



2022 Secretary of Defense

Environmental Awards

Environmental Restoration, Team
Ellsworth ERP PFOS / PFOA Team

Introduction

Nestled in the majestic Black Hills, Ellsworth Air Force Base (AFB), South Dakota, is 10 miles east of Rapid City and just outside of Box Elder, South Dakota. The Base – home to the 28th Bomb Wing (BW) – is one of only two B-1B bases in the world. The 28th BW is aligned with Eighth Air Force under Air Force Global Strike Command. The 28th Bomb Wing guarantees combat airpower for America. Every Airman in the wing, whether sustaining people, maintaining weapons and equipment, generating aircraft, pulling a trigger, or operating a network, provides combat power for our nation. Ellsworth AFB is one of the largest employers in the state with an estimated annual economic impact of over \$350 million.

Ellsworth AFB includes over 3,000 military members and 900 civilian employees, along with their family members. The Base's two sister cities are Box Elder (population of over 10,000) and Rapid City (population of almost 75,000). There are also about 3,800 military retirees in western South Dakota. In 2021, Ellsworth AFB was selected by the Air Force to house the B-21 Raider training program and first squadron. The new bomber mission is expected to double the size of Ellsworth AFB's personnel by bringing an additional 3,000 service members.

The Ellsworth AFB Environmental Restoration Program (ERP) perfluorooctanesulfoanate (PFOS) and perfluorooctanoic acid (PFOA) Team (Team) manages the program with the philosophy of cost-effectively expediting clean-up while meeting the Air Force mission

objectives and promoting environmental stewardship. The multi-division Team includes the Air Force Civil Engineer Center (AFCEC) Operations Division (CZO) and Restoration Program Management Office (CZR) and the Air Force Judge Advocate Operations and International Law/Environmental Law and Litigation Environmental Law Field Support Center (JAOE-FSC):

- Rita Krebs, Remedial Project Manager (AFCEC/CZOM)
- Jens Christensen, Remedial Project Manager (AFCEC/CZOM)
- Kate Need, Section Chief and Contracting Officer's Representative (AFCEC/CZOM)
- Bill Barry, Midwest Region Branch Chief (AFCEC/CZOM)
- Kevin Tarleton, Program Manager (AFCEC/CZRW)
- John McCune, Legal Counsel (JAOE-FSC)



Ellsworth ERP PFOS/PFOA Team

Top Row: Rita Krebs, Jens Christensen, and Kate Need. Bottom Row: Bill Barry, Kevin Tarleton, and John McCune.

Major purposes of the ERP are to protect human health and the environment and complete ERP activities in compliance with federal, state, and local laws and requirements. Specific goals include facilitating partnerships with researchers and vendors to demonstrate technologies that will improve clean-up efficiency and reduce

costs; and implementing early removal actions when appropriate. The Team's success is directly attributed to innovative program management, an extremely high level of technical expertise, regulatory partnerships, and the involvement of stakeholders.

Background

Ellsworth AFB carries with it a rich history from its foundation as the Rapid City Air Base in January 1942 and arrival of the first bomber, the B-17 Flying Fortress, that September. Over the years, the installation has changed names, weapon systems, and missions—evolving to maintain its commitment to providing combat air power for America that began with bombing missions during World War II to the recent presence in Southwest Asia in support of Operation Enduring Freedom. From 1963 to 1994, Ellsworth AFB had an intercontinental ballistic missile (ICBM) mission and maintained two legs of America's strategic triad: strategic bombardment and ICBMs.

Since 1997, Ellsworth AFB has provided crucial long range strike precision capability for numerous operations around the globe. In 2012, Ellsworth AFB also began flying MQ-9 Reaper missions from ground control stations on Ellsworth AFB when the 432nd Attack Squadron (ATKS) was stood up under the 28th Operations Group. Effective October 1, 2015, the 432nd ATKS became a tenant unit at Ellsworth AFB, aligned under the 432nd Wing, Creech AFB, Nevada. It was re-designated the 89th ATKS on June 21, 2016. Today, Ellsworth Airmen continue to play a critical part in our nation's defense. Other primary tenants at Ellsworth AFB include the 372nd Training Squadron, the Air Force Financial Services Center, and the Air Force Office of Special Investigations Detachment 816.

