REINHOLD ENVIRONMENTAL Ltd.

2014 Wastewater-Ash Round Table & Expo Presentation

September 22, 2014, in Birmingham, AL / Hosted by Southern Company

Evolution of Geoenvironmental Challenges for CCR Sites

ANCHOR QEA

2014 Wastewater-Ash Roundtable

Birmingham, Alabama

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September 22, 2014

Outline

CCR Challenges

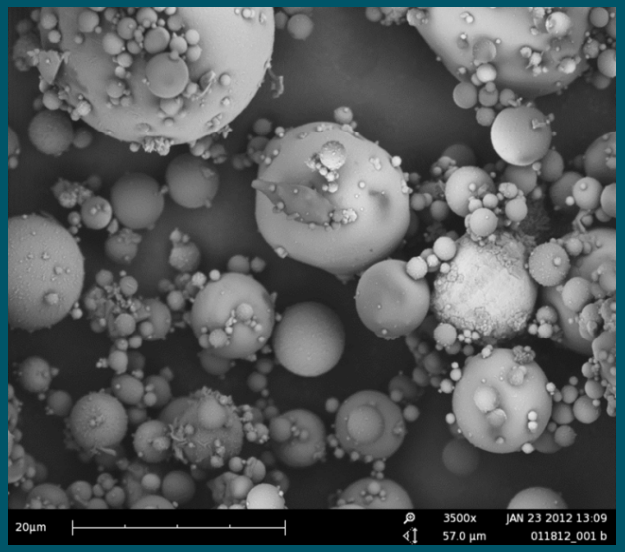
- Historical Overview
- Environmental Regulatory Drivers
- Identifying Geoenvironmental Challenges
- Corrective Actions

CCR Challenges

Historical Overview

Historical Overview

- Resource Conservation and Recovery Act (RCRA)
- Ash exemption and Bevill history
- Co-management of ash
- Kingston ash spill
- Beneficial reuse



Images provided by Portland State University Electron Microscopy and Nanomaterials Research Center

