

ENGINEERING EVALUATION/COST ANALYSIS FOR OFF-BASE DRINKING WATER RESPONSE ACTIONS

**SOUTH CAROLINA AIR NATIONAL GUARD
PFOS/PFOA IMPACTED PRIVATE DRINKING WATER WELLS**

**169TH FIGHTER WING
MCENTIRE JOINT NATIONAL GUARD BASE
Eastover, South Carolina**



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Figure 1 McEntire JNGB Overview with Sampled Area

ATTACHMENTS

Estimated Cost Summaries for Each Alternative

LIST OF ACRONYMS

AFFF	Aqueous film-forming foam
ANG	Air National Guard
ARAR	Applicable or relevant and appropriate requirement
ASD	Assistant Secretary of Defense
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DW	Drinking Water
EE/CA	Engineering Evaluation/Cost Analysis
FW	Fighter Wing
GAC	Granular activated carbon
IX	Ion exchange
JNGB	Joint National Guard Base
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGB	National Guard Bureau
NTCRA	Non-time critical removal action
O&M	Operation and Maintenance
OUSD	Office of the Under Secretary of Defense for Acquisition and Sustainment
PA	Preliminary Assessment
PFAS	Per- and polyfluoroalkyl substances
PFC	Perfluorinated Compounds
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
POETS	Point-of-entry treatment system
ppt	parts per trillion
PRL	Potential Release Location
RAO	Removal action objectives
SAF/IE	Assistant Secretary of the Air Force (Installations, Bases, Environment & Energy)
SAF/IEE	Deputy Assistant Secretary of the Air Force (Environment, Safety, and Infrastructure)
SCANG	South Carolina Air National Guard
SC DHEC	South Carolina Department of Health and Environmental Control
SI	Site Inspection
TBC	to-be-considered
TMV	Toxicity, mobility, or volume
USAF	United States Air Force
USEPA	United States Environmental Protection Agency

EXECUTIVE SUMMARY

National Guard Bureau (NGB) has prepared this Engineering Evaluation/Cost Analysis (EE/CA) to support a non-time-critical removal action (NTCRA). The NGB is responding to the presence of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) (two subsets of per- and polyfluoroalkyl substances (PFAS)) above 70 parts per trillion (ppt), individually or combined, in accordance with DoD policy in two private drinking water (DW) wells near McEntire Joint National Guard Base (JNGB), South Carolina. This EE/CA was conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the USEPA *Guidance for Conducting Non-Time Critical Removal Actions Under CERCLA* (USEPA, 1993), and the Defense Environmental Restoration Program (DERP). This EE/CA describes project background, removal action objectives (RAOs), development and evaluation of removal action alternatives, and identification of the recommended removal action alternatives for the DW wells. The NGB applies the CERCLA process and 70 ppt for PFOS or PFOA in accordance with DoD policy to respond to PFOS/PFOA DW impacts resulting from Air National Guard (ANG) mission-related activities.

Formed in 1946, the South Carolina Air National Guard (SCANG) consists of more than 1,500 Airmen who work and drill at McEntire Joint National Guard Base (JNGB). The 2,400-acre base is home to a squadron of F-16 aircraft and the largest Active Association program in the nation's Combat Air Forces, and more than 1,000 Army National Guard personnel additionally work and drill at the installation. The primary unit of the SCANG is the 169th Fighter Wing (FW). It is comprised of the 169th Operations Group, which includes the 157th Fighter Squadron, 245th Air Traffic Control Squadron, and the 216th Fighter Squadron (Active Association), the 169th Maintenance Group, the 169th Mission Support Group, and the 169th Medical Group. In this EE/CA, environmental response activities are associated with SCANG; other DoD CERCLA responses at McEntire JNGB are occurring separately.

PFOS and PFOA are classified as emerging contaminants. The NGB response strategy for PFOS/PFOA includes CERCLA investigation work and CERCLA response actions. Preliminary Assessments (PAs) are conducted to identify potential storage, usage, or release locations, and Site Inspections (SIs) are conducted to determine releases to the environment and if drinking water has been, or may be, impacted. In May 2016, a PA eliminated three areas of concern and moved forward 18 Potential Release Locations (PRLs) at McEntire JNGB related to SCANG activities. In April 2019, an SI determined PFOS/PFOA was detected in environmental media at 17 PRLs. In 2022, an off-base well survey identified up to 37 off-base private wells downgradient of the 17 PRLs with possible exposure pathways for the ingestion of PFOS/PFOA. Of those 37, four properties were vacant, four property owners declined sampling, and three property owners did not respond. In January and February 2023, with owner permission NGB sampled a total of 27 private wells at 26 properties which had a use that could potentially result in the ingestion of PFAS. Analytical results were received on April 11, 2023. PFOS/PFOA was detected in two of the 27 private drinking water wells at concentrations above 70 ppt for PFOS or PFOA, individually or combined. On April 12 and 13, 2023, NGB began providing bottled water to the two affected properties.

