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# Coal Combustion Residuals Services



## About Us

Anchor QEA is a nationally recognized environmental firm offering integrated science, engineering, and planning services for a variety of projects focused on remediation, restoration, and resilience.

Anchor QEA partners with you to achieve maximum value on every project and integrate efficiencies into every aspect of the services we deliver. We develop effective, cost-saving, and innovative tools to address challenges associated with a wide variety of projects, including coal combustion residuals (CCR) projects.

With a strong presence across the country, Anchor QEA is well positioned to work closely with your team, provide timely responses, and serve as a reliable partner throughout the duration of each project.

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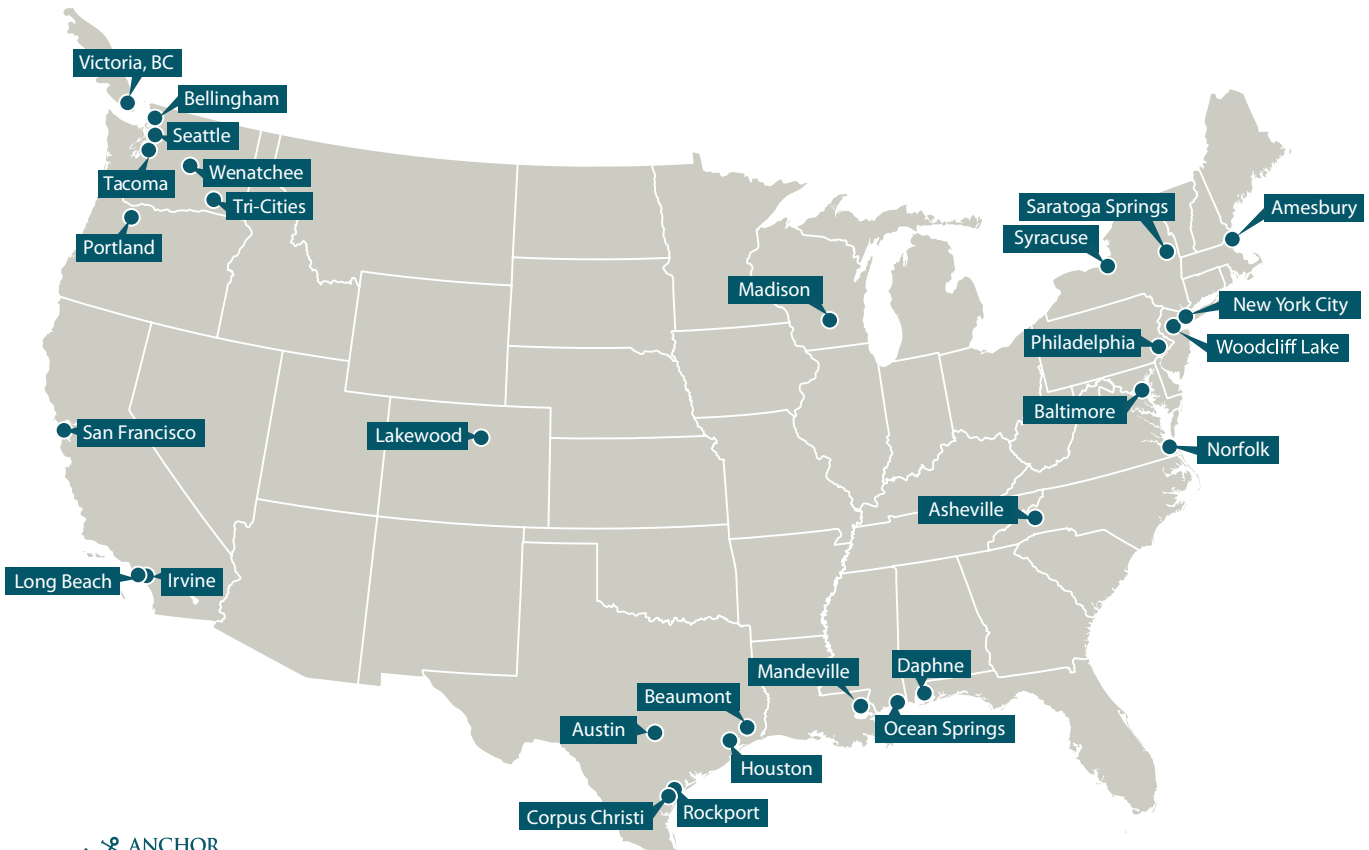
Years in Business

**25+**

Offices Nationwide

**500+**

Staff Nationwide



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# CCR Overview

Anchor QEA staff have decades of experience helping clients manage coal combustion residuals (CCR).