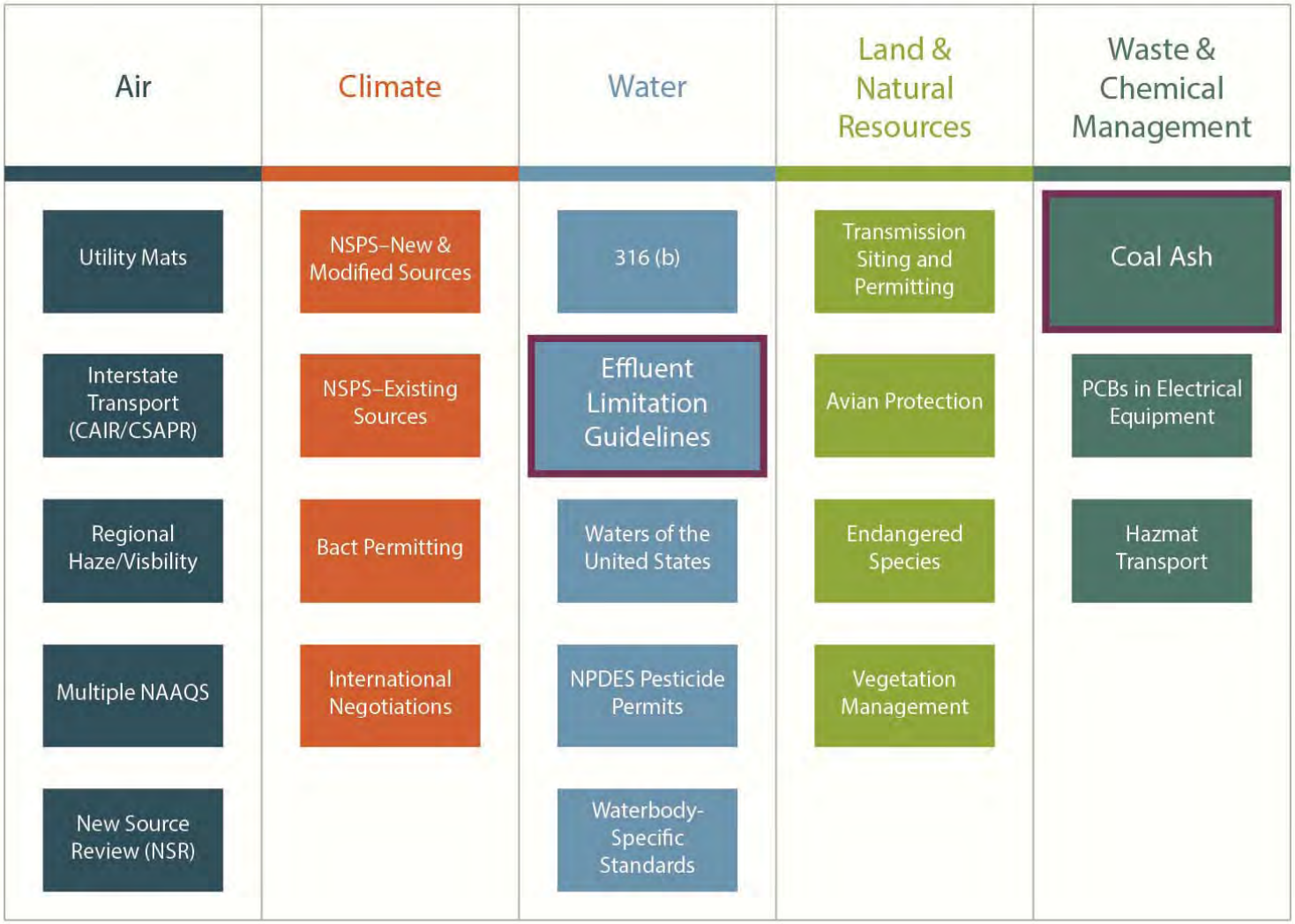
RCRA Timeline

- 1976: Promulgation of RCRA
- 1980: Bevill Amendment to Solid Waste Disposal Act Amendments
  - Exempted from Subtitle C: Coal ash, FGD gypsum, other high volume wastes
- 2008: Kingston ash spill
- 2010 – 2013: Comments
- 12/2014: Final coal ash rule proposed RCRA D anticipated

CCR Challenges

Environmental Regulatory Drivers

Environmental Regulatory Drivers



Likely Revised CCR Rule Impacts

- Revised RCRA Subtitle "D" standards are likely
- Groundwater monitoring at all facilities
- Lining or closure of existing impoundments
- Replacement of wastewater treatment facilities and new landfills
- Remediation of contamination associated with CCR facilities
- USEPA Effluent Limitation Guidelines will also have an effect

