

ENVIRONMENTAL AWARDS

ENVIRONMENTAL RESTORATION INSTALLATION AWARD: FAIRCHILD AIR FORCE BASE

INTRODUCTION

Fairchild Air Force Base (AFB) is home to the 92d Air Refueling Wing and multiple associate units including the 141st Air Refueling Wing of the Washington Air National Guard, the 336th Training Group (Air Force Survival, Evasion, Resistance and Escape (SERE) School), and numerous Army National Guard and Army Reserve units. Air refueling is the principle mission of the 92d and 141st, which operate and maintain thirty-five KC-135 Stratotanker aircraft. The installation is also responsible for providing rapid and reliable passenger and cargo airlift, and aero-medical evacuations. This unique asset greatly enhances the Air Force's capability to accomplish the Rapid Global Mobility element of its mission. The largest employer in Eastern Washington State, Team Fairchild encompasses more than 5,100 active-duty, Air National Guard, tenant unit members, and civilian employees. Fairchild AFB is comprised of over 4,500 acres in Spokane County, Washington, in a rural, flat, semi-arid prairie setting. The installation is located approximately 12 miles west of the City of Spokane, in the northeastern portion of Washington State. Fairchild AFB is located in the drainage basin of the Columbia River on the Columbia Plateau. The area around Fairchild AFB is characterized by channeled scablands and more distantly, mountain ranges. Groundwater at Fairchild AFB is encountered at depths ranging from 3 to 50 feet below ground surface. The highly heterogeneous nature of the geology and hydrogeology at Fairchild AFB significantly impacts the cleanup process and makes groundwater contaminant plumes especially difficult to characterize and remediate.

BACKGROUND

The installation, established in 1942, has played a significant part in our nation's defense strategy and supported numerous missions ranging from a World War II aircraft repair depot, to Strategic Air Command bomber wing during the Cold War, to its current primary mission as an Air Mobility Command (AMC) air refueling wing. Due to its role as an aircraft maintenance and refueling station, the base utilized substantial quantities of hazardous materials and has generated considerable amounts of hazardous waste (HAZWASTE) throughout its 70-year history. As a result, many historical environmental releases have affected soil and groundwater on- and off-base. Releases of these materials to the

environment occurred through landfilling, discharge to the base wastewater drainage systems, fire training exercises, improper maintenance and management of oil-water separators, leakage from underground storage tanks (USTs) and fuel piping, and accidental spills. Contaminants of concern primarily consist of chlorinated solvents, fuels and fuel-related contaminants, metals, and asphaltic/coal-derived carcinogens.

The base initiated investigation and cleanup of potential hazardous material (HAZMAT) releases beginning in September 1984 as part of the Environmental Restoration Program (ERP). In March 1989, Fairchild AFB was included on the Environmental Protection Agency's (EPA's) National Priorities List (NPL). In 1990, a Federal Facility Agreement was signed by Fairchild AFB, EPA, and the State of Washington Department of Ecology outlining appropriate response actions to be taken for sites where releases of contaminants occurred that were determined to pose a potential hazard to public health or the environment. From the time Fairchild AFB was added to the NPL, the base has been active in involving the public and keeping them informed about the program's activities. Since 1989, the base has conducted numerous public workshops and meetings, provided public notices and press releases, mailed fact sheets, and interviewed public officials from surrounding communities. In 1995, Fairchild AFB formed a Restoration Advisory Board (RAB) to provide an information exchange forum between community stakeholders and Fairchild AFB. RAB meetings are currently held annually and more frequently when necessary.

