

**LONG-TERM MANAGEMENT/OPTIMIZATION CASE STUDIES**

Agency	Case Study Title, Date	Description	Website	Technology	Techniques used
<b>Total Number of Case Studies: 74</b>					
<b>Optimization efforts implemented (as described in case studies)</b>					
Navy	Naval Air Station Pensacola, Optimization of RAO to Treat Chlorinated Hydrocarbons in Groundwater (Date Unknown)	Describes cost reductions in long-term monitoring, including reducing sampling frequency and number of constituents being analyzed.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_pensacola.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_pensacola.pdf</a>	P&T	Cost reductions in long-term monitoring
Navy	Naval Submarine Base Kings Bay (In-Situ Chemical Oxidation) (Date Unknown)	Describes system optimization, such as implementing in situ chemical oxidation in addition to pump and treat, to reduce contaminant concentrations in source areas. MNA was implemented to address residual concentrations.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_kingsbay.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_kingsbay.pdf</a>	P&T	Alternate remedies (MNA)
Navy	Groundwater Monitoring Case Study: Industrial Wastewater Treatment Plant/Sludge Drying Beds, MCLB Albany, Georgia, July 1999	Describes cost reductions in long-term monitoring, including reducing sampling frequency at a former sludge drying bed site from quarterly to semiannually, and significantly reducing the number of contractor maintenance visits.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/MCLBAlbany.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/MCLBAlbany.pdf</a>	Groundwater monitoring	Cost reductions in long-term monitoring
Navy	Groundwater Monitoring Case Study: Eastern Plume, NAS Brunswick, Maine, July 1999	Describes cost reductions in long-term monitoring, including reducing the number of wells to be sampled and the sampling frequency.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/NASBrunswick.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/NASBrunswick.pdf</a>	Groundwater monitoring	Cost reductions in long-term monitoring
Navy	Groundwater Monitoring Case Study: Sludge Drying Beds, NAS Pensacola, Florida, July 1999	Describes cost reductions in long-term monitoring, including reducing the sampling frequency at a former sludge drying bed and surge point site, and reducing the number of monitoring wells. NAS Pensacola is currently investigating natural attenuation, hot spot source reduction, and the possibility of ceasing pump and treat operations to further optimize the cost effectiveness of the program.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/NASPeninsula.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/NASPeninsula.pdf</a>	Groundwater monitoring	Alternate remedies (MNA)
FRTR	Pump and Treat of Contaminated Groundwater at the City Industries Superfund Site, Orlando, Florida, September 1998	Describes modifications to P&T extraction system, including increasing pumping from leading edge of plume and decreasing pumping from upgradient wells.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction system
FRTR	Pump and Treat of Contaminated Groundwater at the Des Moines TCE Superfund Site, OU 1, Des Moines, Iowa, September 1998	Describes modifications to P&T system, including changing air stripper media from spherical to chandelier type, and adding anti-corrosion and biofouling agents to the air stripper media.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T system
FRTR	Pump and Treat of Contaminated Groundwater at the Former Firestone Facility Superfund Site, Salinas, California, September 1998	Describes modifications to P&T extraction system, including installing 10 additional wells off-site and increasing overall pumping rate for a 2-week period.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T system

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FRTR	Pump and Treat and Permeable Reactive Barrier to Treat Contaminated Groundwater at the Former Intersil, Inc. Site, Sunnyvale, California, September 1998	Describes modifications to P&T system, including upgrading system and switching to PRB in 1995.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T system; Alternate remedies (PRB)
FRTR	Pump and Treat of Contaminated Groundwater at the JMT Facility RCRA Site, Brockport, New York, September 1998	Describes modifications to extraction and treatment system, including conducting full-scale rehabilitation of extraction well, installing an electrical and piping box at extraction well, and constructing an enclosure around the treatment system to consolidate system operation in one building.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the Keefe Environmental Services Superfund Site, Epping, New Hampshire, September 1998	Describes modifications to extraction system, including constructing two replacement extraction wells.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the Mid-South Wood Products Superfund Site, Mena, Arkansas, September 1998	Describes modifications to extraction and treatment system, including removing five extraction wells, continuously adjusting pumping schedule of extraction wells, and adding a carbon treatment system for one year.