CE 115: Water Chemistry **Fall 2005**

Assignment 1: Due September 6, 2005

Background: One reason why fertilizer runoff and wastewater discharges are concerns is that inorganic N(-III) is toxic to fish. Actually, the toxicity is attributable to the presence of NH_3 (ammonia) which is the biologically-active form of N(-III). The other form of inorganic N(-III), NH_4^+ (ammonium), is not toxic to fish. As a result, water quality regulations for freshwaters are typically written in terms of "unionized ammonia" (*i.e.,* NH_3). A typical limit for protection of aquatic life from NH_3 toxicity in surface water is 0.025 mg/L as N. Monitoring data are reported in terms of total inorganic N(-III).

Use the thermodynamic data in Appendix A for this problem.

1. What is the maximum concentration of total inorganic N(-III) that can be present in surface water at pH=7, T=25˚C without violating the water quality regulations? Assume ionic strength=0.

2. The temperature of surface waters is typically lower than 25˚C. Repeat your calculation at 5˚C.

3. Obviously the water will have some ionic strength. Repeat the calculation at 25˚C for water with an ionic composition identical to that of "typical groundwater" (see Table 1.1 from your textbook). (Ignore any contribution to ionic strength from NH_4^+.)

4. A typical value for the concentration of inorganic N(-III) in municipal wastewater effluent is 25 mg N/L. Calculate the dilution factor (*e.g.,* 1 part wastewater to 10 parts clean water) required to protect aquatic life from ammonia toxicity under the three conditions listed above.