EPA Superfund Groundwater Policy and Federal Facilities Overview

JUNE 1, 2020

FEDERAL FACILITIES RESTORATION AND REUSE OFFICE

OFFICE OF SCIENCE, REMEDIATION, TECHNOLOGY, AND INNOVATION

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Quick Clarification

- This is an educational webinar on the existing EPA groundwater policy and guidance.
- There is an ongoing effort under the EPA Superfund Task Force to look as these policies and any updated policies will be issued. A listening session with other federal agencies occurred on May 26 to solicit feedback on this effort.
- While this effort is ongoing, EPA's current groundwater policy and guidance remain unchanged.

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Group Poll

What has been your biggest challenge when it comes to dealing with groundwater remedies at a Superfund site?

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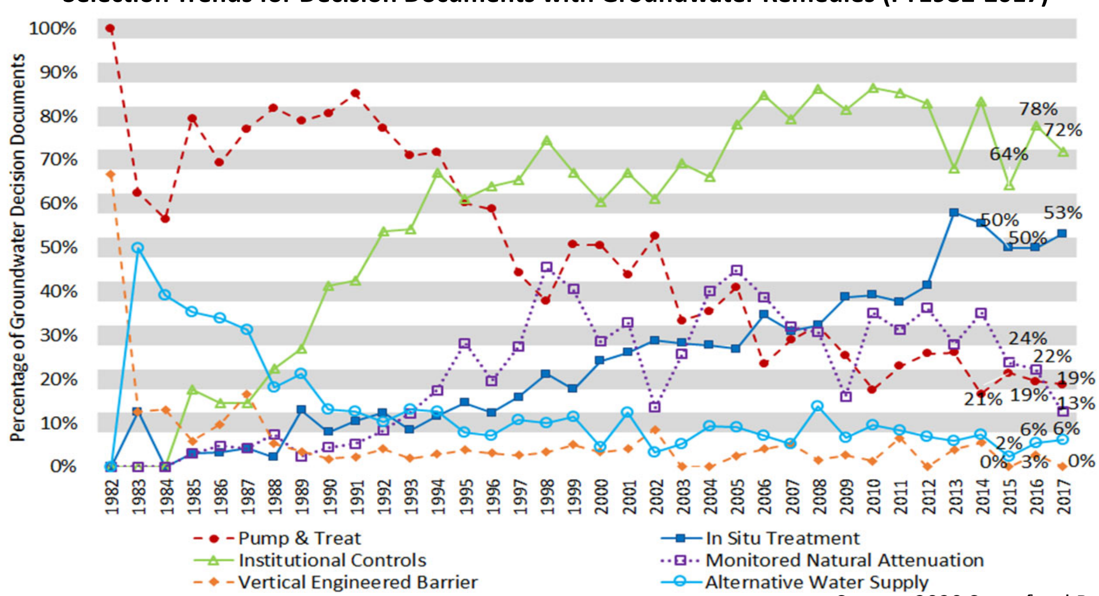
Selection Trends for Decision Documents with Groundwater Remedies (FY1982-2017)



Source: 2020 Superfund Remedy Report

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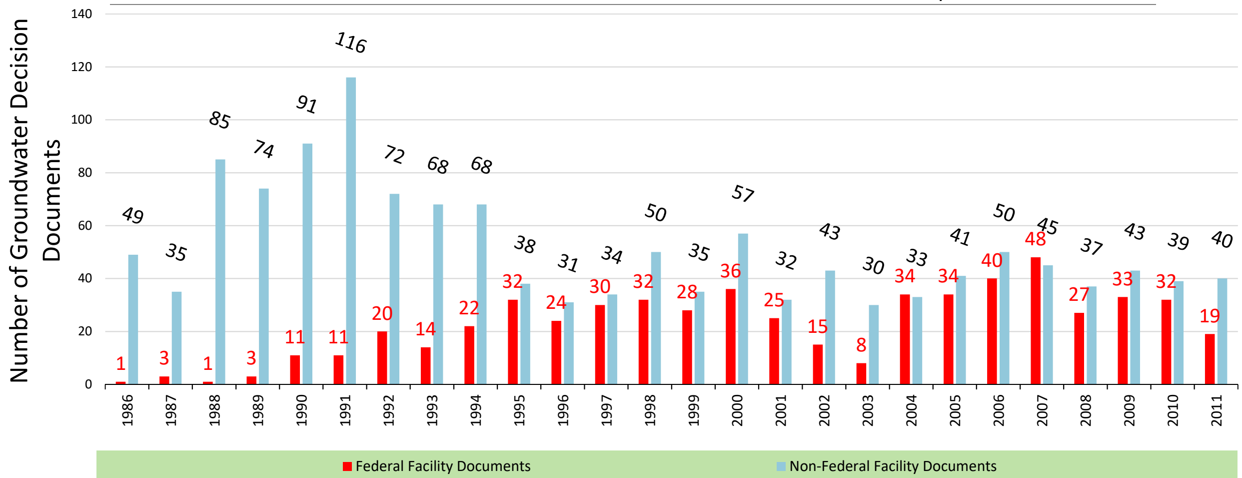
Number of Federal vs. Non-Federal Facility Groundwater Decision Documents*