Historic waste handling and disposal practices coupled with maintenance practices

have resulted in numerous contaminant releases. Most of the releases consist of chlorinated solvents and petroleum products. The Installation was placed on the Comprehensive Environmental Response, Compensation, and Liability Act's (CERCLA) National Priorities List, otherwise known as "Superfund," in 1990. In 1992, a Federal Facility Agreement was signed by Ellsworth AFB, the United States Environmental Protection Agency (EPA) Region 8, and the South Dakota Department of Environment and Natural Resources (now the South Dakota Department of Agriculture and Natural Resources [SDDANR]).

In 1970, the Air Force began using a legacy formula of Aqueous Film Forming Foam (AFFF), which contained PFOS and PFOA, to extinguish petroleum fires commonly associated with burning aircraft. AFFF is the most efficient extinguishing method for petroleum-based fires and is currently widely used across the Department of Defense (DoD), the firefighting industry, and Federal Aviation Administration certified commercial airports to protect people and property. PFOS and PFOA are synthetic fluorinated organic compounds used in many industrial and consumer products such as nonstick cookware, stain-resistant fabric and carpet, and some food packaging. The EPA characterized the two compounds as emerging contaminants due to increasing regulatory interest, the potential risk to human health and the environment, and evolving regulatory standards.

Historic training and use of AFFF has resulted in PFOS/PFOA releases across the Air Force at active, Reserve, Air National Guard, and closed installations. In 2011, PFOS/PFOA was confirmed present in groundwater at the Ellsworth AFB former fire training area (FT001) during a demonstration/validation project. In 2013, the SDDANR requested delineation of the PFOS/PFOA at FT001 with investigative

activities beginning in 2014. On May 19, 2016, the EPA established a lifetime Health Advisory level of 70 parts per trillion for a combined concentration of PFOA and PFOS in drinking water. This spurred sampling of off-Base private drinking water wells that were downgradient of FT001. To date, the PFOS/PFOA impacted groundwater and surface plumes extend into the community surrounding the Installation and continues downstream for at least 18 miles.



Historic Fire Suppression System Testing

The fire suppression system at Dock 73 produced more foam than expected! During a 2002 test, the system generated so much foam so it had to be let outside Dock 73 in order for the doors not to be damaged. This area is now being investigated as part of the Basewide Remedial Investigation.

Accomplishments

Accelerated Environmental Cleanup

The Ellsworth ERP PFOS/PFOA Team has made substantial progress toward reaching Air Force goals by implementing 11 ERP contracts related to PFOS/PFOA totaling over \$16 million, spanning five years, and covering ten source areas. Using innovative technology, aggressive project management, and leveraging strong partnerships with regulators and stakeholders, the Team identified ten primary source areas needing further PFOS/PFOA plume definition and two source areas where no further action is required.

The Team worked closely with JAOE-FSC to navigate the fast-paced and often changing regulatory environment surrounding PFOS/PFOA. One Time-Critical Removal Action (TCRA) and two Non-Time-Critical Removal Actions (NTRAs) have been implemented to date to protect human health and expedite PFOS/PFOA cleanup. To accelerate implementation of removal actions a 2021 Engineering Evaluation/Cost Analysis (EE/CA) and subsequent Action Memorandum were completed in house; saving the Air Force \$240,000 in contracting costs and accelerating report completion by approximately 16 months.

The \$8.2 million Basewide PFOS/PFOA Remedial Investigation (RI) to define the nature and extent of the PFOS/PFOA contamination was one of the first to be awarded at an active installation nationwide in June 2020. As part of this RI, one of the nation's only DoD-certified mobile laboratories will be deployed on-site to make real-time decisions for plume delineation. Additionally, the recently completed basewide conceptual site model is being strategically employed in order to identify where PFOS/PFOA may be travelling off-Base.

