



Welcome to the 20th Fighter Wing

PROVIDING COMBAT READY AIRPOWER TO MEET ANY CHALLENGE, ANY TIME, ANYWHERE

2021 Secretary of Defense

Environmental Awards

Environmental Restoration, Installation
Shaw Air Force Base

Introduction

Shaw Air Force Base (AFB) is seven miles west of Sumter and 36 miles east of Columbia, SC. The base includes approximately 3,326 acres and is surrounded by a semi-rural area consisting primarily of wooded and agricultural land. Before the construction of the base in 1941, the property was used as farmland. Some residential and commercial development has occurred on land adjacent to the west and southeast boundaries of the base. Shaw AFB operates two satellite properties: Poinsett Electronic Combat Range (PECR), a 12,521-acre parcel 7.5 miles south of the base,

and Wateree Recreation Area, a 26-acre parcel approximately 30 miles north of the base.

Construction of Shaw Army Airfield, named after First Lieutenant Ervin David Shaw, began in 1941. The airfield became operational on August 30, 1941, and was training pilots by December 1941. During World War II, the airfield's task evolved from training cadets (basic flight trainees) to fighter transition training by the war's end. In January 1948, Shaw Army Airfield was renamed Shaw AFB. Since that time, the base has been home to many squadrons and missions and had many different

aircraft within its hangars and operating from its runway.

Today Shaw AFB is home to the 20th Fighter Wing, the Air Force's largest F-16 "Fighting Falcon" combat wing, whose mission is to provide combat-ready airpower and combat-ready Airmen. Shaw AFB also serves as home to Headquarters, Fifteenth Air Force; the United States Air Forces Central; Third Army; United States Army Central; and many other tenant units.

Shaw AFB's daytime population is more than 20,000 people. The base supports more than 8,524 military and civilian employees, 11,000 family members on base, and 15,000 military members and retirees off base. Shaw AFB provides essential services to the base, City of Sumter, Sumter County, and surrounding community through a variety of activities, facilities, and programs. The total value of capital assets is \$477M, with \$283M annual payroll and \$121.8M total annual expenditures, providing a \$1.8B total economic impact in South Carolina.

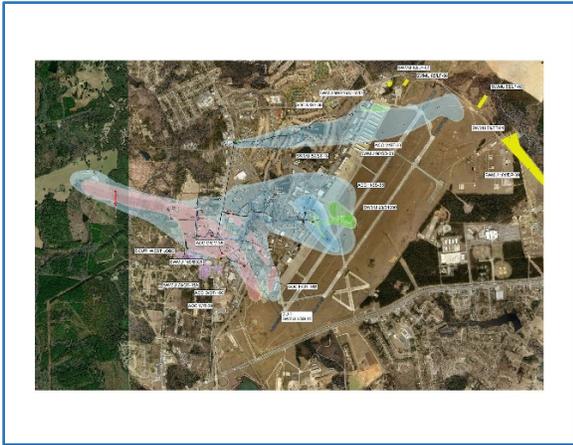
Background

Shaw AFB began its restoration program in 1983, with a records search identifying sites for further investigation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Since Shaw AFB was not included in the United States Environmental Protection Agency's (EPA) National Priorities List, regulatory authority was delegated to the State of South Carolina's Resource Conservation and Recovery Act corrective action program. The South Carolina Department of Health and Environmental Control (SCDHEC) issued Shaw AFB's first corrective action permit in 1992, with the most recent 10-year renewal becoming effective

September 15, 2019. The current permit lists 124 environmental sites with 105 closed (two require confirmatory sampling when the base closes) and 19 sites in various stages of cleanup.

The Remedial Project Manager (RPM) and one full-time contractor oversee the Shaw AFB Environmental Restoration Program; both are supported by project teams from the Air Force Civil Engineer Center, U.S. Army Corps of Engineers, SCDHEC, base leaders, and subject matter experts. The Shaw AFB Restoration Advisory Board holds annual public meetings, and information on current projects is included in newsletters mailed to 450+ recipients. A Community Involvement Plan, updated every three years, outlines how the installation will keep the public informed and involved in the cleanup process.

Over the years, the operation and maintenance of aircraft at Shaw AFB has used hazardous materials. These materials include petroleum hydrocarbons from sources such as jet fuel, motor gasoline, and diesel; fuel contaminants such as benzene, toluene, ethylbenzene, and xylene; polynuclear aromatic hydrocarbons; chlorinated solvents such as trichloroethene (TCE) or tetrachloroethene (PCE); pesticides and herbicides; and more recently, chemicals of emerging concern, per- and poly-fluoroalkyl substances (PFAS) from past use of firefighting foams, and 1,4-dioxane formerly used as a solvent stabilizer. The focus is on cleaning up hazardous wastes from previous disposal and waste management activities on the base that have resulted in soil and groundwater contamination.