*Of total of 1919 decision documents, 30% (583) are for federal facilities.
*EPA 2013, *Superfund Remedy Report*.



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Agenda

Review EPA groundwater policy as applied at federal facility sites on the NPL under CERCLA:

- Groundwater Classification, Institutional Controls (ICs)
- Groundwater Response Actions
- Monitored Natural Attenuation (MNA), and Technical Impracticability (TI) Waivers
- Remedy Optimization
- Adaptive Management at groundwater sites

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Groundwater Classification

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Groundwater Use Designations

- State Guidelines
  - Approved Comprehensive State Groundwater Protection Program
- Federal Guidelines
  - Classification System (EPA Guidelines for Ground-Water Classification, Draft Final 1986)
- Class I: Special Groundwater
- Class II: Actual or Potential Drinking Water Source
  - Class IIA: Current source
  - Class IIB: Potential source of drinking water, agricultural or other beneficial use
- Class III: Not a Potential Source of Drinking Water and of Limited Beneficial Use

Land use is not identified as a consideration in making groundwater classifications

Source: U.S. EPA, 1986, Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy

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Comprehensive State Groundwater Protection Program (CSGWPP)

- 13 States have an EPA-endorsed CSGWPP (CT, MA, NH, RI, VT, DE, AL, GA, IL, WI, OK, NV, WA)
- 1997 EPA Guidance clarified that EPA Regions generally should:
  - *Defer to State determinations of current and future ground-water uses, when based on an EPA-endorsed CSGWPP that has provisions for site-specific decisions;*
  - *Participate in EPA's review and endorsement of CSGWPPs; and*
  - *Use other CSGWPP provisions, as appropriate, for more effective or efficient program implementation (e.g., increased program emphasis in geographic areas identified in a CSGWPP as having higher resource value or priority).*

Source: U.S. EPA, 1997 Guidance, *The Role of CSGWPPs in EPA Remediation Programs*

EPA Groundwater Classification

Class I: Special Groundwater

- Resources of unusually high value that are highly vulnerable to contamination
- Irreplaceable source of drinking water – serves a substantial population, or the alternative sources in the area are economically infeasible
- Ecologically vital - supplies a sensitive ecological system that supports a unique habitat

Photo: https://www.desertusa.com/colorado/intro/du_introcr.html

Source: U.S. EPA, 1986, Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy

EPA Groundwater Classification (cont.)

Class II: Actual or Potential Drinking Water Source

- Class IIA: Current source of drinking water
  - Presence of one or more drinking water wells or springs (in operation)
  - Presence of a water-supply reservoir watershed (or a portion) designated for water quality protection
- Class IIB: Potential source of drinking water, agricultural or other beneficial use

Potential Source Criteria

- Yields at last 150 gallons/day
- TDS less than 10,000 mg/L
- Can be used without treatment or treated with methods found in a public water system

Source: U.S. EPA, 1986, Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy

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EPA Groundwater Classification (cont.)

Class III: Not a Potential Source of Drinking Water and of Limited Beneficial Use

- Salinity greater than or equal to 10,000 mg/L TDS
- Contamination by naturally occurring conditions or by broad-scale human activity (unrelated to specific pollution incident) that they cannot be treated by public water system
- Insufficient yield for an average-size household
- Two subcategories based on interconnection to adjacent units and surface water:
  1. Class IIIA – high-to-intermediate degree of interconnection
  2. Class IIIB – low degree of interconnection

Source: U.S. EPA, 1986, Guidelines for Groundwater Classification Under the EPA Groundwater Protection Strategy

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Groundwater Use and Classification

- "…to the degree that the state or local government have classified their groundwater, EPA will consider those classifications and their applicability to the selection of an appropriate remedy." [55 FR 8733]
- "If a state classification would lead to a less stringent solution than the EPA classification scheme, then the remediation goals will generally be based on EPA classification…If the use of a state classification would result in the selection of a nonprotective remedy, EPA will not follow the state scheme." [55 FR 8733]

Source: U.S. EPA, 1990, Final National Oil and Hazardous Substances Pollution Contingency Plan 55 FR 8733.