Our team is recognized for practical, science-based solutions that meet regulatory requirements while adding value and reducing costs.

We tailor approaches to site conditions for efficient implementation and have supported compliance efforts at more than 30 utility sites nationwide since the EPA's 2015 CCR Rule.

We have developed effective, real-world approaches for evaluating and addressing CCR-related groundwater issues, including corrective measures for CCR constituents.

## Contamination Assessment and Delineation; Groundwater Monitoring and Modeling

Anchor QEA has performed subsurface investigations in every type of hydrogeologic setting. We excel in groundwater and surface water modeling, including modeling at many sites for Appendix IV constituents, and we are often engaged to perform peer reviews of other consultants' work.

## Geogenic Studies to Support Alternative Source Demonstrations

Anchor QEA has conducted alternative source demonstrations (ASDs) at multiple sites for CCR constituents including arsenic, cobalt, lithium, molybdenum, and radium. Successful demonstration of natural (i.e., geogenic) occurrence of CCR constituents could save millions of dollars at CCR sites by avoiding unnecessary groundwater corrective action.

## Human Health and Ecological Risk Assessment

Anchor QEA provides comprehensive risk assessment services ranging from streamlined evaluations to complex baseline risk assessments involving multiple pathways and constituents. Our assessments support the evaluation of site-specific remedial alternatives and development of risk-based cleanup targets using realistic approaches that meet regulatory requirements and support defensible decisions.

## Assessment of Corrective Measures and Remedy Selection; Feasibility Studies

We have performed assessment of corrective measures and remedy selection at many CCR sites. Remedies evaluated include monitored natural attenuation (MNA), hydraulic containment (pump and treat or pump and discharge), injection treatment, barrier and permeable reactive barrier walls, permeation grouting, and combinations of remedies.

## MNA Demonstrations and Monitoring

Anchor QEA developed a successful empirical approach to evaluate MNA as a corrective measure. This protocol meets EPA's specific requirements and has been applied at multiple CCR sites for arsenic, boron, cobalt, lead, lithium, molybdenum, nickel, radium, and/or zinc.

## Pre-Design Investigations and Field Pilot Studies

Anchor QEA has conducted extensive pre-design investigations (PDIs) to inform various corrective measures pilot studies at several sites that include porous media and fractured rock. The PDIs have included geophysical surveys, drilling and hydraulic testing, groundwater quality sampling for multiple specific intervals, and geochemical studies. We have pioneered development of in situ injection treatment (geochemical manipulation), with successful injection treatments for arsenic and ongoing design of treatments for other Appendix IV constituents.

## Laboratory Treatability Studies

Anchor QEA operates our own environmental geochemistry laboratory focused on specialized client needs beyond typical commercial laboratories. We have conducted treatability studies for injection treatment and solid reactive media at multiple sites for power companies addressing a wide range of constituents. Our team has also developed innovative treatment approaches for challenging constituents such as boron and lithium and mixtures of constituents of interest.

## Strategic and Financial Studies; Legal and Expert Witness Support

Anchor QEA has conducted strategic and financial studies for the CCR rule for some of the largest U.S. power companies. Our scientists and engineers also provide expert witness testimony and analysis contributing to settlements in federal and state cases nationwide.

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# Experience at a Glance

**7 Sites** | Assessments of corrective measures and remedy selections

**15 Sites** | MNA demonstrations

**19 Sites** | Strategic and financial studies and/or peer reviews

**6 Sites** | Hydraulic containment evaluations

**12 Sites** | Flow and transport modeling and geochemical conceptual site models (CSMs)

**5 Sites** | ASDs (geogenic studies to support alternative source demonstrations)

**12 Sites** | Laboratory treatability studies for in situ groundwater treatment injection

**5 Sites** | Pilot studies for in situ groundwater treatment injection

**6 Sites** | PDIs for groundwater corrective action

**200+ Sites** | Arsenic assessment and remediation for soil and groundwater at CCR and technically similar sites (e.g., those impacted by arsenic-based herbicides)





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## Environmental Geochemistry Laboratory

**By reducing uncertainty during remedial design, EGL testing supports corrective actions that are practical, targeted, and cost-effective, potentially saving clients millions of dollars compared to other more-conventional corrective actions that are sometimes unnecessary.**

Anchor QEA's Environmental Geochemistry Laboratory (EGL) in Portland, Oregon, conducts advanced laboratory investigations tailored to project-specific needs, with direct integration between laboratory staff and project teams to support defensible CSMs, remedy evaluations, and site-specific solutions.

