

Restoration Advisory Board Site Tour July 14, 2016

Pease





Introduction

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Pease Cleanup Summary

- Environmental restoration underway since 1980s
- 11 Records of Decision (RODs) in place for soil and groundwater areas
- All remedial design and construction activities for Pease have been completed
- 83 Installation Restoration Program (IRP) sites
 - Air Force has closed 51 restoration sites, meaning restoration is *done* and the site is suitable for *unrestricted use*
 - Of the remaining 32 sites
 - 11 have cleanup activities complete (monitoring continues)
 - 21 have active clean up ongoing
 - ✓ Groundwater Treatment
 - ✓ Air Sparging/Soil Vapor Extraction
 - ✓ Permeable Reactive Barrier
 - ✓ Monitored Natural Attenuation
 - ✓ Long-term Monitoring



Stop 1: Site 5, Landfill 5

Site 5 History

Landfill 5 is located in the northeastern portion of the former base and was used as the primary base landfill between 1964 and 1975.

- Most of the material placed in the landfill consisted of municipal-type solid wastes generated from on-base housing, barracks, offices and dining facilities.
- Industrial wastes were also disposed in the landfill, including waste oils, solvents, paints, paint strippers and thinners, pesticide containers, empty cans and drums and sludge from base industrial waste treatment facilities.
- In 1990, more than 1,000 55-gallon drums and 5-gallon cans and seven tanks ranging in size from 250 to 5,000 gallons were removed during an interim remedial measure.

Site 5 Records of Decision

Two Records of Decision (RODs) have been signed for Landfill 5, the first in 1993 and the second in 1995.

1993 ROD And Actions –

- Documented the decision to partially excavate the landfill by removing soil and debris in contact with groundwater and backfilling the landfill with clean fill.
- In accordance with the ROD, the Air Force excavated soil and debris from Landfills 2 and 4 and consolidated the material into Landfill 5.
- Further, the Air Force installed a barrier cap on Landfill 5 to minimize water infiltration and prevent contact between landfill debris and human and ecological receptors. The Air Force also conducts long-term monitoring (LTM) and maintains institutional controls to restrict future activities on the capped area.
- The remedy for the landfill also included installation of piezometers that measure the water table, landfill gas
 monitoring probes and vents. These remedial actions occurred between 1993 and 1995.

1995 ROD -

- The Zone 1 ROD provided the remedy to address contaminated groundwater from Landfill 5.
- Established a Groundwater Management Zone (GMZ) in Zone 1, in the Landfill 5 source area. In accordance with the ROD, the site is being restored using natural attenuation and biodegradation.

Long-Term Monitoring and Inspections

- Inspections and groundwater LTM are ongoing components of the Landfill 5 remedy.
- Nine perimeter wells are sampled once per year in the spring to ensure the cap remains protective of human health and safety.
- Five interior boundary wells are sampled every other year in the spring.
- Other samples, taken yearly in the spring, include six surface water and three sediment samples from Flagstone Brook and the Railway Ditch.
- The numbers of wells to be sampled, frequency of sampling, and analyses to be sampled are determined by
 past and present contaminant concentrations at the site. Close coordination with regulatory agencies includes
 review and approval of all monitoring data and work. Sampling will be conducted every 3 years from this year
 forward.

Stop 1: Site 5, Landfill 5 (cont'd)

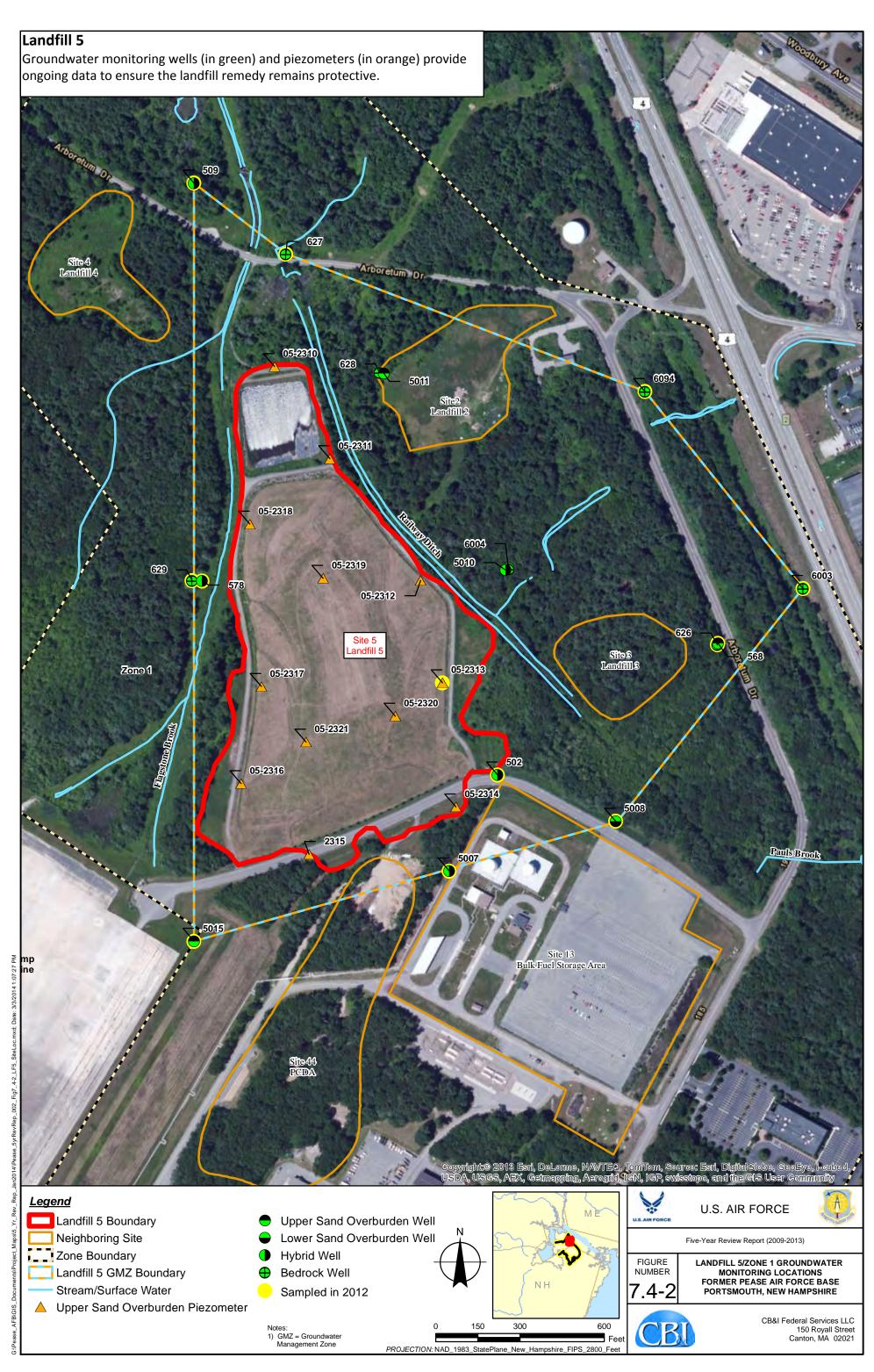
- Semiannual screening of 25 gas vents and probes at Landfill 5 with field instruments is performed in the summer and fall.
- Semiannual visual inspections of the landfill are performed concurrently with the spring sampling and also in the fall and include identification of any deficiencies with the cap, drainage systems, and sedimentation basin.
- Current data indicates contamination is not migrating from under the Landfill 5 capped area.



Landfill 5

Formerly the primary base landfill, Landfill 5 was remediated and capped in 1995. Last remaining actions include long-term monitoring program. Photo taken near top of Landfill 5 looking north toward the drainage pond, which stores water drained from the landfill surface. Passive air vents are used to "off-gas" or vent landfill gasses.

<u>NOTES</u>		



STOP 2: Site 8, Fire Department Training Area #2

Volatile Organic Compound Groundwater Treatment System

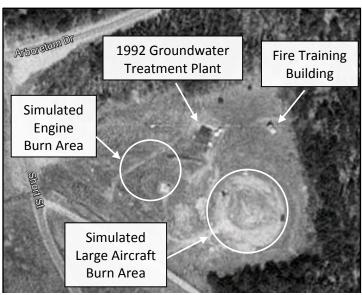
Site 8 History

Site 8 is located in the northern portion of the former base and was the site of one of two Fire Department Training Areas (FDTAs) used at Pease from 1961 to 1988. The site has been undergoing extensive restoration for volatile organic compounds (VOCs) and fuels since the 1980s. VOCs are found predominately in solvents. While the work to remove the VOCs is almost complete, work to address PFCs, a newly identified contaminant, is just beginning. In 1970, the U.S. Air Force began using aqueous film forming foam (AFFF) for extinguishing petroleum fires and for use during firefighting training activities at this location.

- Site 8 is also called FDTA 2.
- The majority of the fire-training exercises were performed in a large circular pit area located in the southeastern portion of the site.
- Small and large aircraft crash fires were simulated using JP-4 fuel and/or mixed waste oils and solvents poured onto mock aircraft.
- The mixture was allowed to burn for a short time and was then extinguished.
- Excess fuels and fire training materials were discharged from the burn pit into a drainage ditch at the northern end of the site.