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Apply Your Understanding

In the EPA Groundwater Classification System, what is Class I groundwater?

A) Actual source of drinking water
B) Special Groundwater
C) Potential source of drinking water
D) None of the above

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Institutional Controls

Role of Institutional Controls (ICs)

- ICs generally are not to be included when evaluating whether a CERCLA remedial action is appropriate (55 FR 8710-8711).
- ICs related to groundwater or surface use may be used as part of a response action.
- ICs do not actively address contamination and are considered to be limited action alternatives

Source: U.S. EPA, 2009, Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration

Role of ICs

- ICs shall not substitute for active response measures as the sole remedy unless such active measures are determined not to be practicable
- Institutional controls will usually be used as supplementary protective measures during implementation of groundwater remedies (55 FR 8732).

Source: U.S. EPA, 2009, Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration

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Groundwater Response Actions

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Groundwater Response Actions

- Under CERCLA Section 121(d)(2)(A) and congressional mandate for groundwater response actions
- Such Remedial action shall require a level or standard of control which
  - At least attains Maximum Contaminant Level Goals established under the Safe Drinking Water Act; and,
  - Water quality criteria established under section 304 or 303 of the Clean Water Act
  - Where such goals or criteria are relevant and appropriate for the release

Photo: https://epa.ohio.gov/ddagw/gw_support

Source: U.S. EPA, 1980, Superfund Law (CERCLA – Comprehensive Environmental Response, Compensation and Liability Act of 1980)

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Groundwater Restoration

- NCP includes general expectations for groundwater restoration
  - EPA expects to return usable groundwaters to their beneficial uses wherever practicable,
  - Within a timeframe that is reasonable given site circumstances.
- When restoration to beneficial use is not practicable, EPA expects to
  - prevent further migration of the plume,
  - prevent exposure to the contaminated groundwater, and
  - evaluate further risk reduction"

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Principles for Groundwater Restoration

1) *If groundwater that is a current or potential source of drinking water is contaminated above protective levels, a remedial action under CERCLA should seek to restore that aquifer to beneficial use wherever practicable.*
2) *Groundwater contamination should not be allowed to migrate and further contaminate the aquifer or other media*
3) *Technical impracticability waivers and other waivers may be considered and granted under appropriate circumstances if the statutory criteria are met when groundwater cleanup is impracticable*

U.S. EPA, 2009, Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration.

Principles for Groundwater Restoration

4) *Early actions should be considered as soon as possible. ICs related to groundwater use, or even surface use, may be useful to protect the public*
5) *ICs should not be relied upon as the only response to contaminated groundwater or as a justification for not taking action under CERCLA.*
   - *Cleanup levels should address all pathways of exposure that pose an actual or potential risk to human health and the environment*

In working with other Federal agencies to make groundwater clean up decisions at sites where the other Federal agency is lead for cleanup, EPA Regions should use the principles highlighted in this document to the same extent as at non-federal facility sites.

U.S. EPA, 2009, Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration.

NCP Expectations in DoD Guidance

- DoD DERP Manual acknowledges NCP expectations for groundwater:
  - If remedial action for groundwater is necessary to protect human health or the environment, the DoD Component should consider the NCP expectation that useable groundwaters will be returned to their beneficial uses whenever practicable, within a timeframe that is reasonable given the particular circumstances of the site, when establishing remedial action objectives in accordance with subpart 300.430(a)(1)(iii)(F) of NCP.
  - When restoration to beneficial uses is not practicable, EPA expects to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction, pursuant to subpart 300.430(a)(1)(iii)(F) of NCP.
    - If ARARs cannot be met, the DoD should appropriately justify an ARAR waiver in accordance with subpart 300.430(f)(1)(ii)(C) of NCP.

Source: Section 4 of DoD DERP Manual, DoD Environmental Restoration Program

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Groundwater Remediation Phased Approach

- Site response activities are implemented in a sequence of steps so information gained from earlier phases refines subsequent investigations, objectives or actions.
  - Includes early and interim actions
- Considerations for the use of interim actions:
  - More data to assess restoration potential
  - Attainable objectives can be set for each response phase
  - Flexibility in response to unexpected site conditions
  - Increased remedy performance (decreased timeframes and cost)

Source: U.S. EPA, 1996, Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites.