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the Odessa Chromium I Superfund Site, OU 2, Odessa, Texas, September 1998	Describes modifications to extraction and treatment system, including adding three injection wells, converting two monitoring wells to recovery wells, adding a chamber to the reaction tank, and adding a backwash unit for the filter.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the Odessa Chromium IIS Superfund Site, OU 2, Odessa, Texas, September 1998	Describes modifications to extraction and treatment system, including adding two injection wells, installing a recovery well, adding a chamber to the reaction tank, and adding a backwash unit for the filter.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the Old Mill Superfund Site, Rock Creek, Ohio, September 1998	Describes modifications to extraction and treatment system, including adding three collection trenches, and replacing two carbon canisters with one.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system

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FRTR	Pump and Treat of Contaminated Groundwater at the SCRDI Dixiana Superfund Site, Cayce, South Carolina, September 1998	Describes modifications to extraction and treatment system, including adding a collection trench, reducing extraction wells by five, and replacing the tower air-stripper with a shallow air-stripper.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the Sol Lynn/Industrial Transformers Superfund Site, Houston, Texas, September 1998	Describes modifications to extraction and treatment system, including adjusting the pumping strategy because additional contamination in the silty aquifer identified.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the Solid State Circuits Superfund Site, Republic, Missouri, September 1998	Describes modifications to extraction and treatment system, including adding three wells off-site to contain the plume, and electronically linking the air stripper blower to transfer pumps so blower would shut off when not pumping.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat and Containment of Contaminated Groundwater at the Sylvester/Gilson Road Superfund Site, Nashua, New Hampshire, September 1998	Describes modifications to extraction system, including adding six extraction wells.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction system
FRTR	Pump and Treat of Contaminated Groundwater at the U.S. Aviox Superfund Site, Niles, Michigan, September 1998	Describes modifications to extraction and treatment system, including adjusting pumping rates for each well continuously to optimize the system based on the concentration data for each well, and adding pH adjustments to reduce scaling of equipment and discharge piping.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the United Chrome Superfund Site, Corvallis, Oregon, September 1998	Describes modifications to extraction and treatment system, including turning off some extraction wells, flushing some areas, switching to sending untreated water to POTW, and injecting deep aquifer water into upper aquifer.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Pump and Treat of Contaminated Groundwater at the Western Processing Superfund Site, Kent, Washington, September 1998	Describes modifications to extraction and treatment system, including discontinuing operation of 210 shallow well points, installing deep wells, and adding metals precipitation to the treatment system.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction & treatment system
FRTR	Enhanced In Situ Bioremediation Process at the ITT Roanoke Site, Roanoke, VA, (Date Unknown)	Process optimization and modifications (no further details provided).	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T system

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FRTR	Pump and Treat and Air Sparging of Contaminated Groundwater at the Gold Coast Superfund Site, Miami, Florida, September 1998	Describes modifications to extraction system, including enlarging two extraction wells, shutting down system for four months, conducting air sparging in source areas, and adding peroxide to wells for a certain period of time.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T	Modifications to P&T extraction system
FRTR	Pump and Treat and In Situ Bioremediation of Contaminated Groundwater at the French Ltd. Superfund Site, Crosby, Texas, September 1998	Describes modifications to treatment system, including adding second sheet-pile wall around DNAPL.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T, In Situ Bioremediation	Modifications to P&T treatment system
FRTR	Pump and Treat and In Situ Bioremediation of Contaminated Groundwater at the Libby Groundwater Superfund Site, Libby, Montana, September 1998	Describes modifications to extraction and treatment system, including testing and converting to low-shear pumps, abandoning four extraction wells and constructing a new one, and replacing a peroxide system for aeration of in situ bioremediation of source water with a bubbleless system.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T, In Situ Bioremediation	Modifications to P&T extraction & treatment system; Alternate remedies (In situ bioremediation)