CCR Challenges

Identified Geoenvironmental Challenges

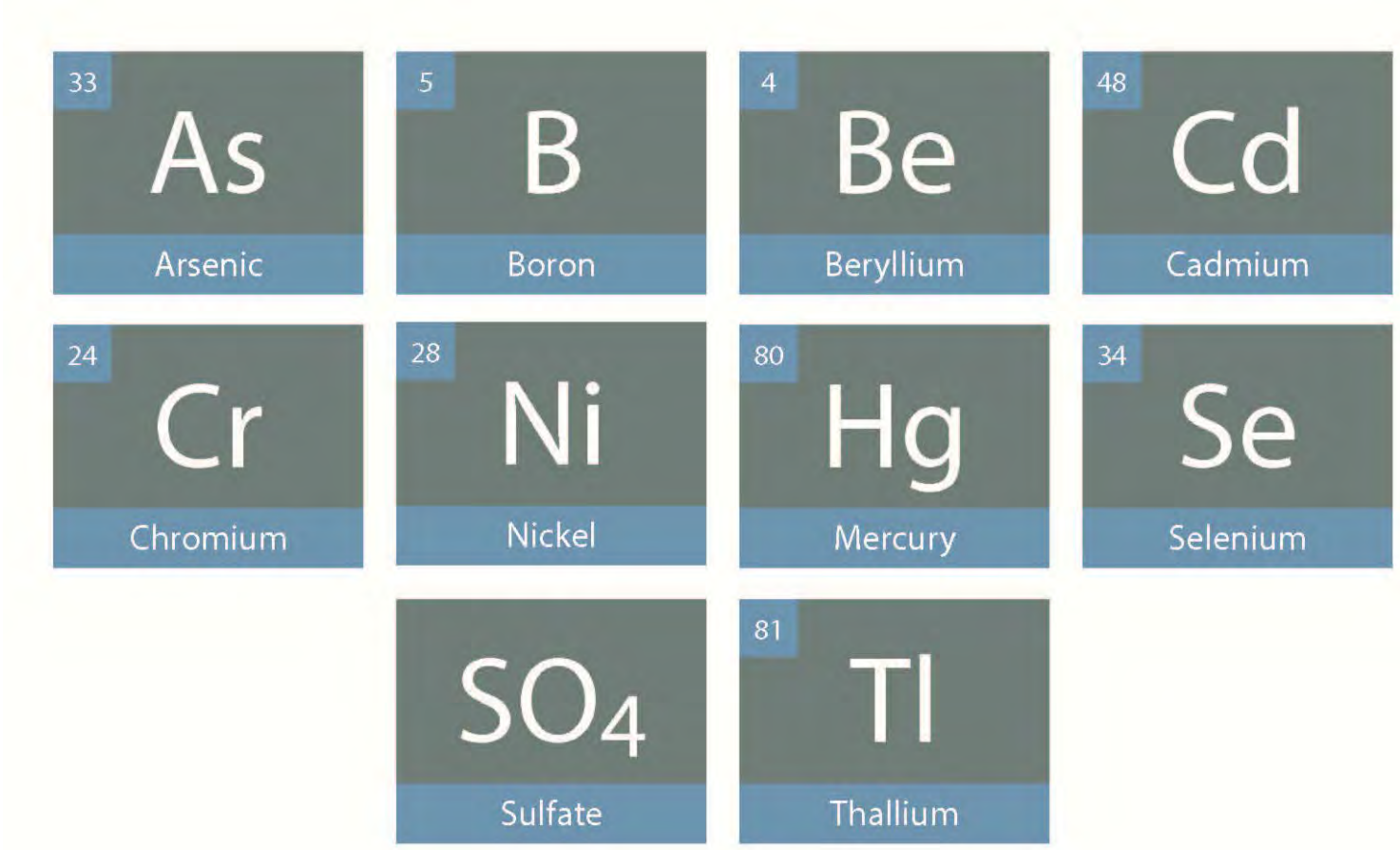
Major Challenges

- Groundwater monitoring programs
- Constituents of concern
- Pond dewatering and hydrogeological setting
- Selection and implementation of corrective action
- Risk assessment