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Basis for CERCLA Action

- The NCP preamble states, "The results of the baseline risk assessment are used to determine whether remediation is necessary, to help provide justification for performing remedial action, and to assist in determining what exposure pathways need to be remediated."
- "Under existing EPA policy, groundwaters that are current or potential sources of drinking water that exceed risk-based standards (e.g., MCLs) or pose an unacceptable risk generally warrant a remedial action under CERCLA."
- "Other routes of exposure, such as vapor intrusion, or current or potential threat to sediment quality, surface water quality, wetlands, or critical habitats for protected species, also may be the basis for remedial action under CERCLA."

Source: U.S. EPA, 2009, Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration

Extent of Contamination

- A site consists of all contaminated areas within the site <u>and any other location to which contamination from that area has come to be located</u>
- Groundwater contamination should not be allowed to migrate and further contaminate the aquifer or other media

Photo: https://www.circleofblue.org/2019/world/epa-says-it-will-regulate-two-pfas-chemicals-in-drinking-water/

Source: U.S. EPA, 2009, Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration

Groundwater ARARs to Consider

- Maximum contaminant level goals (MCLGs), established under the Safe Drinking Water Act, that are set at levels above zero shall be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water, where the MCLGs are relevant and appropriate under the circumstances of the release based on the factors in 300.400(g)(2).

- If an MCLG is determined not to be relevant and appropriate, the corresponding maximum contaminant level (MCL) shall be attained where relevant and appropriate to the circumstances of the release. (40 CFR 300.430(eX2)(i)(B))

Source: U.S. EPA, 2009, Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration

Groundwater ARARs to Consider (cont.)

- The NCP Preamble further clarifies: EPA's policy is that MCLs or MCLGs above zero should generally be the relevant and appropriate requirement for groundwater that is or may be used for drinking, and that a waiver is generally needed in situations where a relevant and appropriate MCL or nonzero MCLG cannot be attained.

- Where groundwaters may impact surface water quality, "water quality criteria established under section 304 or 303 of the Clean Water Act" may be relevant and appropriate standards consistent with CERCLA §121 (d)(2)(A)(ii).

Source: U.S. EPA, 2009, Summary of Key Existing EPA CERCLA Policies for Groundwater Restoration

Apply Your Understanding

Which is NOT true when addressing groundwater contamination at CERCLA sites?

A) Early actions should be considered as soon as possible.

B) Groundwater contamination migrating beyond the "fenceline" or established land site boundaries should be considered.

C) Technical impracticability waivers and other waivers may be considered.

D) Institutional Controls can be relied upon as the only response to contaminated groundwater or as justification for not taking action under CERCLA.

Alternate Concentration Limits (ACLs)

- Section 121(d)(2)(B)(ii) addresses ACLs and limitations concerning their use
- ACLs may not be used if the process assumes a point of human exposure beyond the boundary of the facility, <u>except</u> where:
  - there are known and projected <u>points of entry</u> of such groundwater <u>into surface water</u>;
  - there is or will <u>be no statistically significant increase</u> of constituents in surface water or at any point downstream; and
  - the remedial action includes enforceable measures that will <u>preclude human exposure</u> to the contaminated groundwater.

2005 EPA HQ Memo on ACLs

- Purpose: To provide guidance on the proper use of ACLs in Superfund remedies under the authority of CERCLA Section 121
- Expands on the factors/criteria for guiding the use of ACLs in CERCLA section 121
  - Seven additional site-specific factors added to the three original factors in CERCLA section 121
- Two additional clarifications were noted on the use of ACLs
  - ACLs are directed to substitute for standards that are "applicable" and meet specific criteria
  - ACLs cannot be used when a "relevant and appropriate" standards exist (e.g. MCLs or WQC under the CWA)

Source: US EPA, 2005 Use of Alternate Concentration Limits (CLs) in Superfund Cleanups

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CERCLA Degree of Cleanup

- Under Section 121(d) remedial actions shall attain a degree of cleanup which assures protection of human health and the environment.
- Remedial action shall obtain ARARs unless in limited circumstances it is determined that one of the six waivers specified in Section 121(d)(4) can be invoked.
- "SDWA MCLs are generally considered 'relevant and appropriate' to determining acceptable exposure for groundwater that is or may be used for drinking." [55 FR 8750]

40 CFR 300.340(f)(1)(1)(A)

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Remediation Timeframe

- For groundwater, timeframes will be developed based on the site-specific contaminants, hydrogeological conditions, and size of the plume. [55 FR 8732]
- "EPA's preference is for rapid restoration, when practicable, of Class I groundwater and groundwaters that are currently, or likely in the near-term to be, the source of a drinking water supply." [55 FR 8713]

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Evaluating Completion of Groundwater Restoration Remedial Actions

