STUDENT SUMMER INTERNSHIP TECHNICAL REPORT

Database of Groundwater Pump-and-Treat Systems

DOE-FIU SCIENCE & TECHNOLOGY
WORKFORCE DEVELOPMENT PROGRAM

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ABSTRACT

During the summer of 2013, Department of Energy (DOE) Fellow Paola Sepúlveda interned with the Office of Environmental Management (EM) at DOE Headquarters in Germantown, Maryland. Paola's supervisor was the Director of the Office of Soil and Groundwater (EM-12), Mr. Kurt Gerdes. This office provides integration, planning, analysis, and guidance for ensuring safe and effective management and remediation of contaminated soil and groundwater with the goal of reducing risk and the life cycle cost of remediation. The office identifies, integrates, and advances new and best technical practices related to groundwater and soil characterization, modeling, and remediation that improve the performance of EM projects over their entire lifecycle.

This report expands on a previous database completed for EM-12, presenting twelve DOE sites that use pump and treat (P&T) systems for groundwater remediation. The database contains information on specific locations within the twelve sites, contaminants present, current and past remediation strategies, cost of such strategies and current remediation progress of the sites. The main goal is to use this database to update the End-States Analysis and for future strategic planning.

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1. INTRODUCTION

During the Cold War Era, the U.S. Department of Energy (DOE) did not yet exist; thus, the United States did not have the regulations or knowledge of environmental protection that we have today. A vast amount of nuclear waste was generated, stored and disposed of in such a way that led to the contamination of soil and groundwater in several locations across the U.S. In 1989, the U.S. Department of Energy created the Office of Environmental Management (EM); their main mission was to complete the safe cleanup of nuclear waste, materials, and facilities. EM operates the world's largest nuclear cleanup program, involving two million acres of land located in 35 states with an annual budget of more than $5 billion. Although this office has managed to clean up more than 6,000 contaminated soil and groundwater areas, EM has more work remaining with many challenges lying ahead.

Pump and treat (P&T) systems are extensively used in groundwater remediation strategies. P&T is broadly used to describe any system that withdraws from or injects into groundwater as part of a remediation approach. P&T systems are primarily used to accomplish two goals: (1) hydraulic containment to manage migration of contaminated groundwater, ultimately reducing affected areas; and (2) treatment to lessen dissolved contamination concentrations within the groundwater so that the aquifers comply with cleanup standards and regulations. These P&T systems regularly require an assessment to test the efficiency of the different approaches in restoring contaminated groundwater to proper standards. Consolidating information about the cost of these systems may be important in identifying and evaluating technologies for new projects.

This report expands on a previous database completed for EM-12, presenting twelve DOE sites that use P&T systems for groundwater remediation. The database contains information on specific locations within the twelve sites, contaminants present, current and past remediation strategies, cost of such strategies and current remediation progress of the sites. The main goal is to use this database to update the End-States Analysis and for future strategic planning.

2. EXECUTIVE SUMMARY

This research work has been supported by the DOE-FIU Science & Technology Workforce Initiative, an innovative program developed by the U.S. Department of Energy's Environmental Management (DOE-EM) and Florida International University's Applied Research Center (FIU-ARC). During the summer of 2013, an FIU student (DOE Fellow Paola Sepúlveda) spent ten weeks interning at the Office of Soil and Groundwater EM-12, under the supervision of Mr. Kurt Gerdes.

Per the request of the Office of Soil and Groundwater Remediation, a database that examines different pump and treat systems to remediate groundwater contamination was expanded. The database contained information on specific locations within the twelve DOE sites, contaminants present, current and past remediation strategies, cost of such strategies and current remediation progress of the sites.

3. RESULTS

The DOE sites that contain groundwater P&T systems include the following:

- Hanford Site
- Idaho National Laboratory
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Moab Site
- Nevada Test Site
- Oak Ridge National Laboratory
- Paducah Gaseous Diffusion Plant
- Pantex Plant
- Portsmouth Gaseous Diffusion Plant
- Savannah River National Laboratory
- West Valley Demonstration Project

The P&T database report provides a summary identifying the groundwater P&T systems at all DOE sites. The components of the database provided on the following pages are listed below:

- Location of site
- Contaminants of concern
- Current remediation strategy
- Past remediation strategies
- Dates of remediation
- Cost
- Current progress of remediation
- Sources of material

Hanford							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
100-NR-2	Strontium-90, Diesel		Pump and treat	1994-2006	Total for 100-NR-2 site was $3.212 million CY 2011	Ineffective for Strontium	pg, 5-3; http://www5.hanford.gov/pdw/fsd/AR/FSD0001/FSD0077/00916 80/0091680.pdf
	Strontium	Permeable reactive barrier testing		2008-2012	$3.031 million (08-09)	90% reduction in Strontium concentration	pg B-2; http://www.hanford.gov/c.cfm/sgrp/GWRep09/html/gw09_Appen dix_B.pdf
	Strontium	Long term implementation		2013-2313	10 M emplacement and testing	Meet protectiveness goals at river	Calendar Year 2011 Annual Summary Report …DOE/RL-2012-02 Draft
	Diesel	Bio Remediation / monitored natural attenuation		ROD expected in 2013	500K for 10 yrs then 50K/yr		
100-KR-4	Chromium				Total cost of the 100-KR-4 system was $3.93 million in 2011		pg 5-2; http://www5.hanford.gov/pdw/fsd/AR/FSD0001/FSD0077/00916 80/0091680.pdf
KR-4	Chromium,	Interim pump and treat (300 GPM)		1994-2013	2.2M/yr	Efficiencies gained through use of SIR 700 Resin. Very effective in removing Chromium	
KW	Chromium	Interim pump and treat(200 GPM)	(100GPM exp. in 2009 to 200GPM)	2007 -2013	2.3 M/yr		Calendar Year 2011 Annual Summary Report …DOE/RL-2012-02 Draft
KX	Chromium	Interim pump and treat(600 GPM)		2008 -2013	2.5 M/yr		
	KR-4, KW and KX will become final action pump and treat systems with final ROD in 2013			2013 - 2030	4 to 5M/yr for all three systems with efficiencies implemented in final ROD		
100-BC-5	Strontium-90, Chromium, Tritium						100 Area RI/FS work plans
	Chromium	May be monitored natural attenuation or treat at K area systems		No decision document yet			
200-ZP-1	Carbon Tetrachloride, Technetium-99	Final ROD pump and treat		ROD, 2008		Decreased CCl4 concentrations in hot spot area.	
	Carbon tetrachloride		Interim pump and treatCCl4 only(250 GPM)	1995 - 2012	cost per mass of carbon tetrachloride= $5,332.6/gram (08-09)		pg B-1; http://www.hanford.gov/c.cfm/sgrp/GWRep09/html/gw09_Appen dix_B.pdf
	Carbon Tetrachloride, Technetium-99, nitrate, metals and VOCs	Pump and treat		2012 - 2037	$2,903,100 (08-09);	200 West pump and treat constructed and GW treatment initiated.	
		Monitored natural attenuation		2037 - 2161	50K/yr		
200-UP-1	Uranium, Technetium-99, I-129, Cr Nitrate, CCl4	Interim pump and treat for U and Tc99, 50 gpm to 10X DWS		1996-2012	$0.5M/yr FY 2009	Achieved reduction to 10X DWS	pg 3; http://yosemite.epa.gov/r10/cleanup.nsf/sites/hanford2/$FILE/200 UP1-ESD-0209.pdf
	Uranium	Pump and Treat		2014 -2039	$95.1/gram removed (08-09)	New Interim ROD to be issued 09/30/12	pg B-1; http://www.hanford.gov/c.cfm/sgrp/GWRep09/html/gw09_Appen dix_B.pdf
	Technetium-99				$10,931/gram removed (08-09)		
	Carbon tetrachloride				$2,857.6/gram removed (08-09)		
	Nitrate				$0.01/kilogram removed (08-09)		
					Total cost for P&T: $285,300 (08-09)		
	Residual CCl4	Monitored natural attenuation		2036-2161	20K/yr		
200-BP-5	Uranium, Technetium-99						
	Uranium, technetium, nitrate	No interim action, decision expected by 2015					
200-PO-1	Iodine-129, Tritium						200-PO-1 RI report, Draft
	Iodine, tritium	Monitoring		ROD expected in 2015		Natural attenuation proposed with TI waiver for I-129	
100-HR-3-D	Chromium				The total cost for the HR-3 system during 2011 was approximately $0.8 million		pg 5-1; http://www5.hanford.gov/pdw/fsd/AR/FSD0001/FSD0077/00916 80/0091680.pdf
			Permeable reactive barrier	1994-2020	10M to install and maintain	80% effective but decreasing	Calendar Year 2011 Annual Summary Report …DOE/RL-2012-02 Draft
			Interim pump and treat(100 GPM)	1994-2010	1.5M/yr	Limited Cr removal efficiency	
		DX pump and treat system (600+ GPM)		2010 -2030	2.5M/yr	High Cr removal rates	
100-HR-3-H	Chromium				The total cost for the HR-3 system during 2011 was approximately $0.8 million		pg 5-1; http://www5.hanford.gov/pdw/fsd/AR/FSD0001/FSD0077/00916 80/0091680.pdf
			Interim pump and treat(200-300 GPM)	1994-2011	2.0M/yr	Controlled part of plume	Calendar Year 2011 Annual Summary Report …DOE/RL-2012-02 Draft
		HX pump and treat(800+ GPM)		2011-2030	2.5M/yr	Designed to meet 10 ppb Water Quality Criteria to protect aquatic habitat in river	
		Final ROD expected in 2013					
100-FR-3	Strontium-90, Chromium, Nitrate, TCE	Assessment ongoing, no active remediation required					100 Area RI/FS work plans
				ROD expected in 2013			
300-FF-5	Uranium, TCE, tritium	Monitored natural attenuation		Started in 1996, decision document approved in 1996		Monitored natural attenuation did not work as well as expected. Site investigation for other technologies including phosphate sequestration	300 Area RI/FS work plan
		Possible sequestration with monitored natural attenuation, partial excavation		New ROD expected in 2013			
		Soil washing			39.3 M (estimated for mid 2004)		pg 40; http://www.epa.gov/superfund/sites/rods/fulltext/r1096143.pdf

