Evaluating Corrective Actions at Coal Combustion Product (CCP) Storage Sites: Risk Considerations and More

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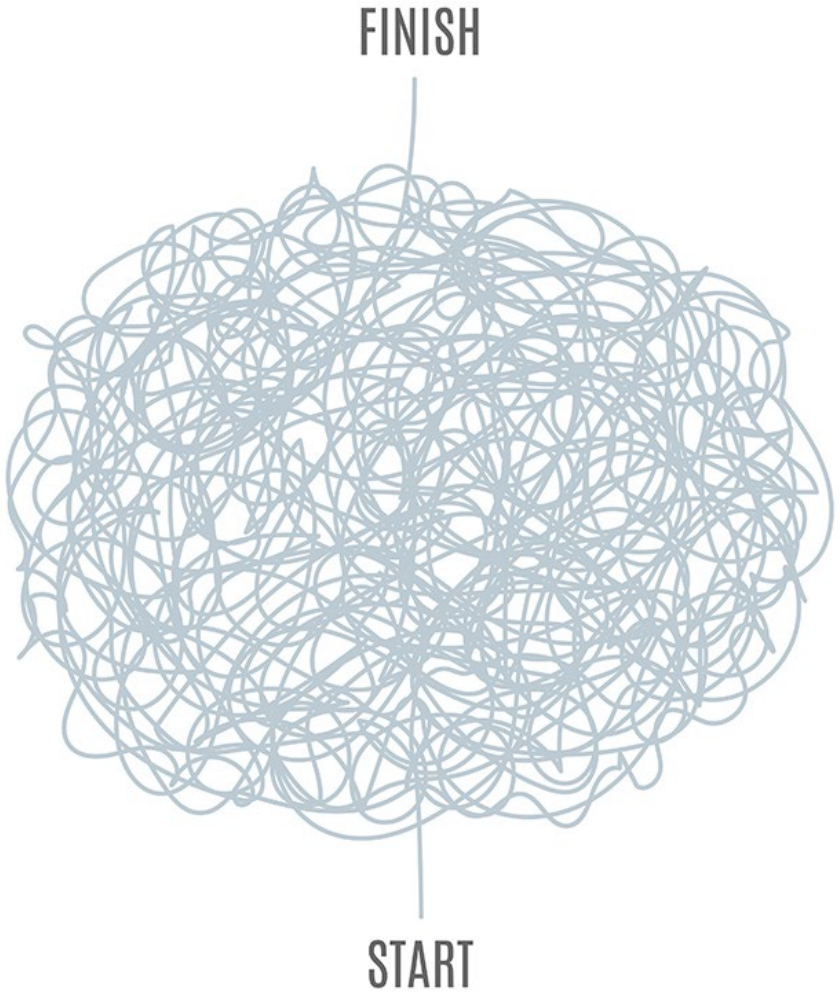
Agenda

- Risk assessment and the Coal Combustion Residual (CCR) Rule
- Risk assessment applications at CCP sites
- Other dimensions of risk/sustainability

Mixed Uses of Risk-Based Approaches

- CCR Rule vague about risk-based approaches
  - Several provisions mention risk, but does not really endorse risk-based approach
  - Interestingly, the CCR Rule based on a risk assessment
- Federal risk guidance
  - None specific for CCP site closure or remediation, but for beneficial uses
  - Standard approach for Superfund sites, waste management
- State programs can vary widely



CCR Rule and Related Actions Inconsistent About Risk-Based Approaches

Not Traditional Site Risk Assessment

- Corrective Action (CCR Rule)
  - "[I]f the monitoring demonstrates an **exceedance of a groundwater protection standard** for any of the identified constituents in CCR, [the owner or operator] must initiate corrective action."

More Traditional Site Risk Assessment

- USEPA Risk Assessment (RA) of Coal Combustion Wastes (CCR Rule)
  - "… EPA concludes that current management practice of placing CCR waste in surface impoundments and landfills poses risks to human health and the environment."
- Remedy Selection (CCR Rule)
  - "Must be protective of human health and the environment" and show a "[m]agnitude of reduction of existing risks."
- Beneficial Use (CCR Rule)
  - "[T]he user must demonstrate … that environmental releases to groundwater, surface water, soil and air will be at or below relevant regulatory and health-based benchmarks for human and ecological receptors during use."