EGL data support MNA evaluations, ASDs, and reactive transport modeling through treatability testing, flow-through column testing, microcosm studies, and specialized geochemical characterization to quantify attenuation capacity, constituent mobility, and reaction rates. The laboratory has completed testing for a wide range of inorganic and organic contaminants, including Appendices III and IV constituents, in groundwater, soil, and sediment.

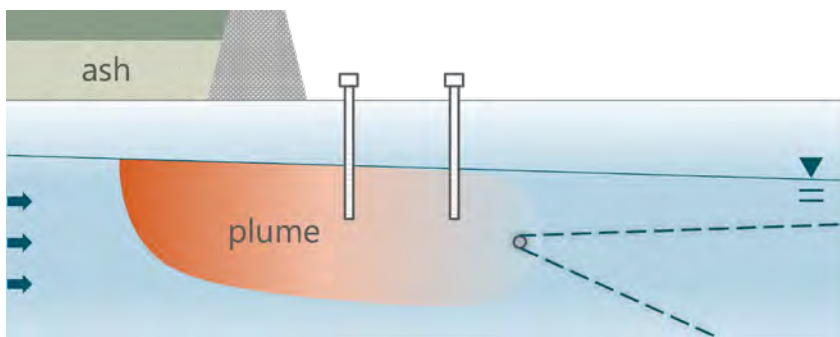
EGL has developed and advanced innovative remedial solutions for a variety of CCR constituents. These include MNA and in situ injection treatment involving optimization for multiple constituents in groundwater.

# Geochemical CSMs and MNA

Anchor QEA develops robust geochemical CSMs that integrate site history, lithology, hydrogeology, groundwater chemistry, and constituent behavior to support corrective action, ASDs, and remedy selection. We strengthen CSMs through targeted in-house laboratory testing and geochemical modeling to evaluate constituent release and attenuation mechanisms.

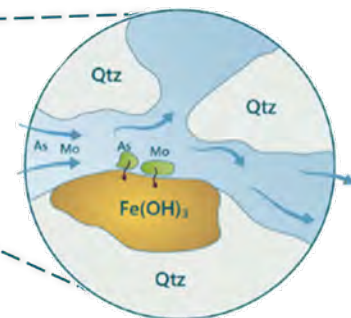
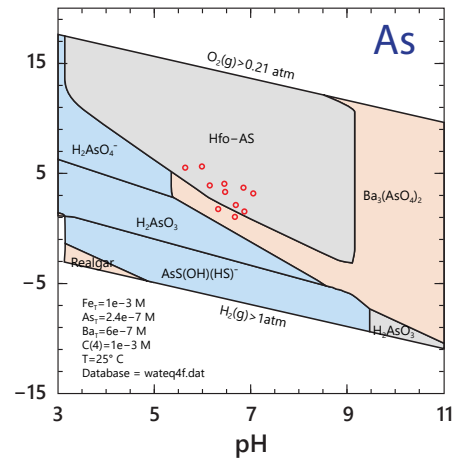
Anchor QEA developed a practical, data-based field and laboratory protocol for meeting the requirements of USEPA's four-tiered framework for MNA. Our protocol has been applied successfully at many sites.

Our MNA demonstrations focus on site-specific geochemical conditions controlling mobility, integrating groundwater chemistry trends, redox indicators, solid-phase characterization, and targeted well solids analysis and modeling as needed. Our integrated CSM and MNA approach supports regulatory acceptance, simplifies long-term monitoring, and has saved clients potentially millions of dollars by avoiding unnecessary or ineffective corrective actions.



Example geochemical CSM

Anchor QEA's field and laboratory protocol for MNA has been successfully applied at 15 CCR sites for constituents including arsenic, boron, cobalt, lead, lithium, molybdenum, nickel, radium, and zinc.





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## Geogenic Studies to Support ASDs

**Anchor QEA's geogenic studies provide a technically defensible basis for ASDs that have the potential to save clients millions of dollars by avoiding unnecessary corrective actions for naturally occurring constituents.**

Anchor QEA has conducted geogenic (i.e., natural source) studies to support ASDs at multiple CCR facilities for constituents including arsenic, cobalt, lithium, molybdenum, and radium. Our approach is grounded in a thorough understanding of the regulatory framework and the use of multiple lines of evidence to meet compliance requirements.