		Polyphosphate injection			Cost of treatability study alone $1,945,000 (06-09)		pg 4.18; http://www.pnl.gov/main/publications/external/technical_reports/PNNL-18529.pdf
1100-EM-1	TCE	Levels below drinking water standards		Site delisted		operable unit removed from NPL	

Idaho							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
Reactor Technology Complex (RTC)	Chromium	Monitoring		ROD late 1997	Total Cost: $3.94 million in 1998 dollars		http://www.em.doe.gov/bemr/BEMRSites/inel.aspx
			Assessment completion	1999			pg. 5-6, http://ar.inel.gov/owa/getgif_2?F_DOC=DOE%2FID-10643&F_REV=00&F_PAGE=71&F_GOTO=70
			Remediation completion	2000			
			Capping, soil retrieval and disposal			Delivered innovative regulatory approach for disposal of D&D waste onsite, Completed dismantlement and demolition of 19 out of 26 total facilities and structures,	https://idahocleanupproject.com/Progress/RTC/tabid/129/Default.aspx
Idaho Nuclear Technology and Engineering Center (INTEC)	Strontium, Nitrate, Technetium, Iodine	Capping in phases and infiltration controls with monitoring		First ROD September 1999	Total Cost: $76,598,000 in 2008 dollars		http://yosemite.epa.gov/r10/nplpad.nsf/0/cb601d3cf3b34eb6852565950047dc53!OpenDocument
				Second ROD June 2007			
				2008-2095			http://www.em.doe.gov/bemr/BEMRSites/inel.aspx
			Assessment completion	1998			
			Remediation completion	2004			
				Cost through 2095			pg 4-6, http://ar.inel.gov/images/pdf/200807/2008073000472TUA.pdf
						Dispositioned 652 of 652 nuclear material items. Disposition completed ahead of schedule in September 2008; Transferred 2,337 of 3,186 spent nuclear fuel units from wet storage in basins to dry storage in casks	https://idahocleanupproject.com/Progress/INTEC/tabid/127/Default.aspx
			Soil Vapor extraction with thermal treatment units installed	1996-2004	1996-2000: $18,065 (Five-Year Averages, Thousands of Constant 1996 Dollars)		http://yosemite.epa.gov/r10/nplpad.nsf/0/cb601d3cf3b34eb6852565950047dc53!OpenDocument

Radioactive Waste Management Complex (RWMC)	Carbon Tetrachloride	combination of situ grouting, continued vadose zone vapor vacuum extraction, evapotranspiration barrier method, and long term management and control		2004-2018, with ROD in 2008	$1.3 billion (20 years to complete in FY 2006 dollars)		pg. 35-36; http://yosemite.epa.gov/r10/CLEANUP.NSF/sites/INEEL/$FILE/INL-ROD-9252008-Radioactive-Waste-mgmt-complex.pdf
				ROD 2008			http://www.em.doe.gov/bemr/BEMRSites/inel.aspx
						Exhumed 17,517 cubic yards of waste zone material at the Subsurface Disposal Area. Cumulative totals for extraction and destruction of volatile organic compounds (toxic vapors) from the subsurface disposal area are more than 224,500 pounds; Dispositioned 27,992 cubic meters of low-level and mixed low-level waste	https://idahocleanupproject.com/Progress/RWMC/tabid/130/Default.aspx
				1992 Record of Decision Technical Support Facility (TSF) Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) (INEL 1992b)			http://ar.inel.gov/images/pdf/201101/20110120000694TUA.pdf
				1995 Record of Decision Declaration for the Technical Support Facility Injection Well (TSF-05) and Surrounding Groundwater Contamination (TSF-23) and Miscellaneous No Action Sites Final Remedial Action (DOE-ID 1995)			
				1997 Explanation of Significant Differences from the Record of Decision			
				2001 Record of Decision Amendment for using in-situ bioremediation and monitored natural attenuation instead of pump and treat			
				2003 Began in-situ bioremediation and monitored natural attenuation			
				2004 Began alternate electron donor optimization			