Interim Remedial Actions

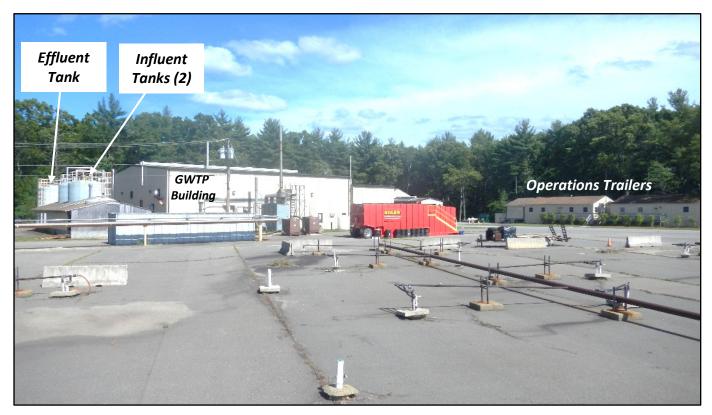
- Site 8 was identified as a potential source of contamination to soil and groundwater in 1983.
- Remedial investigations of the site were conducted between 1984 and 1992.
- Based on these investigations, it was
 determined that the site soil was contaminated with fuels and solvents and there was floating fuel (called
 light nonaqueous phase liquid [LNAPL]) on the surface of the underlying groundwater.
- Interim remedial activities were performed in 1990 and involved the removal of approximately **262 tons of contaminated soil** from the drainage ditch in the northeastern corner of the site, which had received runoff from the main burn pit. Additionally, the Air Force installed an extensive and successful pump-and-treat groundwater remediation system that has nearly achieved its goal of removing VOCs from groundwater.



Site 8

Taken in 1992, this photo helped identify and document important historical activities at Site 8. Analysis of historical aerial photographs and identification of site features is one way the Air Force gains information on past site uses and possible sources of contamination.

STOP 2: Site 8, Fire Department Training Area #2 (cont'd)



Groundwater Treatment Plant

Groundwater from extraction wells (influent) is pumped into two outdoor holding tanks, then into the Site 8 Groundwater Treatment Plant carbon vessels (below) for treatment. After carbon treatment, clean water (effluent) is pumped into an outdoor effluent tank before being pumped back into underground recharge trenches. Wells and venting are associated with a separate soil vapor extraction system used in conjunction with groundwater treatment to remove vapor from soil particles beneath the site.



Carbon Vessels

Groundwater passes through three Granular Activated Carbon (GAC) vessels. As water flows through the activated carbon, the contaminants stick to the surface of the granules and are removed from the water. This treatment is used to remove a wide range of contaminants including solvents, perfluorinated compounds, and other industrial chemicals.

STOP 2: Site 8, Fire Department Training Area #2 (cont'd)

Site 8 Record of Decision for VOCs

In 1994, the Site 8 Record of Decision (ROD) documented selection of a remedy for the site, which included the installation of a **Soil Vapor Extraction** (SVE) system to treat soils at the site, an on-site **groundwater treatment** system for long-term treatment of recovered groundwater, and land use controls, also called "deed restrictions". The land use controls prohibit use of groundwater and residential use of the property (no childcare facilities, playgrounds, athletic fields or schools can be built).

Site 8 Groundwater Treatment for VOCs

Remediation activities at Site 8 began in 1995 and included SVE and groundwater treatment. Treated groundwater, called effluent, is discharged to subsurface recharge trenches after testing to ensure it is clean. An air sparge system was installed in 2008 to supplement the SVE system and aid in the treatment and removal of the floating fuel and soil vapor. **Groundwater monitoring data has confirmed these measures have successfully decreased soil and groundwater contaminant concentrations for volatile organic compounds**. The SVE and air sparge systems were permanently shut off in October 2013 due to limited recovery in recent years (indicating less VOC contamination to remove). In June 2015, the groundwater treatment system was also shutdown because frequent groundwater monitoring confirmed that contaminant concentrations no longer exceeded regulatory limits. The groundwater treatment system was turned back on in August 2015 to address PFC concentrations (discussed further on page 12 of this tour booklet).

Site 8 Groundwater Treatment System for VOCs

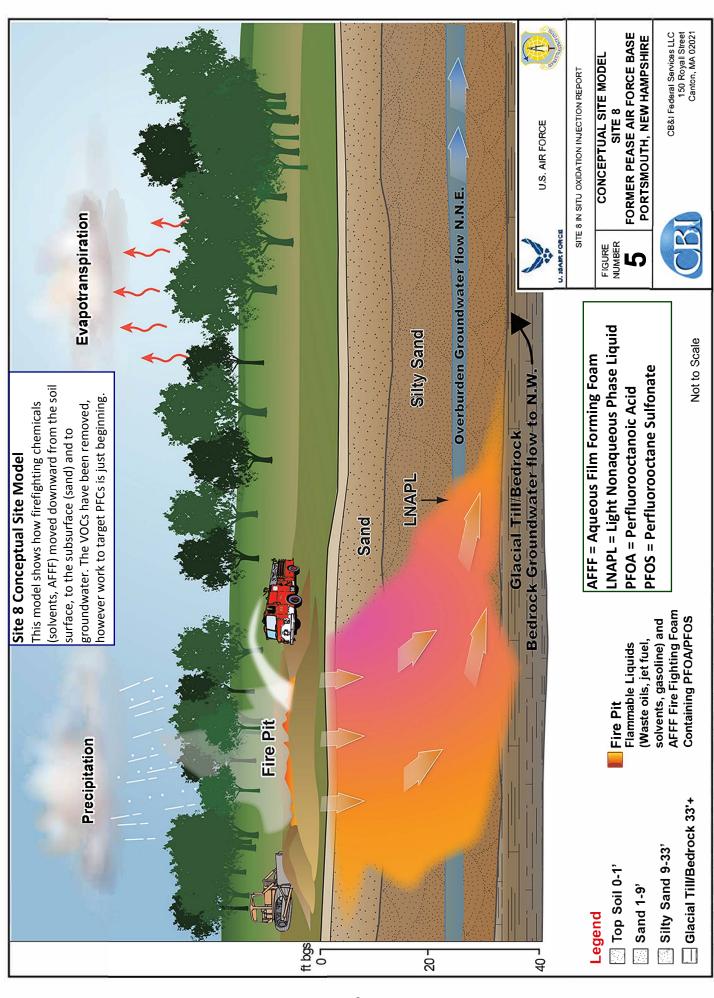
- Operational 1995 to June 2015 to remove VOCs
- 6 extraction wells
- Recovered over 100,000 gallons of light nonaqueous phase liquid (LNAPL) (free product)
- Restarted in August 2015 and currently operating as interim measure to address PFC concentrations

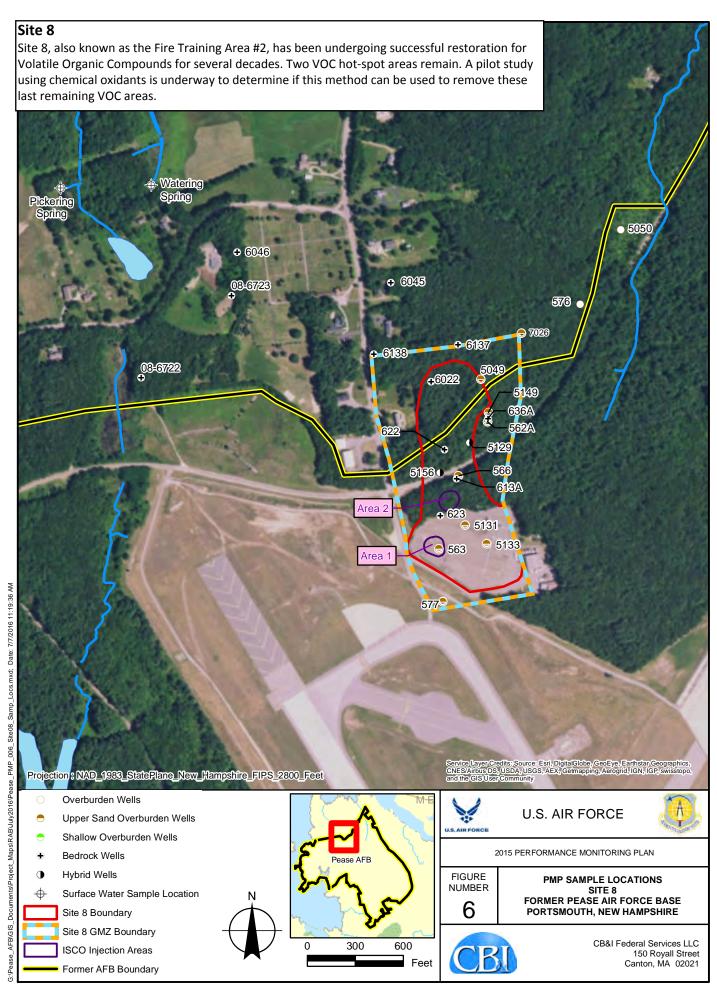
Site 8 Soil Vapor Extraction System for VOCs