The following RAO was developed for the EE/CA for the two impacted DW wells with PFOS/PFOA exceedances:

- Prevent human exposure via ingestion of water containing PFOS/PFOA above 70 ppt for PFOS or PFOA, individually or combined, in accordance with DoD policy

This EE/CA evaluated the following four alternatives for achieving the RAO:

- Alternative 1, No Action, the baseline condition
- Alternative 2, Municipal Water Supply
- Alternative 3, Point of Entry Treatment (POET) System
- Alternative 4, Replacement Well

These alternatives provide a range of options to address the risks at the site. Alternative 1 is required under CERCLA, as a baseline for comparing other alternatives. Alternatives 2 and 3 meet the RAOs, because they are protective of human health. Alternative 4 is included based on stakeholder interest; however, it may not meet the RAO. The EE/CA includes an individual assessment of each proposed removal alternative based on the criteria of effectiveness, implementability, and cost. The EE/CA then compares alternatives using the same criteria and ranks them from most desirable to least desirable.

Based on the comparative analysis, the recommended alternative is Alternative 3. This alternative protects human health by providing treated DW for each affected property.

The recommended alternative has an estimated capital cost of \$26,200 with an annual operation and maintenance (O&M) cost of \$8,000, and periodic five-year maintenance costs of \$15,760. This is a total present value cost of \$354,489 for 30 years of operation. No additional bottled water will be provided once completed. This alternative meets the RAOs, meets the NCP criteria for protectiveness of human health and the environment, and is considered the best long-term solution for providing safe DW to the affected well owners.

1.0 INTRODUCTION

This document presents the Engineering Evaluation/Cost Analysis (EE/CA) completed to support a non-time critical removal action (NTRCA). The National Guard Bureau (NGB) is responding to the presence of perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) (two subsets of per- and polyfluoroalkyl substances (PFAS)) above 70 ppt for PFOS or PFOA, individually or combined in two drinking water (DW) wells near McEntire Joint National Guard Base (JNGB), South Carolina. PFAS compounds are not currently regulated at the federal level.

1.1 Authority

Executive Order 12580 – Superfund Implementation (52 FR 2923, 3 Code of Federal Regulations (CFR), 1987 Comp., p. 193) delegates the authority and responsibility to implement provisions of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) to the Department of Defense (DoD). Response actions are conducted pursuant to CERCLA (42 U.S. Code (U.S.C.) § 9601-9675), the Defense Environmental Restoration Program (DERP) (10 U.S. Code § 2701 et seq), and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR Part 300), as referenced in the DoD Remediation Plan for Cleanup of Water Impacted with PFOS or PFOA (Office of the Under Secretary of Defense for Acquisition and Sustainment [OUSD] 2020). Per amendments to 10 U.S.C. § 10501, described in the DoD Directive 5105.77, the National Guard Bureau (NGB) is a joint activity of the DoD. NGB serves as a channel of communication and funding between the United States Air Force (USAF) and Air National Guard (ANG) organizations in the 54 U.S. states, territories, and the District of Columbia. The NGB oversees and implements the installation restoration process for the ANG facilities.

The NGB has prepared this EE/CA under DERP authorities for ANG Site SS014P associated with Potential Release Locations (PRL) 2, 5, 6, 9 and 10.

1.2 Purpose and Scope

The purpose of this EE/CA is to develop and evaluate alternatives and associated costs to eliminate the human exposure pathway between DW receptors and Site SS014P where PFAS releases have been confirmed above screening levels in environmental media. This EE/CA develops removal action objectives (RAOs) for two impacted DW wells, taking into consideration the most qualified, proven technologies to develop alternatives to achieve the RAOs. The development of alternatives considers a range of technically viable response actions that includes a no action alternative, alternative water supply, and treatment.

1.3 Regulatory and Project Background

The DoD and NGB conduct cleanup primarily under CERCLA and as directed in DERP with a goal of protecting human health and the environment in a risk-based, fiscally-sound manner. PFOS and PFOA are addressed in the same manner as other contaminants of concern within DERP. In May 2016, the USEPA published PFOS and PFOA lifetime Health Advisory values of 70 ppt, both individually or combined (USEPA, 2016a, 2016b, and 2016c). By the August 11, 2016 Memorandum “SAF/IE Policy Perfluorinated Compounds (PFCs) of Concern”, the Assistant Secretary of the Air Force (Installations, Environment & Energy) (SAF/IE) directed the NGB to identify all locations on installations where the NGB has reason to suspect there may have been a PFOS and/or PFOA release

attributable to ANG actions and confirm whether there exists a potential unacceptable risk to human health or the environment, consistent with Federal requirements, and address any PFOS and/or PFOA releases that pose an unacceptable risk, including migration off-base, in accordance with CERCLA, NCP, and Department of the Air Force Instruction 32-7020, Environmental Restoration Program (DAFI 32-7020).

The NGB applies the CERCLA process and 70 ppt for PFOS or PFOA, individually or combined, in accordance with DoD policy to guide cleanup actions in South Carolina and to respond to PFOS/PFOA DW impacts resulting from ANG mission-related activities. When the NGB identifies PFOS/PFOA impacts to DW above 70 ppt for PFOS or PFOA as a result of past ANG mission activities, NGB will initiate an immediate response action, such as providing an alternate DW source, while a long-term remedy is identified (ASD, 2023).