Test Area North (TAN)	VOC, Radionuclides including cesium and strontium			2005-2007 Medial zone rebound test			
			In-situ bioremediation to treat source (Lactate was first injected; later whey powder was used.)	1998-2018	$3,122,332 2004 baseline cost estimate (using FY 1999 $)		pg 35; http://cluin.org/download/techfocus/biochlor/Bio_TAN_Unit_1-07B_2009.pdf
			Monitored natural attenuation to treat distal portion of plume	2001-2095	$2,363,056 in 1999 dollars		pg 13-2, only monitored natural attenuation costs from table included, http://ar.inel.gov/images/pdf/200910/2009100100584TUA.pdf
			Pump and treat to maintain containment in medial zone	2001-2018	$60,205,000 baseline cost estimate (FY 1998 $)		PG 11-1; http://ar.inel.gov/images/pdf/200706/2007061200250TUA.pdf
			Pump and treat air stripper treatment unit shutdown	2001			http://ar.inel.gov/images/pdf/201203/2012031200776BRU.pdf
			Pump and treat air stripper restarted	Jan 31, 2011- July 28, 2011			pg 14-2, table 14-1, only in-situ bioremediation costs from table included, http://ar.inel.gov/images/pdf/200408/2004081100679GSJ.pdf
		Pump and treat air stripper in cold standby		As of March 2012			
					Baseline Cost Through FY18: $37,975,170 (in 1999 dollars)		pg 14-2, http://ar.inel.gov/images/pdf/200408/2004081100679GSJ.pdf
					By using in-situ bioremediation instead of pump and treat, there is an estimated cost savings of $23 M over 30 years (2004 estimate using FY 1999 $)		http://www.jrwbioremediation.com/pdf/TANCaseStudy2011-1.pdf; pg 25 http://ar.inel.gov/images/pdf/200910/2009100100573TUA.pdf
						Completed demolition of 44 excess facilities and 2 high-risk facilities; Elimination of TAN footprint 100% complete	https://idahocleanupproject.com/Progress/TAN/tabid/131/Default.aspx
		Engineered cap		1995-1997			http://yosemite.epa.gov/r10/nplpad.nsf/0/cb601d3cf3b34eb6852565950047dc53!OpenDocument&ExpandSection=-1 pg 7-1; http://yosemite.epa.gov/r10/CLEANUP.NSF/sites/INEEL/$FILE/DOE-NE-ID-11201-R3.pdf

Central Facilities Area (CFA)	Nitrate	Monitoring		1996-2189			pg 7-7 and 11-26; http://yosemite.epa.gov/r10/CLEANUP.NSF/sites/INEEL/$FILE/DOE-NE-ID-11201-R3.pdf
			Assessment completion	2000			pg 8-9 and 10 http://yosemite.epa.gov/r10/CLEANUP.NSF/sites/INEEL/$FILE/DOE-NE-ID-11201-R3.pdf
			Remediation completion	2004			
					1996-2000: $3,221,000 (Five-Year Averages, Constant 1996 Dollars)		
					2005: $203,000 (Five-Year Averages, Constant 1996 Dollars)		
Entire Site		Life Cycle Cost for PBS ID-0030C			7,198,000 Baseline costs (1997-2012)		pg. 37; http://energy.gov/sites/prod/files/2013/04/f0/Volume5.pdf
		Life Cycle Cost for PBS ID-0030B			98,682,000 (FY 2012)		pg 67; http://energy.gov/sites/prod/files/2013/04/f0/Volume5.pdf

Lawrence Livermore National Laboratory							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
Building 801 and Pit 8 Landfall	VOCs, TCE, 1,2-DCA, Nitrate	Monitoring		2002			Groundwater Database: Groundwater Master Report
		Risk and Hazard Management					
					$0.5 million (based on 30 years of monitoring, FY 99)		pg. 2-48; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
						During 2012, the maximum total VOC concentration detected in ground water samples from wells was 5.2 µg/L. Perchlorate was not detected above its 4 µg/L reporting limit in ground water samples from any Building 801/Pit 8 monitor wells. Nitrate and 1,2-DCA are the only COCs remaining above their cleanup standards at Building 801	pg 60; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
Building 812	VOCs, TCE, 1,2-DCA, 1,1 DCE, Uranium, RDX, Tritium, perchlorate	A Remedial investigation/ feasibility study is being prepared		Aimed to be completed by 2014	Not available yet	TBD	http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/db29676ab46e8081882574260074373 4/d83824759d4ae31d88257007005e9408!OpenDocument; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/LLNL-AR-483951.pdf
Building 830	VOCs, Chloroform, PCE, TCE, cis-1,2-DCE, perchlorate, Tritium, Nitrates	Monitored Natural Attenuation		2003-2040			Groundwater Database: Groundwater Master Report
		Monitored only					
		Soil Vapor Extraction					
					$0.8 million (based on 30 years of monitoring and exposure control, FY 99)		pg. 2-49; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
Building 832	VOCs, TCE, cis-1,2-DCE, perchlorate, Tritium, Nitrates	Monitored Natural Attenuation		1999-2060			Groundwater Database: Groundwater Master Report
		Monitored only					
		Soil Vapor Extraction					
					$157.9 million, FY 99		pg. 2-47; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
						Near the 832-SRC treatment facility, concentration trends in extraction wells have remained stable as declining water levels and low yields limit ground water extraction. Soil vapor extraction accounts for most of the VOC mass extracted from this area. During 2012, 14 g of total VOC mass were removed by the 832-SRC GWTS and 48 g were removed by the 832-SRC SVTS. No new issues were identified during this reporting period that could impact the long-term performance of the cleanup remedy for the Building 832 Canyon OU.	pg 52- 59; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
Building 833	TCE, Tritium, Nitrates, VOCs	Monitoring		2002			Groundwater Database: Groundwater
					$0.8 million (based on 30 years of monitoring and exposure control, FY 99)		pg. 2-49; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
						When sampling wells for VOCs they found two orders of magnitude decrease in concentrations.	pg 61; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf

Building 834	VOC, chloroform, PCE, TCE, cis-1,2-DCE, TBOS/TKEBs, Nitrates	Excavate Monitoring Soil Vapor Extraction		1995-2060			Groundwater Database: Groundwater
					$173.9 million, FY 99		pg. 2-38; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
						Substantially more VOC mass is being removed by soil vapor extraction than by ground water extraction. Of the 15,014 g of VOCs removed during 2012, 13,844 g was removed in the vapor-phase. Overall, VOC concentrations in the area impacted by the bioremediation study have decreased significantly due to a combination of *in situ* biostimulation, bioaugmentation and dilution. The implementation of well field modifications for a bioremediation recirculation cell in this area is planned for 2013	pg 14; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
Building 850	VOC, Uranium-238, perchlorate, Tritium, Nitrates	Monitored Natural Attenuation Monitoring only		2002-2040			Groundwater Database: Groundwater
					$17 million, FY 99		pg 2-43; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
						MNA continues to be effective in reducing tritium activities in ground water. Ground water tritium activities continue to decline and are significantly below historic highs throughout the Building 850 plume. Total uranium activities in ground water were below the 20 pCi/L MCL cleanup standard in samples. Monitoring results indicate that microbial reduction significantly reduced perchlorate concentrations in 2 wells. During early 2013, ground water will continue to be extracted from well NC7-70	pg 37; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
Building 851	VOC, Uranium-238, Tritium, Nitrates	Monitoring only		2002			Groundwater Database: Groundwater
					$0.5 million (based on 30 years of monitoring, FY 99)		pg. 2-51; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
						Uranium activities in ground water have always been well below the 20 pCi/L MCL cleanup standard. During 2012, maximum total uranium activity detected in ground water samples from wells was 1.3 pCi/L	pg 63; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
Building 854	VOC, perchlorate, Tritium, Nitrates	Excavate Monitoring Soil Vapor Extraction		1999-2060			Groundwater Database: Groundwater
					$80.3 million, FY 99		pg. 2-46; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
						During 2012, 170 g of VOC mass were removed from ground water by the facility.	pg 51; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf

Central General Services Area	VOC, PCE, TCE, cis-1,2-DCE, 1,1-DCE, Tritium, Nitrates, Sulfates	Monitoring		1993			Groundwater Database: Groundwater
		Soil Vapor Extraction					
				1994-1997	$32,439,000 (FY 1997)		pg 23; http://www-erd.llnl.gov/library/AR-128479.pdf
						Soil vapor is extracted from 7 wells at a combine total flow rate of 35 standard cubic feet per min. Groundwater monitoring was conducted with the exception of 6 analyses due to inoperable pumps and 21 analyses were not performed because there was insufficient water in the wells to collect samples	pg 3; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
Eastern General Services Area	VOC, TCE		Monitoring only	1991-2008			Groundwater Database: Groundwater
					$6,213,000 (FY 1997)		pg. 22; http://www-erd.llnl.gov/library/AR-128479.pdf
						Ground water extraction and treatment system was shut off on February 15, 2007. ground water monitoring was conducted for five years after shutdown to determine if VOC concentrations rise above MCL cleanup standards. VOC concentrations remained below their MCL cleanup standards. Monitoring was discontinued after first quarter of 2012	pg 3; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
HE Process Area	VOC, chloroform, TCE, cis-1,2-DCE, 1,1-DCE, RDX, perchlorate, Tritium, Nitrates	Monitored Natural Attenuation		1999-2060			Groundwater Database: Groundwater
		Monitoring Only					
					$179.5 million, FY 99		pg. 2-41; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
						RDX concentrations continue to fluctuate above and below the 1 µg/L reporting limit. Throughout the reporting period, pumping from HEPA extraction wells has been effective in capturing COCs and preventing contaminated ground water from reaching the Site 300 southern boundary. During 2012, the total VOC mass removed from all HEPA treatment facilities was 176 g; the total nitrate mass removed was 764 kg; the total perchlorate mass removed was 54 g; the total RDX removed was 189 g	28-30; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
	VOC, Tritium, Nitrates	Monitoring only		2002			Groundwater Database: Groundwater
					$0.5 million (based on 30 years of monitoring, FY 99)		pg. 2-51; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf

Pit 2 Landfill						The 2012 ground water samples from monitor wells W-PIT2-2301 and W-PIT2-2302, did not contain tritium above the reporting limit/background activity (100 pCi/L). The maximum 2012 tritium activity within the Tnbs1/Tnbs0 HSU in the area immediately south of the Pit 2 Landfill was 3,520 ± 714 pCi/L. The maximum 2012 uranium activity detected was 4.2 pCi/L perchlorate was detected above the 4 µg/L reporting limit but below the 6 µg/L MCL cleanup standard	pg 64; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
	VOC, PCE, TCE, cis-1,2-DCE, perchlorate, Tritium, Nitrates	Monitored Natural Attenuation		2002			Groundwater Database: Groundwater
		Monitoring Only					
					$4.5 million (for 30 years of remediating, FY 99)		pg. 2-40; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
Pit 6 Landfill						Forty required analyses were not performed because there was insufficient water in the wells to collect the samples and four required analyses were not performed due to an inoperable pump. In general, the primary ground water COCs (VOCs and tritium) at the Pit 6 Landfill OU exhibit generally decreasing trends and ground water levels beneath the landfill remain well below the buried waste. TCE concentrations in ground water remain above the 5 µg/L MCL cleanup standard in samples from only one well.	pg 16; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
	VOC, DCE, VOC, Uranium, perchlorate, Tritium, Nitrates	Monitored Natural Attenuation		2008			Groundwater Database: Groundwater
		Monitoring Only					
					$10.8 million, FY 99		pg. 2-44; http://www.epa.gov/superfund/sites/rods/fulltext/r2008090002439.pdf
Pit 7 Complex						Operation timeframe (2 years and 10 months) and associated hydraulic and chemical data from the area amid the generally extremely low sustainable yields are still insufficient to fully assess the effects of ground water extraction and treatment on COC concentration trends and the performance of the extraction well field. The total volume of water extracted and treated during the 2012 at PIT7-SRC was about 49,000 gallons. Only about 18,000 gallons of water were extracted and treated during the second semester of 2012.	pg40- 44; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf
Total						During the reporting period of January through December 2012, approximately 10 million gallons of ground water and 100 million cubic feet of soil vapor were treated, removing approximately 20 kilograms (kg) of VOCs, 81 grams (g) of perchlorate, 1,500 kg of nitrate, 190 g of RDX, 0.23 g of a mixture of tetrabutyl orthosilicate (TBOS) and tetrakis (2-ethylbutyl) silane (TKEBS) and 4.9 g of total uranium	pg 1; https://www-envirinfo.llnl.gov/content/enviroRecent/site300/cmr.pdf

Los Alamos National Laboratory							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
Sandia/Mortandad Canyon West Area	Chromium	Extent of plume not yet fully delineated, but is undergoing accelerated evaluation.			Not available		pg 14; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
Canon De Valle Area	RDX, tritium, nitrate	Database of Groundwater Pump-and-Treat Systems					pg 14; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
					$52,900,000 (proposed budged 2013)		pg 2; http://energy.gov/sites/prod/files/2013/05/f0/Project%20Dashboard%202013-05-23%20-%20FINAL.pdf
Los Alamos Canyon Area	Nitrate, Tritium	Since plume is limited and not migrating no active remediation required at this time			Not available		pg 14; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
Pajarito Canyon Area	Tritium	Although trace concentrations of tritium have been detected further characterization is pending to confirm contaminants presence			Not available		pg 14; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
Pueblo Canyon Area	Nitrate, tritium, uranium, perchlorate	Since plume is limited and not migrating no active remediation required at this time			Not available		pg 14; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
Sandia/Mortandad Canyon East Area	nitrate, tritium, perchlorate	Since plume is limited and not migrating no active remediation required at this time			Not available		pg 14; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
Total				By December 2015	$2.2 billion effort to completely remediate Los Alamos (FY 2015)		pg 2; http://energy.gov/sites/prod/files/OAS-RA-11-15.pdf
						It was negotiated in early 2012, to remove 3,706 cubic meters of above-grade combustible TRU by end of June 2014. First year goal to remove 800 cubic meters was exceeded; current year efforts on track, but requires substantial increase in remediation and shipping rates. March 2013 ahead of schedule - 30 percent of FY 13 goal achieved. 39 percent of 2014 total goal achieved. Funding issues jeopardizes campaign milestones	pg 6; http://energy.gov/sites/prod/files/2013/04/f0/Chairs%20Webinar%20Presentation%20-%20Waste%20Disposition%20Strategies%20Update.pdf

Moab							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
Tailings Pile/ 150 Acres	Uranium, Ammonia	Interim actions: extraction and injection		2003-2028			pg 16; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
					Removing piles: $250-300 million Relocation of the tailings $1billion (between 2003 and 2028)		pg 2; http://www.grandcountyutah.net/pdf/UMTRA_Status.pdf
						On June 18, 2013, DOE announced that 6 million [short] tons of uranium mill tailings have been shipped from Moab, Utah, to an engineered disposal cell near Crescent Junction, Utah. Remedial action will be scaled back from a year-round effort to nine months annually for the next five years due to funding issues	http://www.wise-uranium.org/udmoa.html
Former Millsite/ 35 Acres	Uranium	No active treatment is being performed			Not available		pg 16; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf

Nevada Test Site							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
Central and Western Pahute Mesa	Uranium-234, Gross Alpha, Gross Beta, Uranium-233,235,238, Tritium	Monitoring Only		2024-2124			Groundwater Database: Groundwater Master Report
					Total cost of 100 years of monitoring projected to be $2.2 billion (2003)		pg 3 and 13; http://nv.energy.gov/nssab/Documents/CAB%20Produced%20Reports/09-17-07%20UGTA%20Technical%20Summation_w_figs%20FINAL%20Rev.pdf
					Modeling/ Monitoring is an estimated $240 million for 50 years (2001)		
Frenchman Flat	Urnium-234, Gross Alpha, gross beta, uranium-235, uranium-238, tritium	Monitoring Only		2014-2114			Groundwater Database: Groundwater Master Report
					Baseline $673,000 (FY 2015) (Only budgeted no formal funding at this point)	Complete negotiations regarding regulatory boundaries, establish long term monitoring requirements, complete internal peer review, prepare closure documents, request approval from Nevada	PG 7; http://www.nv.energy.gov/nssab/documents/minutes/fy%202013/fb/01-16-13%20FB%20Mtg%20Minutes-FINAL.pdf
Rainer Mesa Shosone Mountain	Urnium-234, Gross Alpha, gross beta, uranium-235, uranium-238, tritium	Monitoring Only		2027-2127			Groundwater Database: Groundwater Master Report
					Baseline $398,000 (FY 2015) (Only budgeted no formal funding at this point)	Begin negotiations regarding regulatory requirements, establish long term monitoring requirements, prepare closure documents	pg 8; http://www.nv.energy.gov/nssab/documents/minutes/fy%202013/fb/01-16-13%20FB%20Mtg%20Minutes-FINAL.pdf
Yucca Flat and Climax Mine	Urnium-234, Gross Alpha, gross beta, uranium-235, uranium-238, tritium	Monitoring Only		2025-2125			Groundwater Database: Groundwater Master Report
					Baseline $1,241,000 (FY 2015) (Only budgeted no formal funding at this point)	Complete external peer review, begin drafting Corrective Action plan	pg 8; http://www.nv.energy.gov/nssab/documents/minutes/fy%202013/fb/01-16-13%20FB%20Mtg%20Minutes-FINAL.pdf

OAK RIDGE							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Source**
ETTP 1070-A	TCE		Source removal	2002-2003	$ 19.6 million (in 1999 dollars)		pg 2-22; http://www.epa.gov/superfund/sites/rods/fulltext/r0400085.pdf
		Assessment ongoing					Groundwater Database: Groundwater Master Report
		Monitored natural attenuation proposed					
						K-1070-B burial ground excavation completed	pg 3; http://www.oakridge.doe.gov/em/ssab/Minutes/FY2013/Presentations/SSABPresentation5-8-13.pdf
ETTP K-27/K-29	DCE, TCE, VC, Chromium	Assessment ongoing					Groundwater Database: Groundwater Master Report
		Monitored natural attenuation with land use controls proposed		2018-2020	~$200million (FY 2019)	K-27 Building pre-demo underway; Characterization ongoing; Removal of 6 NaF traps completed	pg 5,9,10; http://www.oakridge.doe.gov/em/ssab/Minutes/FY2013/Presentations/April%202013%20presentations/ETTPPortfolio.pdf
ETTP Mitchell Branch/ Admin Area	DCE, Trichloroethane, TCE, Technetium	Considering impracticability waiver due to remedial action not performing as anticipated					Groundwater Database: Groundwater Master Report
		Ongoing VOC treatability study			$1,648 million (groundwater collection system, monitoring and maintenance) 1997		pg 24; http://www.oakridge.doe.gov/External/LinkClick.aspx?fileticket=3eBMGTU5Ch4%3D&tabid=663&mid=1817
			Seepage capture/collection	1997-2006			
						Mitchell Branch hexavalent chromium treatment system started operation	pg 3; http://www.oakridge.doe.gov/em/ssab/Minutes/FY2013/Presentations/SSABPresentation5-8-13.pdf
West Bethel Valley	Strontium	Source control		2008-2015			Groundwater Database: Groundwater Master Report
		Assessment ongoing		Final ROD expected in 2015			
			Cap source		$3,122,000,000 (1999)		pg 17; http://web.ornl.gov/info/reports/2004/3445605701032.pdf
	TCE, Cobalt		Completed interim ROD remedy	Final decision in 2015			
		Hydraulic containment		2003-2100			Groundwater Database: Groundwater Master Report
		Seepage capture/collection		2003-2100			
		Assessment ongoing		Final decision in 2015			
			Soil removal				
			Grout injection				
			Capping pits and trenches				
			Soil removal from waste pond and three areas				
			Capping at SWSA 4				
			Capping at SWSA 5				
			Capping at SWSA 6				

Melton Valley	TCE, Cobalt, Strontium, Technetium, Uranium		Drill monitoring wells				
					$351.3 million (2006 dollars)		pg 9; http://www.wmsym.org/archives/2008/pdfs/8458.pdf
						Monitoring of exit pathway and offsite wells shows groundwater flow paths converge toward Clinch River. Groundwater pumping offsite has potential to draw DOE contaminants offsite. As a precaution drinking water provided to offsite residents	pg 3; http://www.oakridge.doe.gov/em/ssab/Minutes/FY2013/Presentations/SSABPresentation5-8-13.pdf
Bear Creek Valley	PCE, DCE, TCE, Cadmium, Uranium, Technetium, Nitrate		Reactive barrier	2000-2006	$943,300 (FY08)		pg 21-22; https://www.dndkm.org/DOEKMDocuments/ITSR/SoilGroundWater/Passive%20Reactive%20Barrier.pdf
		Source control		2000-2020			
		Assessment ongoing					Groundwater Database: Groundwater Master Report
		Monitored natural attenuation proposed		2015-2100	$5 million($09 dollars)		www.oakridge.doe.gov/External/LinkClick.aspx?fileticket=J7R7IEDZTPI%3D&
						Uranium flux goal at Integration point is yet to be attained; monitoring indicates Bear Creek Burial Grounds remains a significant contributor to uranium flux in Bear Creek	pg 3; http://www.oakridge.doe.gov/em/ssab/Minutes/FY2013/Presentations/SSABPresentation5-8-13.pdf
Y-12 UEFPC	TCE, PCE, VC, Technetium, Uranium, Nitrate	Source removal					Document : Oak Ridge Reservation_P T Cost Summary
		Pump and treat with air stripping		1999-2100	$1,684,000 capitol cost, $465,000 annual operating cost		Groundwater Database: Groundwater Master Report
		Assessment ongoing		Final ROD expected in 2015			
		Monitored natural attenuation proposed		2015-2100			
						Mercury discharges from storm sewers decreased to pre-cleanout levels although the downstream levels remained elevated	pg 3; http://www.oakridge.doe.gov/em/ssab/Minutes/FY2013/Presentations/SSABPresentation5-8-13.pdf
East Bethel Valley	TCE	In-situ bioremediation		2009-2015			Groundwater Database: Groundwater Master Report
				Final ROD expected in 2015			

