Key Ideas

- Need an organized process:
  - Why to Monitor?
  - What to Monitor?
  - How to Monitor?
  - How to Analyze Data?

Set Goal(s)

Develop Objecives and Approaches
(in tune to the goal)

- Need to integrate Characterization, Monitoring and Remedial Decisions

Characterization and Monitoring

- These terms are often used interchangeably
- Characterization provides data and understanding of processes. Monitoring provides temporal information
- Characterization and monitoring are inter-related and iterative – the conceptual model needs to be examined and refined as more data are developed
- The Data Quality Objective Process – used effectively -- may provide a framework for defining both the characterization and monitoring needed
- Misc. thoughts – monitoring needs to be linked to receptors, encourage indicators or surrogates for efficiency (e.g., water levels), encourage creative goal setting

Plume Monitoring Goals

- Documenting Plume stability, mass balance and flux
  - Controlling hydrology or boundary conditions (e.g., critical water level)
  - Minimizing post-treatment migration, release or flux to a predefined limit;
  - Maintaining/documenting geochemical conditions to ensure continued stability;
  - Minimizing potential flushing during extreme climate conditions;
- Maintaining Concentration at receptor location(s) or sentinel well(s)
- Combinations of above

Flux Monitoring and Mass Balance Concepts

- Looney
- Wood
- Hatfield
- others

Mass Balance and Flux

- Examine the concept of plume stability as a central objective and the resulting significance for monitoring technology
- How much and what type of monitoring is needed to document stability under a variety of conditions (remember what is working from the EPA multiple lines of evidence)?
- What Modeling is needed under a variety of conditions?
- How can approach be implemented to in a graded fashion to provide a high level of protection while not driving up costs?

Geophysics and Other Volumetric Methods

- Kaback
- Rucker
- Versteeg
- Reichhardt
- Fabyshenko
- Farrington
- others

Geophysics

- What are reasonable objectives to set for geophysics (contaminant, geological, plume stability)?
  - Can geophysics be used for monitoring or is it going to be primarily characterization?
  - Can markers or tracers be added to a system to allow more effective use of geophysics for monitoring?

Push Pull Testing and other Hydrologic Methods

- Istok
- Bennett
- Bratton
- Young
- others

Push Pull Testing and other Hydrologic Methods

- What are reasonable objectives to set for hydrologic methods (contaminant, geological, kinetics plume stability)?
- Can hydrologic methods be used for monitoring or primarily for characterization?
- Can markers or tracers be added to a system to allow more effective use of hydrologic methods for monitoring?
- Can we use vadose monitoring or the gas phase for early and sensitive performance indicators?

Consensus

- Chan-Hilton

Consensus

- Discuss optimization and how techniques might be developed to implement “essential monitoring” – a blend of monitoring well network sampling and alternative approaches.
- How can current optimization concepts be adjusted to incorporate non-traditional monitoring data?
- Are there other innovative ideas and approaches for optimization?