1.4 Installation Description and Mission

Formed in 1946, the South Carolina Air National Guard (SCANG) consists of more than 1,500 Airmen who work and drill at McEntire JNGB. The 2,400-acre base is home to a squadron of F-16 aircraft and the largest Active Association program in the nation's Combat Air Forces, additionally, more than 1,000 Army National Guard personnel work and drill at the installation. The primary unit of the SCANG is the 169th Fighter Wing (FW). It is comprised of the 169th Operations Group, which includes the 157th Fighter Squadron, 245th Air Traffic Control Squadron, and the 216th Fighter Squadron (Active Association), the 169th Maintenance Group, the 169th Mission Support Group, and the 169th Medical Group. In this EE/CA, environmental response activities are associated with SCANG; other DoD CERCLA responses at McEntire JNGB are occurring separately. The Site location is shown on **Figure 1**.

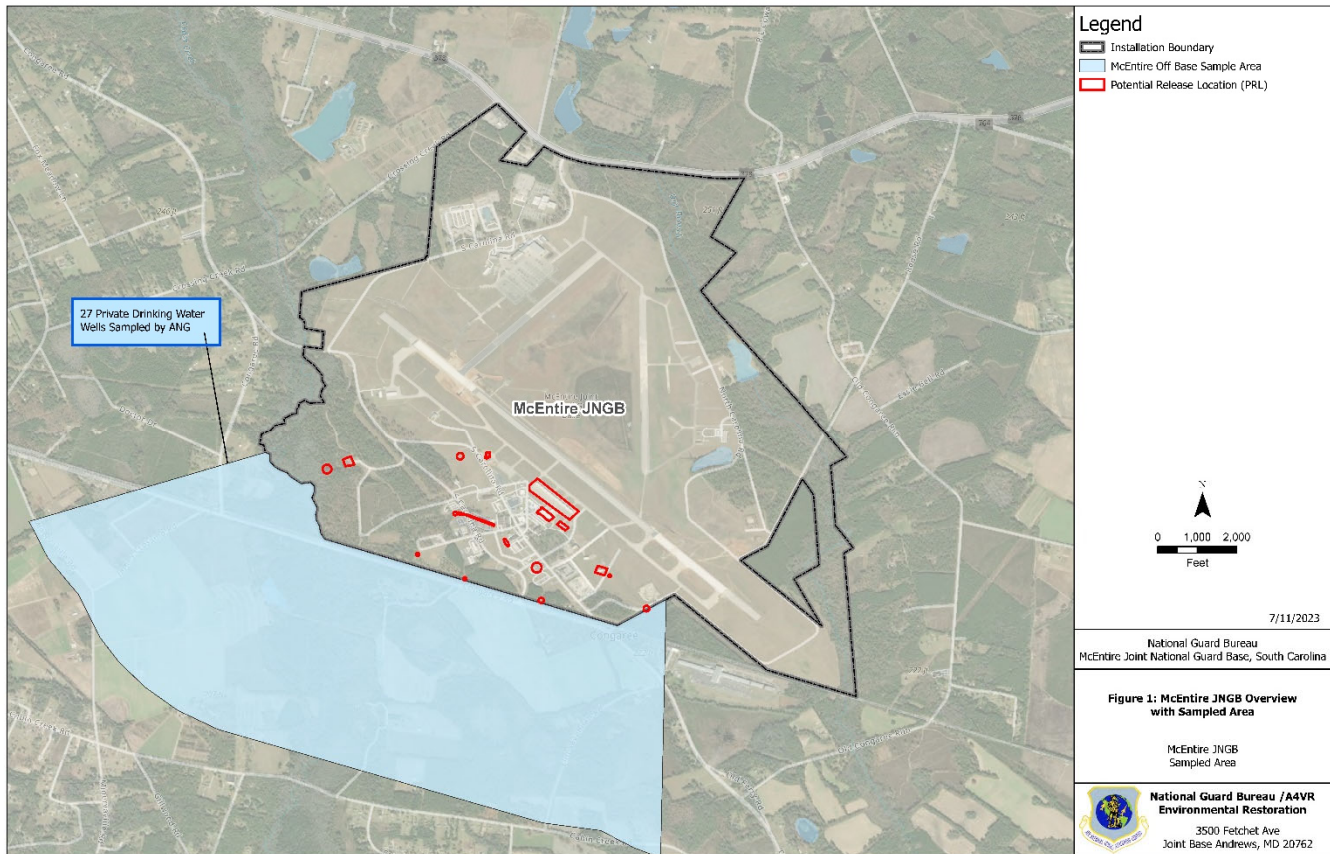


Figure 1: McEntire JNGB, Eastover, South Carolina Overview with Sampled Area

1.5 Previous PFOS/PFOA Investigations and Response Actions

In 2016, the NGB completed a Preliminary Assessment (PA) to identify potential storage, usage, or release locations of aqueous film-forming foam (AFFF) (a source of PFOS and PFOA) into the environment. The PA identified 18 PRLs to be further investigated.

In 2019, the NGB completed a Site Inspection (SI) of 18 PRLs that were moved forward from the PA to determine releases to the environment and if human drinking water has been, or may be, impacted. Laboratory results from the SI confirmed the release of PFOS and PFOA in environmental media above screening levels at nine PRLs.