Initially, 37 sites and two areas of concern were identified as requiring further investigation and cleanup. Cleanup of these sites has been prioritized according to their potential risk, providing cost savings and reducing long-term liabilities associated with each of the sites; the various sites are at different phases of the cleanup process. Four Records of Decision have been signed and govern cleanup at 29 of these sites, and have subsequently resulted in closure of 11 sites for unrestricted use. A proposed plan to address cleanup of seven remaining sites and two Areas of Concern (AOCs) is currently being drafted. In 2007, seven closed military munitions ranges were identified as requiring cleanup and have been added to Fairchild's

ERP. Of the seven ranges, only two require remedial action. An engineering evaluation/cost analysis (EE/CA) has been developed to allow for removal actions to be taken at both sites to address all cleanup requirements. Following the completion of the removal actions, site closure documentation will be prepared for the seven ranges. Additionally since 2010, the Restoration Team has embraced the challenge to seamlessly expand the program to include 36 ERP sites. These ERP sites are primarily associated with former USTs and oil-water separators. These sites are primarily in the investigative phases and remedial action at these sites will also be prioritized according to potential risks.

Fairchild AFB has a well-established, leadership-supported ERP. From the top down, Fairchild's environmental programs, including Environmental Restoration, are a top priority, and environmental awareness is continually promoted throughout the base. Best management practices are implemented through our environmental restoration, HAZMAT management, and HAZWASTE programs, by promoting new and innovative technologies and practices as appropriate, and by working to prevent further releases of contaminants to the environment. The team currently manages over 80 ERP Sites and six operational ranges. Also, multiple programmatic reviews of the Air Force's restoration database and driven efforts to develop accurate, auditable cost-to-complete data were performed for over 80 sites. This 200+ man-hour effort led to the reduction of over \$27M in requirements. Outstanding attention to detail continues to promote a more productive and accurate path forward, laying the groundwork for program success!

ACCOMPLISHMENTS

Supporting the Air Force Mission

The Restoration Team supports the Air Force through financially responsible and mission-minded management of Air Force resources and infrastructure. Two full-scale soil contamination removal projects at former UST sites located within the airfield area were programmed and awarded for completion during an extended runway closure, eliminating impact to mission operations and saving significant resources. The removal projects performed at the former UST sites resulted in the removal of 12,000 tons of contaminated soil and concrete, and the treatment of 310,300 gallons of contaminated groundwater. Also, the long-awaited installation of three monitoring wells at another environmental restoration site located on an active taxiway was also specifically planned

and completed during the runway closure, preventing significant impacts to aircraft movement on the airfield and reducing safety hazards.



Removal projects performed at two former underground storage tank sites. These projects were strategically executed during a runway replacement project, and resulted in no mission impacts. The removal actions resulted in the removal of 12,000 tons of contaminated soil and concrete, and the treatment of 310,300 gallons of contaminated groundwater.

The Restoration Team is always striving to maximize potential land use while protecting the integrity of legal agreements with regulators. Over 400 work clearances and over 500 work requests are reviewed annually by the Restoration Team ensuring compliance with required land use controls and identifying any impacts to any ERP sites and/or monitoring wells. Also, numerous consultations supported potential future mission bed-down in areas of restoration sites and other base infrastructure projects.

The development of detailed base design standards to include environmental specifications enables compliance with applicable environmental regulations and protection of monitoring wells and proper management of contaminated materials. Projects are continually being executed near and around ERP sites, and the Restoration Team ensures valuable monitoring wells are protected. Project design packages are thoroughly reviewed and project sites are routinely visited to ensure necessary project work can be completed in and around restoration sites without incident. In addition, the Team responded to multiple project sites with potential finds of historical contamination. By providing direction to the contracting officer and project managers on the path forward to properly characterize and manage the contamination, the Team helps limit future cleanup liabilities and ensure materials are properly disposed of.

At the site of an elemental mercury spill within a water tower valve vault, the Restoration Team, in coordination with base Occupational Health experts, implemented interim measures in the valve vault and at an associated drainage ditch to prevent exposure and limit the spread of contamination until a removal effort could be performed. Also, the team alerted other bases of the potential for releases associated with obsolete equipment containing elemental mercury typically located at older water tower systems, preventing potentially costly cleanup should similar releases occur at other bases.