Shaw AFB
Environmental Restoration Program sites.

Summary of Accomplishments

Accelerated Environmental Cleanup

Although the Shaw AFB Environmental Restoration Program has operated for the past 35 years, more than half of the program's \$115M total expenditures were obligated in the last few years. In the past two years alone, ten contracts, valued at nearly \$62M, were awarded for environmental restoration.

Shaw AFB is one of the first bases that went through two years of intensive Installation Strategic Acquisition Planning. This new process resulted in the early award of a multi-year \$16.3M, Optimized Remediation Contract (ORC) in August 2020, which replaced three expiring contracts totaling \$32M. The three Performance-based Restoration projects achieved a record ten Site Closeouts, two Responses Complete, and eleven optimized remedies. For the optimized remedies, six sites achieved dramatic reductions in groundwater plume footprints giving these sites the opportunity to achieve Response Complete under the new contract.

A major optimization effort is the expansion of the circa 1997 10-extraction well pump-and-

treat system that treats massive 2-mile long, 1-mile wide, co-mingled chlorinated solvent plumes that have migrated off base. The recent expansion more than doubled the number of extraction wells to 23, installed a second air stripper to double treatment capacity to 1,200 gallons per minute, drilled 38 new re-injection wells, and centralized the deep groundwater treatment of not just two but three large chlorinated solvent plumes, covering nearly one-third of the base's total footprint. Modeling calculations indicate this enhanced pump, treat and inject (PTI) system will reduce the 180-year estimated cleanup period by 50-75%. To manage the 1.5-mile long off-base leading edge of the plume, which is outside of the hydraulic influence of the expanded PTI system, a \$3.5M demonstration project was installed at a private farm in early 2019 to stop the leading edges down gradient movement.

Following EPA's release of the drinking water lifetime Health Advisory (HA) levels for perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) in May 2016, Department of the Air Force (DAF)-wide actions to address releases of firefighting foam containing PFOS/PFOA commenced using CERCLA authority. When Shaw AFB finalized Site Inspection of six Aqueous Film Forming Foam (AFFF) release sites in January 2019, findings confirmed down gradient impacts to on-base and off-base drinking water sources, which triggered the start of four PFOS/PFOA removal actions totaling over \$7.6M. These four projects addressed Expanded Site Inspection at the base boundaries, initiated sampling of off-base drinking water supply wells with interim bottled water service, and retrofitted the PTI system with an ionic exchange resin-based filtration component to ensure re-injected treated water is free of PFOS/PFOA following

a Mar 2019 shut down due to elevated detections.

Right before the end of FY20, the six AFFF release sites underwent rapid new site validations and relative risk site evaluations for priority funding and 30-day public review. As a result, Shaw AFB is among the DAF's first FY20 Top 12 locations to execute a PFOS/PFOA Remedial Investigation using a \$2.79M task order contract awarded September 2020.

Innovative Technology Demonstration/Validation and Implementation

The Shaw AFB Environmental Restoration Program, has delivered several innovations, earning praise from the base leadership and from the State. These technologies are the firsts of their kind in the State of South Carolina.

When a deep TCE/PCE plume's leading-edge migrated beyond the base boundary 1.5 miles, and the main PTI system could not contain it, an innovative demonstration project was put into place. The BOS 100® treatment barrier is a Trap & Treat® In Situ remediation technology specifically designed to degrade chlorinated solvents. The barrier was installed about 100 feet below ground surface, 650 feet long, 20 feet wide, and approximately 30 feet thick. Within the confines of the treatment barrier, BOS 100® aqueous slurries were injected into 130 temporary injection points, proactively intercepting and treating the plume's leading edge to prevent further uncontrolled impacts to down-gradient private parcels. The first semi-annual performance monitoring report recorded an average 38% reduction in TCE/PCE levels passing through the 20-year barrier.