In 2022, an off-base well survey identified 37 potential off-base private wells downgradient of the nine PRLs with possible exposure pathways for the ingestion of PFOS/PFOA. Of those 37, four properties were vacant, four property owners declined sampling, and three property owners did not respond. In January and February 2023, with owner permission, NGB sampled a total of 27 active private wells (on 26 properties) having a use that could potentially result in the ingestion of PFAS. The downgradient off-base sample area is shown on **Figure 1**. Analytical results were received on April 11, 2023. PFOS/PFOA was detected in two of the 27 private drinking water wells at concentrations above 70 ppt for PFOS or PFOA, individually or combined. On April 12 and 13, 2023, NGB began providing bottled water to the two affected properties and continues to provide bottled

water until a long-term DW solution is implemented. The remaining 25 wells were below 70 ppt for PFOS/PFOA.

In 2023, NGB completed an SI Addendum. The SI Addendum summarized the off-base well survey results for a 4-mile radius, the off-base well survey results for a 1-mile downgradient focus area, the off-base private drinking water well sampling activities and results, and the comparison of previously collected SI data to updated screening levels. The SI Addendum documented the NGB decision to proceed to a Remedial Investigation/Feasibility Study to define the nature and extent of PFAS impacts at PRLs 2, 4, 5, 6, and 9 through 13 and documented the decision for no further action at PRLs 1, 3, 7, 8, and 21. It was also determined that PRLs 14 through 20 are considered potential pathways to receptors, not PRLs, and should be considered during the RI during characterization. As described above, various PFOS and PFOA investigations have been completed at McEntire JNGB starting in 2015. The analytical results for completed and published investigations identified within this document are available on the Administrative Record website at: <https://ar.afcec-cloud.af.mil/search.aspx>. Analytical data for the ongoing investigations and monitoring events will be published in the Administrative Record upon completion of the associated reports.

1.6 Streamlined Risk Evaluation

NGB is completing response actions to reduce exposure risk to human health resulting from PFOS or PFOA, individually or combined, above 70 ppt in DW attributable to ANG mission-related activities. Laboratory data confirmed that PFOS/PFOA concentrations were above 70 ppt for two off-base private drinking water wells downgradient of McEntire JNGB.

In accordance with CERCLA and the NCP, the NGB took an immediate response action by providing regular deliveries of bottled water to the affected wells owners to limit exposure. However, a permanent solution is still required to ensure the exposure pathway from ANG source areas to the impacted DW wells has been eliminated.

2.0 DEVELOPMENT OF REMOVAL ACTION OBJECTIVES

This section discusses the justification for the removal action, applicable or relevant and appropriate requirement (ARARs), and the specific RAOs developed for the impacted private DW wells.

2.1 Justification for the Proposed Removal Action

NGB identified the existence of unacceptable risk to human health due to the presence of PFOS/PFOA above 70 ppt for PFOS or PFOA in two off-base private DW wells attributable to SCANG mission-related activities. As such, due to potential exposure of PFOS and/or PFOA via DW ingestion, a removal action is warranted based on the following factors listed in the NCP:

- 40 CFR 300.415(b)(2)(i): “Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;” and
- 40 CFR 300.415(b)(2)(ii): “Actual or potential contamination of DW supplies or sensitive ecosystems.”

2.2 Applicable or Relevant and Appropriate Requirements

Pursuant to 40 CFR 300.415(j), removal actions shall, to the extent practicable considering the exigencies of the situation, attain ARARs. Currently, there are no state of South Carolina or federal level promulgated chemical-specific ARARs for PFOS and PFOA. In the absence of ARARs, cleanup levels are based upon “...other reliable information. ...” (See 40 CFR§300.430(e)(2)(i).)

Reliable information can be derived from other to-be-considered (TBC) criteria, advisories, or guidance (40 CFR § 300.400(g)(3)). These advisories, criteria, or guidance are developed by USEPA, other federal agencies, or states and may be useful in developing the removal action. TBCs complement ARARs but do not override them. Therefore, in the absence of an ARAR, NGB is using 70 ppt for PFOS or PFOA, individually or combined, as TBC criteria.

2.3 Removal Action Objectives

The following RAO was developed for the EE/CA for two DW wells with PFOS/PFOA exceedances:

- Prevent human exposure via ingestion of water containing 70 ppt for PFOS or PFOA, individually or combined.

3.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

This section presents the removal action alternatives developed from the technologies that are applicable to the site conditions and contaminants in groundwater sources. The action applies to the two DW wells downgradient from McEntire JNGB.

The Guidance on Conducting NTCRA under CERCLA (USEPA, 1993) recommends the EE/CA discuss only the most qualified technologies that apply to the media or source of contamination. Limiting the number of alternatives to those selected in the past at similar sites or for similar contaminants provides an immediate focus to the discussion and selection of alternatives. Technologies may be combined, if applicable, to create alternatives that will meet the RAOs that are appropriate for the site conditions and have been shown to be effective at similar sites.

This section identifies removal action alternatives that include no action, alternative water supply, treatment, and installation of replacement wells. Each alternative is identified along with its advantages, limitations, and potential for being retained for further evaluation.

3.1 Alternative 1 – No Action

Alternative 1 is the No Action alternative and is included in this analysis to comply with the NCP. This alternative will provide a baseline for alternative comparisons. Under the No Action alternative, bottled water delivery would stop, and there would be a continued higher human exposure risk resulting from potential ingestion of PFOS/PFOA-impacted DW above 70 ppt for PFOS/PFOA. There would be no cost or implementation required for this alternative, as no action would be taken. This alternative would not meet the RAO.