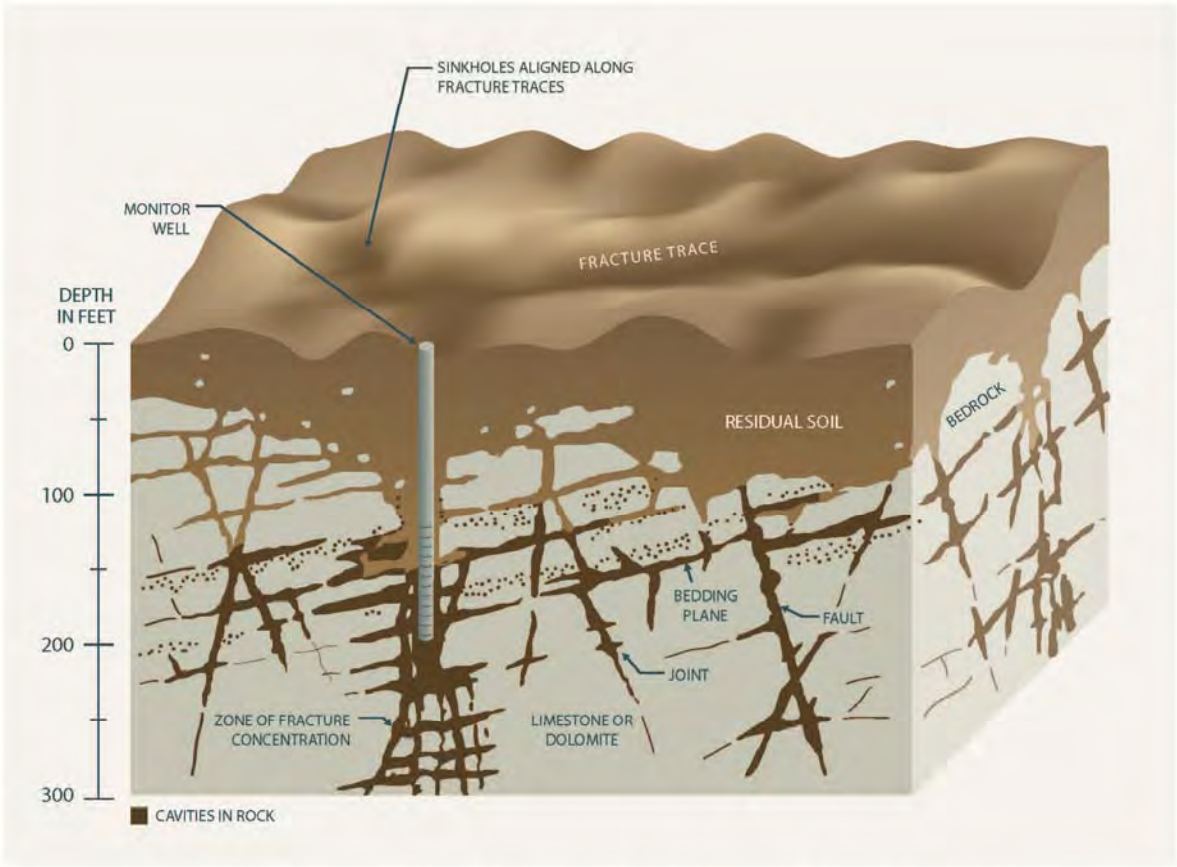
Groundwater Monitoring

- Plan development
- RCRA-type detection monitoring followed by assessment monitoring
- Location and number of wells
- Data management
- Statistical analysis

Contaminants of Concern for CCRs Are Not Well Known and May Be Difficult to Treat