Trap & Treat® In Situ Remediation Technology Demonstration

South Atlantic Environmental Drilling and Construction Company workers use a Geoprobe Rotary Sonic drill rig to drill a small diameter pipe into the ground at Sans Souci Farm in Sumter, S.C., March 7, 2019. The pipes serve as conduits for the precise injection of the [BOS 100®] product at the prescribed depths. (U.S. Air Force photo by Senior Airman Ashley Maldonado)

When a contaminant plume is located beneath the base's most restricted area where aircraft weapons systems are parked, traditional vertical drilling will not do the job for mission readiness, and expensive airfield pavement infrastructure will be compromised. This problem was solved with the installation of two 3-inch high-density polyethylene injection pipes, horizontally drilled at a record 1,919 feet and 2,069 feet in length, one of the longest of its kind in the southeast region. Today, the screened horizontal pipes are injecting atmospheric air for treatment just below the plume and 60 feet below the surface, which reduced cleanup time without impact to flight operations. Atmospheric air injection via horizontal injection wells promotes contaminant degradation through increased dissolved oxygen concentrations in the contaminated shallow groundwater, reducing the cleanup time by approximately a decade.

When the main Groundwater Treatment Plant (GWTP) detected elevated levels of PFOS/PFOA above the HA, personnel acted

quickly to pause treatment in its influent and effluent streams in March 2019. Shaw AFB and SCDHEC collaborated to address a chemical of emerging concern while at the same time find a way to restart the treatment plant to ensure hydraulic control of three chlorinated solvent plumes remain in check. In less than four months, a \$3.26M removal action contract was put into place to design/build a state of technology, ionic exchange resin-based PFOS/PFOA-filtration component to the GWTP.



PFOS/PFOA Response Action

Construction crew installing an ionic exchange resin-based PFOS/PFOA-filtration component to the Groundwater Treatment Plant.

Partnerships Addressing Environmental Restoration Issues Between DoD and Other Entities

The heart of Shaw AFB Environmental Restoration Program's success is with proactive and involved stakeholders, bonded by close partnerships and constant collaboration. It starts with AFCEC's Restoration Program Management Office meeting every year, refining Shaw's 30-year cost-to-complete program and providing a blueprint for future success. The reason for Shaw's recent \$62M contract execution lies with its core project team, headed by the RPM and supported by a cadre of contract, technical, legal, and public affairs specialists.

Shaw AFB's success is attributed to strong Tiered-partnering efforts with the State, actively supported by a biennially-renewed DoD-State Memorandum of Agreement, which allows nearly 200 documents per year submittals to complete regulatory review, and complemented by bi-weekly partnering teleconferences and quarterly face-to-face on-site meetings. Recent collaborative achievements with the State included a pre-solicitation regulatory review of the new multi-year base-wide cleanup contract's Statement of Work and site visit participation with prospective bidders, resulting in the contract's early \$16.3M award.

As Shaw AFB implemented the three-step approach (Identify-Respond-Prevent) of the Air Force's PFOS/PFOA response plan, the State was very supportive of the base in sampling potentially impacted public/private drinking wells outside of the base perimeter, as the State itself had just developed its 2020 Per- and Polyfluoroalkyl Substances Response Strategy. The Air Force's centralized control of the direction of the PFOS/PFOA response has a unifying effect among its impacted installations, as each installation is learning from one another, cross-feeding lessons learned in the field.

Shaw AFB also has a very close partnering relationship with the Defense Logistics Agency (DLA), incorporating the Agency's three active sites into the base's corrective action permit and the recently awarded base-wide cleanup contract, integrating both DAF-funded and DLA-funded sites for focused oversight. A recent success story is DLA's funding of a mission-critical \$23M military construction project to centralize aircraft refueling operations inside the administrative boundary

of a cleanup site that was fully coordinated with the State regulatory agency.

The largest stakeholder is the community. The Shaw AFB leadership is the face of the Air Force, engaging proactively using the 25-year-old, 14-member Restoration Advisory Board as its primary community outreach tool, supplemented with newsletters in between annual public meetings. Outreach communications start from the base, and in turn, community concerns go back to the base.

Reducing Risk to Human Health and the Environment

The Shaw AFB Environmental Restoration Program's primary objective is reducing risk to human health and the environment. Air Force senior leaders continually echo this commitment. Mr. Mark A. Correll, Deputy Assistant Secretary of the Air Force for Environment, Safety, and Infrastructure, asserts, "Protecting human health is our priority." In his 2020 Shaw AFB Commitment to Environmental Protection letter, Col. Lawrence Sullivan, 20th Fighter Wing commander, declared, "Our commitment to environmental protection is the right thing to do, and it is critical for the long-term sustainment of the base."

Close to home at Shaw AFB are potential human and ecological receptors due to a large-scale deep chlorinated solvent plume migrating off the west boundary, affecting over 130 private properties. To mitigate, Shaw annually implements an overlapping set of protective administrative and legal land-use controls to (1) annually screen property transfers; (2) if new owner, invite to allow the Air Force to apply a deed notice on the property; (3) contact well drilling companies for recent activities; (4) contact State on notices of intent to drill; (5)

physically survey private wells; (6) sample monitoring wells; (7) send an annual notice to landowners or occupants; (8) hold annual public meetings; (9) conduct response activities if limits exceeded; and (10) report progress of activities.