3.2 Alternative 2 – Municipal Water Connection

Alternative 2 involves municipal water system connections for an ongoing permanent source of treated DW. This action would involve disconnecting and capping the existing piping between each well and associated dwelling. This alternative protects human health by providing an alternate source of clean DW that undergoes routine testing by the municipality. An advantage of this alternative is that it would be a permanent source of DW from a municipal water supplier, and there are no maintenance requirements.

The nearest connection points are approximately 0.67 and 1.15 miles from each of the two properties. Connecting the two properties to municipal water would also require an additional water distribution line extension of 0.95 miles to meet return loop distribution line installation requirements associated with prevention of dead-end water lines. The total extension would consist of 1.6 miles of six-inch water distribution line along with associated fire suppression design requirements and connection to each dwelling, with a total estimated cost of \$1,590,720. The total cost of construction for installation of 1.6 miles of supply lines would be a significant expenditure in comparison to other options and for connection of only two properties. Note the cost estimate listed above is not a detailed construction cost estimate; however, a detailed cost estimate would be prepared if this alternative is selected.

Typically, for an impacted private DW well, alternative water is obtained by connecting to a public water system. However, property owners do not always desire a connection to municipal water and the related recurring commodity cost for this service. Other considerations include addressing potential safety risks for personnel performing construction activities, managing administrative

requirements, and identifying capital costs for infrastructural upgrades, particularly if an extensive water main extension or other infrastructure is required. Additionally, this alternative would require each well owner/occupant to pay a recurring water bill to the providing water utility in place of paying maintenance costs associated with the drinking water well, such as water distribution piping and electricity fees for pump operations. The well could remain a source of water other than for drinking water purposes, or it could be abandoned and sealed. This alternative would not remove or remediate groundwater impacted by PFOS/PFOA.

3.3 Alternative 3 – Treatment

For Alternative 3, a point of entry treatment (POET) system would be installed at the two impacted properties where the DW well supply pipe enters each residence. A POET would provide whole-house treatment and could be installed along the service line either between the well and the dwelling or immediately inside the dwelling. The space required for a typical household system is approximately 4 feet by 6 feet by 8 feet high. Treatment media in a POET is typically either granular activated carbon (GAC) or ion exchange resin (IX). This alternative will also necessitate periodic maintenance and monitoring of treatment system performance, waste disposal for used water filters, and spent media changeouts for the treatment vessels. Recurring sampling of treated water over the lifetime of the system is required to identify the potential for breakthrough of PFOS/PFOA in DW, and to ensure timely GAC or resin replacement.

Typically, treatment is used for impacted private DW wells in rural areas. Other considerations include pre-treatment concentrations and estimated spent media replacement schedules. Infrastructure upgrades may also be required if existing piping and electrical are not compliant with existing codes. This alternative removes insignificant amounts of PFOS and PFOA from the groundwater aquifer. The total estimated cost of this alternative is \$354,489.

3.4 Alternative 4 – Replacement Well

For Alternative 4, a new well would be installed on the affected property(s). As the impacted private DW wells are screened in the shallow unconfined aquifer, the replacement well would be planned to be drilled into the confined aquifer (Middendorf Aquifer), which is greater than 150 feet below ground surface. Short distances can see drastic reductions in PFOS and PFOA concentrations in the shallow unconfined aquifer depending on geology and hydrology. The total estimated cost of this alternative is \$30,888.

At this stage of the environmental investigation, nature and extent of PFOS and PFOA impacts have not been fully delineated. Without a complete Conceptual Site Model, it is difficult to identify locations on affected properties that would have groundwater results below 70 ppt for PFOS/PFOA. Installation of Alternative 4 is included based on stakeholder interest; however, it may not meet the RAO. Per the 6 January 2021 Deputy Assistant Secretary of the Air Force for Environment, Safety, and Infrastructure (SAF/IEE) memo, *Approach for Response to PFOS/PFOA-Impacted Drinking Water Sources*, drilling of a replacement private drinking water well would be at the owner's expense. Covered expenses would only include installation of a filter system to an operating DW well after well completion.

3.5 Evaluation Criteria

USEPA NTCRA Guidance recommends identifying and assessing a limited number of alternatives appropriate for addressing the RAOs. The technologies and methods proposed are all considered presumptive remedies, have been used before, and are generally accepted in the remediation industry. The identified alternatives are evaluated against three broad criteria, with sub-criteria, as noted below:

3.5.1 Effectiveness

- Protectiveness
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of chemical toxicity, mobility, or volume (TMV)
- Short-term effectiveness

3.5.2 Implementability

- Technical feasibility
- Administrative feasibility
- Availability of services and materials
- Regulatory acceptance
- Community acceptance

3.5.3 Cost

- Capital
- Annual O&M
- Periodic
- Present value

Each alternative is evaluated against the above criteria (as applicable) in the following paragraphs.

3.6 Effectiveness

3.6.1 Protectiveness

This criterion assesses whether each alternative provides adequate protection of human health and the environment. The evaluation of protectiveness focuses on the reduction or elimination of risks by the proposed remedial alternative. This criterion is considered a threshold for the evaluation and must be met by the selected alternative.