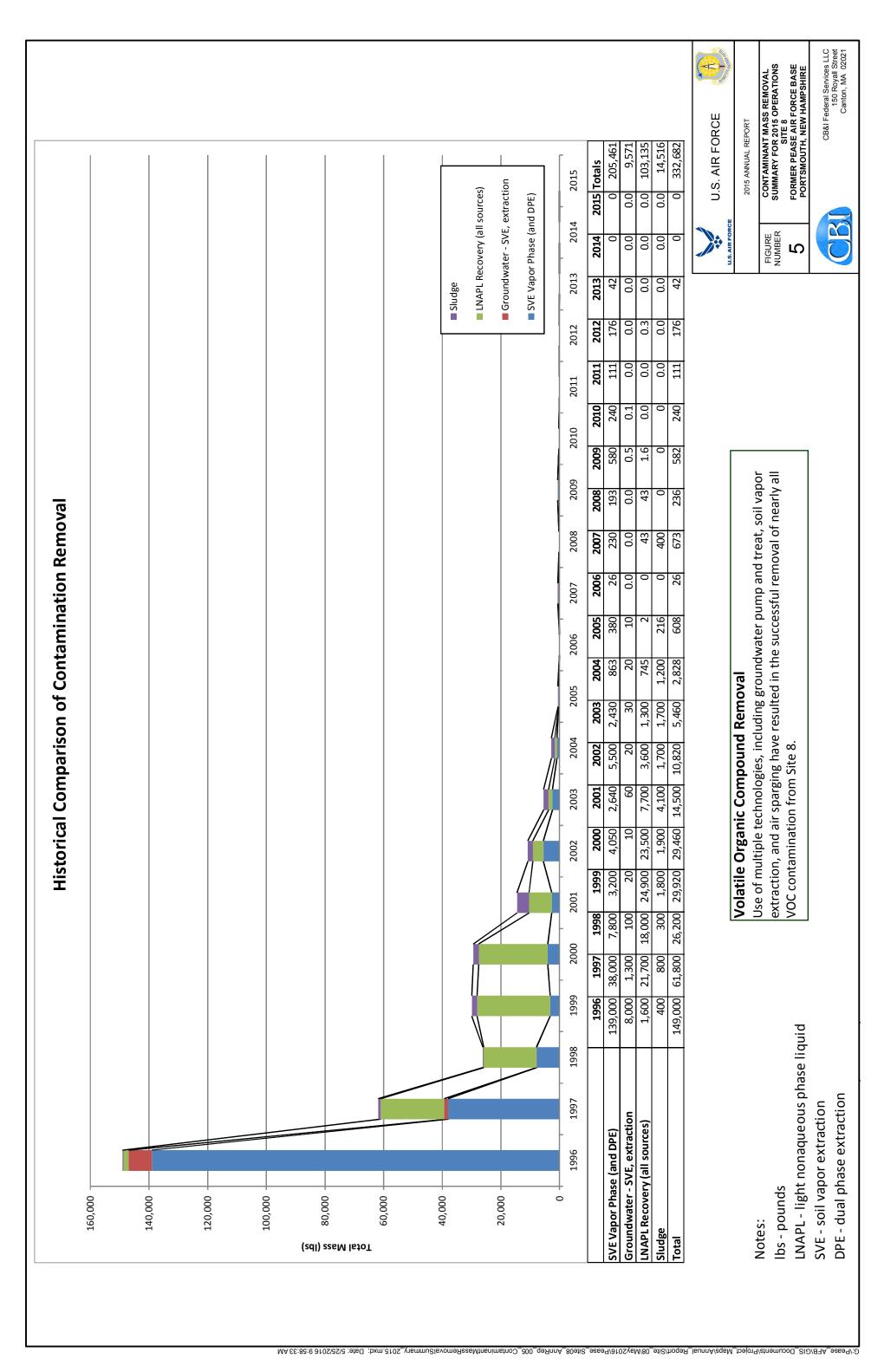
- Operational 1995 to 2013
- 189 soil vapor extraction vents
- 200,000 pounds of volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) removed
- SVE system accomplished its goal of significantly reducing VOC concentrations
- Note: SVE is not an effective technology for PFCs

Site 8 VOC Pilot Study

Based on recent site investigations, two known hot spots (small localized areas) of residual VOCs remain in soil and groundwater at Site 8. A pilot study is underway to determine the effectiveness of using chemical oxidants to remove these areas. This technology, called In Situ Chemical Oxidation (ISCO), is used to treat many types of organic contaminants, like fuels and solvents. Under the study, chemical oxidants were injected into the existing well network within the hot spot areas to degrade VOC contamination and convert it into a form that biodegrades naturally. The pilot study injections were conducted in November 2015 and monitoring of contaminant concentrations within each area is on-going.







Perfluorinated Compounds

Interim Measure – Site 8 Groundwater Treatment System Optimization for Perfluorinated Compounds (PFCs)

In August 2015, the groundwater treatment system was restarted to address perfluorinated compounds (PFCs) in groundwater and to control migration of PFC-impacted groundwater from the FTA toward the town of Newington. Note that although not designed specifically for treatment of PFCs, the groundwater treatment system has been remediating these compounds since the system was started in 1995.

A plan has been prepared to evaluate the existing extraction wells to ensure maximum PFC plume containment. As part of the plan, a site-specific treatability study for use of two different types of activated carbon was conducted and has helped the Air Force select the best available technology option for interim PFC treatment at the existing groundwater treatment system. Restart and optimization of the existing system is considered an interim measure while other strategies to remove PFCs from groundwater, like the Interceptor System discussed below, are evaluated.

Site 8 Groundwater Treatment System for PFCs

- August 2015 Restarted to Address PFCs Immediately
- July 2016 Customized system specifically designed for treatment of PFCs in design stage

Site 8 Interceptor Well Modifications

The Air Force plans to construct additional interceptor wells at Site 8 as part of its overall strategy to treat PFC-impacted groundwater and control migration toward Newington. The new wells will become part of a new Site 8 groundwater treatment system specifically designed for PFC removal. Two PFC treatment options have been evaluated for effectiveness as part of the design. The additional interceptor treatment system is at the 50% design stage.

NOTES .			

Perfluorinated Compounds (cont'd)

Proposed Airfield Interim Mitigation System

The Air Force and its contractors have been actively involved in project planning and meetings with stakeholders to determine the best approach to restore the aquifer at the former Pease Air Force Base. This approach will ensure the protection of human health by eliminating exposure to drinking water that may have perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) impacts above the lifetime health advisory values established by the USEPA.

Conceptual Site Model

Site investigation activities have been conducted at the former base as part of efforts to refine the conceptual site model and improve the overall understanding of PFC distribution and aquifer characteristics. PFC sampling and groundwater flow patterns have identified four areas that are likely the primary contributors to the PFCs seen in the Haven Well. Frequent groundwater monitoring indicates PFC concentrations are not changing, signifying PFC contaminants are moving slowly, if at all.

Proposed Pease Airfield Interim Mitigation System (AIMS)

A proposed solution for treating PFC-impacted groundwater and protecting the Pease aquifer has been developed. The objective of the proposed approach is to prevent the migration of PFC-impacted groundwater toward the Haven Well and the Smith and Harrison Wells.

The system will consist of a series of groundwater extraction wells, called "cut-off" or "interceptor" wells, located upgradient of the Haven Well along the flow path where higher PFC concentrations have been identified. These will be coupled with the reinjection of the treated water into the aquifer downgradient of the cut-off wells (but upgradient of the Haven Well) to create a hydraulic barrier and prevent migration of PFC-impacted groundwater toward the Haven Well.

Conceptual Extraction System

The groundwater flow model developed as part of the PFC response activities has been used to develop a preliminary layout of the extraction and injection system in order to optimize hydraulic control and recovery of PFC-impacted groundwater. These design details as well as overall capacity of the treatment system will be determined following completion of an aquifer pump test and further evaluation of the groundwater flow model and data that continues to become available from monitoring activities.

Treatment of Extracted Groundwater

Groundwater extracted by the proposed Pease AIMS will be treated with the best available technology for removal of PFCs. There are currently two treatment options available – carbon filtration and treatment through an ion exchange resin. PFCs in extracted groundwater will be removed by an ion exchange resin. Upon review of aquifer characterization data, a final design for the system and permitting requirements will be completed.

Perfluorinated Compounds (cont'd)

Carbon Filtration

Treatment through carbon is a proven and effective technology for the removal of PFCs and other contaminants from groundwater. Water extracted from the aquifer passes through two carbon vessels and, if necessary, the appropriate pre- and post-treatment technologies prior to reinjection and/or discharge to surface water.

Ion-Exchange Resin

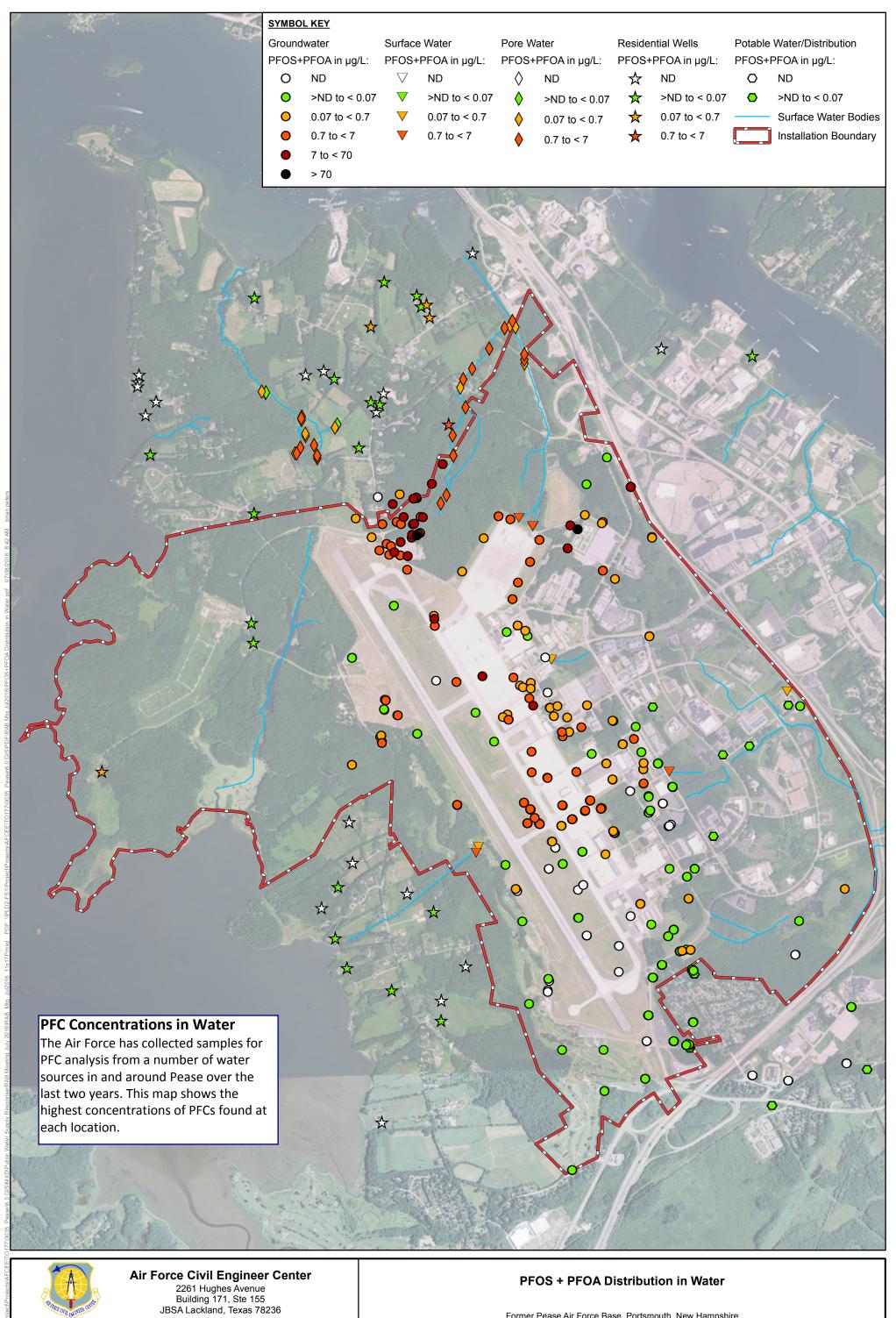
This is an emerging technology for the treatment of PFC-impacted groundwater. Water extracted by the system passes through three vessels containing resin and, if necessary, the appropriate pre- and post-treatment technologies prior to reinjection and/or discharge to surface water.