Innovations

Innovative restoration project management at Fairchild AFB spurred the implementation of new technologies and techniques resulting in multi-million dollar cost savings, reduction of future environmental liabilities, and enhanced remediation of contamination in both soil and groundwater.

Remediation of contaminated groundwater plumes at Fairchild AFB presents unique difficulties because of the heterogeneity of the base hydrogeology and geology, resulting in uncertainties and significant data gaps at the various environmental restoration sites. To minimize uncertainty and fill data gaps, base personnel partnered with subject matter experts (SMEs) at the Air Force Civil Engineer Center (AFCEC) to utilize an existing Air Force contract and develop a base-wide conceptual site model (CSM) to guide restoration efforts. This site model provided a holistic vision of the base's hydrogeology, geochemistry, and geology, supporting future cleanup activities, as well as enabling the assessment of groundwater in the area of the new Wing Headquarters building.

An energy efficient ground source heat pump (GSHP) system was proposed within the design of the new Wing Headquarters building, requiring the installation of upwards of 70 vertical borings stretching a few hundred feet below ground surface and penetrating multiple layers and aquifers. The extent of groundwater contamination from a chlorinated solvent plume in the area was undefined but there was significant risk that the implementation of a GSHP system would increase cleanup costs, cause additional contamination issues, and create vapor intrusion pathways. Proactive management allowed two wells planned for the base-wide conceptual site model to be strategically placed to serve a dual purpose by evaluating groundwater within the footprint of the proposed GSHP system.



Opportunistically, Fairchild's Restoration Team was able to utilize an existing Air Force Civil Engineer Center Technical Division contract to install a set of wells to quickly assess groundwater at the proposed location of a ground source heat pump system (GSHP) associated with new Wing Headquarters Building. This effort utilized innovative techniques to provide real-time data on contaminant concentrations in groundwater which quickly led to the decision not to pursue the installation of a GSHP system at the project site. The data collected from this effort was also utilized to contribute to the development of a base-wide conceptual site model.

Base personnel partnered with Air Force SMEs to utilize an in-house GC/MS unit to provide real-time analyses of groundwater samples facilitating critical decision points relative to the Wing Headquarters design. Groundwater samples were collected as water-bearing units were identified throughout drilling to determine the depth and extent of chlorinated solvent contamination in the area (extending to approximately 200 feet below ground surface). Findings were validated by an off-base laboratory and were analyzed with respect to the regulatory chemical toxicity levels, stratigraphic lithology and other water quality results acquired as part of the base-wide conceptual site model. The GC/MS identified groundwater contamination over three times the cleanup level which quickly led to the decision not to pursue the installation of a GSHP system at the project site. The timely partnering of Fairchild program managers and Air Force SMEs prevented the installation of a GSHP system that would have increased environmental liabilities and risks to human health. The timely sampling and analysis allowed for the quick re-design of another energy efficient technology to be utilized at the new Wing Headquarters building.

During installation of the two targeted conceptual site model wells, specialized drilling techniques were employed to prevent any cross contamination of aquifers and gain valuable information on the various alluvial and basaltic layers in the formation. As part of the model, a synoptic

groundwater elevation survey of 336 wells was performed and water quality samples were collected from 50 wells for geochemical analysis, age dating, and stable isotope identification.



A synoptic groundwater elevation survey of 336 wells, along with water quality samples from 50 wells and a compilation of historical data, led to the development of a base-wide conceptual site model. The base-wide conceptual site model provides a holistic picture of Fairchild's hydrogeology. The base-wide conceptual site model also transforms conventional site-specific investigations to identify efficiencies to be gained and fine-tune site closure exit strategies.

This assisted with tracing groundwater flow paths and interconnections between shallow and deeper aquifers and characterized the origin and compositional history of groundwater in the hydrogeological system. Developing and creating a more holistic picture of the Fairchild hydrogeology through the base-wide conceptual site model transforms the conventional site-specific investigations and identifies efficiencies gained from a larger perspective.