Innovative Technology Demonstration/ Validation and Implementation

The Ellsworth ERP is at the forefront of remediation technology implementation, most notably for innovative technology projects associated with treating PFOS/PFOA. These emerging contaminants are toxic and difficult to treat because of their high stability and mobility. The Ellsworth ERP adeptly employs innovative techniques to simplify processes and to test new treatments for PFOS/PFOA. During the award period three demonstration/validation projects were initiated with estimated completion dates and determining next step outside the award period.



Green and Innovative Remediation

The surface water drainage alongside the former fire training area is prepared for the subsequent installation of a sorbent flow-through barrier (a.k.a. clay mats). The clay mats project is one of three innovative remediation technology demonstration projects hosted at Ellsworth AFB. Additionally, this project shows green remediation by reducing the amount material removed from the site for treatment or disposal.

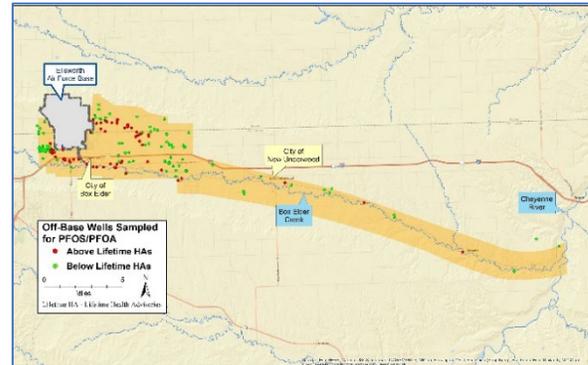
The first demonstration/validation project was initiated during the period to assess PFOS/PFOA transport through the vadose zone using suction lysimeters. Studies have shown that PFOS/PFOA are retained in surface soils. Twelve pairs of suction lysimeters were installed to measure the amount of PFOS/PFOA contamination leaching from the soil to the groundwater within the source area at the former fire training area. This investigation will also further validate physiochemical parameters that govern PFOS/PFOA transport within source zones. The Air Force will utilize the study results to evaluate the degree to which PFOS/PFOA leaches from soil to groundwater. The default regulatory guidelines for assessing the potential for PFOS/PFOA in soil to leach to groundwater are conservative. The results of this study are important to show that using the current conservative guidelines is resulting in cleanups that may be excessive or unnecessary.

The second demonstration/validation project was initiated to evaluate the viability of chemically stabilizing PFOS/PFOA-impacted sediment. Ellsworth AFB Pond 1 was selected for this project since it receives runoff from the former fire training area and then discharges surface water off-Base which impacts down gradient drinking water wells. Although the project is a demonstration project that will be useful during future Feasibility Studies, it may prove to be the final remedy for impacted material in Pond 1.

The third demonstration/validation project was initiated to determine if sorbent flow-through barriers (a.k.a. clay mats) are effective at reducing PFOS/PFOA transfer from groundwater to surface water. The clay mats were installed along a 400-foot length of the surface water drainage flowing into Pond 1, which is adjacent to the former fire training area (the site with highest PFOS/PFOA concentrations). Quarterly monitoring completed for two years following installation will measure PFOS/PFOA concentrations and the capability of the clay mats to reduce PFOS/PFOA discharges from groundwater into surface water. The results of the demonstration will be useful when it comes time to evaluate remedial alternatives for PFOS/PFOA contamination in future Feasibility Studies across the Air Force.

Additionally, the Team augmented the existing Ellsworth ERP Geographic Information System (GIS) database to track sampling data and property ownership to enable data driven, rapid responses to numerous information requests. During the period, the Team used this GIS database to determine the appropriate responses to requests for sampling nine previously inoperable off-base drinking water wells. Additionally, the Team used the GIS database to determine that nine of twelve properties unresponsive to the Air Force's information requests were not likely to have

impacted drinking water wells as they were either outside the known impacted areas or likely connected to municipal water.