Remedy Selection

CCR Rule § 257.97 Selection of Remedy

Remedies must: "[B]e protective of human health and the environment"

The effectiveness and protectiveness of the selected remedy should consider:

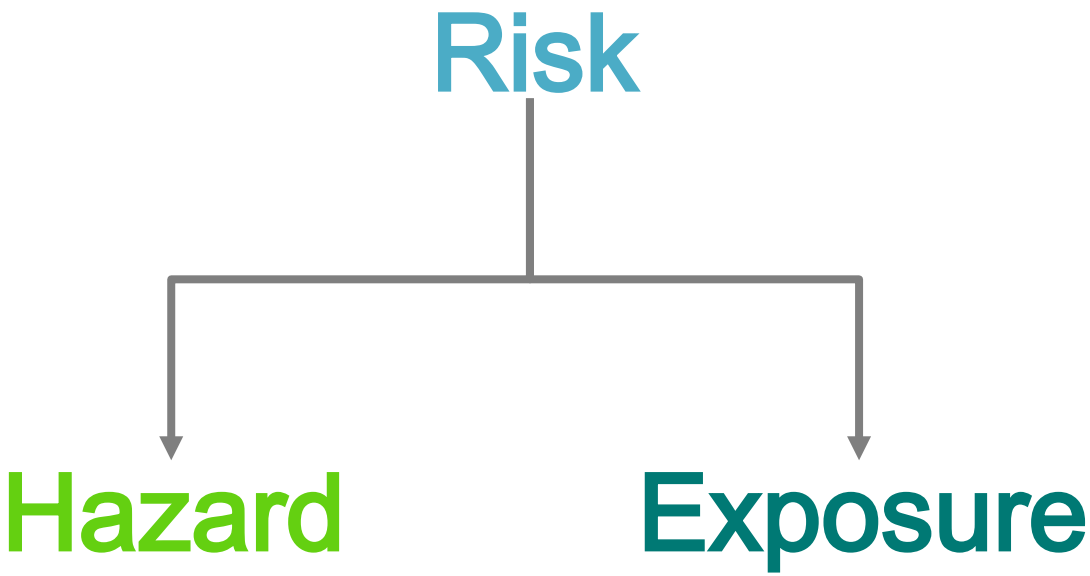
- Magnitude of **reduction of existing risks**
- **Magnitude of residual risks** in terms of likelihood of further releases due to CCR remaining following implementation of a remedy
- **Short-term risks** that might be posed to the community or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with **excavation, transportation, re -disposal, or containment**
- Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated **with excavation, transportation, re-disposal, or containment**

Need for corrective action is not risk based, but selection of remedy is

Purposes of Risk Assessment

Traditional Human Health/Ecological Risk Assessment

- **Quantity** potential for adverse effects (human health and environmental) from exposure to chemicals
- Regulatory basis, established guidance
- Center stone of most health-based regulations



Risk Assessment Hurdles

- What guidance?
  - No specific guidance for CCP sites
  - CCP, state, or Superfund RA guidance
- What exposure pathways?
  - Groundwater related only? Workers?
- What constituents?
  - Appendix IV only?
- What benchmarks?
- Surface water?
  - Usually key exposure pathway
  - Data usually less robust than groundwater data