Fairchild AFB has supported technology demonstration projects to promote early cleanup actions and contribute to the development of sustainable environmental remedies. In 2011, Fairchild AFB implemented an in-situ bioreactor at the site of a chlorinated solvent groundwater plume. The bioreactor uses solar energy to pump groundwater through a mulch bed with an added carbon source (recycled cheese whey) thus utilizing natural processes to degrade trichloroethylene (TCE) in groundwater. This sustainable, low cost, energy efficient technology reduced contamination by upwards of 90%. The initial

installation of the bioreactor also enabled the removal of contaminated soil within the area excavated for the mulch bed, contributing to the cleanup of groundwater in the area.



Cheese whey being applied during the construction of the sustainable bioreactor demonstration project. Fairchild AFB worked cooperatively with a local creamery to enable the reuse of cheese whey, a bi-product from creamery processes. The cheese whey served as a necessary carbon source within the construction of the solar-operated bioreactor and promotes the breakdown of contaminants in groundwater using natural processes.

As a follow-up to a previously installed demonstration project at Fairchild AFB, the Restoration Team contributed to a publication presenting lessons learned and the progress of a multi-base initiative highlighting a phytoremediation project. This sustainable remediation technique utilizes poplar trees to remove and metabolize TCE contaminated groundwater. The Fairchild AFB phytoremediation area was revisited to identify the primary processes that plants use to remediate groundwater contaminants and to quantify the annual amount of TCE that is removed by the plant stand. The study conducted at the site concluded that measured contaminants removal rates were significant when compared to the mass of contaminants measure below the plant stand. The calculate TCE mass in groundwater below the plant stand decreased 10 percent in a 5 year span. Additionally, while there are limitations to the phytoremediation process, because of the depth of impact below the water table, it can be a component of an overall remedial approach which makes use of its low impact, low maintenance, and highly sustainable features.

Proactive Management: Identification of Off-Base Groundwater Plume

In August 2011, a bench mark 100+ page Record of Decision (ROD) was signed for the cleanup of a chlorinated solvent contaminated groundwater plume extending across the length of the base. The tri-party signature of the ROD was the culmination of 3 years of intense negotiations between the Air Force, EPA, and the State of Washington. Precedent setting conditions required both formal and informal dispute resolution. Fortunately, the Restoration Team secured regulatory approval to proceed with pilot tests moving clean-up forward while final goals were negotiated. Regulatory concerns with vapor intrusion were also tirelessly pursued prior to the ROD signing. A housing area potentially impacted by vapor intrusion was vacated and demolished, easing negotiations over vapor intrusion issues in residential housing areas on the base.

A conceptual plume model update and a vapor intrusion assessment were required to be performed as part of cleanup objectives outlined in the ROD. The Restoration Team collaborated with regulators and technical experts to effectively prioritize Air Force objectives and address regulatory concerns through the development of work plans and pilot testing activities. As part of the conceptual site model update, additional monitoring wells and geophysical analyses were performed to further delineate the lateral and vertical extent of the chlorinated solvent plume in groundwater. This allowed the Team to determine which buildings could be potentially impacted by vapor intrusion and to determine the most efficient and effective areas to implement the remedy, minimize potential health risks, reduce mission impacts and alleviate land use concerns.

A groundwater monitoring well was subsequently installed at the northern base boundary to assess the deeper aquifer in the area. Contaminated groundwater above the EPA maximum contaminant level of 5 micrograms/liter for TCE was identified in the deeper aquifer. The Restoration Team responded immediately, informing regulators and base leadership of the situation. Base agencies and regulatory bodies worked cooperatively to develop a communication plan and proactively contact nearby residents to facilitate a short-notice residential well sampling event. Nineteen residential wells were sampled within 60 days of discovering off-base contamination. All wells except an unused agricultural well were found to be below the cleanup level. Efforts were made to quickly

notify the residents of the sampling results, building and maintaining community trust and confidence in Fairchild's ERP. Additional wells were also installed at the base boundary, in addition to other areas throughout the chlorinated solvent plume to determine the lateral extent of the contamination. This enabled the development of updated plume maps and further identified potential contamination source areas for future remediation.