Central Bethel Valley	Mercury, Strontium, Tritium	Pump and treat		1995-2100			Groundwater Database: Groundwater Master Report
		Source control-excavation		2002-2015			
				Decision document expected in 2015			
						Tank W-1A soil and tank shell excavation completed; CH-8 plume extraction system upgrade completed. Sr-90 levels at 7500 Bridge (Integration Point) decreased; RA completed on 18 slabs and associated structures in Northwest Quadrant; Legacy material removed from Building 30385; Completion documents approved for D&D projects and Bethel Valley Burial Ground RA completed in 2011	pg 3; http://www.oakridge.doe.gov/em/ssab/Minutes/FY2013/Presentations/SSABPresentation5-8-13.pdf
total					Total Bethel Valley cost: 18 million (2011)		pg 2; http://energy.gov/sites/prod/files/EM%20Completed%20Projects%202005%20to%20Present%202012-12-07.pdf
					$2,625,527.71 (2008-11)		http://www.edi-nm.com/services-pdf/map-pdf/15_SF330%20DOE%20Oak%20Ridge%20Reservation%20CERCLA%20Documents_2011.pdf

PADUCAH GASEOUS DIFFUSION PLANT							
	Contaminant	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
Northwest Plume	Trichloroethylene and Technetium-99	Continue public water supply to residents through CERCLA action	Public water supplied to residents through CERCLA Action Memorandum	Action Memorandum - 1994			http://www.paducaheic.com/media/32701/s-i-02102-0111-ARI52.pdf (Action Memorandum)
		Continue pump and treat using air stripping and ion exchange while source remedial actions are being implemented	Pump and treat system installed as an interim action in high concentration areas of dissolved phase plume to provide partial containment.	Record of Decision - 1993. Operations initiated in 1995.	$13.2 million		http://www.paducaheic.com/media/25951/I-00113-0010-ARI32.PDF (Explanation of Significant Differences) and http://www.paducaheic.com/media/34580/I-00122-0003-PDI08.PDF (Post construction Report)
		Pump and treat system optimized with new extraction wells and pumping locations and additional monitoring wells		2010	$2.6 million		DOE/LX/07-0359&D1, Post construction Report for the Northwest Plume Optimization at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky and http://www.paducaheic.com/media/99105/I-00126-0013-PDI07.PDF (Explanation of Significant Differences)
		Dissolved Phase Plumes Project scheduled to begin 2015		2015			http://www.paducaheic.com/media/104034/ENV1.A-00139-ARI41.pdf (2012 Site Management Plan)
Southwest Plume	Trichloroethylene	CERCLA ROD for treatment of three sources signed 2012	Not applicable	2012			http://www.paducaheic.com/media/103655/ENV%201.A-00118-ARI50.pdf (Record of Decision)
		Soil Mixing with steam and chemical amendments and interim Land use Controls for source area SWMU 1-Oil Landfarm		2013	$10.6 million (Estimated Cost)		
		Enhanced Bioremediation or Long-term Monitoring and interim Land use Controls for source areas SWMUs 211-A and 211-B at C-720 Building		2016	$10.1 million (Estimated Cost)		
		Dissolved Phase Plumes Project scheduled to begin 2015		2015			http://www.paducaheic.com/media/104034/ENV1.A-00139-ARI41.pdf (2012 Site Management Plan)
		Continue public water supply to residents through CERCLA action	Public water supplied to residents through CERCLA Action Memorandum	Action Memorandum - 1994			http://www.paducaheic.com/media/32701/s-i-02102-0111-ARI52.pdf (Action Memorandum)

Northeast Plume	Trichloroethylene	Continue pump and treat using PGDP C-537 Cooling Tower for air stripping TCE contamination while source remedial actions are being implemented. Alternate treatment methods are being planned for use when PGDP discontinues enrichment operations and cooling towers are no longer used.	Pump and treat system installed as an interim action in high concentration areas of dissolved phase plume to provide partial containment.	Record of Decision - 1995 Operations initiated 1997	$5.1 million		http://www.paducaheic.com/media/41288/i-00213-0004-ARI34.pdf (Record of Decision) and http://www.paducaheic.com/media/34823/i-00218-0025a-PDI09.pdf (Post construction Report)
		Optimize Northeast Plume Pump and Treat facility with new well locations and a stand-alone treatment capability for use when cooling towers use is discontinued		2013	$6.1 million (Estimated Cost)		
		Dissolved Phase Plumes Project scheduled to begin 2015		2015			http://www.paducaheic.com/media/104034/ENV1.A-00139-ARI41.pdf (2012 Site Management Plan)
C-400 TCE Source Area Treatment	Trichloroethylene	Electrical resistance heating was divided into two phases (1 & 2) following an Independent Remedial Evaluation in 2007. Due to reduced effectiveness of electrical resistance heating in the Regional Gravel Aquifer, Phase 2 has been divided further into Phase 2A and 2B.	Record of Decision signed in 2005 to treat C-400 UCRS and RGA source areas with electrical resistance heating as an interim remedial action.	ROD signed 2005			http://www.paducaheic.com/media/23350/I-04613-0075-ARI24.PDF (Record of Decision)
				Phase 1 Operations -2010	Phase 1 total cost = $29 million (monitoring costs not included)		
		Phase 2A will utilize electrical resistance heating in the UCRS and upper RGA soils to a depth of 60-70'.		Phase 2A Operation - 2013	Phase 2A estimate ~ $11.5 million		
		Phase 2B will utilize an alternate technology in the RGA source area that is currently being evaluated by the FFA parties.		Phase 2B Operations - To be determined	Phase 2B = To be determined		DOE/LX07-1263&D1. Revised Proposed Plan for the Volatile Organic Compound Contamination at the C-400 Cleaning Building at the Paducah Gaseous Diffusion Plant

Total						Treated ~3 billion gallons of groundwater and captured 2,300 gal of TCE; improved TCE capture in NW plume to nearly 100 percent; used thermal treatment system to recover ~2,500 gallons TCE. During 2011, NW plume pump and treat optimization was completed. And as of 2012, one of eight TCE sources was treated, completed construction of SW Plume pump and treat system and initiated operations	pg 11; http://www.pgdpcab.energy.gov/Meetings/2011/MARCH/ddfo.pdf

