Treatment System Optimization Resources Matrix

In accordance with Executive Order 14057, DoD evaluates remedial alternatives to ensure they are efficient; are environmentally, economically, and fiscally sound; consider sustainable practices; and reduce the environmental footprint of remediation systems. Optimization concepts include the development of a conceptual site model, realistic remedial action objectives (RAOs), performance objectives, and identification of treatment zones and exit strategies. Optimization efforts should not compromise data quality or environmentally responsible decision making. The objective of optimization is to maintain the efficiency and effectiveness of the remedial action and reduce the remedy's footprint.

This matrix provides DoD and Federal and State regulators resources to inform and consider how to optimize remedies at Defense Environmental Restoration Sites. The matrix includes the document title, publication date, a short description of the document's scope, the applicable Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) phase(s), and a link to the resource. The resources are sorted chronologically by the publishing organization. DoD compiled this matrix with input from the Best Practices for Cleanup Optimization Subgroup, under the Defense and State Memorandum of Agreement Steering Committee. Resources included have been published and issued by the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), DoD, Interstate Technology and Regulatory Council (ITRC), the U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA).

The information contained in this document is for general information purposes only and does not constitute an endorsement of or recommendation for any of the resources. This is not an all-inclusive list of optimization resources. The matrix is a living document and may be updated in the future as more information or additional resources are identified.

Resource	Publication Date	Description	CERCLA Phase	Resource(s) Link
ASTSWMO				
Optimizing for the Post Construction Phase of Superfund Sites Presentation	September 2019	This document is intended to help States in identifying efficient and effective adaptive Operational and Maintenance management practices that can be utilized to respond to changing conditions while ensuring protectiveness of human health and the environment.	RA-O	https://astswmo.org/files/Policies_and_Publications/CERCLA_and_Brownfields/2019-Optimizing-for-the-Post-Construction-Phase-of-Superfund-Sites.pdf

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Resource	Publication Date	Description	CERCLA Phase	Resource(s) Link
ASTSWMO Position Paper on Resource Conservation and Recovery Act (RCRA) Subtitle C Hazardous Waste Program Information and RCRA Info Database Operation and Maintenance	October 2016	Since the enactment of RCRA in 1976 and subsequent amendments, the EPA has developed and maintained several information systems. These evolving information management systems are necessary for tracking and maintaining information pertaining to the multitude of sites around the country involved in the generation, transportation, and management of hazardous waste.		https://astswmo.org/files/policies/Hazardous_Waste/ASTSWMO_Position_Paper_on_RCRAInfo_Issues_October_2016.pdf
DoD				
U.S. Army Corps of Engineers (USACE) Environmental Remedy Optimization Fact Sheet	September 2024	This fact sheet gives an overview of USACE Environmental and Munitions Center of Expertise's (EM CX) Remediation System Evaluation process.	RA-O	https://www.hnc.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/482099/environmental-remedy-optimization/
USACE Long-term Groundwater Monitoring Optimization Fact Sheet	September 2024	This fact sheet gives an overview of long-term monitoring optimization.	RA-O	https://www.hnc.usace.army.mil/Media/Fact-Sheets/Fact-Sheet-Article-View/Article/482118/long-term-groundwater-monitoring-optimization/
Department of the Navy's Optimization Webpage	N/A	This webpage includes the Navy's optimization policy, as well as other resources for optimization throughout the CERCLA process.	RI – RA-O	https://exwc.navfac.navy.mil/Products-and-Services/Environmental-Security/NAVFAC-Environmental-