We apply advanced hydrogeologic and geochemical methods to document natural sources of constituents of interest and demonstrate that these sources can account for observed groundwater concentrations under site conditions. This work integrates hydrogeologic setting, groundwater chemistry trends, geochemical modeling, and mineralogical and geochemical characterization of aquifer solids.

Site-specific evaluations have identified constituent associations with minerals such as clays, carbonates, iron sulfides, and iron and manganese oxides through quantitative trace element analysis, leaching studies, and sequential selective extractions.



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## Human Health and Ecological Risk Assessment

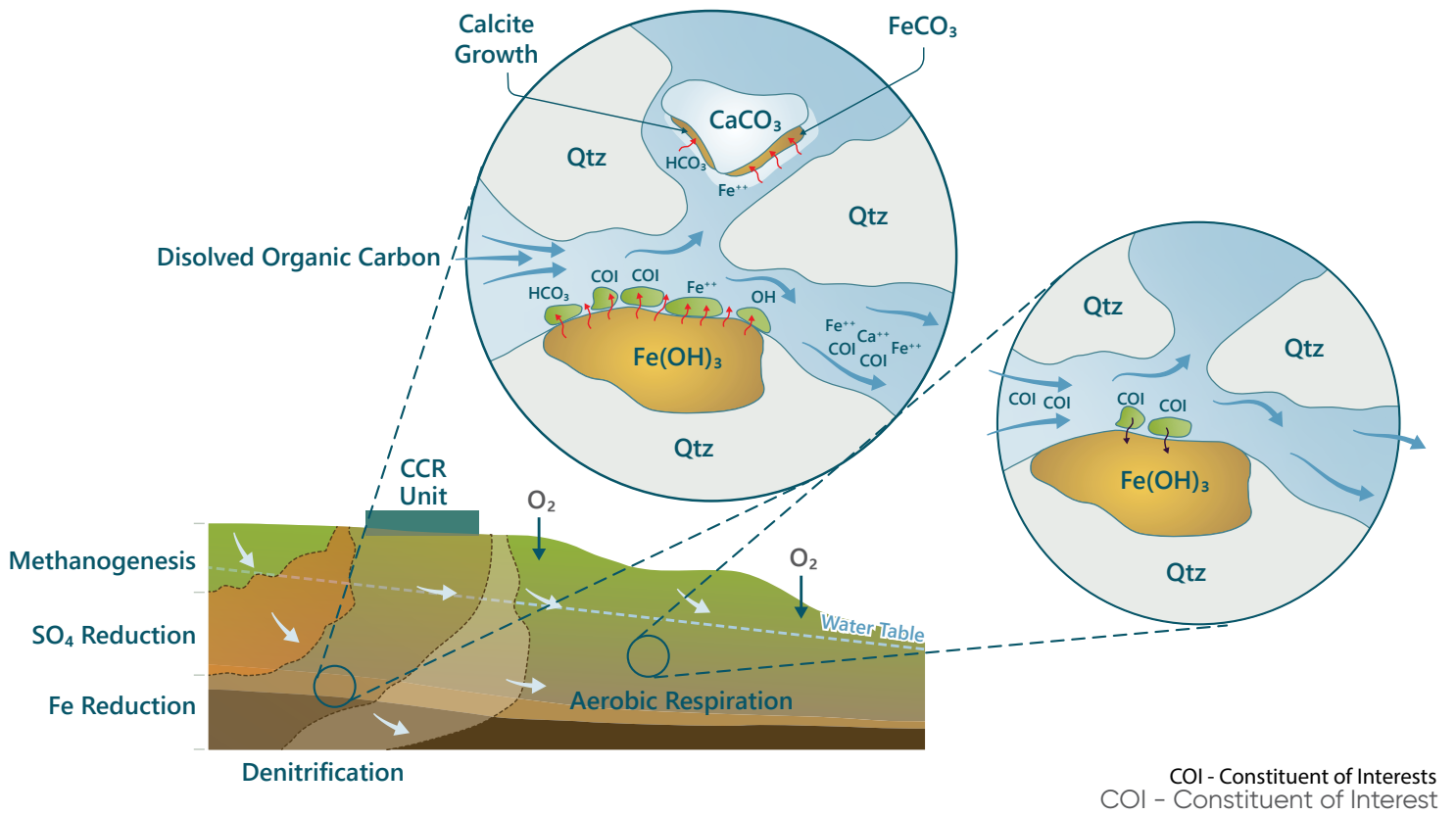
Anchor QEA provides comprehensive risk assessment services ranging from focused evaluations to complex baseline risk assessments involving multiple exposure pathways, receptors, and constituents. Our team applies practical, science-based approaches to evaluate carcinogenic and non-carcinogenic risks associated with a wide range of organic and inorganic constituents while supporting regulatory compliance and informed decision-making.