Alternative 1, No Action, is the baseline condition. It does not provide full protection of human health.

Alternative 2, Municipal Water Supply, provides protection by obtaining potable water from another water source that undergoes regular treatment and water quality testing.

Alternative 3, Treatment, protects human health by removing PFOS/PFOA originating from the DW source before it is available for possible consumption at the point of use.

Alternative 4, Replacement Well, may be protective of human health if drilled into the deeper confined aquifer, since the groundwater flow in this Aquifer is from the west to the east and there is no evidence that this aquifer has been impacted beneath the installation. However, uncertainty remains of PFOS and PFOA concentrations in the subsurface at the affected properties.

3.6.2 Compliance with ARARs

Currently, there are no state of South Carolina or federal level promulgated chemical-specific ARARs for PFOS/PFOA. PFOS/PFOA concentrations in DW will adhere to a 70 ppt for PFOS or PFOA, individually or combined, as TBC criteria for any chosen alternative.

3.6.3 Long-Term Effectiveness and Permanence

Each alternative is evaluated in terms of risk that remains after the RAOs have been met. The primary focus of this evaluation is the extent and effectiveness of controls used to manage the risk posed by treatment residuals or untreated wastes. Long-term effectiveness is one of the balancing criteria. The following factors will be considered in evaluating this criterion:

- Adequacy of remedial controls.
- Reliability of remedial controls.
- Magnitude of the residual risk.

Alternative 1, No Action, would not effectively remove PFOS/PFOA impacts to DW supplied by the impacted well and does not prevent human ingestion of PFOS/PFOA. This alternative does not satisfy the RAO.

Alternative 2, Municipal Water Supply, would permanently eliminate human exposure to PFOS/PFOA impacted DW originating from the private DW supply wells.

Alternative 3, Treatment, would effectively remove PFOS/PFOA impacts to DW supplied by impacted private DW Dwells for as long as the treatment system is properly maintained.

Alternative 4, Replacement Wells, would potentially eliminate human exposure to PFOS/PFOA but there is uncertainty due to nature and extent not being fully delineated at this stage of the investigation.

3.6.4 Reduction of Chemical Toxicity, Mobility, or Volume (TMV)

This evaluation criterion addresses the CERCLA statutory preference for treatment options that permanently and significantly reduce the TMV of PFOS/PFOA. The criterion is satisfied when treatment reduces the principal threats through the following:

- Destruction of toxic contaminants
- Reduction in contaminant mobility
- Reduction in the total mass of toxic contaminants
- Reduction in the total volume of contaminated media

Although CERCLA includes a statutory preference for treatment, this criterion is not a threshold that must be met.

Alternatives 1, 2, and 4 do not reduce the TMV, as PFOS/PFOA concentrations would remain unchanged in the groundwater. Alternative 3, Treatment, provides an insignificant reduction in TMV in the subsurface through removal of PFOS/PFOA in the relatively low volume of water extracted by the well.

3.6.5 Short-Term Effectiveness

This evaluation criterion addresses the effects of the alternative during the construction and implementation phase until the RAO is met. Under this criterion, alternatives are evaluated for their effects on human health and the environment during implementation of the removal action. The following factors will be considered:

- Exposure of the community during implementation
- Exposure of workers during construction
- Environmental impacts
- Time to achieve RAOs

Alternative 1, No Action, assumes no change, and PFOS/PFOA concentrations in the DW well and impact would remain as is.

Alternative 2, Municipal Water Connection, would require continuation of bottled water deliveries until the household is connected to the municipal system and would entail construction, which is estimated to take approximately six months for completion of work.

Alternative 3, Treatment, would require continuation of bottled water delivery until the treatment system is installed and would entail construction, which is estimated to take approximately two weeks for completion of work once any applicable permits are obtained.

Alternative 4, Replacement Well, would result in potential exposure to construction personnel during well installation, which is standard practice to mitigate exposure with the use of personally protective equipment. Environmental impacts would be minimally changed due to the relatively low volume of extracted water in comparison to the volume of the aquifer.

3.7 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials that may be required during its implementation. The following factors were considered:

- Ability to construct the technology
- Monitoring requirements
- Availability of equipment and specialists
- Ability to obtain approvals from regulatory agencies

Alternative 1, No Action, would not require an action be implemented, and water deliveries would be discontinued.

Alternatives 2 (Municipal Water Connection), 3 (Treatment), and 4 (Replacement Well) would require consideration of lead times for equipment, supplies, vendors, and subcontractors, along with coordination with property owners. No technical or administrative feasibility concerns associated with the alternatives would be anticipated. These implementability considerations are similar to other actions performed for other residents or at other sites with PFOS/PFOA impacted DW wells. There are also no anticipated availability concerns associated with the alternatives.

3.7.1 Regulatory Acceptance

The South Carolina Department of Health and Environmental Control (SC DHEC) is the regulatory partner for ANG-led environmental investigations and response actions at McEntire JNGB. SC DHEC will conduct a review of the Draft Final EE/CA Report, with any comments incorporated into the Final EE/CA Report following concurrence. Since the action is minor in nature and prevents exposure to PFOS/PFOA, there are no anticipated issues with regulators accepting either Alternative 2 or 3.