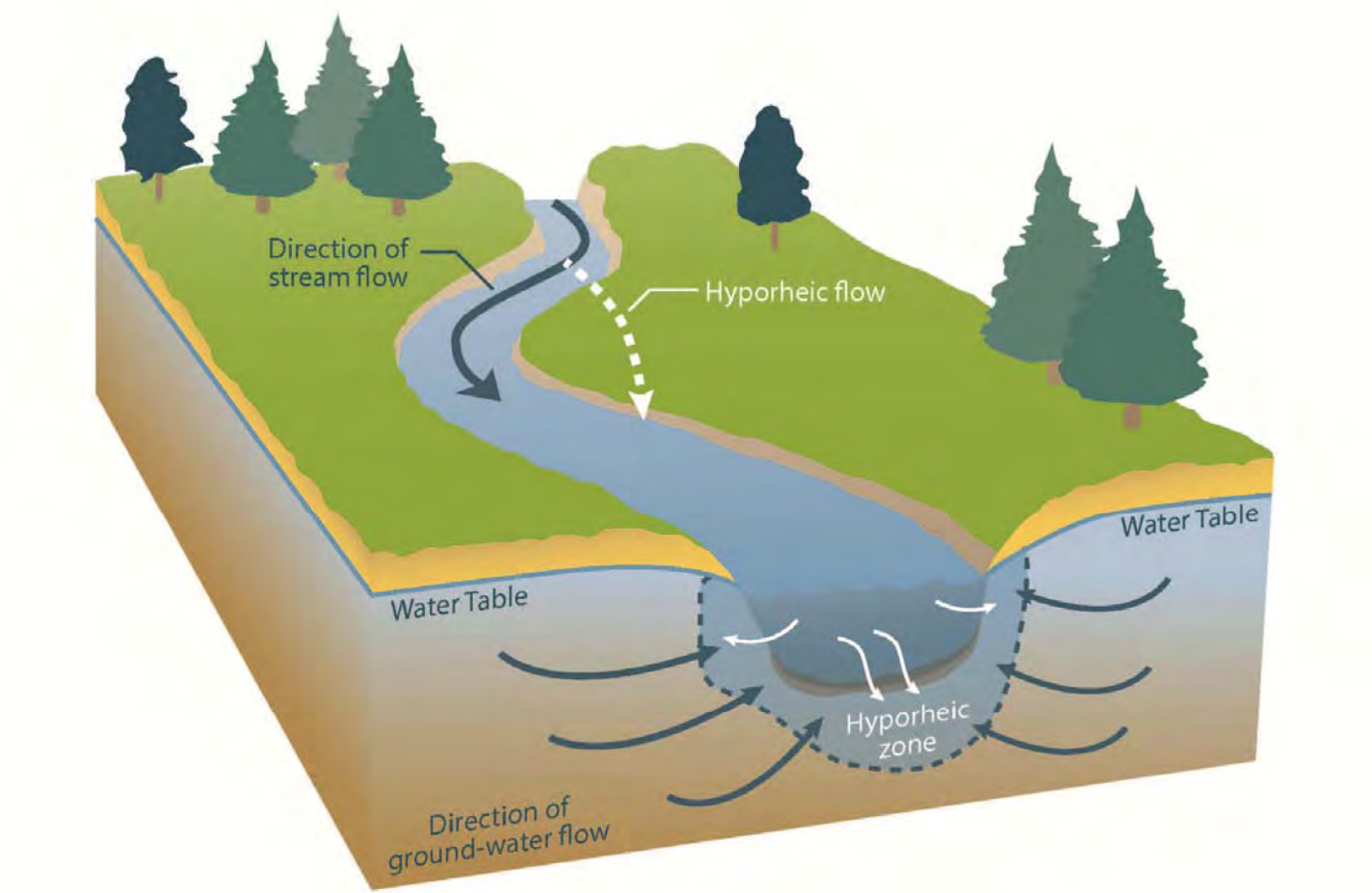


Site Conceptual Model/Hydrogeologic Settings

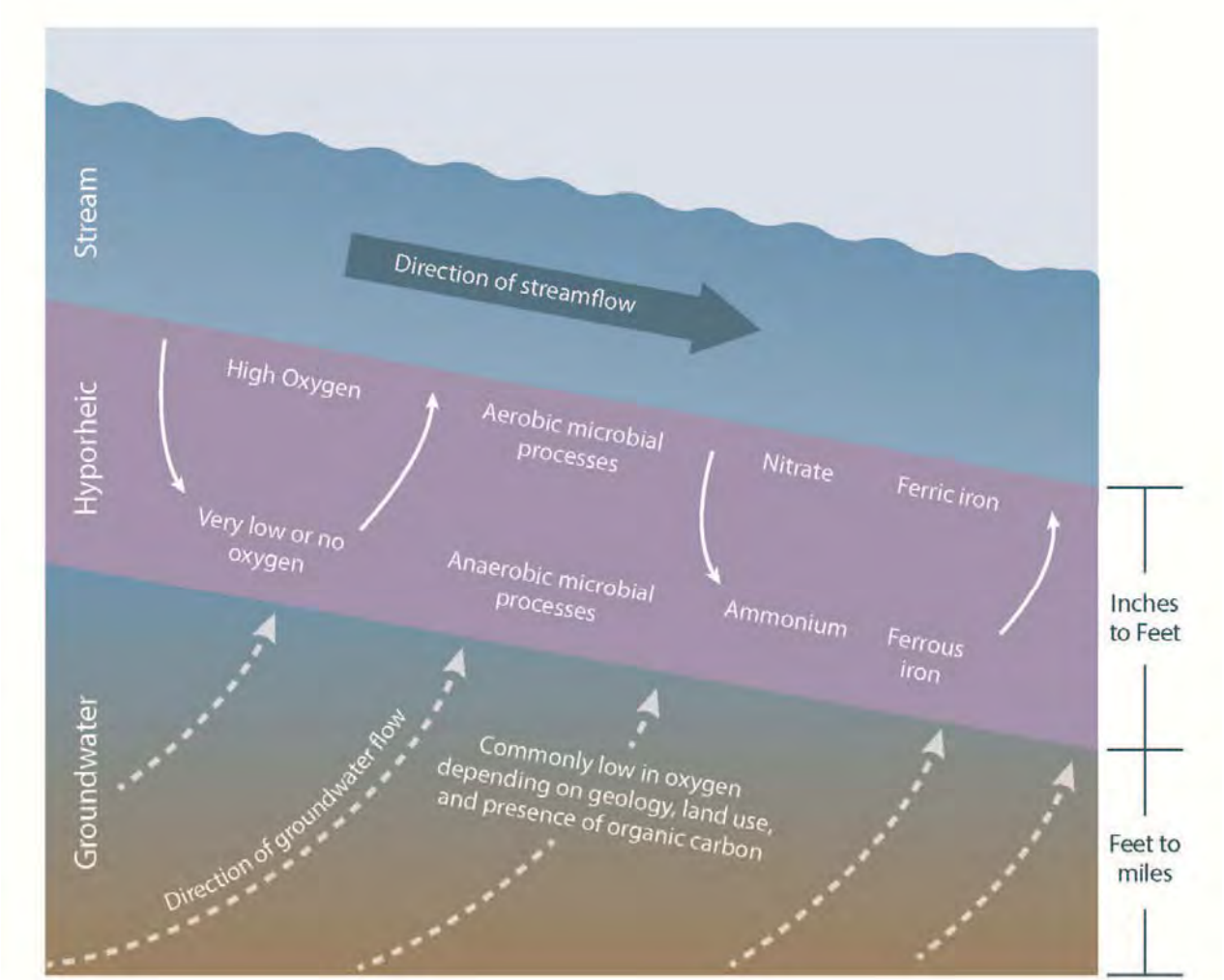


Geology Typical of Transmissive Carbonate Rocks or Karst
(modified from Lattman and Parizek, 1964)

Hyporheic Zone of Groundwater and River Water Mixing



Processes in the Hyporheic Zone



CCR Challenges

Corrective Actions

Potential Corrective Actions

- Capping
- Barrier walls
- Retrofit liner, line in place
- Hydraulic containment
- Geochemical manipulation
- Source removal
- Phytoremediation, constructed wetlands

Potential Corrective Actions

- Permeable reactive barrier
- Pump and treat
- Monitored natural attenuation (MNA)
- In situ solidification stabilization

Corrective Action Key Considerations

- Constructability for different site conditions
- Construction duration
- Risk of failure
- Size dependence
- Permanence for different site conditions
- Magnitude of residual risk
- Ability to monitor effectiveness
- Technology status

Corrective Action Key Considerations

- Worker and community health and safety
- Effectiveness of CCR contaminants of concern
- Reliability
- Time to effectiveness
- Sequencing

Subaqueous Reactive Cap Installation

- Placement under wet conditions
- Effective barrier and containment measure
- Pairs with MNA remedy
- First step in habitat restoration
- Famous example: 400-acre subaqueous cap at Onondaga Lake

Challenges

- Issues facing underground injection of wastewaters
  - Suitable geology and hydrogeology
  - Regulatory and public acceptance
  - Permitting process
  - Well integrity