We help clients identify the constituents, exposure pathways, and receptors that drive risk, providing the technical basis for evaluating remedial alternatives, developing risk-based remediation goals, and supporting site-specific corrective action decisions. Our assessments focus resources on actions that deliver meaningful risk reduction and long-term value while demonstrating that corrective actions and closure strategies are protective of human health and the environment.

Anchor QEA supports the development and implementation of risk-based remedial strategies through the establishment of risk-based remediation goals and corrective action objectives. Supporting services include bioaccumulation modeling, bioavailability evaluations, toxicity assessments, fate and transport analyses, and post-remedy reviews that evaluate remedy performance, long-term protectiveness, and residual risk. These tools help clients develop practical, cost-effective remedial approaches aligned with site conditions, regulatory expectations, and permit requirements.

**Anchor QEA provides comprehensive risk assessment services ranging from streamlined evaluations to complex baseline risk assessments involving multiple pathways and constituents.**

**Our assessments support the evaluation of site-specific remedial alternatives and development of risk-based cleanup targets using realistic approaches that meet regulatory requirements and support defensible decisions.**



## Reactive Transport and Geochemical Modeling

Anchor QEA models integrate site-specific hydrostratigraphy, groundwater flow, aqueous speciation, and biogeochemical reactions that control constituent fate and transport. We use reactive transport modeling to delineate where monitoring wells are not feasible, evaluate post-closure conditions, evaluate and select remedies, quantify aquifer attenuation capacity, determine time to achieve groundwater protection standards, and manage uncertainties. Anchor QEA is a leader in groundwater modeling, staying current with the latest advancements and sometimes collaborating in modeling software development.

Reactive transport modeling is used to assess MNA viability and time frames, optimize in situ groundwater treatment, and develop remedy performance monitoring plans. Model inputs are based on laboratory and field data, including mineralogical characterization, batch and column testing, tracer tests, and pilot studies.

Our modeling results provide defensible compliance time frames and guide remedy design decisions to support effective corrective action at CCR sites.



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## Bedrock and Karst Hydrogeology

Anchor QEA has extensive expertise and experience working in karst and fractured rock terrain. We have solved environmental problems at CCR, Superfund, and other sites for both inorganic and organic contaminants and have supported new generation development. Some of this work dates back to when these staff were employed directly by large power companies.

Depending upon the site, Anchor QEA has used the following techniques for fractured rock and karst sites:

- Studies of aerial photography and remotely sensed imagery (lineament and sinkhole studies)
- Surface geophysics (electrical resistivity imaging, microgravity, and self-potential)
- Geologic mapping
- Core logging (>10,000 feet at one site alone)
- Hydraulic conductivity testing
- Dye and tracer tests
- Thermal techniques in surface waterbodies
- Extensive data analysis and synthesis

**Anchor QEA personnel have decades of experience working in karst (limestone and dolomite) and fractured rock.**

The following examples highlight some of our major work in karst terrain:

- Identified stable areas for CCR landfill development in karst terrain, supporting permitting and securing the state's first landfill exemption; use of on-site land saved the client \$56M versus a viable off-site option requiring new land acquisition and development
- Investigated sinkhole formation beneath a CCR pond and supported prevention, mitigation, and groundwater monitoring design in karst terrain
- Performed karst studies for energy infrastructure, including nuclear, pumped-storage hydropower, solar, battery storage, and substations
- Led investigations of water loss from a large hydroelectric reservoir and supported mitigation with engineers and boards of consultants
- Completed per- and polyfluoroalkyl substances (PFAS) investigations at 10 karst sites

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## Anchor QEA offers practical support for groundwater monitoring and corrective action at CCR sites.