Significant progress is being made to obtain an access agreement with the private property owner of the contaminated agricultural well that will allow for the installation of monitoring wells and quarterly monitoring of the existing residential well where contamination was identified. These efforts will continue to ensure residents are not impacted by contamination and will allow further delineation of the extent of contamination leaving the base. Fairchild AFB is working alongside the EPA to determine the best placement of monitoring wells and is continuing to develop real estate agreements and associated environmental baseline studies.

Optimizing Remediation

New technologies and optimization of existing remedies and monitoring is a major component in the effective management of the Fairchild AFB restoration program. Multiple proactive efforts have been initiated to accelerate site closure, optimize site cleanup schedules, and reduce long-term costs.

Optimization of the groundwater extraction and treatment system at Craig Road Landfill operated simultaneously in conjunction with the implementation of dual-purpose remediation wells for soil vapor extraction (SVE) and in-situ chemical oxidation (ISCO) injections into groundwater have increased TCE removal from groundwater by an astounding 600%. The groundwater extraction and treatment system is now run in batch operations, promoting "flushing" of contaminants out of the formation. This is accomplished by allowing the treatment system to be inactive for a period of time (approximately 6 months per year) while allowing groundwater to rise and come in contact with the contamination source, achieving greater removal of chlorinated solvents from groundwater when the system is turned back on. This batch treatment process has saved significant utility and operations costs. The SVE system implemented at Craig Road Landfill alone captured over 70 pounds of TCE in less than 3 months; more than the groundwater extraction and treatment system captured previously in a year! Over \$250K per year has been saved



Dual-purpose remediation wells are connected to the soil vapor extraction system. Soil vapor extraction has been implemented in conjunction with in-situ chemical oxidation injections, and batch operations at the existing groundwater extraction and treatment system. The triad of remedies implemented has optimized chlorinated solvent removal and degradation at Craig Road Landfill.

using the SVE system by decreasing groundwater extraction and treatment system lifecycle costs and accelerating site closure. Also, the Restoration Team employed ISCO injections at the Craig Road Landfill site, breaking down TCE using natural chemical processes resulting in greater efficiency than the groundwater extraction and treatment system without the operational costs. This is because the groundwater extraction and treatment system's effectiveness is limited to the radius of influence and installed depths of groundwater extraction wells. The implementation of SVE and ISCO injections has remediated contamination in the vadose zone and in fractured basalt that was previously unreachable. In 2011 and 2012, the SVE system removed over 210 pounds of chlorinated solvents compared to 46 pounds that were removed through the groundwater extraction and treatment system. ISCO injections reduced TCE concentrations in monitoring wells from as much as 16,000 micrograms/liter to non-detect. The triad of utilizing SVE and ISCO in conjunction with batch operations of the groundwater extraction and treatment system has increased the effectiveness of operations and saved valuable time and resources.

Fairchild AFB Restoration Program contracts and projects are designed to promote optimization, sustainable design, and accelerated cleanup. Remedial action operations at nine ERP sites have been optimized to reduce groundwater monitoring requirements; saving \$100K with no compromise to service, data quality, and community relations. At two of the nine sites, concurrence from regulators was received for no further action, allowing for decommissioning of 16 monitoring wells and saving at

least \$20K per year in groundwater monitoring costs. Also, the Restoration Team was able to execute a \$130K project for a vapor intrusion evaluation of industrial facilities by utilizing in-house resources to provide educational and training experiences for base personnel and limited the use of contractor personnel – initiatives which saved both time and money! Additional resources were saved by performing building reconnaissance, coordinating with facility managers and occupants, and reviewing buildings as-built to optimize the future vapor intrusion sampling effort. Other optimization efforts include:

