

# PCPG

Pennsylvania Council of Professional Geologists  
116 Forest Drive • Camp Hill, PA 17011  
Phone (717) 730-9745 • pcpg.org

## ***Introduction to Inorganic and Organic Groundwater Geochemistry***

***Presented by Bill Deutsch***

**September 12-13, 2019**

Doubletree by Hilton Pittsburgh Cranberry  
Mars, PA

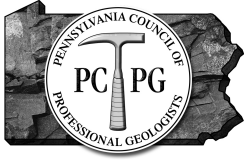
**September 16-17, 2019**

Doubletree Suites by Hilton Philadelphia West  
Plymouth Meeting, PA

### **Western**

### **DAY ONE**

- 7:30 - 8:00**      **Registration and Continental Breakfast**
- 8:00 - 10:00**    **The Geochemical System, Chemical Reactions, and Data Collection Requirements**
- Geochemical Systems
  - Overview of Water/Sediment/Gas Interactions
  - Definitions and Concentration Units
  - Sampling Requirements
- 10:00 - 10:15**    **Break**
- 10:15 - 12:00**   **Solution and Gas Phase Reactions**
- Solution Species and Speciation Reactions
  - Concentration, Activity, and Activity coefficients
  - Henry's Law
  - Partial Pressure
  - Solubility of O<sub>2</sub> and CO<sub>2</sub> in Water
  - Groundwater pH control
- Noon - 1:00**      **Lunch**
- 1:00 - 3:00**      **Mineral Dissolution/Precipitation**
- Chemical Equilibrium
  - Mineral Solubility
  - Solution Factors affecting Solubility
  - Reactive Minerals
- 3:00 - 3:15**      **Break**
- 3:15 - 5:00**      **Oxidation/Reduction Reactions**
- Electron Transfer
  - Acid Mine Drainage
  - Landfill Environment
  - Eh Measurement & Equilibrium
- 5:00**              **Course evaluation, Adjournment (Certificate pick up after day two concludes)**



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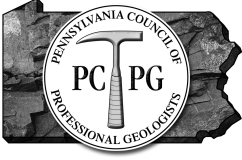
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### **DAY TWO**

- 7:30 - 8:00**      **Registration and Continental Breakfast**
- 8:00 - 10:00**    **Adsorption/Desorption Reactions**
- Surface Complexation
  - Kds and other Isotherms
  - Retardation Factor
  - Solid Phase Adsorption Characterization
- 10:00 - 10:15**    **Break**
- 10:15 - 12:00**   **Geochemical Processes Controlling Fate and Transport of Inorganic Contaminants**
- Natural Attenuation
  - Adsorption/Desorption Effects
  - Mineral Dissolution/Precipitation Effects
  - Limitations on Natural Attenuation
  - Conservative Contaminants
- Noon - 1:00**      **Lunch**
- 1:00 - 3:00**      **Geochemical Processes Controlling Fate and Transport of Organic Contaminants**
- Focus on petroleum hydrocarbons and chlorinated solvents
  - Volatilization
  - Adsorption
  - Biodegradation
- 3:00 - 3:15**      **Break**
- 3:15 - 5:00**      **Case Studies**
- Coal Combustion Residuals
  - Arsenic
  - Chromium
  - Petroleum hydrocarbons and chlorinated solvents
- 5:00**              **Course evaluation, Adjournment, and Certificate Pick-Up**

Please turn in your course evaluation and pick up your Certificate of Attendance before leaving.  
Hope you enjoyed the course and found it to be useful.



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### **Instructor Biography**

Bill Deutsch holds a B.S. and M.S. in geological sciences from the University of Washington, Seattle. As a groundwater geochemist with research and consulting firms for more than 30 years, his project experience includes environmental assessments and investigations of landfills, refineries, CCR sites, pesticides plants/distributorships, military bases, mines and mills, federal weapons facilities and a wide variety of additional industrial sites. In addition, he has participated in remedial designs of sites contaminated with metal, radionuclides, pesticides, solvents, petroleum hydrocarbons and ordnance compounds. Since 1985, Bill has instructed more than 200 courses on groundwater geochemistry and geochemical modeling. He is the author of *Groundwater Geochemistry*, published by CRC Press, and is an independent environmental consultant.