### EGL Services

- Treatability Studies
- Column Testing
- Microcosm Studies
- Leaching Studies
- Advanced Solid-Phase Geochemical Characterization
- Aqueous Geochemical Analysis
- MNA Support
- Remedial Design
- Construction Quality Assurance Performance Assessment

### Geochemical CSMs and MNA Demonstrations

- Site History, Closure Activity, and Current Conditions
- Site Geology, Hydrogeology, and Geochemical Setting
- Groundwater Data Trend Analysis
- Well Solids Analysis
- Identification of Geochemical Mechanisms and Rates
- Constituent Speciation and Fate and Transport
- Field and Laboratory Approach to Meet USEPA's Four-Tiered Requirements
- Plume Stability
- MNA Monitoring

### Karst Geology and Groundwater

- Geotechnical Investigations
- Engineering Analysis
- Physical and Engineering Soil Properties
- Engineering Analysis
- Geophysical Surveys
- Hydrogeologic Evaluation

### ASDs and Geogenic Studies

- X-Ray Fluorescence and Laser-Induced Breakdown Spectroscopy
- X-Ray Diffraction
- Scanning Electron Microscopy–Energy Dispersive Spectrometry
- TESCAN Integrated Mineral Analyzer
- Electron Microprobe Analysis
- Laser Ablation Inductively Coupled Plasma Mass Spectrometry

### Reactive Transport Geochemistry Modeling Groundwater Flow Modeling

- Geochemical Modeling
- Reactive Transport Modeling
- Advanced Coding and Numerical Modeling
- Attenuation Capacity
- In Situ Treatment Design
- Risk Management

### Additional Services

- Civil and Geotechnical Engineering
- Decommissioning, Decontamination, and Demolition
- Manufactured Gas Plant and Other Legacy Remediation
- Construction Management
- PFAS
- Habitat Restoration
- Sediment Investigation, Management, and Remediation
- Stormwater Management and Water Resources
- Renewable Energy Design and Implementation
- Permitting and Regulatory Compliance

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# EPRI

# Collaboration

Anchor QEA staff have been actively engaged with EPRI for decades, including as EPRI contractors. Recent Anchor QEA projects for EPRI that are relevant to CCR and/or supported by our EGL, follow:

- *Well Solids Analysis to Inform Corrective Action Decisions for Groundwater at Electric Utility Sites*, 2026 (in progress)
- *Injection Treatment for Inorganic Constituents in Coal Combustion Product and Other Electric Utility Settings*, March 2026 workshop
- *Sequestration of Molybdenum Through Bioremediation*, EPRI Reports 002030073, 2025, and 3002027241, 2023
- *Pilot Test for In Situ Treatment of Boron, Lithium, and Molybdenum: Site 14147*, EPRI Report 3002030074, 2024
- *Implementation Report-Injection for In Situ Treatment of Boron, Lithium, and Molybdenum: Site 14147*, EPRI Report 3002021936, 2022
- *Evaluation of Thermolyzer and Chromated Copper Arsenate (CCA) Removal from Biochar as a Potential End-of-Life Solution for Treated Wood Utility Poles*, EPRI Report 3002023933, 2022
- *High-Resolution Site Characterization: An Approach for Application in Bedrock to Inform Remediation Decisions at Coal Combustion Product Sites*, EPRI Report 3002018785, 2020
- *Groundwater-Surface Water Interactions at Coal Combustion Product Landfills and Impoundments: Geochemical Reactions and Investigation Methods*, EPRI Report 3002012312, 2018
- *Monitored Natural Attenuation for Inorganic Constituents in Coal Combustion Residuals*, EPRI Report 3002006285, 2015
- *Corrective Action for Closed and Closing Ash Ponds*, EPRI Report 3002006292, 2015
- *Hydrogeologic Environments at Coal Combustion Residuals Management Facilities*, EPRI Report 3002003765, 2014
- *CD-MUSIC Reaction Database for Modeling Adsorption of Oxyanions on Iron Oxyhydroxides*, EPRI Report 1017921, 2009
- Numerous presentations at EPRI workshops and advisor meetings since 2007, such as the Boron Virtual Summit, 2021

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# CCR Leads



**Joe  
Smith, PE**

**CCR Primary Contact**

Site Investigation, Feasibility,  
and Remediation Engineer  
jsmith@anchorqea.com



**Dimitri  
Vlassopoulos, PhD**

Chief Geochemist and  
CCR Technical Expert



**Jim  
Redwine, PhD, PG**

Geologist, CCR Technical Expert



**Wayne  
Weber, PE, PG**

Remediation Engineer and  
CCR Technical Expert



**Jason  
Stuckey, PhD**

Geochemist and EGL Manager



**Kelly  
Ferri**

Geologist and CCR Rule  
Compliance Specialist



**Chuck  
Pippin, PG, RSM**

Geologist/Hydrogeologist and  
Fractured Rock Technical Expert



**Alec  
Macbeth, PG**

Geologist/Hydrogeologist and  
CCR Field Program Lead



**Kristi  
Mitchell, PE**

CCR Rule Compliance and Site  
Investigation and Remediation  
Engineer