Pantex							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
Playa 1 Perched Groundwater	Explosives(HMX, TNT, DNT2A, DNT4A), Boron	Pump and Treat to extract and treat the perched groundwater and preventing migration of contamination from reaching Ogallala Aquifer		2008			Groundwater Database: Groundwater Master Report
					$9,410,920 (Capital Cost) + $22,177,352 (Periodic and O&M Costs) FY 2009		pg 5-4; http://www.pantex.com/mission-strategies/Documents/Basis%20for%20Remedial%20Actions%20at%20Pantex/072833.pdf
						During 4th quarter operational rates was at 96%, daily treatment throughput was over 348,000 gallons per day	pg 8; http://www.pantex.com/mission-strategies/Documents/Remedial%20Action%20Reporting/Quarterly%20Report%204Q2012.pdf
SE Perched Groundwater	Metals (As, Cr, Th, Ni, Ba, Bo, Cr, Co, Mg), Isotopes (Am, Co, Cs, I, Pu, Ra) Explosives (DNT, HMX, TNT, TNB, tertyl)						Groundwater Database: Groundwater Master Report
		In situ bioremediation		2008	$6,672,500 (Capital Cost) + $36,272,861 (Periodic and O&M Costs) FY 2009	Last injection was during 2nd quarter 2012, system has maintained adequate treatment zone for reduction of high explosives. 3 of the closest down gradient monitoring wells have concentrations near or below 2ug/L. As P&T systems continue to remove water, future need for injections could decline	pg 10; http://www.pantex.com/mission-strategies/Documents/Remedial%20Action%20Reporting/Quarterly%20Report%204Q2012.pdf
		Monitored Natural Attenuation Proposed			$2,139,000 (Capital Cost) + $14,745,303 (Periodic and O&M Costs) FY 2009		pg 5-4; http://www.pantex.com/mission-strategies/Documents/Basis%20for%20Remedial%20Actions%20at%20Pantex/072833.pdf
		Pump and Treat		1995	$1,850,000 (Capital Cost) + $25,200,599 (Periodic and O&M Costs) FY 2009	During 4th quarter operational rates was at 94%. Treatment throughput was over 408,000 gallons per day. P&T system was affected in December due to restricted flow to the WWTF and frozen injection lines	pg 8; http://www.pantex.com/mission-strategies/Documents/Remedial%20Action%20Reporting/Quarterly%20Report%204Q2012.pdf
Zone 11 Perched Aquifer	Chloroform, DCA, DCE, TCE, 1,4-dioxane, Explosives (RDX, perchlorate)	Bioremediation proposed		2008		Mild to strong reducing conditions have been maintained. All 3 down gradient monitoring wells continue to demonstrate reduced perchlorate concentrations. Zone 11 well rehabilitation and injection will begin 1st quarter 2013 to treat TCE complex	pg 10; http://www.pantex.com/mission-strategies/Documents/Remedial%20Action%20Reporting/Quarterly%20Report%204Q2012.pdf
					$29,765,581 FY 2009		5-5; http://www.pantex.com/mission-strategies/Documents/Basis%20for%20Remedial%20Actions%20at%20Pantex/016005.pdf

PORTSMOUTH							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Source**
X-740 Area Plume	TCE		Phytoremediation	1999			Groundwater Database: Groundwater Master Report
				Decision document in 1999			
			Oxidant injection	2008-2009			
		Enhanced Anaerobic Bioremediation		2011-2012	$253,200 for EAB injections between 2011 and 2012		Ports FBP Annual Work Plans
						Emulsified oil, a slow-acting fermentable carbon compound, was injected into the selected portions of the X-740 groundwater plume during December 2010 and January 2011. Monitoring the pilot study took place throughout 2011.	pg 3-11; http://www.pppo.energy.gov/pdf/pppo_docs/2011%20Portsmouth%20ASER.pdf
X-749/120 Area Plume	TCE, Technitium-99		Landfill cap and barrier walls	1992			Groundwater Database: Groundwater Master Report
			Pump and treat	Constructed in 1992			
			South barrier wall	1994			Portsmouth Pump and Treat Cost Summary
			Groundwater collection systems	1992 and 1997			
				Decision document in 2001			
			Phytoremediation	2002-2003			
		Extraction wells		2007			
		Groundwater collection and treatment			$912,000/yr for operation and maintenance average between 2005 and 2012		Portsmouth Pump and Treat Cost Summary
						Objective were achieved by preventing migration of contaminants from the X-749 Landfill and controlling migration of the X-749/X-120 groundwater plume. However, Ohio EPA and DOE agreed that the phytoremediation system was not as successful as anticipated in reducing concentrations of TCE in groundwater	pg 3-6; http://www.pppo.energy.gov/pdf/pppo_docs/2011%20Portsmouth%20ASER.pdf
				1991			Groundwater Database: Groundwater Master Report
				Decision document in 2003			

X-701B Area Plume	TCE, Technitium-99		In situ chemical oxidation with sodium persulfate to destroy TCE	2006-2009			
		Groundwater collection and treatment		2011-2012	$203,500 for groundwater collection and treatment between 2011 and 2012		Ports FBP Annual Work Plans
						Sampling data collected indicate that while TCE concentrations decreased in soil samples collected during the IRM, groundwater monitoring data collected during 2011 for wells that monitor the IRM area indicate a rebound in groundwater TCE concentrations.	pg 3-10; http://www.pppo.energy.gov/pdf/pppo_docs/2011%20Portsmouth%20ASER.pdf
7-Unit Area Plume	TCE, Technitium-99		Pump and treat	Constructed in 1989			Groundwater Database: Groundwater Master Report
			Source removal	1998			Portsmouth Pump and Treat Cost Summary
		Groundwater collection and treatment		2005-2012	$417,000/yr for operation and maintenance average between 2005 and 2012		Portsmouth Pump and Treat Cost Summary
5-Unit Area Plume	TCE		Pump and treat	Constructed in 1991			Groundwater Database: Groundwater Master Report
			Engineered cap	Constructed in 2000			Portsmouth Pump and Treat Cost Summary
				Decision document in 2001			
		12 additional wells added		2001, 2009			
		Groundwater collection and treatment		2005-2012	$912,000/yr for operation and maintenance average between 2005 and 2012		Ports FBP annual work plans
					$65,793 spent on average each year from 1996-2000 in thousands of 1996 dollars		Groundwater Database: Groundwater Master Report

Total site						Portsmouth is going through transition of combining USEC into their organization. Converters are being removed. There is a milestone to get all components off-site by the end of the year (2013). 6257 drums will be shipping to NNSS in late spring early summer 2013.	pg 6: http://www.efcog.org/wg/wm/events/WMWG_2013_Spring_Meeting/WMWG_Mtg_MINUTES_02-27-13_FINAL.pdf

SAVANNAH RIVER							
Location	**Contaminants**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Source**
A/M Area	PCE, TCE, nitrate, sulfate	Pump and treat with air stripping		1985-2017			http://www.srs.gov/general/programs/soil/rod/015841.pdf
			In-situ chemical oxidation	1996-1996			http://www.osti.gov/bridge/servlets/purl/10173696-kZyGev/native/10173696.pdf
			In-well stripping	1996-2020			
			Dynamic underground stripping	2001-2009			
			Active and passive soil vapor extraction		$2,641,782 (FY 06)		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf
						All remedial work has been completed and work has now progressed to the monitoring phase with annual inspections and Five-Year Reviews	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ecods-b
C Area	VOC, Tritium	Electrical Resistance Heating with soil vapor extraction		Decision ongoing			
		Monitored natural attenuation for VOCs in groundwater					Groundwater Database: Groundwater Master Report
			Selective removal of soils		C- Area Reactor Groundwater OU in construction (estimated $1,229,940 FY 06)		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf
						The ROD selected in situ decommissioning with land use controls as the preferred remedy. DOE is evaluating the potential for the C-Area Reactor Building to serve as a museum	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ecods-b
			Pump and treat with air stripping and soil vapor extraction	1994-2008			http://www.em.doe.gov/Pages/groundwaterDatabaseReports.aspx
		Soil vapor extraction		Started in 2003			
			Engineered cap	2006-2006			
				ROD in 2004			
					$1,232,798 (FY 06)		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf

TNX Area	VOC					Cleanup completed in 2006, marking the first Area Closure at SRS. Removed and disposed of two thousand cubic yards of highly contaminated soil off site, demolished all buildings and capped the 10-acre former industrial area with a geosynthetic engineered cover	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ecods-b
D Area	VOC, Tritium, Cadmium, Mercury	Assessment ongoing					Groundwater Database: Groundwater Master Report
			Soil vapor extraction		$794,755 (FY 06) Oil Seepge Basin		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf
			Partial removal of soils		$209,939 (fey 06) BRP OU		
			Thermal treatment on concrete slabs and adjacent soil				
						Multiple removal actions are planned for D-Area during 2011-2012 to address tritium contamination and contamination associated with the coal storage and disposal piles in the area.	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ecods-b
K Area	VOC, Tritium	Monitored natural attenuation and mixing zone					Groundwater Database: Groundwater Master Report
		Assessment phase		As of 2009			http://www.srs.gov/general/programs/soil/rod/015841.pdf
					$123,092 (FY 06BPOP OU). $349,619 (FY 06 BRP & RP OU). $129,610 (FY 06 Reactor Seepage Basin OU)		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf
						The in situ decommissioning end state will not be implemented until all missions have ceased at these Reactor Complexes. An Early Action ROD for the K-Area Reactors is currently in place	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ou79-91
		Monitored natural attenuation		2007-2097			
				ROD in 2007			Groundwater Database: Groundwater Master Report
					L- area Southern Groundwater OU in construction (estimated $3,327,850)		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf

L Area	VOC, Tritium					The monitoring well network data show that contamination levels are decreasing and none of the contaminants were detected at the boundary of the OU . The Northern site is currently being investigated to determine the nature and extent of contamination and identify any potential threats to human health and the environment	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ecods-b
GSA Area (E, F/H. and Mixed Waste Management Areas)	Cadmium, Mercury, Tritium, Uranium, Iodine, Technetium, Nitrate, Lead, VOC	Barrier walls with base injection at funnel and gate			GSA consolidation unit in construction (estimated $2,213,505)		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf
		Low permeable cap on sources					
		Phyto-irrigation					
						DOE/SRS met the goal and is proceeding with the waste determination effort for Tanks 18 and 19, which will lead to a closure module for the two tanks and, ultimately, a waste determination and tank closure.	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ou86
R Area	VOC, Tritium, Strontium	Monitored natural attenuation and mixing zone					Groundwater Database: Groundwater Master Report
			Selective removal of soil and debris				
			Groundwater monitoring and extraction wells and associated documents				
			Stabilization with concrete cover		$123,092 (FY 06 BPOP OU)		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf
		Assessment phase			$9 million 2011		Pg 3; http://energy.gov/sites/prod/files/EM%20Completed%20Projects%202005%20to%20Present%202012-12-07.pdf

						The R-Area Reactor Disassembly Basin: 70 percent complete. The R-Area PSL Combined Subunit: 80 percent complete. The R-Area Reactor Area Cask Car Railroad Tracks as Abandoned Subunit: completed in May 2010. The R-Area Ash Basin subunit: 90 percent complete.	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ecods-b
P Area	VOC, Tritium	Chemical oxidation and soil vapor extraction					Groundwater Database: Groundwater Master Report
			Selective removal of soil and debris				pg 6; http://www.epa.gov/superfund/sites/rods/fulltext/e0403094.pdf
			Biostimulation & bioaugmentation				
			Removal of soil and capping				
			Passive in-situ soil vapor extraction with soil fracturing and chemical oxidant injection		$105,662 (FY 06 BRP OU) P-area Rector Seepge Basin OU (estimated $596,000 in construction)		pg 23; http://www.srs.gov/general/programs/soil/rod/015841.pdf
			In-situ stabilization with soil cover		Estimated at $5,010,000 which includes maintenance to the end of its life (2003)		pg 6; http://www.epa.gov/superfund/sites/rods/fulltext/e0403094.pdf
					$18 million (2011)		Pg 3; http://energy.gov/sites/prod/files/EM%20Completed%20Projects%202005%20to%20Present%202012-12-07.pdf
						An Explanation of Significant Differences was signed in early fiscal year 2010 to accelerate the cleanup using American Recovery and Reinvestment Act funding. The final ROD was signed in fiscal year 2011 and documented the selection of land use controls for P-Area.	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ecods-b
			Air sparging	1999-2000			Groundwater Database: Groundwater Master Report
			Thermal treatment with soil vapor extraction	2001-2005			
		Monitored natural attenuation		2008-2048	$3,432,000 (based on 2000 yd3) 2003		pg 22; http://www.epa.gov/superfund/sites/rods/fulltext/a0403020.pdf

CMP Pits	VOC, Pesticides					Starting in 2001, SVE removed 9,300 pounds of solvents. In 13 months, over 3,500 pounds of contaminants were removed using ERH. The ERH facility has since been dismantled. MNA is being used to ensure that natural cleanup processes are proceeding as anticipated and reporting is conducted annually. Ground water testing is ongoing.	http://www.epa.gov/region4/superfund/sites/fedfacs/savrivscareas.html#ecods-b
Total					The P&R Area: expended $297 million of the allotted $418 million.		pg 2-3; http://energy.gov/sites/prod/files/OAS-RA-L-11-12_0.pdf
					The M&D Area: expended $18 million of the allotted $24 million		
					The Site-Wide Completion Project: expended $189 million of the allotted $236 million.		

West Valley							
Location	**Contaminant**	**Current Strategy**	**Past Strategy**	**Dates**	**Cost**	**Progress**	**Sources**
WMA-1,2,3,4,5	Strontium, Cesium		Pump and Treat	1995			pg 27; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
			Small permeable reactive barrier	2010			
		Final remediation options are under evaluation					
						The Main Plant Process Building will be decontaminated to a demolition-ready status. A tank and vault drying system will be installed at the WMA 3 Waste Tank Farm to dry the remaining heels in the waste storage tanks.	pg 141; http://www.oecd-nea.org/rwm/docs/2011/rwm-r2011-3.pdf
North Plateau Lagoon 1 Plume (WMA-2)	Strontium, Tritium, Cesium	Plume has only migrated a short distance, so final remediation options are under evaluation (The recommended remedial alternative included in situ treatment of the Sr-90 plume using a full-scale passive zeolite permeable treatment wall)		2010			pg 27; http://energy.gov/sites/prod/files/em/Groundwater_Booklet-2008.pdf
						This effort has reached the 30% design milestone with final design and construction expected in FY10.	Pg 7; https://www.wmsym.org/archives/2010/pdfs/10396.pdf
Total					$380 million (Amount budgeted for Fiscal Year 2009 through Fiscal Year 2013.)		pg 141; http://www.oecd-nea.org/rwm/docs/2011/rwm-r2011-3.pdf
						Cleanup of reprocessing activities at the site, including "low-level" waste removal and decontamination, is expected to take 40 years and cost over $5 billion.	http://www.ucsusa.org/assets/documents/nuclear_power/west-valley-fact-sheet-final.pdf
					~$4.5 billion for WVDP activities over a timeframe of 40 years. That figure has since been updated to reflect an increase of roughly $800 million due to schedule delays and waste disposal uncertainties. The price of building the West Valley facility is not included in those estimates. The cost of constructing the reprocessing site was estimated to $150-180 million in 2006 dollars.		http://www.ucsusa.org/assets/documents/nuclear_power/west-valley-fact-sheet-final.pdf

4. CONCLUSION

An extension of a previous database containing information related to pump and treat systems across the DOE complex was conducted. Twelve tables were completed for a variety of DOE sites; the contaminants of concern and current and previous remediation strategies were included in these tables. This full database could be used by the Office of Soil and Groundwater (EM-12) to update their work on End-State Analysis.