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Resource	Publication Date	Description	CERCLA Phase	Resource(s) Link
				Restoration-and-BRAC/Focus-Areas/Optimization/
Department of the Navy's Guidance for Optimizing Remedial Action Operation	November 2012	This document provides guidance to the DON activities regarding optimization during various phases of the cleanup process at Navy installations.	RA-O	https://exwc.navfac.navy.mil/Portals/88/Documents/EXWC/Restoration/er_pdfs/gpr/navfacexwc-ev-ug-1301-opt-rao-20121001.pdf?ver=5eqQ5rqyUSM3RWWY-TZw8w%3D%3D
DOE				
Performance Assessment for Pump-and-Treat (P&T) Closure or Transition	September 2015	This document provides a structured approach for assessing P&T performance to support a decision to optimize, transition, or close a P&T remedy.	RA-O	https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-24696.pdf
Soil Vapor Extraction (SVE) System Optimization, Transition, and Closure Guidance Document	February 2013	The guidance presented here builds from existing guidance for SVE design, operation, optimization, and closure from the EPA, USACE, and the Air Force Center for Engineering and the Environment.	RA-O	https://www.pnnl.gov/publications/soil-vapor-extraction-system-optimization-transition-and-closure-guidance
EPA				
EPA Superfund Task Force Final Report – Recommendations 3 (page 22) and 6 (page 27)	September 2019	This report identifies multiple opportunities to accelerate cleanup and reuse of Superfund sites.	Multiple	https://semspub.epa.gov/work/HQ/100002231.pdf

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Resource	Publication Date	Description	CERCLA Phase	Resource(s) Link
Remediation Optimization: Definition, Scope, and Approach Primer	June 2013	This document provides a general definition, scope, and approach for conducting optimization reviews within the Superfund Program and includes the fundamental principles and themes common to optimization.	RA-O	https://clu-in.org/optimization/pdfs/OptimizationPrimer_final_June2013.pdf
National Strategy to Expand Superfund Optimization Practices from Site Assessment to Site Completion	September 2012	This National Strategy institutes changes to Superfund remedial program business processes to take advantage of newer tools and strategies that promote more effective and efficient cleanups.	All	https://semspub.epa.gov/work/HQ/174096.pdf
Optimization Strategies for Long-Term Ground Water Remedies Document	May 2007	This fact sheet discusses the principles and techniques for optimizing long-term ground water remedies, with particular emphasis on optimizing P&T systems.	RA-O	https://clu-in.org/download/remed/hyopt/542r07007.pdf
A Cost-Comparison Framework for Use in Optimizing Ground Water Pump and Treat Systems	May 2007	This fact sheet discusses a framework for comparing costs of remedial alternatives or modifications in conjunction with the optimization of long-term ground water remedies, including P&T systems.	FS, RA-O, RD	https://clu-in.org/download/remed/hyopt/542r07005.pdf

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Resource	Publication Date	Description	CERCLA Phase	Resource(s) Link
Roadmap to Long-Term Monitoring Optimization	May 2005	This roadmap focuses on optimization of established long-term monitoring programs for groundwater. Tools and techniques discussed concentrate on methods for optimizing the monitoring frequency and spatial (three-dimensional) distribution of wells (i.e., physical program optimization).	RA-O	https://clu-in.org/download/char/542-r-05-003.pdf

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Resource	Publication Date	Description	Relevant Section(s)	CERCLA Phase	Resource(s) Link
ITRC					
Sustainable and Resilient Remediation (SRR) Guidance	April 2021	This guidance updates ITRC's Green and Sustainable Remediation: A Practical Framework (2011). The SSR includes Federal and state best practices, expanded information on social and economic evaluation tools, an updated framework on how and why sustainability and resilience should be integrated into a project's life cycle, and checklists.	Section 4 Section 6 Section 7	RI – RA-O	https://srr-1.itrcweb.org/
Performance-Based Optimization of Pump and Treat Systems Guidance Document and Fact Sheet	Guidance Document: June 2023 Fact Sheet: May 2021	This document provides comprehensive guidance and a systemic and adaptive framework for the optimization of these systems.	Section 2	RA-O, FS	Pump and Treat Home: https://pt-1.itrcweb.org/
Optimizing Injection Strategies and In situ Remediation Performance Guidance Document	February 2020	The design wheel involves consideration of the amendment, delivery method, and dose simultaneously throughout the in situ remedial design characterization, design, implementation, and monitoring process.	Section 3.1	RA-O, RD, RI	https://ois-isrp-1.itrcweb.org/