- Recommends evaluating contaminant of concern (COC) concentration levels on a well-by-well basis for:
  - Remediation monitoring
  - Attainment monitoring
- Well-specific conclusions used with conceptual site model to demonstrate that:
  - The contaminant cleanup level for each COC has been met groundwater has met
  - Groundwater will continue to meet cleanup levels for all COCs in the future

Source: U.S. EPA, 2013, Guidance for Evaluating Completion of Groundwater Restoration Remedial Actions

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Monitored Natural Attenuation (MNA)

Use of MNA

- Not considered as a "no action" approach, but as an alternative means of achieving remediation objectives
- Should be selected only where it meets all relevant remedy selection criteria and where it will meet site remediation objectives within a timeframe that is reasonable compared to that offered by other methods.
- Does **not** imply that active remediation measures are infeasible or are "technically impracticable" from an engineering perspective.

Source: U.S. EPA, 1999, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.

Use of MNA (cont.)

- Use of MNA may be appropriate as one component of the total remedy, either in conjunction with active remediation or as a follow-up measure.
  - Source control measures must be evaluated
- MNA in-situ processes include biodegradation; dispersion; dilution; sorption; volatilization; radioactive decay; and chemical or biological stabilization, transformation, or destruction of contaminants.
  - EPA prefers processes that degrade or destroy contaminants

Source: U.S. EPA, 1999, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.

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MNA Pros and Cons

PROS

- Less remediation waste generated
- Reduced potential for cross-media transfer of contaminants
- Reduced risk of human exposure to contaminants
- May result in in-situ destruction of contaminants
- Less surface intrusion
- Potential for application to all or part of a site
- Can be used in conjunction with active remedy
- Potentially lower remediation costs

CONS

- Longer timeframes to achieve remediation objectives
- More complex/costly site characterization
- Toxicity/mobility of transformation products may exceed parent compound
- Long-term performance monitoring required
- Long-term ICs may be needed
- Potential for continued migration
- Environmental conditions may change and increase migration
- More outreach/education may be needed to gain public acceptance

Source: U.S. EPA, 1999, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.

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MNA Lines of Evidence

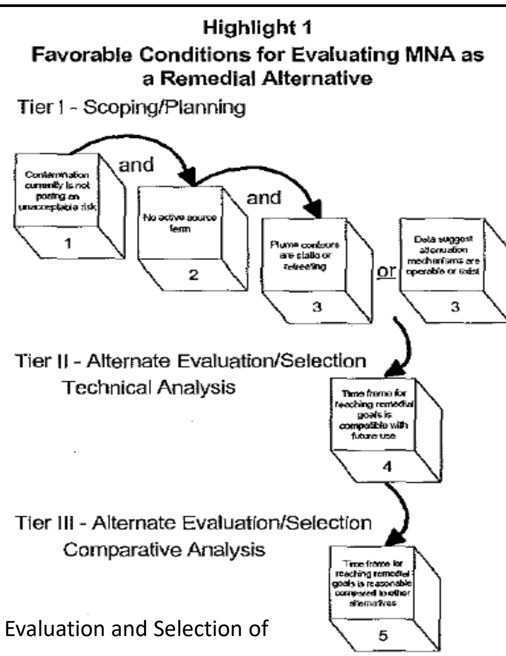
1. Data that demonstrate decreasing trend of contaminant mass and/or concentration over time
   - Statistically significant decreases in concentrations within individual wells along flow paths over time
2. Data that demonstrate **indirectly** the type(s) of natural attenuation processes active at the site and their rates
3. Data from field or microcosm studies which **directly** demonstrate the occurrence of a particular natural attenuation process at the site and its ability to degrade the COCs
   - Typically used for biological degradation processes only

Three-Tiered Approach where more information is collected as necessary

Source: U.S. EPA, 1999, Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites.

DOE Guidance on MNA

- DOE advocates the use of a "tiered" decision-making approach.
- Tiers are structured to streamline the MNA evaluation process while ensuring site resources are expended wisely.
- Data collection and modeling to support MNA are initiated only in those situations where MNA appears sufficiently promising.



Source: U.S. DOE, 1999, Decision-Making Framework Guide for Evaluation and Selection of Monitored Natural Attenuation Remedies at DOE Sites.

Key Considerations from DOE MNA Guidance

Tier I – Scoping/Planning
- Contamination currently not posing risk
- No active source term (releases to the plume/increasing plume mass)
- Plume perimeter is static or retreating
- Attenuation mechanisms are operable or exist

Tier II – Technical Analysis
- Determine time frame needed for MNA to attain remediation objectives
- DOE considers anticipated future land and groundwater use
- Protection during implementation
- Distance to potential receptors

Tier III – Risk Management Considerations
- Effectiveness (timeframe)
- Implementability (monitoring network)
- Cost (lifecycle)

Source: U.S. DOE, 1999, Decision-Making Framework Guide for Evaluation and Selection of Monitored Natural Attenuation Remedies at DOE Sites.