Geographic Information System Database

The Ellsworth ERP PFOS/PFOA Team created a Geographic Information System database with private well and property ownership records to rapidly respond to inquiries from the public.

Partnership Addressing Environmental Restoration Issues Between DoD and Other Entities

The Team successfully managed 11 projects by partnering with key stakeholders and government entities. In addition to EPA Region 8 and the SDDANR, the Team leveraged relationships with the United States Geological Survey (USGS), South Dakota Ellsworth Development Authority (SDEDA), the Pennington County Commissioner's Office, and the local residents and communities.

USGS expertise was leveraged to collect data to supplement the on-going off-base drinking water impacts and RI investigative work. The data was then published in an online GIS available for public use. The USGS also completed work to characterize the surface water/groundwater interaction. This information has been used to determine how drinking water wells extending 18 miles down gradient became PFOS/PFOA-impacted.

A very strong partnership has been created between the Ellsworth ERP and SDEDA. From this partnership, the Department of the Air Force (DAF) and SDEDA have teamed

together to implement the NTCRA recommendation to design and construct a new community water system (CWS) which will provide an alternative water source to properties impacted by PFOS/PFOA releases attributable to DAF operations without requiring the properties to be annexed into any municipality. The design phase of this \$17 million, three-year project kicked off in September 2021.

The Ellsworth ERP is very engaged with the community. The Team updated the Community Involvement Plan (CIP) in house; this accelerated completion of the CIP and saved \$60,000 in contract costs. The Ellsworth ERP implements the CIP and shares information with the community by sending out quarterly newsletters (250+ entity mailing list); regularly posting documents to the online publicly available AFCEC administrative record; holding one-on-one meetings, open houses, and/or public meetings; and corresponding with residents one-on-one.

A Restoration Advisory Board (RAB) for Ellsworth AFB was started in the 1990s and unofficially dissolved sometime in the 2000s due to lack of interest. Regular public meetings continued until 2019 and although these public meetings were called RAB meetings, there was no official RAB committee. Interest in reestablishing the RAB is reassessed every 24-months. The Team completed a RAB interest assessment during the period in collaboration with the Installation's Civil Engineer Squadron. Less than three percent of those polled expressed interest in reinstating the RAB. Due to this lack of interest, the Wing Commander signed a Memorandum of Record documenting the decision not to reestablish the RAB.

An EE/CA, which included a public comment period, was completed as part of each NTCRA. Following the comment period for the 2020 NTCRA, 19 one-on-one meetings and one open house were held with

impacted property owners/residents in September/October 2020. All significant public or regulatory comments were addressed/incorporated into actions.

Ellsworth Air Force Base Restoration News
 SEPTEMBER 2021 ISSUE 18
 Keeping local residents informed of cleanup activities

Air Force and South Dakota Ellsworth Development Authority Enter Partnership to Design a Community Water System

The U.S. Air Force (USAF) and the South Dakota Ellsworth Development Authority (SDEDA) entered into a one-year Environmental Services Agreement on September 1, 2021. Under the agreement, SDEDA will design a community water system that will provide an alternate source of drinking water to:

- Residents in Areas A and B whose private drinking water wells are impacted by Perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) above the Lifetime Health Advisories (HLAs) of 70 parts per trillion (ppt); and
- Residents currently connected to the Base-operated Southwest Waterline.

Once the system is designed, the USAF and SDEDA will enter into a follow-on agreement in 2022 to build the system and connect households to the system. SDEDA will ultimately own and operate the new community water system. Tentative plans include obtaining water from a new well installed into the Madison Aquifer. Connection to the system will not require annexation into a municipality. The USAF and SDEDA will be reaching out to each property owner to discuss additional details. The goal is to meet with 100% of the impacted property owners.

