SPECIAL PROJECT (option 1)

Biodegradation Treatment for MTBE in Contaminated Groundwater. Methyl tertiarybutyl ether (MTBE) is a gasoline additive that has been found widespread in groundwater environments in the United States. There is much interest in evaluating bioremediation technology for "in situ" treatment of MTBE in groundwater. Your project will require an evaluation of the factors involved in affecting bioremediation of MTBE in subsurface environments, and then the preparation of a design approach for the "in situ" bioremediation of MTBE contaminated groundwater.

Your Special Project assignment involves the following steps:

1. Conduct a literature search that includes:
    a. Biodegradation pathway/biodegradability of MTBE
    b. "in situ" biodegradation of MTBE in groundwater and soil environments
    c. microorganisms that have been characterized for MTBE biodegradation
    d. environmental factors affecting MTBE biodegradation (pH, nutrients, temperature, toxicity, electron acceptors, etc.)
    e. biodegradability of ethers as a class of organic compounds

Note – you must cite references in the text and list the references in the "Reference" Section following your literature search for your statements and findings.

2. Design an "in situ" bioremediation approach for MTBE contaminated groundwater that identifies:
    a. Requirements for electron acceptor (how much oxygen (unit weight)) per MTBE (unit weight)
    b. Requirements for nutrients – use ammonia as the nitrogen source (ammonia-nitrogen (unit weight) per MTBE (unit weight)
    c. What is the biomass production (unit weight of biomass produced per unit weight of MTBE)
    d. Design a water injection system to carry to nutrients and oxygen to the subsurface microorganisms and MTBE in the aquifer
    e. Propose a monitoring plan to monitor the progress of bioremediation of contaminated groundwater
    f. Discuss the effects of subsurface characteristics on the success of MTBE bioremediation in an aquifer, including permeability or hydraulic conductivity, heterogeneity, texture, etc.

Note – you must cite references in the text and list the references in the "Reference" Section following your "Conceptual Design"

SPECIAL PROJECT (option 2)

Volatilization Treatment for MTBE in Contaminated Groundwater. Methyl tertiarybutyl ether (MTBE) is a gasoline additive that has been found widespread in groundwater environments in the United States. There is much interest in evaluating air stripping technology for both "in situ" and "ex situ" treatment of MTBE in groundwater. Your project will require an evaluation of the factors involved in affecting air stripping of MTBE and TBA in subsurface environments, and then the preparation of a design approach for either "in situ" or "ex situ" air stripping of MTBE contaminated groundwater.

Your Special Project assignment involves the following steps:

1. Conduct a literature search that includes:
    a. physical and chemical characteristics of MTBE
    b. applications of air stripping and other volatilization technologies (e.g., soil vacuum extraction, heat, etc.) MTBE contaminated groundwater
    c. theory of air stripping of MTBE, including relevant equations
    d. general applicability of air stripping to the ether class of organic compounds

Note - you must cite references in the text and list the references in the "Reference" Section following your literature search for your statements and findings.

2. Conduct two fugacity analyses under the following conditions:
    e. fugacity analyses of MTBE and TBA in a groundwater environment consistent of 30% water and 70% solid (aquifer) phases, 1 gram each of MTBE and TBA, a total volume of 1000 cubic meters, and the organic carbon content of the aquifer phase at 5.0 percent, i.e., foc = 0.05.
    f. fugacity analyses of MTBE and TBA in an air and water (above ground) environment, consisting of 80% air and 20% water phases, 1 gram each of MTBE and TBA, and a total volume of 1000 cubic meters

Note – show % of MTBE and TBA in each phase, mass of MTBA and TBA in each phase, and the concentrations of MTBE and TBA in the water phase.

Note – you must cite references in the text and list the references in the "Reference" Section following your literature search for your statements and findings.

3. Design an air stripping approach for MTBE and TBA contaminated groundwater that includes the following:
    a. Discuss the effects of subsurface characteristics on the success of MTBE and TBA air stripping for an aquifer, including permeability or hydraulic conductivity, heterogeneity, texture, etc.
    b. Requirements for air (how much air (unit weight)) per water (unit weight) MTBE and TBA (unit weight)
    c. Propose a monitoring plan to monitor the progress of remediation of contaminated groundwater using air stripping

Note – you must cite references in the text and list the references in the "Reference" Section following your "Conceptual Design"