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Technical Impracticability (TI) Waivers

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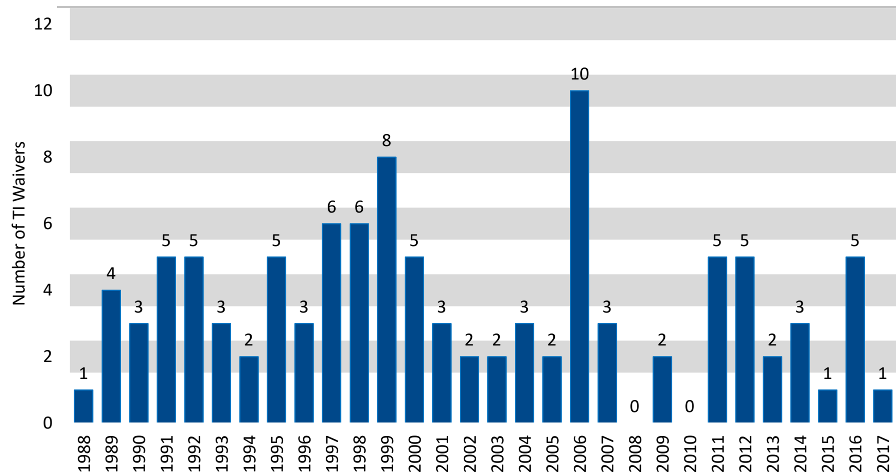
Technical Impracticability (TI) Waivers

- Superfund law allows for waivers of ARARs in limited circumstances
- TI just one of six waivers - most used
- TI waiver may be appropriate when compliance with an ARAR "is technically impracticable from an engineering perspective" (40 CFR 300.430(f)(2)(ii)(C)(3))
- Remedy must still be protective of human health and the environment

TI Waivers (cont.)

- 105 TI waivers granted to date
- Most TI waivers are for groundwater (a few for surface water)
- Waivers typically based on:
  - Inability to treat, remove or contain contaminants:
    - Contaminant chemical and physical properties
    - Complex subsurface geology/hydrogeology
    - Ineffective remedial technologies
  - Long remedial timeframe

TI Waivers per Fiscal Year (FY 1988-2017)



Total Number of TI Waivers = 105*

*11 of the 105 TI waivers are for federal facilities.

Source: U.S. EPA, 2020, Superfund Remedy Report, 16h Edition

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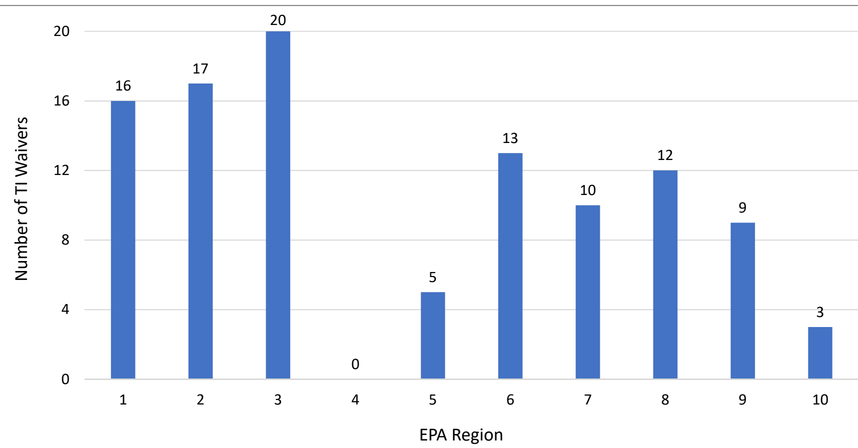
TI Waivers per Region (FY 1988-2014)



Total Number of TI Waivers = 105*

*11 of the 105 TI waivers are for federal facilities.

Adapted from: U.S. EPA, 2012, Summary of Technical Impracticability Waivers at National Priorities List Sites,

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Technical Impracticability (TI) Waivers

- ❑TI and other waivers may be considered, and under appropriate circumstances granted if the statutory criteria are met, when groundwater cleanup is impracticable; the waiver decision should be scientifically supported and clearly documented.
- ❑Requires review process with regional EPA offices and Headquarters/OLEM.
- ❑TI Evaluation should address these elements to help reviewers decide whether a TI waiver is appropriate based on the site-specific circumstances

Source: U.S. EPA, 2016, Clarification of the Consultation Process for Evaluating the Technical Impracticability of Groundwater Restoration at CERCLA Site

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Evaluating Technical Impracticability of Groundwater Restoration - Checklist

Source: U.S. EPA, 2016, Clarification of the Consultation Process for Evaluating the Technical Impracticability of Groundwater Restoration at CERCLA Sites.