Discharge of Treated Groundwater

NIOTEC

The Air Force is evaluating several options for discharge of treated groundwater into the aquifer. The majority of water treated by the Pease AIMS will be reintroduced into the aquifer through reinjection. The ability to discharge treated groundwater to surface water will be a contingency measure to ensure uninterrupted operation.

NOTES		



STOP 3: City of Portsmouth

Tradeport Drinking Water Treatment

City of Portsmouth Tour Handouts

Pease International Tradeport Water System Update – June 30, 2016

Portsmouth and Pease International Tradeport Water Systems, July 2016

Summary of PFC Analytical Results Public Water Supply Monitoring Program, May 2016

Treatment Plan for Pease Tradeport Water Supply

Pease Tradeport Water System Components

City of Portsmouth Department of Public Works



June 30, 2016

Pease International Tradeport Water System Update

The following update regarding the Pease Tradeport Water System's response and actions since the discovery of PFCs (perfluorochemicals) in the Haven Well in May 2014:

Health Advisory for PFOA and PFOS

EPA recently issued new health advisories of $0.070~\mu g/L$ (micrograms per liter) for PFOA and PFOS. The prior values for these compounds were $0.400~\mu g/L$ for PFOA and $0.200~\mu g/L$ for PFOS. The two wells that supply the Pease Tradeport Water System have combined levels of PFOA and PFOS that have consistently been below this limit since sampling began in 2014. The Smith well is sampled weekly and the Harrison well bi-weekly. In addition to monitoring the wells, the water supplying Pease is blended with City of Portsmouth water which lowers the level of PFCs serving Pease customers. The most recent samples of tap water in Pease both had combined levels of PFCs of $0.018~\mu g/L$. Once the City receives the validated results for these wells, plus quarterly sampling in the distribution system, the data is updated and posted on the City's website at:

http://www.cityofportsmouth.com/publicworks/phwn.html

The following table summarizes the most recent sample data the Pease water system:

Sample Location	Sample Date	PFOA	PFOS	Combined
		(µg/L)	(µg/L)	(ug/L)
* EPA Health Advisory Limt (May 2016)		0.070	0.070	0.070
Harrison Well	May 26, 2016	0.007 J	0.023	0.030
Smith Well	May 31, 2016	0.005 J	0.011 J	0.016
DES Office (New Hampshire Avenue)	May 26, 2016	0.006 J	0.012 J	0.018
Fire Station No. 3 (International Dr.)	May 26, 2016	0.006 J	0.012 J	0.018

ND – Not Detected

μg/L – micrograms per liter or parts per billion

J – The result is an estimated value

Water System Operations

The Pease Water System water demands are currently being met by supply from two Pease wells, the Harrison and Smith wells, supplemented by water boosted from the City of Portsmouth pressure zone. Overall water system demands for the combined Pease/Portsmouth water system have been met by the combined resources of the system's surface water supply and eight other wells. System operators continue to track water system demand on a daily basis to assure that our supply meets demand. This information is summarized and published monthly on the City's website via the "Water Supply Status Report." The current dry conditions, coupled with high water demand, have led to the issuance of an advisory to all customers to be as efficient as possible with water use through voluntary water restrictions.

http://www.cityofportsmouth.com/publicworks/index.htm - Public Works - Water

Water Quality Monitoring

The Air Force's consultant has been performing frequent routine sampling of the water supply wells in the system near the Haven Well. The Smith Well is sampled weekly for PFCs and the Harrison Well is sampled every two weeks. In addition to the water supply wells, the Air Force's consultant is sampling other monitoring wells in the surrounding area to track the aquifer and monitor for any PFCs moving toward the supply wells. To date, PFC levels in the currently operating supply wells remain below the EPA's health standards. Data is updated on the City's website once it has been validated by the laboratory and provided to the City by the Air Force's consultant.

PFC Contaminant Investigation

The Air Force has engaged their engineering consultant to further identify the source areas where the PFC contamination is concentrated. They have also installed additional monitoring wells in the aquifer to develop a profile of the contaminated zones so they can better assess the potential for it to travel beyond the Haven Well area. This information has provided the basis for further investigations and/or mitigation. Preliminary reports of these assessments have been submitted to the City for our review and comment.

Biometric Monitoring of Potentially Impacted Water Users

The New Hampshire Department of Health and Human Services (DHHS), Division of Public Health Services has been the lead agency in response to the potential health effects of PFCs. They are also the lead agency involved with blood testing of people exposed to the water. Questions with respect to health effects and/or testing are to be directed to the New Hampshire Department of Health and Human Services Public Information Office at (603) 271-9391.

Additional information can be accessed at the DHHS website:

http://www.dhhs.nh.gov/dphs/investigation-pease.htm

Treatment of Pease Wells

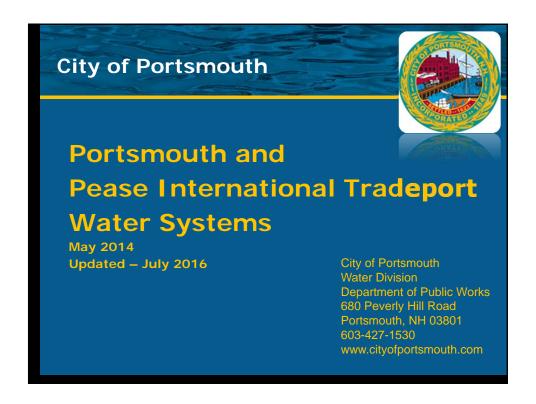
In April, 2016 the City of Portsmouth, the Pease Development Authority (PDA) and the United States Air Force announced the execution of an agreement to enable an upgrade of the Pease Tradeport water treatment system in order to install carbon filters to treat PFCs from water supplied by the Smith, Harrison and Haven Wells. Through this agreement, the City is moving forward with the installation of carbon filters for the Harrison and Smith wells, and subsequent design of treatment for the Haven Well. Treatment of all the wells has been a goal of the City since the contamination was first discovered and was requested directly of the Air Force through correspondence beginning in June 2014.

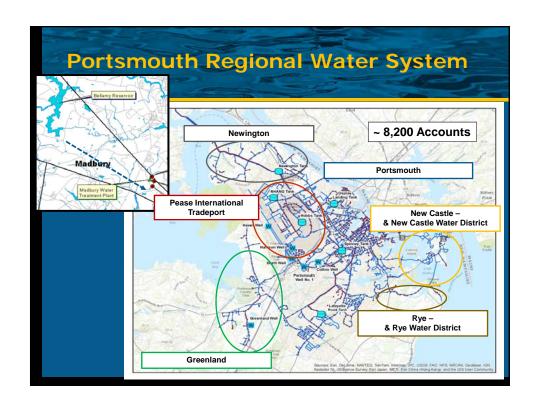
The treatment of the Harrison and Smith wells will demonstrate the effectiveness of the technology and performance of the system. This information will then be used by the City's consultant to revise the final design parameters for treatment of the Haven Well. The filters are on order and we anticipate delivery in mid-July with installation to follow. Design of the Haven treatment system will proceed after the demonstration filters have been installed. Portsmouth also continues to support the goals of the EPA and DES with regard to aquifer restoration; our work will continue to be in parallel with the work that the Air Force is undertaking to satisfy the EPA's administrative order issued in July 2015.

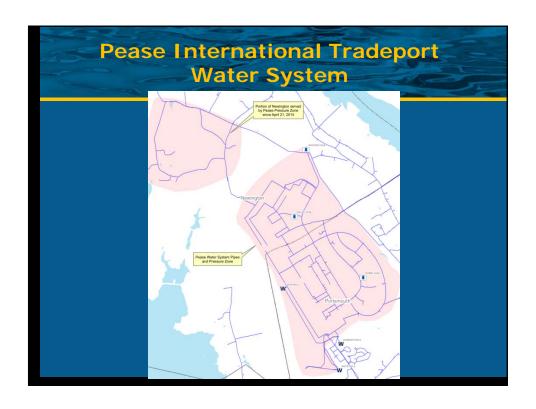
This agreement with the Air Force will reimburse to the City for up to \$58,700 for the system piloting and \$831,000 for the filter installation and demonstration project. Additional agreements between the City and the Air Force for design and construction of the Haven Well treatment system are anticipated to be negotiated later in this year.