Typical Injection Well

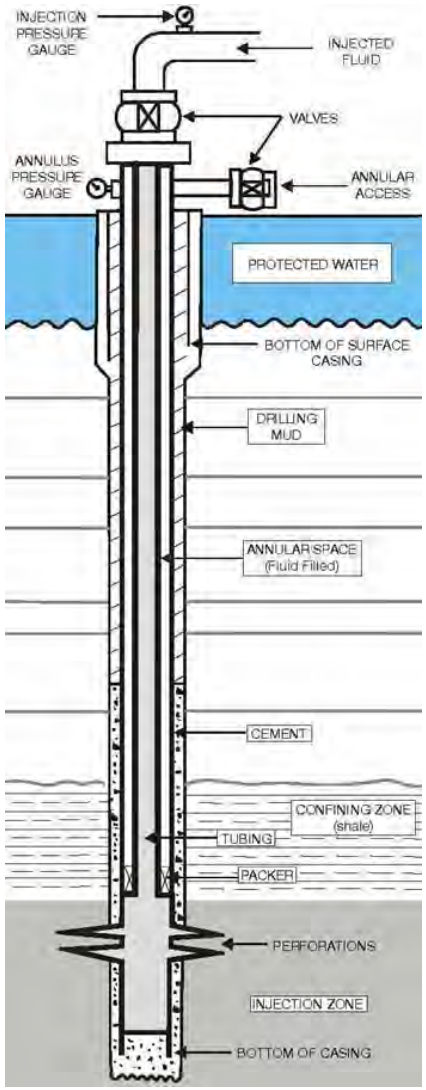


Figure from New Mexico's Underground Injection Control Program, Class II Well Facts, Oil Conservation Division

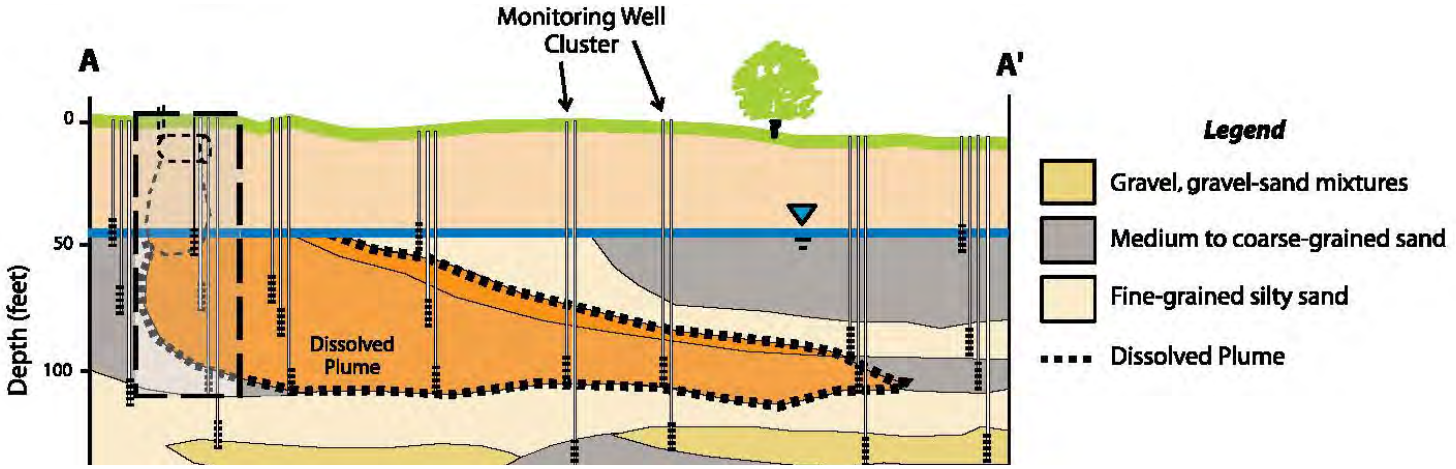
Pond Closure Considerations

- Pond size
- Dewatering methods
- Remedial plan integration if needed
- Site layout constraints
- Long-term monitoring/maintenance
- Final site use plans
- Constructability of new features

Geotechnical Challenges to Working with Ash

- Dewatering methods
- Cover stability and settlement
- Stacking limitations
- Sensitivity of ash (thixotropic)
- Variability between sites

Feasibility of Monitored Natural Attenuation



- Advantages
  - Lower cost
  - Easier to implement
  - Less invasive
  - Sustainable, green remediation
- Disadvantages
  - Long time to clean up
  - Regulatory/public acceptance