- ❑Specific ARARs or Media Cleanup Standards
  - Specific ARARs for which TI waiver is sought
  - Technical feasibility of restoring some of the groundwater contaminants
- ❑Spatial Extent of TI Decisions
  - Spatial (vertical and horizontal) contaminant distribution in saturated and saturated zones
  - Spatial extent of TI zone as small as possible
- ❑Development and Purpose of the Conceptual Site Model (CSM)
  - Geologic and Hydrologic information
  - Contaminant distribution, transport, and fate parameters

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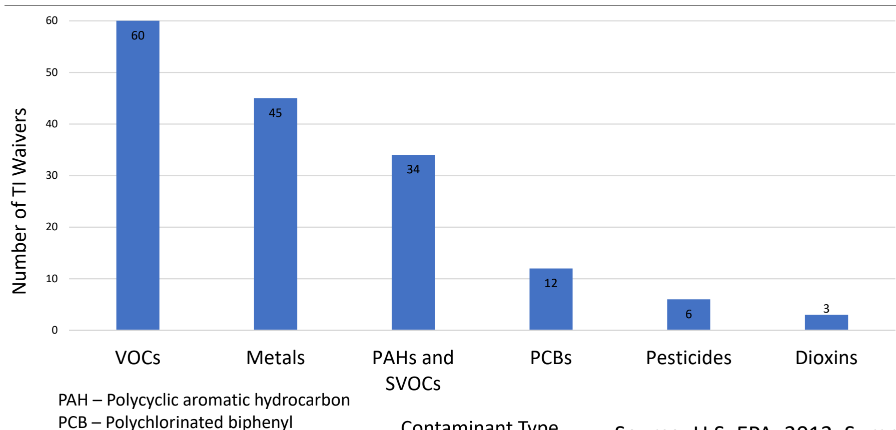
TI Evaluation Checklist

- Evaluation of Restoration Potential
  - Source control measures
  - Remedial action performance analysis
  - Restoration timeframe analysis
  - Other applicable technologies
- Cost Estimates
  - Estimates for potentially viable remedial alternatives
- Alternate Remedial Strategies
  - Strategy that is technically practicable, protective, and meets ARARs
- Additional Remedy Selection Considerations
  - Consider shorter timeframes to reduce exposures

Source: U.S. EPA, 2016, Clarification of the Consultation Process for Evaluating the Technical Impracticability of Groundwater Restoration at CERCLA Sites

Types of Contaminants Addressed by TI Waivers (FY 1988-2011)



Total Number of Waivers with Contaminant Information = 90

PAH – Polycyclic aromatic hydrocarbon
PCB – Polychlorinated biphenyl
SVOC – Semi-volatile organic compound
VOC – Volatile organic compound

Source: U.S. EPA, 2012, Summary of Technical Impracticability Waivers at National Priorities List Sites

Remedy Optimization

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EPA Remediation Optimization (2013)

- Efforts at <u>any phase</u> of the remedial response to
  - improve the effectiveness and
  - cost-efficiency
- May also improve
  - remedy's protectiveness and
  - long-term implementation which may facilitate progress towards site completion.
- Groundwater remedies may benefit from optimization efforts due to the long-term nature of the response and potential for changes to the conceptual site model

Source: U.S. EPA, 2013, Remediation Optimization: Definition, Scope and Approach

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Remediation Optimization (2013) (cont.)

- Review considers
  - the goals of the remedy,
  - available site data,
  - conceptual site model (CSM),
  - remedy performance, and
  - exit strategy.
- Activities include:
  - Examining site documents
  - Interviewing site stakeholders
  - Evaluating site data
  - Developing findings and recommendations
  - Compiling a report for the purposes of project documentation and technology transfer