In implementing Air Force PFOS/PFOA actions, Shaw AFB inquired with the State about sharing private/public well databases and approached local public water providers to help identify which parcels are connected to their services. From these screenings, supported by on-the-ground confirmations, over 1,800 parcels were evaluated, and over 1,000 survey letters were mailed. Shaw AFB implemented a three-step due diligence process: (1) send survey letters by regular mail; (2) follow-up with certified mail; and (3) if both steps fail, door knock. Nearly 30%, 309 letters were unresponsive or failed mail delivery, prompting further field confirmation, door-knocking, or hand-delivery of mail for confirmation. Off-base field sampling started in Feb-Mar 2020 and continues every quarter. Currently, three community water systems servicing three mobile home parks, three businesses, and 27 residential wells have PFOS/PFOA concentrations greater than the lifetime HA levels; bottled water is provided to 259 residences and three businesses.

Since Shaw AFB produces its own water, its drinking water supply wells need continual monitoring. An aggressive Drinking Water Working Group, comprised of the base bioenvironmental and civil engineer representatives, including the RPM, serves as a dedicated sentinel to ensure the water is safe to drink.



Off-Base AFFF Expanded Site Inspection

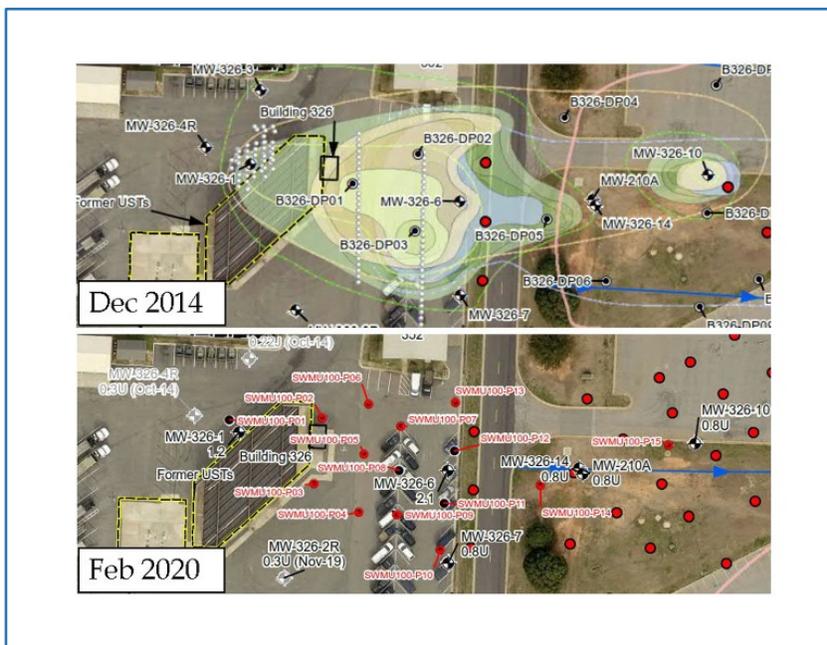
Field crew conducting quarterly PFOS/PFOA sampling at off-base residential drinking water well.

Green Remediation

The Shaw AFB Environmental Restoration Program is always looking for green and sustainable remediation opportunities. The recent expansion of the pump-and-treat system to incorporate re-injection capabilities paid big dividends by daily returning more than 850,000 gallons of clean treated water back into the deep groundwater source and helping “push” contaminated water closer to a down gradient extraction well, which will, in turn, cycle treated water. The recently completed ion-

exchange resin-based PFOS/PFOA-filtration system component to the GWTP will enhance its capability of processing liquid investigation-derived wastes, not only those containing chlorinated solvents but now also liquid wastes generated from PFAS release sites. The GWTP’s treatment approach is simple, sustainable science -- chlorinated solvents readily volatilize, breaking down into harmless emissions when exposed to atmospheric air as the GWTP’s air strippers aerate the contaminated water passing through.

The approach of the 13 active In Situ Chemical Oxidation treatment systems is to use readily-available reactants – ozone or atmospheric air. Treatment involves injecting air into multiple locations just below the shallow contamination, percolating up through the groundwater contamination, and then breaking down its constituents into harmless byproducts. Eight sites are showing dramatic reductions (averaging 80%) in plume footprints; six are projected to achieve Response Complete under the new 6-year ORC.



Achieving Response Complete

An underground storage tank release site completing air injection treatment, about to achieve its Response Complete objective.