



Site Closure Tools in 2021

PRESENTED BY

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1.0 Introduction and Purpose

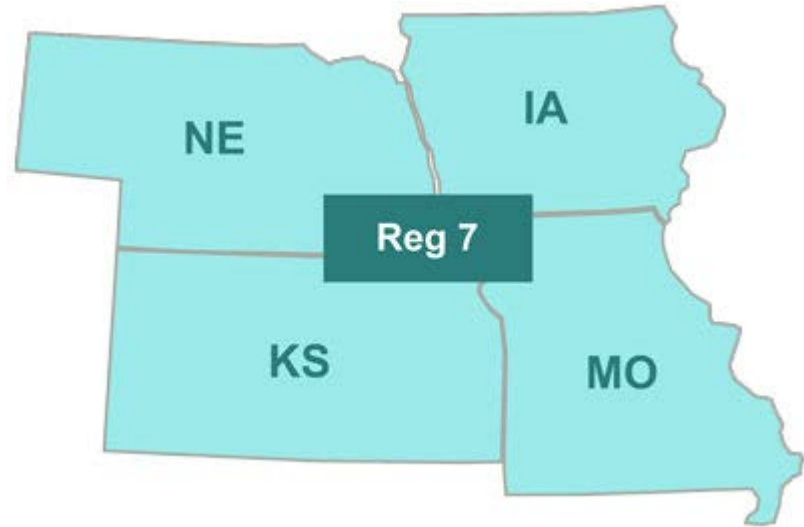
- ✔ To provide an overview of regulatory strategies and technical tools designed to take a contaminated Site to complete closure
- ✔ Over 40 years have passed since initial set of cleanup rules (e.g., CERCLA, RCRA, Brownfields)
- ✔ Federal and state rules have progressed, and risk-based and practical methods are available to clean up a Site
- ✔ These updated rules allow application of newer technical tools

1.0 Introduction and Purpose

Today's Topics

- ✓ 2.0 Regulatory drivers for Contaminant Assessment and Remediation (CAR)
- ✓ 3.0 Current status of Sites in clean up programs
- ✓ 4.0 Existing regulatory strategies
- ✓ 5.0 Overview of available technical tools
- ✓ 6.0 Why invest time and money to close a Site in the near term?
- ✓ 7.0 Questions and Additional Ideas

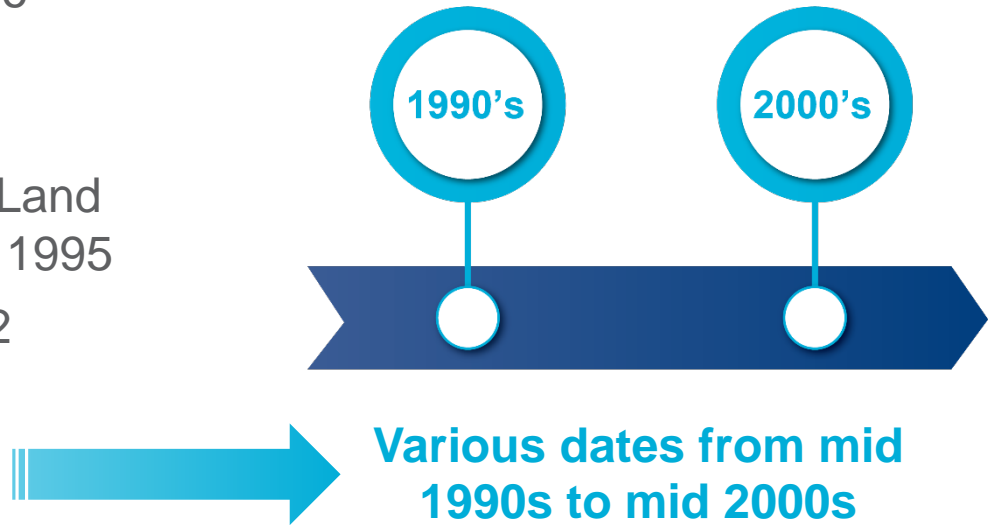
2.0 Contaminant Assessment and Remediation Regulatory Drivers



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Regulatory History – Clean Up Programs

- RCRA – October 21, 1976
- CERCLA – Superfund – December 11, 1980
- USEPA Brownfields and Land Revitalization Program – 1995
- API/ASTM–RBCA – 2002
- State Voluntary Cleanup Programs and RBCA Guidance



2.0 Contaminant Assessment and Remediation Regulatory Drivers

Federal Closure Language – a release from liability

- **CERCLA**

- Delisting – Deletion from the NPL

- **RCRA**

- Certificate of Closure
 - Post-Closure Permit
 - No Further Action



2.0 Contaminant Assessment and Remediation Regulatory Drivers



KANSAS-KDHE

- Closure: No Further Action
- Site-Specific RA: RSK Manual – Tier 3
- Long-term Option: Risk Management Program



MISSOURI-MDNR

- Closure: Certification of Completion
- Site-Specific RA: MRBCA – Tier 3



IOWA-IDNR

- Closure: No Further Action Certificate/Letter
- Site-Specific RA: 567—137.6(455H)