FRTR	Pump and Treat, In Situ Bioremediation, and In Situ Air Sparging of Contaminated Groundwater at Site A, Long Island, New York, September 1998	Describes modifications to extraction system, including expanding the system by adding more sparging wells to address additional contamination discovered during demolition activities.	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	P&T, In Situ Bioremediation	Modifications to P&T extraction system
FRTR	Phytoremediation Using Constructed Wetlands at the Milan Army Ammunition Plant, Milan, Tennessee, June 2000	Long-term monitoring and optimization conducted (no further details provided).	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	Phyto-remediation	Long-term monitoring
FRTR	Soil Vapor Extraction at Camp LeJeune Military Reservation, Site 82, Area A, Onslow County, North Carolina, July 1999	SVE optimization conducted (no further details provided).	<a href="http://www.frtr.gov/costperf.htm">http://www.frtr.gov/costperf.htm</a>	SVE	SVE optimization
<b>Optimization efforts evaluated (as described in case studies)</b>					
Air Force	Draft RPO Report For Operable Unit D, McClellan Air Force Base, California, October 2000	Provides recommendations for modification of the existing groundwater P&T system, including identifying the wells removing the greatest mass and terminating operations at others, conducting regular SVE equilibrium testing, and evaluating the cost effectiveness of the current SVE catalytic oxidation treatment system.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/r172/McClellan_Draft_OU_D_Report.doc">http://www.afcee.brooks.af.mil/er/rpo/reports/r172/McClellan_Draft_OU_D_Report.doc</a>	P&T	RPO; Modifications to P&T extraction system

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Air Force	RPO Phase II Evaluation Report for OUs 1 and 4, Defense Depot Hill, Utah, (Date unknown)	Provides recommendations for optimization of P&T system, including cessation of operation with continued monitoring of groundwater conditions for one year for OU 1, and maintaining operation of system for OU 2 until cis-1,2-DCE concentrations fall below MCL, followed by elimination of 14 extraction wells and 16 injection wells.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/dla/DDH_U_Eval_Report.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/dla/DDH_U_Eval_Report.pdf</a>	P&T	RPO; Modifications to P&T extraction system
Air Force	RPO Scoping Visit (RSV) Defense Supply Center Richmond (DSCR) Draft Report 25-28 September 2000	Provides recommendations based on a Remedial Process Optimization evaluation, including performing quantitative trend analysis of plume, evaluating pump and treat extraction well effectiveness, and studying and reviewing MNA to verify appropriateness as an alternative technology.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/dla/DSCR_RSV_final.doc">http://www.afcee.brooks.af.mil/er/rpo/reports/dla/DSCR_RSV_final.doc</a>	P&T	RPO; Modifications to P&T extraction system; Alternate remedies (MNA)
Air Force	RPO Report for Operable Unit 1 Northeast Disposal Area - George AFB, November 2000	Provides recommendations for short-term P&T system modifications, including removing 11 of the existing 18 wells in the extraction network from service, reducing the system flow rate by as much as 50 percent, and evaluating alternate treatment and disposal options for extracted groundwater.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Final_George_RPO.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Final_George_RPO.pdf</a>	P&T	RPO; Modifications to P&T extraction system
Air Force	Final RPO Report for Site LF014 Contaminant Plume Zone 1, Kelly AFB, TX, July 2000	Provides an evaluation of alternatives to the existing extraction well system at Site LF014 to provide improved containment of groundwater. Other remedial actions under consideration include installation of a SVE system in the northwestern portion of the site, and regrading/revegetation of the site to minimize precipitation infiltration and resultant leachate generation.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Kelly_AFB_LF014.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Kelly_AFB_LF014.pdf</a>	P&T	RPO; Alternate remedies (MNA)
Air Force	RPO Scoping Visit Report and Final Work Plan for the Phase II RPO Evaluation at Castle AFB, California, August 2000	Work plan for the RPO Phase II Evaluation planned at Castle AFB.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Castle_RSV.doc">http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Castle_RSV.doc</a>	P&T	RPO
Air Force	AFCEE RPO Scoping Visit Draft Report Hanscom AFB, MA 30 October - 2 November 2000	Contains an evaluation of 8 sites at Hanscom Air Force Base amenable to optimization, and provides specific recommendations	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/hanscom_draft_rsv_report.doc">http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/hanscom_draft_rsv_report.doc</a>	P&T, Free Product Recovery	RPO