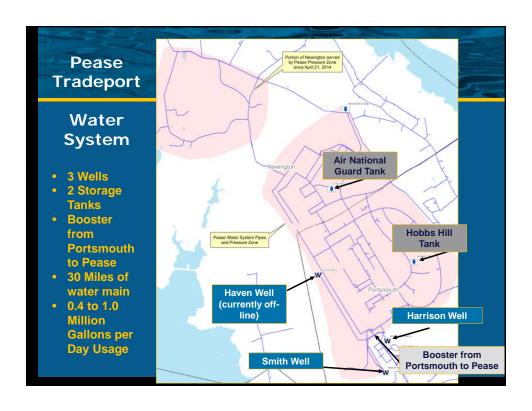
Further Updates and Information

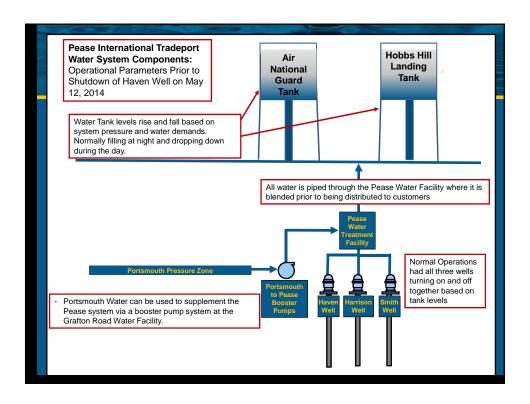
The City and the Air Force will continue to provide additional updates. This information will be distributed electronically on the City of Portsmouth's website in the Department of Public Work's "Water" section. If anyone needs additional information or has questions contact Brian Goetz, Deputy Director of Public Works at 766-1420.

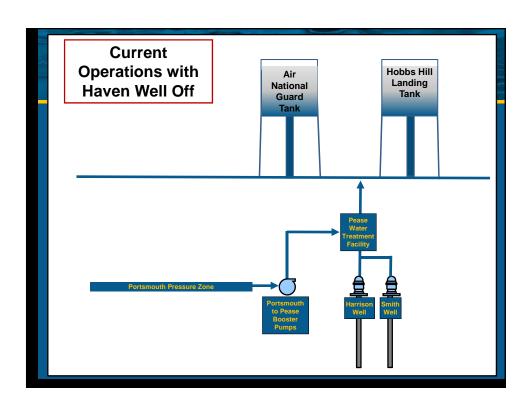


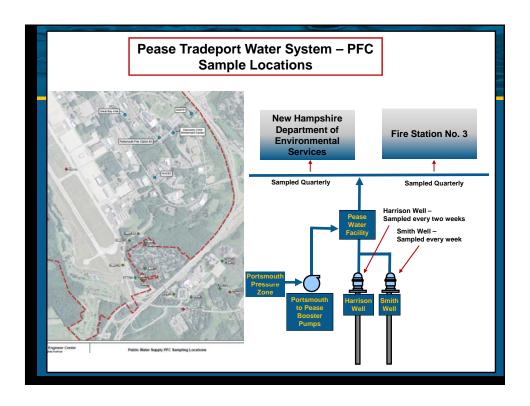


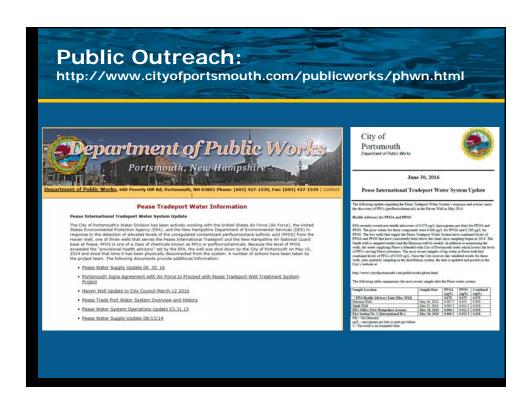












Summary of PFC Analytical Results Public Water Supply Monitoring Program Former Pease Air Force Base, New Hampshire Table 1

AO34+2O34	0.070	0.018	0.018	0.030	0.016	
bios oionsoabnuoroulfreq (AnUTq)	-	AN	ΥN	ΥN	NA	
Perfluorotridecanoic acid (AG1T74)	-	AN	AN	ΥN	NA	
Perfluorotetradecanoic acid (ACbT79)	1	NA	NA	NA	NA	
(Aeqqq) bios oionstreqoroultreq	-	0.006	0.004 J	0.008 J	0.004 J	
Perfluorooctanoic acid (PFOA)	0.070	0.006 ر	0.006 J	0.007 J	0.005 J	
Perfluorooctanesulfonic acid (PFOS)	0.070	0.012 J	0.012 J	0.023	0.011 J	
Perfluorooctane sulfonamide (ASO39)	ı	QN	QN	QN	ND	
Perfluorononanoic acid (PFNA)	ı	QN	QN	QN	QN	
Perfluorohexanoic acid (PFHXA)	ı	QN	QN	0.007 J	0.006 J	
Perfluorohexanesulfonic acid	ı	0.013 J	0.012 J	0.024	0.013 J	
Perfluoroheptanoic acid (AqHTq)	ı	QN	QN	0.005	QN	
Perfluoroheptane sulfonate (PFHpS)	1	QN	ND	0.005 J	QN	
Perfluorododecanoic acid (AoGT9)	1	AN	NA	NA	NA	
Perfluorodecanoic acid (PFDA)	ı	NA	NA	AN	NA	
Perfluorodecane sulfonate (PFDS)	1	AN	NA	N	NA	
Perfluorobutanoic acid (PFBA)	-	0.008	ر 200.0	0.00 J	ND	
Perfluorobutanesulfonic acid (PFBS)	-	0.005 J	0.005 J	0.005 J	0.006	
M-Methyl Perfluorooctane Sulfonamidoethanol (MEFOSE)	1	AN	NA	NA	NA	
M-Methyl Perfluorooctane Sulfonamide (MEFOSA)	ı	AN	NA	AN	NA	
N-Ethyl perfluorooctane sulfonsmidoethanol (EtFOSE)	ı	AN	NA	NA	NA	
N-Ethyl perfluorooctane sulfonamide (EtFOSA)	1	AN	NA	AN	NA	
S:8) Fluorotelomer sulfonate (S:2)	1	QN	QN	QN	ND	
S:3) etsnoribus raulfonote (S:3) FTS)	<u>.</u>	QN	ND	N	ND	
Collection Date	visory (HA)	5/26/16	5/26/16	5/26/16	5/31/16	
Sample ID	USEPA Health Advisory (HA):	DES-OFC-GW_20160526	FIRESTATION3- GW_20160526	HARRISON-GW_20160526	SMITH-GW_20160531	
Well Type Sample Location						10+014
					ш	

Grey text indicates the parameter was not analyzed or not detected.

All concentrations in µg/L - micrograms per liter

All values in micrograms per liter

All values in micrograms per liter

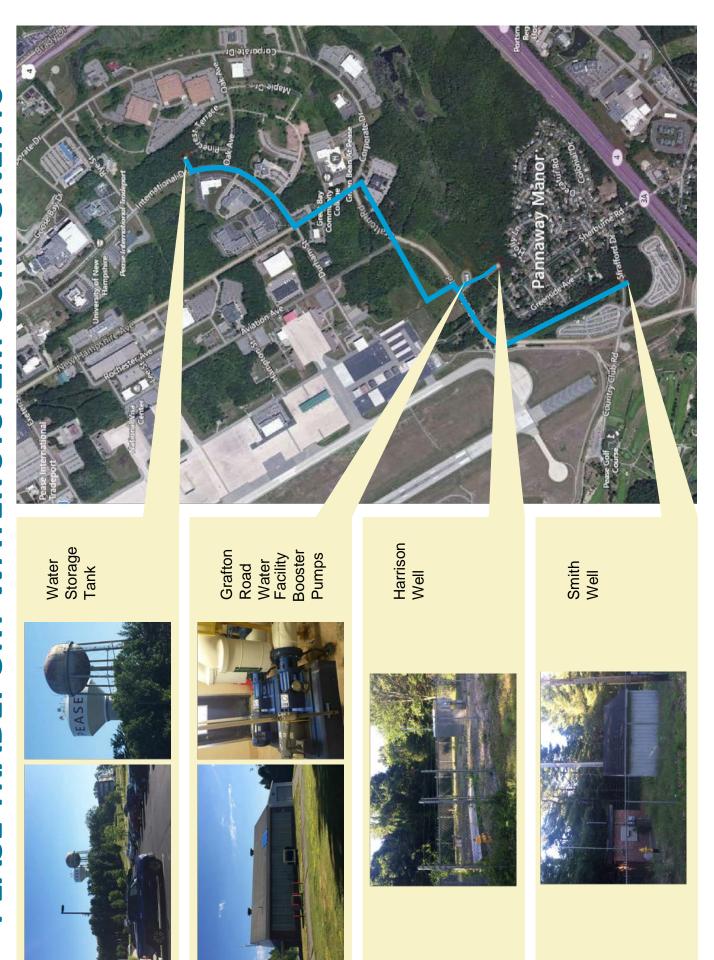
D - duplicate sample

J - The result is an estimated value.

B - Detected in Blank.

Q - The analyte is both B qualified because of blank detection and J qualified because of an additional QC issue.

PEASE TRADEPORT WATER SYSTEM COMPONENTS



TREATMENT PLAN FOR PEASE TRADEPORT WATER SUPPLY

Harrison and Haven Wells. Through this agreement, the City is moving forward with the installation of Treatment of all the wells has been a goal of the City since the contamination was first discovered and In April, 2016 the City of Portsmouth, the Pease Development Authority (PDA) and the United States Air treatment system in order to install carbon filters to remove PFCs from water supplied by the Smith, Force announced the execution of an agreement to enable an upgrade of the Pease Tradeport water carbon filters for the Harrison and Smith wells, and subsequent design of treatment for the Haven Well. was requested directly of the Air Force through correspondence beginning in June 2014.