Progress Made Over Last Decade Cleaning up Trichloroethylene in Groundwater at Ellsworth AFB

The Ellsworth AFB Environmental Restoration Program continues making progress in reducing the trichloroethylene (TCE) groundwater contaminant plume. The figures on the reverse show the plumes shrinking by 80% between 2010 and 2020. Significant progress was made at the PRIDE Hangar/South Docks Main BGD4 and Twining/Ranger-8GD5 plumes. Since 2012, the primary cleanup action on-Base is in-situ reductive treatment, which supports natural processes to clean up harmful chemicals in the environment. Natural bacteria that live in the soil and groundwater "eat" the harmful chemicals and change them into water and harmless gases. In May 2020, the USAF awarded an 8-year contract to OTE/AECOM with the goal of speeding up treatment processes. The USAF team is working closely with the U.S. EPA and South Dakota Department of Agriculture and Natural Resources to close areas of the plume where TCE concentrations are below the Maximum Contaminant Level (MCL). The MCL for TCE is 5 parts per billion. One complicating factor is the presence of PFOS/PFOA mixed in with the same groundwater as the shrinking TCE plumes. Reduction of TCE on-Base will continue even though PFOS/PFOA are present.

Environmental Restoration Newsletter

This excerpt of the September 2021 newsletter is an example of the quarterly newsletter mailed to 250+ entities to keep the community informed of PFOS/PFOA issues.

In September 2021, the RPM personally contacted each of the PFOS/PFOA impacted off-base residents to invite them to one-on-one meetings to discuss the 2021 NTCRA implementation. Additionally, SDEDA and the Pennington County Commissioner's office attended all meetings held in September/October 2021 as a key partner in the NTCRA implementation. The meetings took place outside this period.

Reducing Risk to Human Health and the Environment

After discovering PFOS/PFOA in an off-Base private drinking water well during the FT001 PFOS/PFOA RI, a rapid response commenced to systematically sample private drinking water wells downgradient of the base. The TCRA began in September 2018

and continues through the present. The TCRA immediately cut off human consumption of PFOS/PFOA-impacted drinking water, initially providing bottled water to approximately 94 residences serviced by 23 drinking water wells impacted by PFOS/PFOA. The TCRA then followed up with installing a well head treatment system on an impacted CWS serving approximately 70 residences, point of entry treatment systems (POETSs) at 17 impacted individual residences, and connecting four impacted individual residences to an existing municipal water system. Activities completed during this award period included completing two connections to an existing municipal system, installation of three POETSs, and operation/maintenance of a CWS well head treatment system.



Residents Meetings are a crucial way the Ellsworth AFB ERP exchanges information with the public. The Team collaborated with key partners South Dakota Ellsworth Development Authority and the Pennington County Commissioner's Office to discuss the NTCRAs with impacted property owners/residents.

To monitor the effectiveness of the TCRAs, four semiannual treatment system monitoring events were completed during the award period. From those events, 45 customized letters were created and sent to impacted residents providing status updates.

Additionally, seven quarterly monitoring events were completed during the award period to confirm that additional residences drinking water had not been impacted by PFOS/PFOA. The results of the quarterly events were provided to the impacted residents via 31 customized letters.

Following the TCRA, NTCRA's were evaluated for all impacted properties. A \$20 million, multi-year execution strategy was developed to implement the area-specific actions determined to be the most protective to human health and cost effective for the Air Force. These actions include: connection to an existing CWS and installation of a new private water well through traditional contracting; a new CWS is being designed and built through environmental services agreements; and one property is being purchased to be reused for wetlands banking for the new mission (beneficial to both the ERP and the new B-21 mission).

Green Remediation

The Team is practicing green remediation of PFOS/PFOA at Ellsworth to reduce the environmental footprint of cleanup activities through the use of innovative *in-situ* demonstration projects and treating liquid investigation derived waste on site. As previously discussed, both the sediment stabilization at Pond 1 and clay mats project aim to show that these *in-situ* technologies can effectively treat PFOS/PFOA in place without the use power cleanup equipment otherwise requiring grid electricity or onsite fuel consumption. The action not only reduce the amount of contaminated material that must be removed from the site to be treated, but also reduce fossil fuel usage in transportation, and greenhouse gas and criteria air pollutant emissions associated with waste transportation and treatment activities.