Air Force	RPO Report For Site SD-57 Mather Air Force Base, California, June 2001	Provides an assessment of the effectiveness and efficiency of remediation systems currently in operation for treatment of hydrocarbon-contaminated soils at Site SD-57, as well as a plume of hydrocarbon-contaminated groundwater originating at Site SD-57. Evaluates supplemental or alternative treatment technologies that could potentially be applied at the site, and to determine if cleanup goals can be met more quickly and cost effectively by implementing these technologies.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Mather_Phase_II_Eval.doc">http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Mather_Phase_II_Eval.doc</a>	P&T, SVE	RPO; Alternate remedies
Air Force	RPO Report for Operable Unit No. 1 - Hill AFB, December 2000	Provides recommendations for modification of the Internal Draft Performance Standard Verification Plan, to include suggested text regarding procedures and methodologies for statistical evaluations of groundwater monitoring data.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Hill_OU1_Report.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Hill_OU1_Report.pdf</a>	Groundwater monitoring	RPO

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Air Force	Groundwater Monitoring Program Evaluation Report for Sites OT-17, LF-03, and LF-04, Robins AFB, GA, May 2001	Presents the results of the groundwater monitoring program evaluation for Installation Restoration Program sites OT-17, Landfill 3, and Landfill 4 at Robins Air Force Base in Warner Robins, Georgia.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Robins_GW_Eval_Rpt.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Robins_GW_Eval_Rpt.pdf</a>	Groundwater monitoring	Groundwater monitoring program evaluation
Air Force	Phase II RPO Evaluation Report for the Building 1325 UST Site, Castle Airport, California, February 2001	Provides results of the Phase II Remedial Process Optimization evaluation performed by Parsons Engineering Science, Inc. at the Building 1325 underground storage tank site at Castle Airport, including providing a strategy for achieving regulatory site closure.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Castle_1325_Eval.doc">http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Castle_1325_Eval.doc</a>	MNA	RPO
Air Force	Final RPO Scoping Visit Report Defense Distribution Depot Susquehanna, Pennsylvania, October 2001	Provides recommendations for system optimization, including evaluating the role of phytoremediation in natural attenuation of dissolved VOCs in the South Central Plume, and evaluating the processes, past practices, and precedents of implementing off-installation institutional controls for addressing the groundwater and surface water pathways	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/to24/Susquehanna_Final_RSV_Rept.doc">http://www.afcee.brooks.af.mil/er/rpo/reports/to24/Susquehanna_Final_RSV_Rept.doc</a>	Phyto-remediation	RPO; Alternate remedies (phytoremediation)
Air Force	RPO Phase II Evaluation Report for Defense Depot Memphis, TN. June 2001	Provides recommendations for optimizing SVE system, including considering deletion of four monitoring wells from current Dunn Field monitoring program, considering deletion of SVOCs and pesticides from target analyte list, and clarifying fraction organic carbon content of the fluvial aquifer to better predict cleanup time frames and plume migration distances.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/dla/DDMT_Final_Phase_II_Eval.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/dla/DDMT_Final_Phase_II_Eval.pdf</a>	SVE	RPO; Optimization of SVE system
Air Force	RPO Phase II Evaluation Report for the Tracy Defense Distribution Depot, San Joaquin, CA, May 2001	Provides recommendations for SVE system optimization, including focusing SVE in TCE/PCE hot spots, eliminating off-gas treatment of SVE vapor effluent based on system monitoring data, and implement passive extraction of SVE systems during inactive periods of system cycling.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/dla/Tracy_Final_Phase_II_Eval.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/dla/Tracy_Final_Phase_II_Eval.pdf</a>	SVE	RPO; Optimization of SVE system
Air Force	RPO Report for Site 5/15 Contaminant Plume South Base Operable Unit No. 2 - Edwards AFB, February 2000	Provides recommendations to improve SVE system performance, including terminating operation of the liquid-recovery system and reducing the SVE system flow rate by 20%, reducing the frequency of sampling, and reducing the number of groundwater monitoring wells sampled from 56 to 16.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Edwards_RPO.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Edwards_RPO.pdf</a>	SVE	RPO; Optimization of SVE system