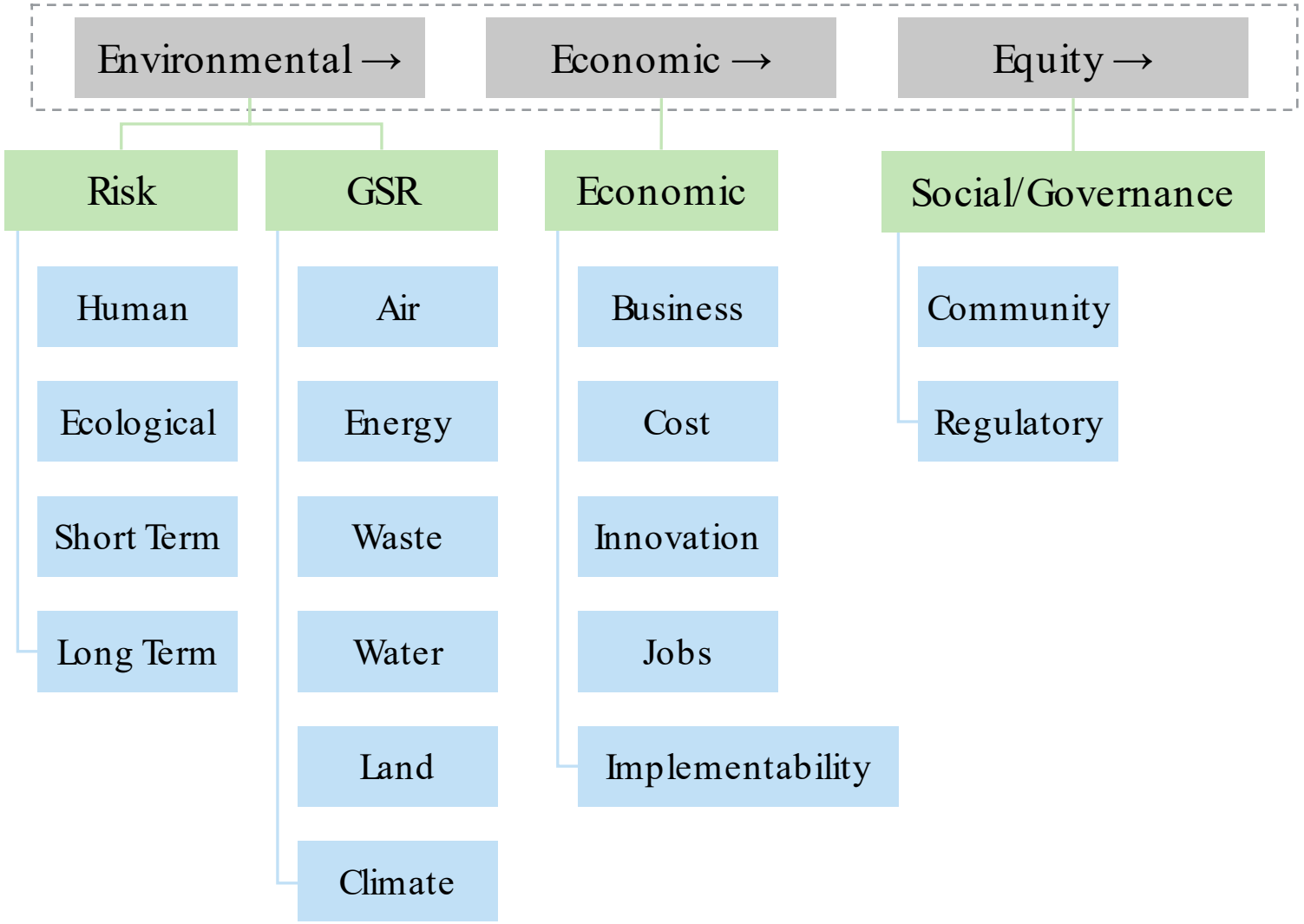
What Benchmarks? (Arsenic Example)

Water Source	Benchmark	Who?	Level (µg/L)
	GWPS	**US EPA (CCR Rule)**	**10**
Groundwater	MCL (drinking water)	US EPA	10
	RSL (tap water)	US EPA	0.052
Surface Water	Fish Ingestion	US EPA (NRWQC)	0.140
		Alabama	0.300
		Mississippi	24
		Tennessee	10
	Fish Ingestion and Drinking Water	US EPA (NRWQC)	0.018
		Alabama	0.120
		Mississippi	0.078
		Tennessee	10
	Protection of Freshwater Aquatic Organisms	US EPA (NRWQC)	150
		Alabama	150
		Mississippi	150
		Tennessee	150

Risk Assessment Applications at CCP Sites

- Remedy selection
  - Magnitude of reduction of existing risks
  - Magnitude of residual risks
- Remedy implementation
  - Conditions may change during remediation/closure
  - Adaptive site management
- Risk communication
  - Essential component for addressing concerns raised by communities and other stakeholders
  - Technical analysis, followed by more public-facing communications
- Litigation support

Beyond Risk Assessment… Corrective Action Alternatives Analysis



- Risk assessment important to address potential long-term adverse effects associated with remediation
- Sustainable remediation literature expands risk examination
  - Triple bottom line
  - Green and Sustainable Remediation (GSR)
  - Life Cycle Analysis (LCA)
  - Net Environmental Benefit Analysis (NEBA)
  - Environmental, Social, and Governance (ESG) considerations

Corrective Action Alternatives Analysis

- Combines traditional risk assessment with more measures of "sustainability" and cost
- Evaluation system in which both positive and negative effects of a certain action are quantified and/or considered
- Can be tailored to applications
- Defensible approach to support and justify decisions
- Supports proactive sustainability/ ESG-related goals
- Useful for public communication
- Can be required for permit approval by environmental agencies

Alternatives Analysis Relevant to CCP Sites?