Source: U.S. EPA, 2013, Remediation Optimization: Definition, Scope and Approach

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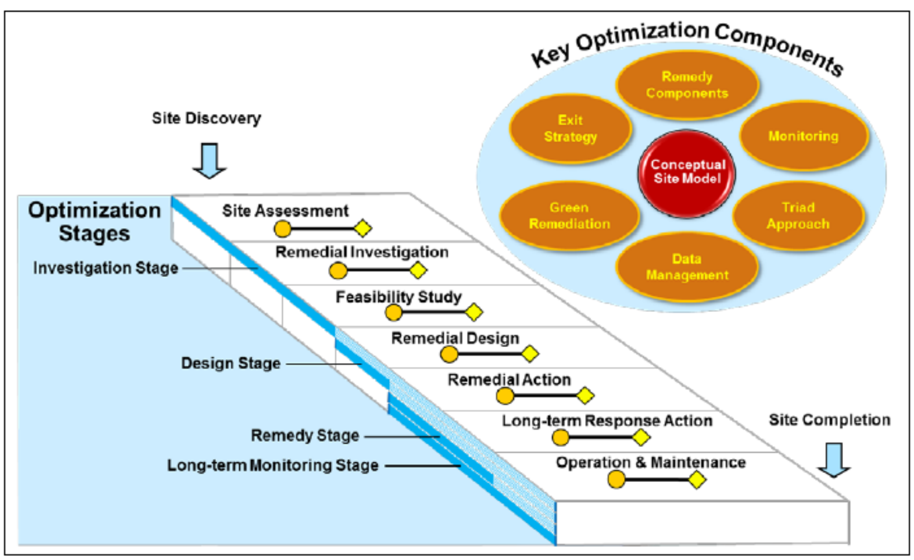
Figure 1 - Optimization Applied to Cleanup Activities from Site Assessment to Site Completion



Source: U.S. EPA, 2013, Remediation Optimization: Definition, Scope and Approach

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Optimization Review Report Outline

- A typical draft optimization review report or memorandum includes the following information:
  - Executive summary
  - General site background
  - Summary of the characterization or remediation objectives
  - Findings from document reviews, data analysis and interviews
  - Recommendations (including expected costs/savings implications) that address critical data gaps, remedy implementation, protectiveness, cost, and progress to site closure

Source: U.S. EPA, 2013, Remediation Optimization: Definition, Scope and Approach

DOE Guidance for Optimizing Groundwater Response Actions at DOE Sites

- Designing optimal response strategies includes:
  - Planning Response Priorities
  - Addressing Current or Imminent Risk
  - Groundwater Restoration Evaluation
  - Evaluation of Source Control Measures
  - Evaluation of Mass Reduction Measures
  - Monitoring
- Other consideration include:
  - Technical Impracticability
  - Transition and Exit Strategies
  - Communicating Groundwater Response Strategies

Source: Guidance for Optimizing Groundwater Response Actions at DOE Sites, DOE, 2002

DoD Remedial Optimization Policy (2012)

1. The DoD Component shall maximize DERP effectiveness and minimize the DERP financial liabilities and environmental footprint
2. The DoD Component shall, to the maximum extent possible, identify specific environmental restoration objectives
3. Optimization of remedial alternatives begins during the analysis of remedial alternatives when the DoD Component considers means to evaluate and improve the remedy over time
   - Optimization process continues through the operating life of the remedy to the end state condition

Source: DoD Manual 4715.2

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Adaptive Management at Groundwater Sites

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What is Adaptive Management?

- EPA's working definition:
  - Formal and systematic site or project management approach centered on rigorous site planning and firm understanding of site conditions and uncertainties
  - Rooted in sound use of science and technology
  - Decisions implemented consistent with CERCLA, the National Contingency Plan, and EPA policy and guidance
- Focus on taking action and learning: Encourages continuous re-evaluation and prioritization of activities to account for new information or changing conditions.

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What Adaptive Management is NOT

- Trial and error
- An end in itself
- A silver bullet
- One size fits all
- Make it up as we go

"adaptive management is a very powerful, yet poorly understood natural resource management tool…but (it) must be understood by those who use, support, fund, and challenge it."
-Van Cleve et al. 2003

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Adaptive Management Application at Sites with Contaminated Groundwater

Early in the Site Planning Process

- Establishes a site strategy considering a phased approach (use of early or interim response actions)
- Focuses resources on taking actions where there is sufficient information/certainty
- Targeted monitoring and assessment of early actions to collect information needed to reduce uncertainty and inform a final CERCLA remedy decision

Remedy Decision Implementation

- CERCLA, NCP, and EPA guidance compliant decision document (interim, final, contingency ROD)
- Phased remedy implementation approach
- Established interim objectives for each phase
- Monitor and assessment of first phase to determine scope of next phase actions

Adaptive Management Application at Sites with Contaminated Groundwater cont.

SIte Completion Strategies

- Design site-specific remedy evaluations (key decision points)
- Develop performance metrics and collect monitoring data
- Conduct remedy evaluations using site-specific metrics
- Make management decisions and remedy adjustments