Air Force	RPO Phase II Evaluation Report for the Sharpe Defense Distribution Depot, San Joaquin, CA, February 2001	Provides recommendations for optimizing SVE system, including selecting and implementing site-specific soil cleanup goals, discontinuing active SVE operations at specific sites, focusing SVE to TCE hot spots at the remaining active SVE sites, eliminating off-gas treatment of SVE vapor effluent based on system monitoring data, and implementing passive extraction of SVE systems during inactive periods of system cycling.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/dla/DDJC_Sharpe_Eval.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/dla/DDJC_Sharpe_Eval.pdf</a>	SVE	RPO; Optimization of SVE system
Air Force	RPO Report for Building 3001 - Tinker AFB, December 2000	Provides an evaluation of the feasibility of using SVE to remediate source-area soils.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Final_Tinker_RPO.pdf">http://www.afcee.brooks.af.mil/er/rpo/reports/r172/Final_Tinker_RPO.pdf</a>	SVE	RPO

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Air Force	Phase II RPO Evaluation Report for the Fire Training Area 1 Site, Castle Airport, California, August 2001	Provides results of the Phase II Remedial Process Optimization evaluation performed by Parsons Engineering Science, Inc. at the Fire Training Area 1 site at Castle Airport, including evaluation of the soil vapor extraction system and recommendations for regulatory site closure.	<a href="http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Castle_FTA-1_Eval.doc">http://www.afcee.brooks.af.mil/er/rpo/reports/afbca/Castle_FTA-1_Eval.doc</a>	SVE	RPO
Navy	Long Term Monitoring Optimization Case Study, MCB Camp Lejeune, North Carolina, August 1999	Provides recommendations for optimization of long-term monitoring of pump and treat systems, including reducing number of monitoring points, reducing the duration and frequency of monitoring, field-procedure efficiency improvements, and simplification of analyses.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/MCBCampLejeune.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/MCBCampLejeune.pdf</a>	P&T	Long-term monitoring of P&T systems
Navy	Long Term Monitoring Optimization Case Study, NAS Patuxent River, Maryland, August 1999	Provides recommendations for optimization of long-term monitoring, including considering eliminating two or three wells, reducing monitoring from quarterly to semi-annually, investigating the potential for using micropurging techniques by determining if well recharge is adequate, and reducing the analyte list.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/paxriver(11-15-99).pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/paxriver(11-15-99).pdf</a>	P&T	Long-term monitoring of P&T systems
Navy	Long Term Monitoring Development Case Study, NWIRP Dallas, Texas, September 1998	Provides recommendations for optimization of long-term monitoring, including eliminating approximately 80% of the installation monitoring points from the monitoring program, reducing sampling frequency, refining micropurging techniques, decreasing the analyte list, and coordinating the monitoring database with a GIS application.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/dallasfinal(11-15-99).pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/dallasfinal(11-15-99).pdf</a>	P&T	Long-term monitoring of P&T systems
Navy	Marine Corps Base Camp Lejeune, Operable Units 1 and 2 (Pump and Treat Systems), January 2000	Provides recommendations for optimization of long-term monitoring, including shutting down the OU 1 North system once contaminant mass removal from certain extraction wells reach asymptotic levels, consider using MNA as the long-term remedy, shutting down operation of the OU 1 South system at the earliest opportunity, and delineating the extent of contamination in the shallow and deep aquifer zones of OU 2.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_lejeune.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_lejeune.pdf</a>	P&T	Additional delineation of contaminant plume; Alternate remedies (MNA)
Navy	Marine Corps Base Camp Lejeune, Campbell Street Fuel Farm (Pump and Treat Systems), January 2000	Provides recommendations for optimization of long-term monitoring, including shutting down specific trenches, continuing hot spot removal on an interim basis, and gathering MNA data to confirm the potential of a passive remedial approach for AS-143 once remaining hot spots have been removed.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_csff.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_csff.pdf</a>	P&T	Alternate remedies (MNA)
Navy	Naval Air Station Brunswick, Eastern Plume (Pump and Treat System), January 2000	Provides recommendations for optimization of long-term monitoring, including beginning a formal evaluation of MNA, continue and enhance mass removal in the Eastern Plume, and modify the aboveground treatment system to allow effluent discharge to surface water.	<a href="http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_brunswick.pdf">http://enviro.nfesc.navy.mil/erb/erb_a/support/wrk_grp/raoltm/case_studies/rao_brunswick.pdf</a>	P&T	Alternate remedies (MNA)