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Resource	Publication Date	Description	Relevant Section(s)	CERCLA Phase	Resource(s) Link
Light Non-Aqueous Phase Liquid (LNAPL) Site Management: LNAPL Conceptual Site Model (LCSM) Evolution, Decision Process & Remedial Technologies	March 2018	This guidance provides a framework to develop LCSM to identify specific LNAPL concerns; establish appropriate LNAPL remedial goals and objectives for identified LNAPL concerns; select technologies to best achieve LNAPL remedial goals; and evaluate implemented remedial technologies.	Section 4 Section 5 Section 6	RI – RA-O	https://lnapl-3.itrcweb.org/
Geospatial Analysis for Optimization at Environmental Sites Checklist	November 2016	The purpose of this checklist is to address common questions about geospatial analysis. This checklist can be used to explain the use of geospatial analysis at an environmental site.	Using Analysis Results for Optimization	RI – RA-O	https://gro-1.itrcweb.org/review-checklist/
Using Remediation Risk Management to Address Groundwater Cleanup Challenges at Complex Sites Guidance Document	January 2012	This document applies the framework of project risk management for site remediation to identify and manage groundwater remediation at complex sites.	N/A		https://itrcweb.org/risk-management-groundwater-complex-sites/

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Resource	Publication Date	Description	Relevant Section(s)	CERCLA Phase	Resource(s) Link
Integrated dense, nonaqueous-phase liquid (DNAPL) Site Strategy Guidance Document	November 2011	Discusses optimizing the monitoring and remedial processes through the cleanup of DNAPL sites.	Section 5.6 Section 6.2 Table 6-2 Section 6.3	RI – RA-O	https://idss-2.itrcweb.org/
Development of Performance Specifications for Solidification/Stabilization Guidance Document	July 2011	Presents an overview of the material performance goals and the general role of performance specifications in the design and implementation process.	Section 3 Section 4	RD, RA-C	https://itrcweb.org/wp-content/uploads/2024/09/ss-1.pdf#page=8
Use and Measurement of Mass Flux and Mass Discharge Guidance Document	August 2010	Mass flux/discharge estimates can be used to evaluate changes within the source zone or plume, remedy performance, and system optimization.	Section 3.4	RI – RA-O	https://maf-1.itrcweb.org/
Phytotechnology Technical and Regulatory Guidance and Decision Trees, Revised Guidance Document	February 2009	Discusses reviewing, updating, and optimizing remediation systems.	Section 2.3.3.4	RI – RA-O	https://itrcweb.org/wp-content/uploads/2024/09/PHYTO-3.pdf#page=7

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Resource	Publication Date	Description	Relevant Section(s)	CERCLA Phase	Resource(s) Link
Improving Environmental Site Remediation Through Performance-Based Environmental Management Guidance Document	November 2007	RPO allows for systematic evaluation and refinement of remediation processes to ensure that human health and the environment are being protected over the long term at minimum risk and cost.	Section 3.5	RI – RA-O	https://itrcweb.org/wp-content/uploads/2024/12/RPO-7.pdf
Exit Strategy–Seeing the Forest Beyond the Trees Technology Overview	March 2006	Discusses the common obstacles to implementing a performance-based exit strategy.	N/A	RD, RA-O	https://itrcweb.org/exit-strategy-rpo/
Above-Ground Treatment Technologies Technology Overview	March 2006	Identifies optimization considerations for above-ground treatment systems and common problems to look for when conducting optimization studies. Prepared in support of the RPO guidance.	N/A	RA-O	https://itrcweb.org/above-ground-treatment/

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Resource	Publication Date	Description	Relevant Section(s)	CERCLA Phase	Resource(s) Link
Identifying Opportunities for Enhanced and More Efficient Site Remediation	September 2004	Provides guidance on how to systematically evaluate and refine remediation processes to ensure that (1) the remediation process progresses to site cleanup objectives and (2) selected remedial approaches attain objectives and remain protective of human health and the environment.	Section 3	RI – RA-O	https://itrcweb.org/increased-efficiency-rpo/
Strategies for Monitoring the Performance of DNAPL Source Zone Remedies Guidance Document	August 2004	Discusses two types of performance monitoring: remedial effectiveness monitoring and system efficiency monitoring.	Section 5.1 Table 5-2	RD, RA-O	https://itrcweb.org/wp-content/uploads/2024/09/DNAPLs-5.pdf#page=6