The treatment of the Harrison and Smith wells will demonstrate the effectiveness of the technology and

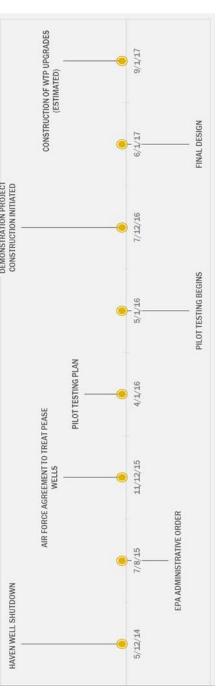
performance of the system. An initial pilot study was completed in June 2016. Modifications to the Grafton Road Plant will allow for the installation of two 20,000 lb. granular activated carbon vessels (GAC) to filter and remove PFCs from the Harrison and Smith Wells. This work will be completed by early Autumn 2016. Information from both the pilot and the demonstration study will then be used by the City's consultant to revise the final design parameters for treatment of the Haven Well. Pilot testing results indicated that the GAC filter media will remove PFCs without significant pressure build up or fouling in the media. General chemistry results indicate acceptable levels for pH and alkalinity with no anticipated disruption to the existing distribution system. Frequent sampling, filter monitoring, and operational requirements from the demonstration project will be evaluated for six months. Data from these efforts will be used to optimize the final design of a full-scale treatment system providing treated water to the Tradeport for the removal of PFCs. Final data and design plans for the Haven treatment system are planned for Spring 2017 with construction anticipated in the Fall of 2017. Haven well design will also include contingency planning and treatment retrofits to treat other contaminants if necessary.

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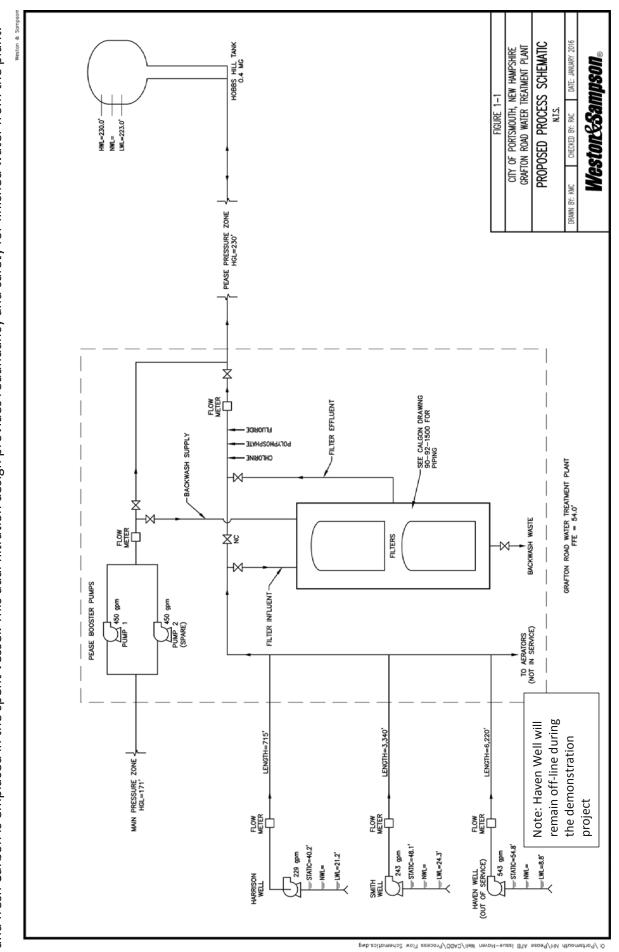
This agreement with the Air Force will reimburse to the City for up to \$58,700 for the system piloting and \$831,000 for the filter installation and demonstration project. Additional agreements between the City and the Air Force for design and construction of the Haven Well treatment system will follow once the design parameters have been finalized

While implementing a frequent monitorin program (see http://www.cityofportsmoutl com/publicworks/phwn.html), the City o Portsmouth negotiated an agreement with th Air Force to fund:

- An initial Pilot Study to evaluate the use of Granular Activated Carbon (GAC) Filtration
- A full-scale Demonstration/Feasibility Project
 Final design of a treatment facility capable of handling up to 1.2 million gallons per day



filter (lag) will provide additional filtration capacity to ensure effective removal of PFCs if any pass through the lead filter. Water quality will be monitored before, between, and after the filters to evaluate media life. The use of a lead/lag arrangement allows the GAC to be replaced in the The filtration system for the demonstration will consist of granular activated carbon (GAC) as a filter media. Calgon pressure vessels will be filled filter vessels for the demonstration project will be placed in series. Groundwater will be pumped through a primary filter (lead), while a second with Filtrasorb 400 TM, which has been used effectively to treat PFCs in drinking water systems in Minnesota and Maryland. Like the pilot study, lead filter when adsorptive capacities are fully utilized and PFC removal effectiveness is diminished. The lag filter is then placed in the lead role, and fresh Carbon is emplaced in the spent vessel. This dual filtration design provides redundancy and safety for finished water from the plant.



STOP 4: Haven Well

Air Force Pease PFC Action Plan



Protecting Drinking Water

- Updating City of Portsmouth Drinking Water Treatment System
- Monitoring of public water supply wells
- Inventoried and sampled private drinking water wells within a 1-mile radius
- Provided bottled water to homeowners of private wells exceeding PFC Health Advisory levels (3 private wells and one seasonal well)

Haven Well Pump House

This building located on the Pease Airfield houses the Haven Well, which will be part of the final Pease Tradeport drinking water treatment system upgrade

Evaluating Potential PFC Sources

- Investigated 21 Areas at Pease where PFCs may have been released into the environment
- Basewide investigation of soil and groundwater underway



Monitoring Wells

Monitoring wells are used to keep track
of contaminant concentrations

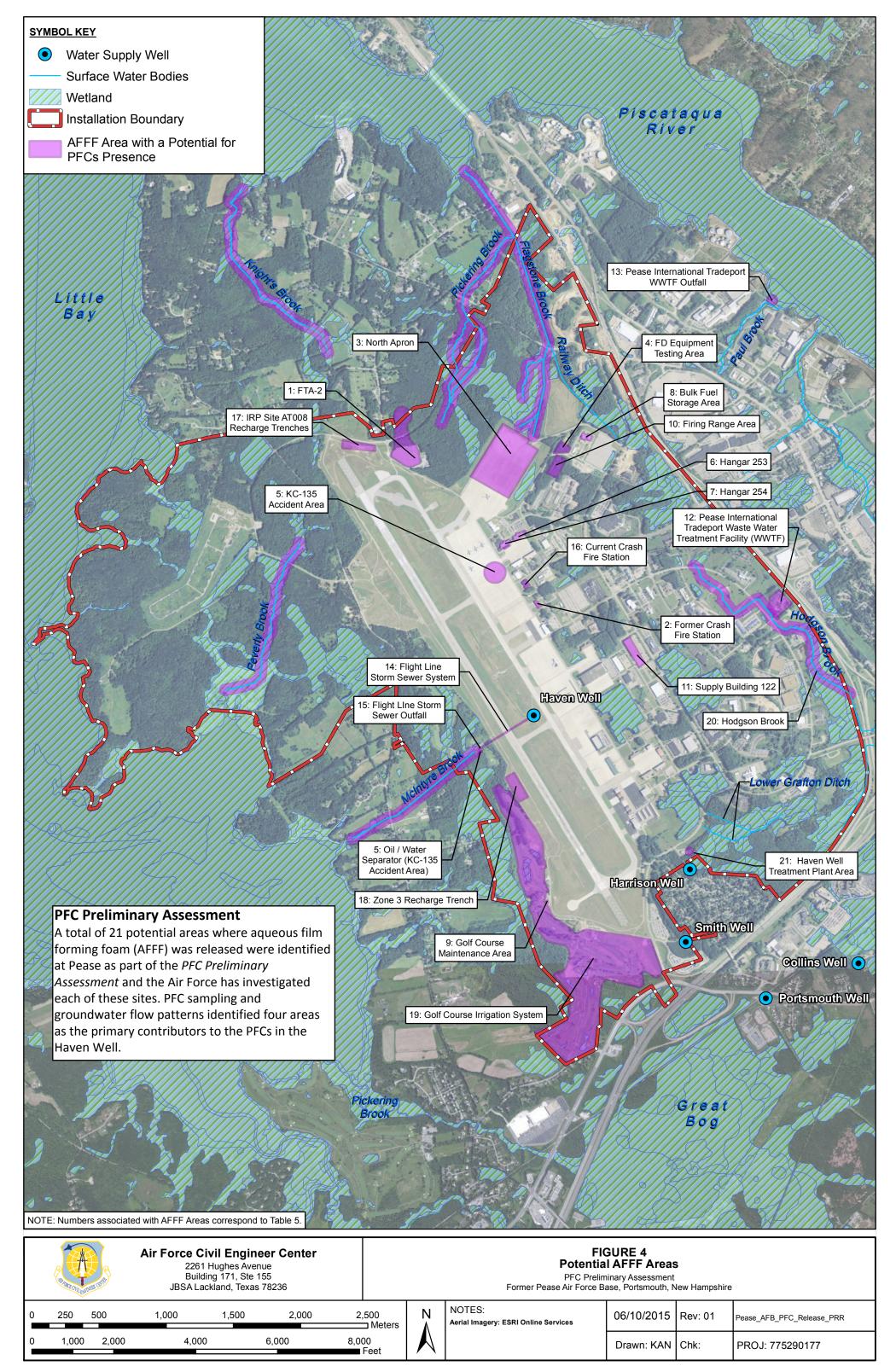


Restoring Groundwater

- Existing Site 8 GWTP Being Upgraded With Additional New Extraction Wells
- New Airfield Interim Mitigation System Under Design

Extraction Wells

Extraction wells keep contaminated groundwater from migrating at Pease. The well and piping are located at the bottom of the vault shown above. An electrical box houses the electrical components of the well.