3.7.2 Community Acceptance

The community will be invited to provide input during a 30-day public comment period for the Final EE/CA Report. A written response will be made to significant comments received during the public comment period and included with the Final EE/CA Report in the Administrative Record file. Alternative 2 or Alternative 3 will likely be acceptable to the community since they prevent exposure to PFOS/PFOA at the impacted properties.

Regarding regulator and community involvement in this NTCRA, the NCP requires that the federal agency follow 40 CFR § 300.820(a), which in this case includes the community notice requirements in 40 CFR 300.415(n)(1) and (4), and requires the following among others: 1) Publish a notice of availability of the administrative record in a major local newspaper of general circulation or use one or more other mechanisms to give adequate notice to a community at the time the EE/CA is made available for public comment; 2) Provide a public comment period, as appropriate, of not less than 30 days from the time the administrative record file is made available for public inspection; and 3) Prepare a written response to significant comments.

3.8 Cost

All alternative costs are based on actual contract cost, standard cost estimating data, and previous experience with other similar projects. These costs represent the total estimated cost scenario to NGB over a 30-year period.

3.8.1 Alternative 1 – No Action

Alternative 1, No Action, is the baseline against which the other alternatives were compared. As such, no costs are associated with Alternative 1.

3.8.2 Alternative 2 – Municipal Water Supply

Alternative 2, Municipal Water Supply, includes NGB-funded and owner-funded costs. If this alternative were selected, NGB would pay the cost to connect to a municipal source with water treated to below 70 ppt PFOS/PFOA. NGB would not pay for commodity (i.e., water) costs; prior to

connection to the alternate drinking water source, the owner would agree to bear all commodity costs in perpetuity.

Capital Costs: Estimated costs are identified at \$ 1,590,720 for installation of 1.6 miles of water distribution piping from the impacted dwelling to the nearest public drinking water supply connection. If this option is selected, an actual quote would be requested from the Richland County Public Water System.

Annual O&M Costs: N/A

Municipal Water Usage Costs: Paid by customer

Total Present Value = \$1,590,720

3.8.3 Alternative 3 – Treatment (estimated at present value costs)

Alternative 3, Treatment, includes NGB-funded costs associated with installation and O&M of a POET system. Installation costs include equipment, electrical connection, and plumbing. O&M costs include periodic testing of the water as well as change out and disposal of granulated activated carbon canisters. NGB will pay O&M costs until such time as active or passive response actions reduce PFOS/PFOA concentrations in the groundwater to below the ARAR without treatment. Once such concentration levels are reached, the owner will pay any continued O&M costs in perpetuity, if the active remediation measure remains in place at the owner's request.

Initial cost to provide and install the treatment system is approximately \$13,100 per system with annual operation and maintenance estimated at \$8,000/year total for both systems. The \$13,100 installation cost includes a pre-treatment system, main GAC or IX system, performance monitoring, and water quality testing. The \$8,000 annual cost includes quarterly site visits, an annual site visit, and sampling. Periodic costs are estimated at \$15,760 total for both systems. The periodic costs are estimated to be incurred every five years and include a site visit, spent media replacement, spent media disposal, and performance monitoring. Note: The frequency of change out of media canisters would be predicated on water usage and sampling results, and it is assumed that a 0.4% discount factor (for present value comparison) is achievable.

Capital Costs: \$26,200

Annual O&M Costs: \$8,000 (Years 1-30 total)

Periodic Costs: \$15,760 (Typically, Years 5, 10, 15, 20, 25, 30 total)

Total Present Value = \$354,489

3.8.4 Alternative 4 – Replacement Well (estimated at present value costs)

Alternative 4, Replacement Well, includes owner-funded costs associated with installation of a replacement well, NGB-funded costs of treatment installation, and owner-funded costs associated with treatment O&M. If the owner chooses not to connect to the alternative DW source but rather chooses to maintain their existing private DW well or to drill a private DW well at the owner's expense, NGB will pay only the cost to install a filter system to an operating drinking water well.

This presumes the owner has the requisite water rights and has complied with applicable legal authorities regarding installation of the well. Prior to installation of the filter system to an operating well, the owner will agree to bear O&M costs for the well and filter system.

Capital Costs: \$30,888 (paid by well owner)

Annual Costs: \$0 (Years 1-30 total)

Total Present Value = \$30,888

4.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the four assembled alternatives, including the No Action Alternative, are compared to each another relative to the RAOs, following the NTCRA Guidance. Alternatives were ranked relative to each other, with the best rating scored with a 1 and the worst rating scored with a 4. Comparable alternatives are ranked with the same score. The comparative analysis of the removal action alternatives is summarized below in **Table 4-1**.

Table 4-1. Comparative of Alternatives

Criterion	Alternative			
	1. No Action	2. Municipal Water	3. Treatment	4. Replacement Well
Protection of Human Health & the Environment	4	1	1	3
Compliance with ARARs ¹	4	1	1	3
Long-Term Effectiveness & Permanence	4	1	2	3
Reduction of Toxicity, Mobility or Volume	4	2	1	2
Short-Term Effectiveness	4	2	1	3
Implementability	1	2	2	2
Present Value	1	4	3	2
TOTAL SCORE	22	13	11	18

¹There are no promulgated chemical-specific ARARs for PFOS and PFOA. Therefore, in the absence of an ARAR, the DAF is using 70 ppt for PFOS or PFOA, individually or combined, which qualify as material, as protective levels for human health in drinking water.