NEBRASKA-NDEQ

- Closure: No Further Action Letter
- Site-Specific RA: Tier 3 Voluntary Cleanup Program (VCP) Remediation Goals (RGs)

2.0 Contaminant Assessment and Remediation Regulatory Drivers

Numbers – Closed Sites – Approximate

- CERCLA – 390-400 (delisted)
- RCRA – 120 (ready for reuse)
- MO – 1,500
- IA – 1,300
- NE – 80
- KS – 15

Note: some state numbers include multiple clean up programs and not just VCP Sites

3.0 Current Status of Sites in Remediation Programs



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- The Contaminant Assessment and Remediation (CAR) process is mature....Sites are actually being closed!
- However, many Sites are in “limbo”, or “out of sight out of mind” in any of the three CAR phases listed below:

**1.0 Active
remediation**

**2.0 Passive
remediation**

**3.0 Long term
monitoring**

3.0 Current Status of Sites in Remediation Programs

Challenges to take a Site to “complete” closure



TECHNICAL

- Remaining “Source” material
- Residual contamination in subsurface
- Risk standards and clean up levels are outdated or not Site specific



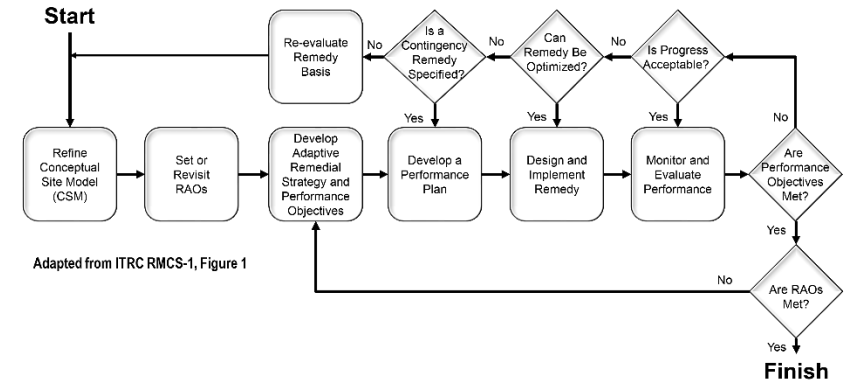
REGULATORY

- Outdated rules and clean up criteria
- Limited history with the agency of complete site closure
- Lack of regulator knowledge of the new technologies

4.0 Existing Regulatory Strategies to Complete Site Closure



Adaptive Site Management Process



RITS 2019: Adaptive Site Management

4.0 Existing Regulatory Strategies to Complete Site Closure

Potential Strategies – Federal Clean Up Programs



CERCLA - SUPERFUND

- Technical Impracticality Waivers
- ARAR Waivers
- Alternate Concentration Limits
- Groundwater Reclassification
- Site-Specific Risk Assessment
- Institutional Controls



RCRA - CORRECTIVE ACTION

- Similar to CERCLA
- Interim Measures
- Institutional Controls
- Risk Assessment
- TI Through CMS
- FLCA
- RCRA FIRST

4.0 Existing Regulatory Strategies to Complete Site Closure

Newer Regulatory Guidance, examples:

- Adaptive Site Management
- Remediation Management at Complex Sites
- Project Risk Management for Site Remediation
- Others



4.0 Existing Regulatory Strategies to Complete Site Closure

Potential Strategies – State Clean Up Programs

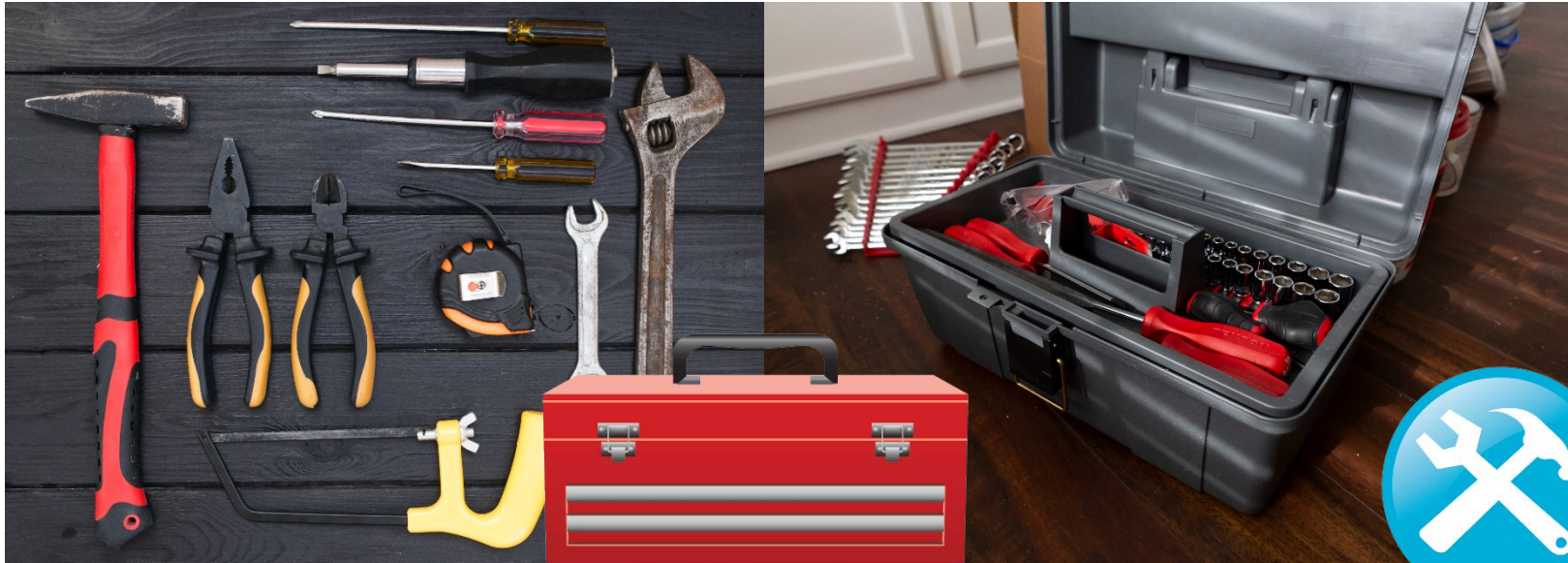
- Generally, these are found under rules for state RBCA, VCP, or Brownfields clean up programs
- Technical Impracticability demonstrations
- Tier 3 Risk Assessment
- Institutional Controls – Environmental Land Use Controls
- Adjusted Standards
- Rule Changes