Contacts for Additional Information

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Air Force Civil Engineer Center Pease Webpage http://www.afcec.af.mil/brac/pease/index.asp

Key Documents

Key documents referenced below are available for viewing or download on the Air Force Administrative Record (AR) website. The AR is the Air Force's online archive for official documents pertaining to restoration activities. The AR holds records for both Active and BRAC Air Force installations and is located at http://afcec.publicadmin-record.us.af.mil/.

At the main webpage, click the "BRAC" button and select "Pease AFB" from the pulldown installation list. Any search terms can be used, or if a specific document is desired and the AR number is known, the AR number can be input in the "Full Document Search" field. AR numbers for each key document below can be found at the end of each reference.

- AMEC Foster Wheeler, 2015. Final PFC Preliminary Assessment for former Pease AFB. December. AR #469495.
- AMEC Foster Wheeler, 2016. Final Long Term Residential Well PFC Monitoring Plan for former Pease AFB. February. AR #471817.
- AMEC Foster Wheeler, 2016. December 2015 Tier I & II Groundwater Monitoring Data. 22 February. AR #472320.
- CB&I, 2014. Five-Year Review Report (2009–2014). Former Pease Air Force Base. September. AR #451143.
- CB&I, 2015. In Situ Chemical Oxidation Pilot Study Work Plan, Site 8, AT008, Fire Department Training Area 2. September. AR #467630.
- CB&I, 2016. Final Performance Monitoring Plan for Perfluorinated Compounds Site 8, AT008, Fire Department Training Area 2. February. AR #472181.
- CB&I, 2016. Optimization Completion Report, Site 8, AT008, Fire Department Training Area 2. February. AR #472851.
- CB&I, 2016. Long-Term Monitoring Plan, Revision 3, Site 8, AT008, Fire Department Training Area 2. February. AR #472850.
- CB&I, 2016. 2014 Annual Report, Landfill 1 (LF001), Landfill 5 (LF005), Landfill 6 (LF006), CRD-1 (DP009), and CRD-2 (DP017). February. AR #472852.
- CB&I, 2016. Postclosure Monitoring and Maintenance Plan Landfill 1 (LF001), Landfill 5 (LIF005), Landfill 6 (LF006), CRD-1 (DP009), and CRD-2 (DP017). March. AR #474617.
- Weston, 1993. Record of Decision for a Source Area Remedial Action at Landfill 5. September. AR #822.
- Weston, 1994. Record of Decision for Site 8 at Pease. September. AR #824.

Glossary of Terms

The terms in this glossary are general definitions for common regulatory and scientific terms.

Α

Aquifer—A zone of soil or rock below the surface of the earth that is capable of producing water.

В

Biodegradation — The breaking down of organic substances by microorganisms through the breaking of intramolecular bonds.

C

Conceptual Site Model (CSM) – The CSM is a description of a site and its environment that is based on existing knowledge. It describes sources and receptors, and the interactions that link these. It assists the cleanup team in planning, interpreting data, and communicating. The CSM will provide a planning tool to integrate information from a variety of resources, to evaluate the information with respect to project objectives and data needs, and to respond through an iterative process for further data collection or action.

Contaminant— Any physical, chemical, biological, or radiological substance in air or soil or water that has an adverse effect. Any chemical substance whose concentration exceeds background concentrations or which is not naturally occurring in the environment.

Contamination—Introduction into air, water, and soil of chemicals, toxic substances, wastes, or wastewater in a concentration that makes the impacted medium unfit for its next intended use.

D

Dissolved Phase —The part of hydrocarbon contamination which has partitioned into a body of water.

E

Effluent— Treated (or un-treated) wastewater that flows out of a treatment plant.

Extraction well—A well specifically designed for the removal of groundwater or air.

G

Granular Activated Carbon (GAC) - A porous adsorbent material created through the heating of organic material such as coal, wood, or coconut shell, which is then crushed into granules. The granular activated carbon is positively charged and therefore able to remove dissolved organic solutes by adsorption onto the activated carbon.

Groundwater— Water under the surface of the earth that fills pores in soil or opening in rock. When groundwater accumulates in sufficient quantities and quality, it may be used as a source of drinking water.

Н

Hydrocarbons— Chemical compounds that consist primarily of carbon and hydrogen, such as petroleum.

Glossary of Terms

ı

Influent—Untreated wastewater flowing into a treatment plant.

Injection Well —A device that is used to place fluid (e.g., treated water) into soil or rock formations.

In situ— Where contaminated material(s) are treated without prior excavation or extraction from the ground.

Interim Measure— Early action(s) taken to eliminate, reduce, or control the hazards posed by a site or to expedite the completion of site cleanup.

L

Light Non-Aqueous Phase Liquid (NAPL) - Contaminants that remain undiluted as the original bulk liquid in the subsurface (e.g., free product).

M

Monitoring well— A well that provides access to groundwater or soil vapor that provides access for field measurements and collection of samples for laboratory analysis.

P

Plume—A visible or measurable discharge of a contaminant from a given point of origin.

R

Receptor—A person, organism, habitat, or water that is being, or could be, harmed by a potential contaminant.

Remediation—An action taken to improve a contaminated site in order to prevent, minimize, or mitigate damage to human health, or the environment. Remediation includes the development and application of a planned approach that removes, destroys, contains or otherwise reduces the availability of contaminants to receptors of concern.

S

Saturated Zone—The zone where voids of the soil or rock are filled with water.

Soil vapor—The vapor of gas phase of a substance that is found in the unsaturated zone.

Soil Vapor Extraction (SVE) - A physical treatment process for remediation of volatile contaminants in a vadose zone.

V

Vadose Zone —The zone between the earth surface and the water table within which the moisture content is less than saturation. The soil pore space typically contains air or soil vapor.

Volatile Organic Compounds (VOCs) - Human-made hydrocarbon compounds that have low boiling points and therefore evaporate readily. Propane, benzene, and other components of gasoline are all volatile organic compounds.

Glossary of Terms

W

Water Level—The upper limit of the saturated zone. It is measured by installing wells that extent a few feet into the saturated zone and then recording the water level in those wells.

Water Table—The level of groundwater.

Environmental Cleanup Concepts

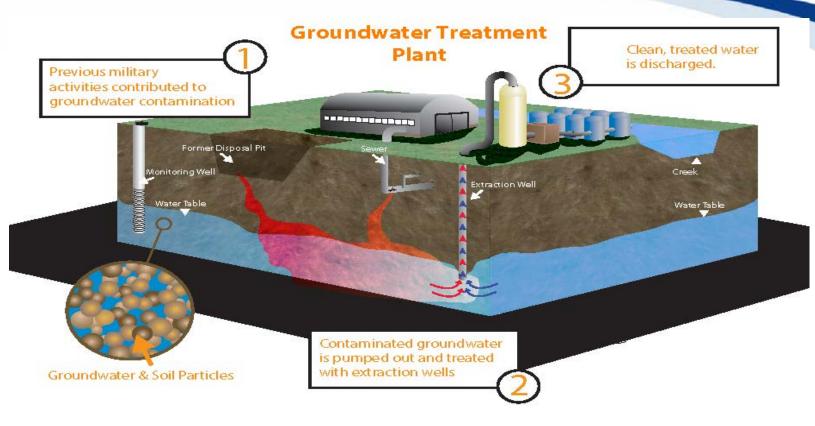
Fact Sheets

Fact sheets presenting general information on the types of remediation systems currently in use at Pease are included in this section. Note these fact sheets and figures are not intended to represent site-specific remediation systems at Pease, but rather, are intended to provide the reader with a better understanding of the components, mechanisms, and intended functions of each remediation system.

Facts Sheets Included

Groundwater Treatment
Soil Vapor Extraction
Permeable Reactive Barrier
Monitored Natural Attenuation





Pump and Treat Technology

One technology that is used to clean up contaminated groundwater involves pumping out the water and cleaning it (pump-and-treat). It's a 2-step process that uses groundwater extraction wells to remove contaminated groundwater from the aquifer. A groundwater well is a hole drilled into an aquifer supported by a pipe. A pump is used to pull water out of the ground and a screen filters out unwanted particles that could clog the pipe.

Wells come in different shapes and sizes, depending on the type of soil the well is drilled in and how much water is being pumped out. A treatment system at the ground surface removes contaminants from the extracted water. Groundwater monitoring wells are used to collect groundwater samples to monitor the levels of contamination and the movement of the contaminant plume.

What is Groundwater?