- Receiving concurrence from regulators to no longer operate or maintain the groundwater extraction and treatment system at one site
- Performance of low-cost interim removal actions at two soil contamination sites including a radioactive disposal area, and an elemental mercury spill site, preventing implementation of land use controls and long-term monitoring costs
- Embracing next generation information technology through use of SharePoint sites and teleconferencing resources to more efficiently and cost-effectively share data and limit travel costs
- Performing in-house management of land use controls
- Continuously updating monitoring well inventories and base Geographic Information System (GIS) maps to ensure uniformity and maintain resource integrity.

Stakeholder Involvement

The Fairchild AFB Restoration Program emphasizes the importance of stakeholder interaction through our RAB, co-chaired by a community leader; extensive interface with local, state, and federal regulatory agencies; support of educational outreach opportunities; education of base leadership of environmental programs; and through promoting mutual and honest communication with stakeholders.

Comprehensive RAB meetings are held annually and are led by the Vice Wing Commander and community co-chair. The meetings cover topics from all programs including the Military Munitions Response Program, Operational Range Assessment Program, Compliance Restoration Program, and Washington Air Nation Guard Restoration Program. The goal of the base is to promote full transparency and build strong community relations! Comprehensive RAB minutes are compiled by Restoration Team members and provided to RAB and community members to serve as a permanent record of discussions.

One-on-one outreach to community members is utilized to solicit additional RAB input and membership.

Fairchild AFB's strength and commitment to stakeholder interaction is illustrated by the following example. In light of identifying contamination at the base boundary, the Restoration Team immediately notified the necessary regulatory agencies, RAB members, base Public Affairs and Legal Office, and Bioenvironmental Engineering, and briefed base leadership. An exhaustive record search of state and local databases was performed to determine the nearby residents potentially impacted and to gather information on the residential wells in the affected area. The Restoration Team proactively contacted nearby residents through letters and phone calls to notify them of the identified contamination and facilitate an urgent, high priority sampling event to ensure residents drinking water had not been impacted by the plume leaving the base. Restoration team members accompanied the sampling team during the residential sampling event of 19 residential wells to address any questions or concerns of the residents. Impacted residents were individually invited to the upcoming RAB meeting and were provided base point of contact information to address any additional questions or concerns. Also, multiple base agencies worked cooperatively on short notice, over a two-week period of time, to develop a leadership-backed communication plan and public notice to effectively communicate risks with adjacent residents and the surrounding community leaders and members.

Other stakeholder interaction highlights include:

- Providing local landowners quarterly sampling results and trends from residential well sampling events
- Presenting a restoration program overview at a Society of American Military Engineers meeting highlighting many successes and partnering efforts
- Teaming with a local municipality to allow for Fairchild AFB monitoring wells to be utilized to ensure a newly installed water reclamation facility does not affect the regional aquifer
- Partnering with Spokane County to remediate an abandoned railroad line on the base, saving the Air Force \$100K and transferring land back to the Air Force which meets clean-up standards for the base populace to enjoy
- Promoting environmental awareness through hundreds of hours spent mentoring local boy scout troops
- Promoting fun and educational, family-oriented outreach to Air Force families on Earth Day and environmental stewardship briefings to newcomers

Diligent efforts are continually put forth by the Restoration Team to partner with the State of Washington, EPA, and AFCEC for systematic program management and to accelerate cleanup schedules and site closure - a key to long-term success. The mature, credible, aggressive ERP at Fairchild AFB garners minimal public concern, unquestionable integrity, and much appreciation by Air Force leadership and the surrounding communities.



Fairchild AFB Environmental Team participated in local elementary school science fair. The Environmental Team provided an interactive activity for students and their families about aquifers and importance of keeping our aquifers clean. Fairchild AFB participates annually in numerous fun and educational, family-oriented outreach activities on environmental stewardship.