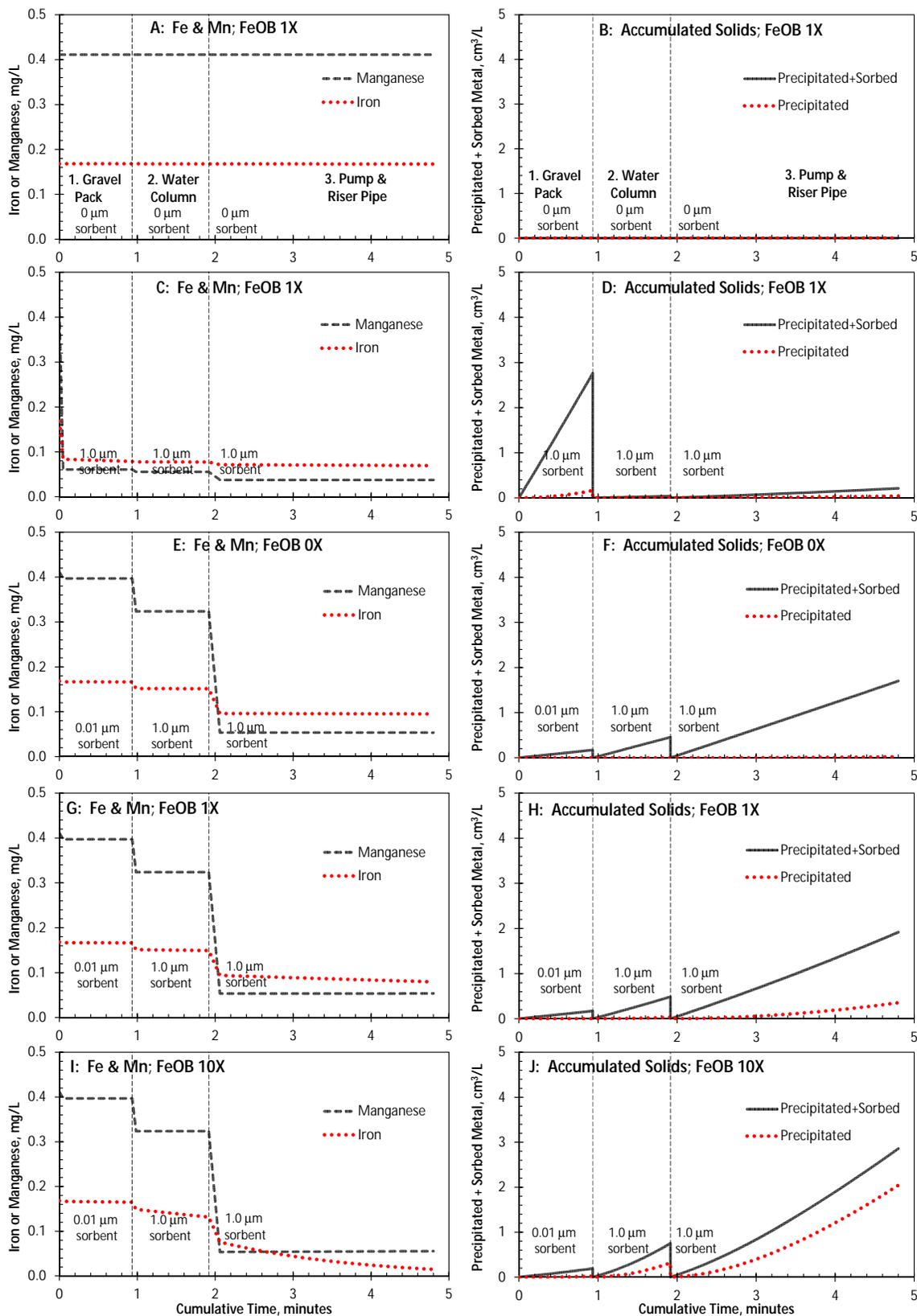


Figure SI.4. PHREEQC simulation of mixing anoxic water (41%) and oxic water (59%) combined with sequential kinetic and equilibrium speciation reactions in gravel pack, water column, and pump+riser pipe of geothermal loop extraction well. Dissolved  $\text{Fe}^{\text{II}}$  and  $\text{Mn}^{\text{II}}$  concentrations and associated solids accumulated considering (A, B) autocatalytic sorbent, only; (C, D) equally distributed sorbent coating of 1.0  $\mu\text{m}$  thickness (100% HFO) plus autocatalytic sorbent; (E, F) previously accumulated sorbent of varied mass (thickness 0.01  $\mu\text{m}$  in gravel pack and 1.0  $\mu\text{m}$  in well and pump+riser) and composition (100% HFO in gravel pack and well and 97% HFO, 2.9% HMO, and 0.1% HAO in pump+riser) plus autocatalytic sorbent, but without microbial catalysis; (G, H) same coating as E and F, with default rate of microbial catalysis (1X); and (I, J) same sorbent as G and H, with 10X microbial rate. [ $\text{Fe}^{\text{II}}$  and  $\text{Mn}^{\text{II}}$  oxidation rates consider homogeneous and heterogeneous contributions, plus that for  $\text{Fe}^{\text{II}}$  also considers microbial catalysis of the heterogeneous process. Homogeneous rates depend on the aqueous metal concentration; heterogeneous rates depend on the adsorbed metal concentration. Vertical dashed lines delineate zones with different detention times, aeration coefficients, and sorbent characteristics (mass and composition). The volume of accumulated solids was computed assuming a density of 1.25  $\text{cm}^3/\text{g}$  for metals attenuated within the zone expressed as  $\text{Fe}(\text{OH})_3$ ,  $\text{MnOOH}$ , and  $\text{Al}(\text{OH})_3$ .]