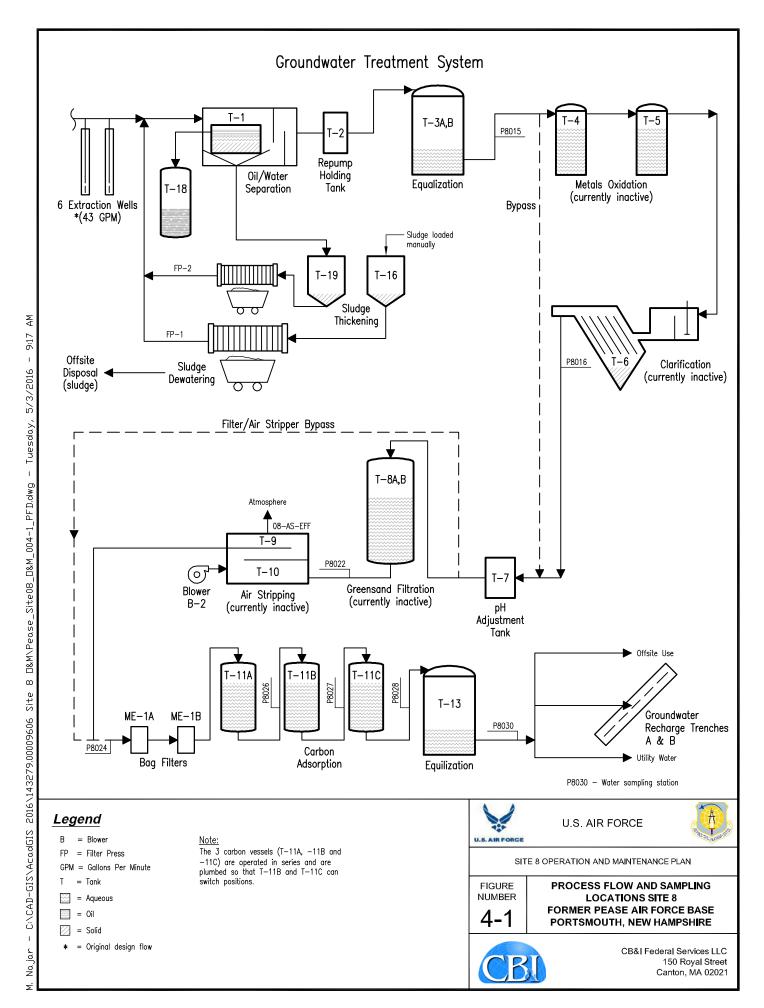
Imagine pouring a glass of water onto a pile of sand. Where does the water go? The water moves into the spaces between the particles of sand.

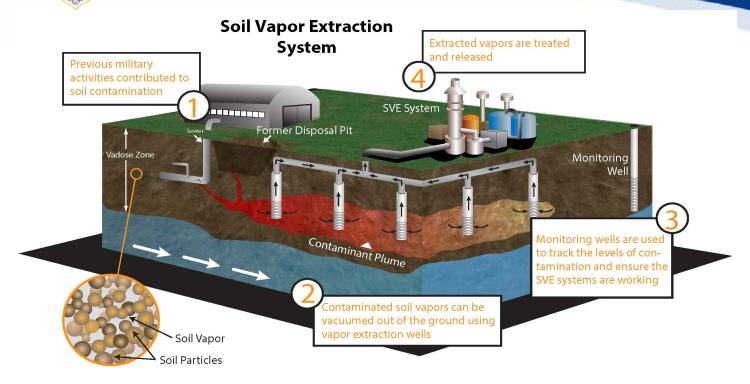
Groundwater is water that fills the spaces between rocks and soil particles underground. The area where water fills these spaces is called the saturated zone. The top of this zone is called the water table. The water table may be only a foot below the ground surface or it may be hundreds of feet down.

The water table rises and falls depending on many factors, including heavy rains, melting snow and extended periods of dry weather. Human activity may also draw down the water table by pumping out water for drinking water supplies or irrigation.

Groundwater is stored in and moves through layers of soil, sand and rocks called aquifers. The speed at which groundwater flows depends on the size of the spaces in the soil or rock and how well the spaces are connected. Aquifers typically consist of gravel, sand or fractured rock. These materials are permeable because they have large connected spaces that allow water to flow through.

Groundwater supplies are replenished, or recharged, by rain and snow melt. If contamination is present in or on soil above the aquifer, rain and snow melt can carry contaminants through the soil to the aquifer. An area of contamination in groundwater is called a plume.





What is Soil Vapor?

The soil at McClellan is made of small bits of minerals, rocks, sand and clay, and organic materials such as pieces of plants. Also, there are other things in soil such as water and air in the spaces between soil particles. Soil vapor is gas in the spaces between soil particles. Soil vapor contains air, evaporated water, and in some places contaminants spilled onto the soil. Some of these chemicals evaporate (or "volatilize") easily. Chemicals that readily change from liquid to vapor, including many solvents and fuel products, are called volatile organic compounds (VOCs). These VOCs can move with soil vapor through the soil in all directions, including down into groundwater and up into buildings.

What is Soil Vapor Extraction?

Soil Vapor Extraction (SVE) is a technology used to remove contaminants from the soil above the water table (vadose zone). As the name suggests, SVE removes contaminants from the soil in vapor form, making it an ideal cleanup technology for VOCs. Soil vapor is vacuumed out of the ground through extraction wells. These wells are like slotted straws and are installed in holes drilled through the vadose zone. The number of extraction wells depends on site conditions such as the amount of contamination and the type of soil. SVE is most effective in loose soils, such as sand and gravel, because soil vapor moves quickly through the large spaces between the soil particles. In tight soils, such as silt and clay, SVE systems must operate longer to get maximum results. Extraction wells are connected together using above-or below-ground pipelines, when are connected to vacuum pumps. When soil vapors are removed from the ground, VOCs are captured and treated as appropriate to assure protection of human health and the environment.

SVE systems are easy to install, can be used with other cleanup technologies and are effective under a variety of site conditions. SVE does not require digging up contaminated soils. Soil vapors extracted using SVE usually require treatment, but costs for treating extracted vapors are low compared to costs for digging up and treating soil. Additionally, SVE prevents contaminants from migrating to the groundwater – cleaning up contaminated groundwater takes longer and costs more.

When ongoing monitoring shows that contaminants have been removed to a prescribed level, the SVE system at a site is temporarily shut down for approximately six months then the well resampled. In the event that contaminants in small tight soil pockets have re-emerged (or rebounded) back into the area the system will be restarted and will operate until sampling results over several months to years consistently show that contaminants have not rebounded.

At that point the system is no longer needed, it is permanently shut down and the wells are removed.

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Permeable Reactive Barriers

WHAT ARE THEY?

A Permeable Reactive Barrier (PRB) is an underground wall made of iron filings designed to treat shallow groundwater contaminated with cer-tain chemicals.

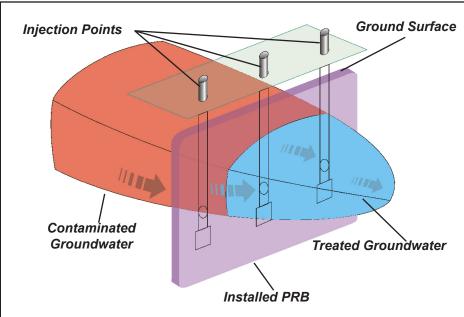
HOW DO THEY WORK?

PRBs treat contaminated groundwater using iron filings to change the chemicals into less toxic or non-toxic substances.

As the groundwater flows through the barrier the iron reacts with the chemicals and converts them into harmless compounds. PRBs are ideal for treating ground-water contaminated with tetrachloroethylene (PCE), trichlóroethylene (TCE), dichloroethéne (1,2-DCE) and vinyl chloride. Water samples taken from nearby monitoring wells are tested and help experts determine how well a PRB is working by comparing chemical levels over time.

WHAT ARE THE BENEFITS?

PRBs offer a more efficient method of reducing chemicals contaminating groundwater than traditional meth-ods such as pump and treat systems. Additionally, PRBs can provide signifi-cant cost savings over other clean-up methods.



A conceptual model of an injected Permeable Reactive Barrier.

HOW ARE THEY INSTALLED?

Permeable Reactive Barriers can be installed in two different ways: trench-ing and injecting.

Using the trenching method, workers use heavy equipment to dig a trench long enough and deep enough in the ground to intersect with the shallow groundwater zone.

The trench is then filled with the iron filings and covered up.

The injection method uses heavy equipment to bore wells into the ground, also intersecting with the groundwater zone. The iron filings are then injected into these wells until a wall is formed.

While both installation methods may cause temporary street closures and other construction-related inconveniences, the injection method is generally less disruptive.

ABOUT AFCEC

The Air Force Civil Engineer Center oversees the environmental cleanup activities at former Air Force bases throughout the United States. Our goal is to complete cleanup actions needed to protect human health and the environment and to transfer property for reuse. AFCEC also plays a key role in property reuse/privatization and serves as the Air Force liaison supporting interim property leases.

For more information, contact the Air Force Civil Engineer Center Community Relations Office (916) 643-6420 x257 or http://www.afcec.af.mil/brac/pease

Air Force Civil Engineer Center

Monitored Natural Attenuation

WHAT IS IT?

Monitored natural attenuation (MNA) uses everyday natural processes to clean up contaminated soil and groundwater.

HOW DOES IT WORK?

MNA takes advantage of naturally occuring biological, chemical and physical processes to clean soil and groundwater contaminated with chemicals.

These processes may include biodegradation, phytoremediation, sorption, dispersion, dilution, chemical reactions and volatilization. Soil and groundwater is constantly monitored to verify the cleanup is progressing.

WHAT ARE THE BENEFITS?

MNA is a less expensive method of cleaning up soil and groundwater compared to other methods and can achieve cleanup in the same amount of time. It can also be used with other cleanup methods to speed remediation.

Since the method relies on nature to passively clean up soil and groundwater, exposure to contaminants is kept to a minimum. Construction of remedial systems is also kept to a minimum.

WHAT ARE THE NATURAL PROCESSES USED IN MNA?



Biodegradation uses natural microbes in soil and groundwater to digest chemicals in groundwater. This process can be improved by changing underground conditions to better suit microbes.

Phytoremediation uses plants such as trees and grass to clean chemicals from groundwater. As roots take out nutrients from soil and groundwater, they break down chemicals into less harmful products.

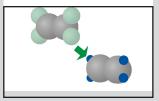




Sorption involves the containment of contaminated water by using soil and sediment particles. As the groundwater flows by, the soil acts like a sponge, keeping chemicals from contaminating other areas.

Dispersion and dilution lowers the concentration of contaminants as water flows away from the source, just like a beam of light that gets dimmer as it moves from its source.





Naturally occuring chemical reactions in soil and groundwater can also change chemicals in the groundwater into less harmful chemicals.

Volatilization is the process where chemicals evaporate into gases while still in the soil. These gases then move to the surface where they are destroyed by the sun.



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