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<b>Agency</b>	<b>Case Study Title, Date</b>	<b>Description</b>	<b>Website</b>	<b>Technology</b>	<b>Techniques used</b>
EPA	Remediation System Evaluation, Silresim Chemical Corp. Superfund Site, December 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including establishing a target capture zone for each layer in the groundwater flow model, utilizing enhanced particle tracking techniques for capture zone analysis, and conducting periodic monitoring of sediments in specific areas for VOCs.	<a href="http://clu-in.org/download/remed/rse/silresim.pdf">http://clu-in.org/download/remed/rse/silresim.pdf</a>	P&T	RSE; Modifications to P&T system; Groundwater flow models; Capture zone analysis
EPA	Remediation System Evaluation, Oconomowoc Electroplating Superfund Site. August 2000	Provides recommendations for potential modifications to existing groundwater P&T system, including a capture zone analysis and additional delineation of groundwater contamination.	<a href="http://clu-in.org/download/remed/rse/oconomowoc.pdf">http://clu-in.org/download/remed/rse/oconomowoc.pdf</a>	P&T	RSE; Modifications to P&T system; Capture zone analysis
EPA	Remediation System Evaluation, MacGillis and Gibbs Superfund Site. February 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including developing and updating a target capture zone for PCP and chromium, regularly evaluating actual capture compared to target zone, implementing a long-term monitoring plan for specific aquifers, improving site security, and evaluating proposed new building that will potentially overlie NAPL.	<a href="http://clu-in.org/download/remed/rse/macgillis.pdf">http://clu-in.org/download/remed/rse/macgillis.pdf</a>	P&T	RSE; Modifications to P&T system; Capture zone analysis
EPA	Remediation System Evaluation, Elmore Waste Disposal Superfund Site. April 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including additional characterization to better define plume, formal capture zone analysis, indoor air sampling, and surface water sampling.	<a href="http://clu-in.org/download/remed/rse/elmore.pdf">http://clu-in.org/download/remed/rse/elmore.pdf</a>	P&T	RSE; Modifications to P&T system; Capture zone analysis
EPA	Remediation System Evaluation, FCX Statesville Superfund Site. March 2002	Provides recommendations for potential modifications to existing groundwater P&T system, including updating target containment zone, cleaning up site, and improving or replacing existing treatment system enclosure and header piping.	<a href="http://clu-in.org/download/remed/rse/fcx_statesville.pdf">http://clu-in.org/download/remed/rse/fcx_statesville.pdf</a>	P&T	RSE; Modifications to P&T system
EPA	Remediation System Evaluation, Bayou Bonfouca Superfund Site, June 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including evaluating containment of free and dissolved phase contamination, and determining effectiveness of remedy in limiting migration of site-related contaminants into bayou.	<a href="http://clu-in.org/download/remed/rse/bonfouca.pdf">http://clu-in.org/download/remed/rse/bonfouca.pdf</a>	P&T	RSE; Modifications to P&T system
EPA	Remediation System Evaluation, Mattiace Petrochemical Superfund Site, July 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including analyzing capture zones for groundwater extraction and delineating contaminant plume.	<a href="http://clu-in.org/download/remed/rse/mattiace.pdf">http://clu-in.org/download/remed/rse/mattiace.pdf</a>	P&T	RSE; Modifications to P&T system; Capture zone analysis
EPA	Remediation System Evaluation, Hellertown Manufacturing Superfund Site, November 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including installing an additional monitoring well downgradient of the site to help delineate the plume, implementing institutional controls and deed restrictions, and investigating possible presence of an additional source area.	<a href="http://clu-in.org/download/remed/rse/hellertown.pdf">http://clu-in.org/download/remed/rse/hellertown.pdf</a>	P&T	RSE; Modifications to P&T system; Additional delineation of contaminant plume

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EPA	Remediation System Evaluation, Raymark Superfund Site, December 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including more accurate plume delineation and evaluation of capture zone, sealing of unused wells, and conducting indoor air monitoring.	<a href="http://clu-in.org/download/remed/rse/raymark.pdf">http://clu-in.org/download/remed/rse/raymark.pdf</a>	P&T	RSE; Modifications to P&T system; Additional delineation of contaminant plume
EPA	Remediation System Evaluation, Claremont Polychemical Superfund Site, March 2002	Provides recommendations for potential modifications to existing groundwater P&T system, including converting depth-to-water measurements to water levels, analyzing process data and quarterly aquifer data, and better delineating the VOC plume.	<a href="http://clu-in.org/download/remed/rse/claremont.pdf">http://clu-in.org/download/remed/rse/claremont.pdf</a>	P&T	RSE; Modifications to P&T system; Additional delineation of contaminant plume