- Federal and state regulations require various forms of remedy selection analysis
  - **Federal:** 40 CFR 257.96 – Assessment of Corrective Measures
  - **Federal:** 40 CFR 257.97 – Remedy Selection
  - **Illinois:** Title 35, Part 845.710 – Closure Alternatives Analysis
  - **Illinois:** Title 35, Part 845.660 – Assessment of Corrective Measures
  - **Illinois:** Title 35, Part 845.670(e) – Corrective Action Alternatives Analysis
  - **Virginia:** Senate Bill 1398 (2017) – Prior to closing, owners/operators must evaluate corrective measures, evaluate recycling options, evaluate clean closure and other potential closures

Key Resources

Year	Author	Title
2008	US EPA	Green Remediation: Incorporating Sustainable Environmental Practices into Remediation of Contaminated Sites
2012	US EPA	Methodology for Understanding and Reducing a Project's Environmental Footprint
2010	CL:AIRE	A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (SuRF-UK)
2020	CL:AIRE	Supplementary Report 1 of the SuRF-UK Framework: A General Approach to Sustainability Assessment for Use in Achieving Sustainable Remediation
2020	CL:AIRE	Supplementary Report 2 of the SuRF-UK Framework: Selection of Indicators/Criteria for Use in Sustainability Assessment for Achieving Sustainable Remediation
2009	Ellis and Hadley	Sustainable Remediation White Paper – Integrating Sustainable Principles, Practices, and Metrics into Remediation Projects
2017	ASTM	Standard Guide for Greener Cleanups
2011	ITRC	Green and Sustainable Remediation: State of the Science and Practice

Corrective Action Alternative Indicators

Risk	GSR
• Magnitude of reduction of existing risks (human health/ ecological) • Type and quantity of residual contamination • Human health risks to community • Human health risks to workers • Accident risks to community • Accident risks to workers	• Fuel type and use • Greenhouse gas emissions • Total air and dust emissions • Total power use/energy efficiency • Use of heavy equipment • Re-use and recycling of waste/materials • Freshwater consumption • Land impacts • Invasive *in situ* technologies • Post-remedial climate vulnerabilities • Disturbance of natural habitats
Economic	**Social/Governance**
• Use of local contractors • Capital costs • Annual operation and maintenance (O&M) costs • Project lifespan risk • Innovation	• Future land use • Noise/odor • Minimal disruption to local business • Consideration of environmental justice communities • Community acceptance • Community resource preservation • Create community assets (*e.g.*, parks, open space, habitat)

Closure Alternatives Analysis

Impact Metric	Closure in Place	Closure by Removal
1) Risks to Human Health/Environment		
a. Risks to groundwater receptors (human)		
b. Risks to surface water receptors (human)		
c. Risks to ecological receptors		
2) Risks of Potential Future CCP Releases		
a. Releases due to dike failure		
b. Flood-related releases		
3) Groundwater Quality		
4) Surface Water Quality		
5) Air Quality		
6) Climate Change and Sustainability		
a. GHG emissions (CO_2, NO_x)		
b. Energy consumption		
7) Worker Safety		
8) Community Impacts		
a. Accidents		
b. Traffic		
c. Noise		
d. Environmental justice		
9) Habitat Impacts		
a. Habitat availability and biodiversity		
b. Threatened and endangered species		

- Evaluates the "gains" in environmental/ecological properties due to some actions (*e.g*, remediation, closure)
- Methodology for comparing and ranking alternatives
- Considers all benefits and adverse impacts
- Flexible

GRADIENT

Corrective Action Alternative Hurdles

- No federal guidance, let alone guidance for CCP storage sites
- Which indicators?
- Approaches/methodologies to assess?
- Qualitative *vs.* quantitative?

Currently working on project with EPRI:

- Define relevant indicators
- Identify evaluation methods/tool
- Application to hypothetical site

Take-Aways

- Risk assessment and more expansive analyses that consider other facets of risk useful for selecting corrective action alternatives
- Federal and state CCP regulations often requiring some form of decision analysis
- Regardless, useful tool for communicating with public and regulators and for proactively exploring sustainable remediation practices
- Tools are available to assist with analyses that are flexible and/or designed for CCP sites
- **Leads to a scientifically defensible outcome/decision**

Thank You!

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