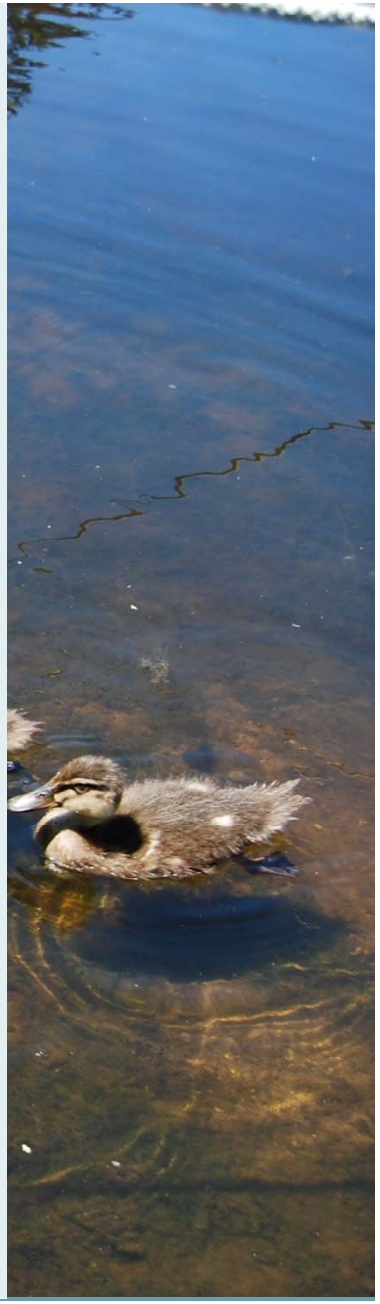
Tiered Approach to Monitored Natural Attenuation

Tier I	Demonstrate that plume is static or shrinking, has not reached compliance boundaries, and does not impact existing water supplies
Tier II	Determine apparent rate and mechanisms of attenuation
Tier III	Determine stability of immobilized contaminant and capacity of aquifer to sustain uptake
Tier IV	Establish a monitoring plan and contingency plans in event of MNA failure

References: EPA/600/R-07/140 October 2007

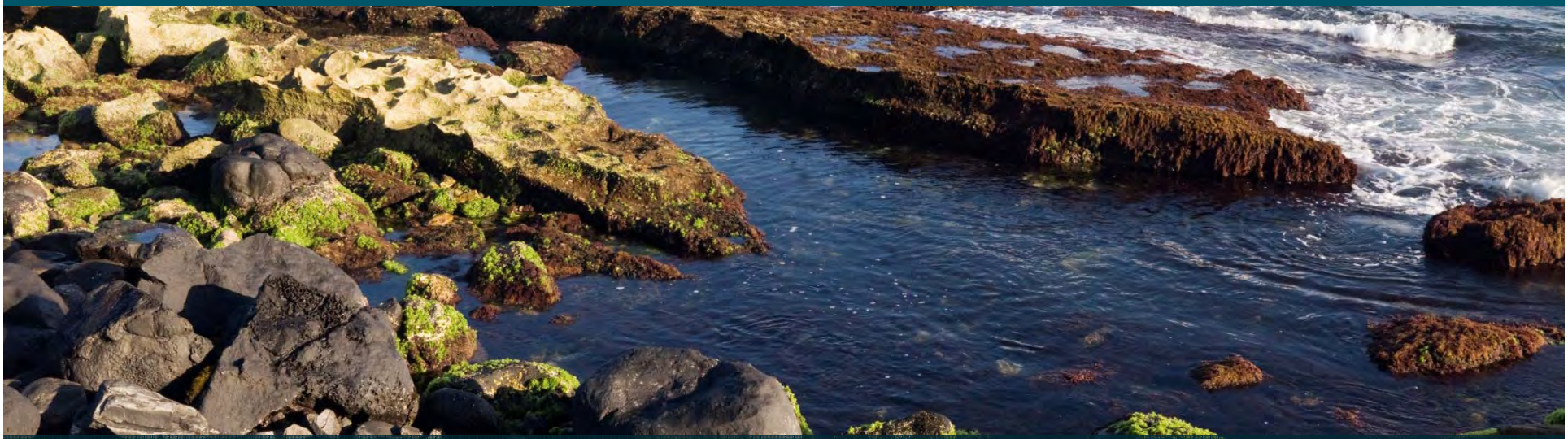
Risk Assessment

- Identify hazardous substances and levels
- Determine exposure pathways and dose
- Develop a conceptual site model
- Evaluate carcinogenic and non-carcinogenic effects



Questions or Comments?

Contact Information



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