EPA	Remediation System Evaluation, Ott/Story/Cordova Superfund Site, March 2002	Provides recommendations for reducing life-cycle costs of existing groundwater P&T system.	<a href="http://clu-in.org/download/remed/rse/osc.pdf">http://clu-in.org/download/remed/rse/osc.pdf</a>	P&T	RSE
EPA	Remediation System Evaluation, Brewster Wellfield Superfund Site, April 2002	Provides recommendations for potential modifications to existing groundwater P&T system, including conducting a GeoProbe investigation in a specified area followed by installation and groundwater sampling, defining the target capture zone, and refining the site conceptual model.	<a href="http://clu-in.org/download/remed/rse/brewster.pdf">http://clu-in.org/download/remed/rse/brewster.pdf</a>	P&T	RSE; Modifications to P&T system; Groundwater flow model
EPA	Remediation System Evaluation, Selma Pressure Treating Superfund Site, January 2002	Provides recommendations for potential modifications to existing groundwater P&T system, including conducting a capture zone analysis, clearly delineating plume boundaries, developing potentiometric surface maps, and using the groundwater flow model to optimize the extraction system by relocating wells or adjusting pumping rates.	<a href="http://clu-in.org/download/remed/rse/selma.pdf">http://clu-in.org/download/remed/rse/selma.pdf</a>	P&T	RSE; Modifications to P&T system; Capture zone analysis; Additional delineation of contaminant plume
EPA	Remediation System Evaluation, Midland Products Superfund Site, June 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including delineating contaminant plume more accurately, and sampling for carrier oils quarterly for one year.	<a href="http://clu-in.org/download/remed/rse/midland.pdf">http://clu-in.org/download/remed/rse/midland.pdf</a>	P&T	RSE; Modifications to P&T system; Additional delineation of contaminant plume
EPA	Remediation System Evaluation, Savage Municipal Water Supply Superfund Site, September 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including reconfiguring system to dispose recovered solvent offsite, evaluating effectiveness of capture outside slurry wall, relocating recharge points beyond influence of extraction wells, verifying containment offered by slurry wall, and analyzing monthly operations data.	<a href="http://clu-in.org/download/remed/rse/savage.pdf">http://clu-in.org/download/remed/rse/savage.pdf</a>	P&T	RSE; Modifications to P&T system

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EPA	Remediation System Evaluation, Baird and McGuire Superfund Site, January 2002	Suggestions for O&M cost reductions, such as reducing process monitoring, automating treatment plant, modifying sludge disposal procedure, and replacing current air strippers with a more efficient unit.	<a href="http://clu-in.org/download/remed/rse/baird_and_mcguire.pdf">http://clu-in.org/download/remed/rse/baird_and_mcguire.pdf</a>	P&T	RSE; O&M cost reductions
EPA	Remediation System Evaluation, Cleburn Street Well Superfund Site, July 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including rehabilitating extraction wells, improving capture zone delineation, feeding well-purge water through air strippers, and conducting indoor air monitoring for PCE.	<a href="http://clu-in.org/download/remed/rse/cleburn_street_well.pdf">http://clu-in.org/download/remed/rse/cleburn_street_well.pdf</a>	P&T	RSE; Modifications to P&T system
EPA	Remediation System Evaluation, Comm. Bay/South Tacoma Channel, Well 12A Superfund Site, December 2001	Provides recommendations for potential modifications to existing groundwater P&T system, including improving capture zone analyses, conducting regular and consistent sampling, and analyzing influent to Well 9 for VOCs.	<a href="http://clu-in.org/download/remed/rse/well_12a.pdf">http://clu-in.org/download/remed/rse/well_12a.pdf</a>	P&T	RSE; Modifications to P&T system; Capture zone analysis
EPA	Remediation System Evaluation, McCormick and Baxter Superfund Site, February 2002	Provides recommendations to improve effectiveness, reduce life-cycle costs, and gain site close-out for alternate strategies for containment of groundwater and NAPL contamination.	<a href="http://clu-in.org/download/remed/rse/mccormick_and_baxter.pdf">http://clu-in.org/download/remed/rse/mccormick_and_baxter.pdf</a>	P&T	RSE; Reduce life-cycle costs
Other (LLNL)	Remediation Tradeoffs Addressed with Simulated Annealing Optimization, February 1998	Presents an optimization application building on a pump-and-treat model, yet assuming a priori removal of different portions of the source area to address the evolving management issue of more aggressive source remediation. Separate economic estimates of in-situ thermal remediation are combined with the economic estimates of the subsequent optimal pump-and-treat remediation to observe tradeoff relationships of cost vs. highest remaining contamination levels (hot spots).	<a href="http://www.llnl.gov/tid/lof/documents/pdf/233524.pdf">http://www.llnl.gov/tid/lof/documents/pdf/233524.pdf</a>	P&T	Economic estimates