4.0 Existing Regulatory Strategies to Complete Site Closure

Implementation of Closure Strategies

- Complete Site closure accomplished with a combination of regulatory approaches under existing rules and guidance
- Options for closure through legal filings (adjusted standards, reclassification) or rule changes
- More time and effort are required to proceed through these strategies due to:
 - Limited experience or history with the closure process
 - Company and agency decision processes
 - Technical and regulatory demonstrations must be in series

5.0 Technical Tools to Demonstrate No Further Risk - Complete Closure



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- Two Major Hurdles to Complete Site Closure: (1) Source Material and (2) Residual Contamination
- (1) Source Removal or Control
 - ITRC/ASTM – LNAPL Immobility Assessments
 - ITRC Natural Source Zone Depletion Assessments
 - Enhanced Source Removal (e.g., Bio-Sparge with NSZD)
 - Physical Barriers – Engineering Controls
 - Technical Impracticality Demonstrations

5.0 Technical Tools to Demonstrate No Further Risk - Complete Closure

(2) Residual Contamination in Soils and Groundwater

- Tier 3 or Site-Specific Risk Assessment
 - Adjusted for new risk factors and other toxicological data
 - Adjusted for actual exposure pathways
- Fate and Transport Modeling (BioChlor, BioScreen, RT3D, etc.)
 - Adjusted for current Site conditions
 - Adjusted for updated models and input parameters
 - Adjusted for actual receptors or a new point of compliance
 - Adjusted for current acceptance by the regulatory agency

5.0 Technical Tools to Demonstrate No Further Risk - Complete Closure

Residual Contamination in Soils and Groundwater

– Plume Stability Evaluations

- Traditional statistical analyses (i.e., M.K. trends and regression analyses) and typical concentration time plots
- Comprehensive time weighted evaluations as outlined by Joe Ricker (2012):
 - Center of plume
 - Plume volume and mass
 - Plume shape-area
 - Plume mass flux
- NAPL – immobility demonstrations – tied to dissolved phase
- NAPL – natural depletion documentation – tied to dissolved phase

5.0 Technical Tools to Demonstrate No Further Risk - Complete Closure

Vapor Intrusion (VI) Situations

- Tier 2 or Tier 3 adjusted soil gas remedial objectives
- Modifications to the Johnson Ettinger Model
- Use of recent/current indoor air sampling to shut down mitigation systems



5.0 Technical Tools to Demonstrate No Further Risk - Complete Closure

Newer Remedial Technologies

- Traditional methods (e.g., P&T, insitu bio, SVE, air sparge, etc.) have improved, but others exist
- Newer, (semi-)passive technologies
 - Biosparge into NAPL – shortens time for NSZD
 - Anerobic benzene degrading bacteria
 - Sulfate injection for anerobic degradation of hydrocarbons
 - Phytoremediation
- Apply newer technologies to move the Site to next CAR phase or to complete closure

6.0 Why Invest Time and Money to Obtain Closure in the Near Term



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- Change in federal and state environmental administrations
- Emerging contaminants could be re-openers
- A track record has now been established on complete Site closure
- Newer technical tools have been accepted by the regulators in most venues
- There are more data on the Site today when compared to its entry into the clean up program

6.0 Why Invest Time and Money to Obtain Closure in the Near Term

SITE CLOSURE GOALS



- ✓ Eliminate near term operating costs and long-term monitoring costs
- ✓ Eliminate environmental liability – reduce the reserves
- ✓ Increase company reputation factors – community relations/EJ
- ✓ Meet internal sustainability metrics and external ESG factors
- ✓ Address regulatory pressure – enforcement schedules

7.0 Questions and Additional Ideas?



8.0 References



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