5.0 RECOMMENDED ALTERNATIVE

Four alternatives were evaluated to achieve the RAOs for the impacted private DW wells. These alternatives consist of the following:

- Alternative 1 — No Action
- Alternative 2 — Municipal Water Supply
- Alternative 3 — Treatment
- Alternative 4 — Replacement Well

5.1 Recommended Alternative

The recommended response action for the affected properties is Alternative 3, the installation of a POET system to address the impacted DW wells. NGB is currently providing bottled water to the affected well owners. NGB would maintain the POET indefinitely until PFOS/PFOA detections in each well are below 70 ppt for PFOS or PFOA, individually or combined, or applicable promulgated action levels. This alternative involves NGB providing all equipment, labor, testing and O&M on each treatment system until well water is considered safe to drink. These activities would be at no cost to the property owner.

5.2 Scope of Removal Action

POET System - Equipment and materials may consist of:

- Pre-filtration, including sediment filter and/or iron and manganese removal
- At least two primary treatment vessels in lead/lag series configuration utilizing PFAS-selective GAC with a bed depth of not less than 36 inches and empty bed contact time of 2.5 minutes
- Clear particle filter
- Carbon post-filtration
- Totalizing flow meter
- Sample ports and pressure gauges before and after each treatment vessel
- Plastic piping, manifold, fittings, and valves, as required, to connect the vessels and allow for GAC change outs and isolation

6.0 REFERENCES

ASD, 2023. Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program, August 24, 2023.

BB&E, 2016. Final Perfluorinated Compounds Preliminary Assessment Site Visit Report, May 2016.

LEIDOS, 2019. Final Site Inspection Report for Perfluorooctane Sulfonate and Perfluorooctanoic Acid at McEntire Joint National Guard Base, South Carolina, April 2019.

OUSD, 2020. DoD Remediation Plan for Cleanup of Water Impacted with PFOS or PFOA. Office of the Under Secretary of Defense for Acquisition and Sustainment, June 2020.

SAF/IEE, 2021. Secretary of the Air Force for Environment, Safety, and Infrastructure (SAF/IEE) memo, *Approach for Response to PFOS/PFOA-Impacted Drinking Water Sources*. 6 January 2021.

USEPA, 2016a. *Drinking Water Health Advisory for Perfluorooctane Sulfonate (PFOS)*, EPA 822-R-16-004. United States Environmental Protection Agency, May 2016.

USEPA, 2016b. *Drinking Water Health Advisory for Perfluorooctanoic Acid (PFOA)*, EPA 822-R-16-005. United States Environmental Protection Agency, May 2016.

USEPA, 2016c. *Drinking Water Health Advisories for PFOA and PFOS*, Retrieved from: <https://www.epa.gov/ground-water-and-drinking-water/drinking-water-health-advisories-pfoa-and-pfos>

USEPA, 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. EPA540-R93-057, August 1993.

**Alternative 2
Public Water System Connection**

COST ESTIMATE SUMMARY

<p>Site: McEntire JNGB Location: Eastover, SC Phase: EE/CA Base Year: 2023 Date: June 2023</p>	<p>Description: Alternative 2 consists of the installation of a hot-tap service connection from the nearest public water supply main to each of two residences plus an extension to a separate distribution line to create a looped system connection (prevent dead end water line). Capital costs occur in Year 0. No O&M costs are included in this Alternative *Note this is an estimated value based on anticipated design requirements</p>
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CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Public Water System Expansion Construction					
6 inch water distribution line extension	8,448	LF	\$150	\$1,267,200	
Fire suppression requirements (fire hydrants)	10	EA	\$5,000	\$50,000	
SUBTOTAL				\$1,317,200	
Private Service Line Construction					
Excavation and backfill Water Main	60	CY	\$15	\$900	
Tap (Meter connection Fee)	2	EA	\$1,500	\$3,000	
Piping	300	LF	\$15	\$4,500	
SUBTOTAL				\$8,400	
SUBTOTAL				\$1,325,600	
Contingency	20%			\$265,120	10% scope + 10% bid
TOTAL				\$1,590,720	

TOTAL CAPITAL COST

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR- 0.4%	PRESENT VALUE	NOTES
Capital Cost	0	\$1,590,720	\$1,590,720	1.000	<u>\$1,590,720</u>	Estimated Value
TOTAL PRESENT VALUE OF ALTERNATIVE					\$1,590,720	

Alternative 3

COST ESTIMATE SUMMARY

Point-of-Entry Treatment System

Site:	McEntire JNGB	Description:	Alternative 2 consists of the installation of a point-of-entry treatment system (POETS) at each of two affected properties/wells. Capital costs occur in Year 0. Annual O&M costs occur in Years 1-30. Periodic costs occur in Years 5,10, 15, 20, 25, & 30.
Location:	Eastover, SC		
Phase:	EE/CA		
Base Year:	2023		
Date:	June 2023		

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
POETS Installation					
Pre-Treatment System	2	EA	\$1,500	\$3,000	
GAC or IX System	2	EA	\$7,000	\$14,000	Including piping, gauges, ect...
Sampling and Analysis					
Water Quality Testing	2	EA	\$500	\$1,000	1 per system
Startup Performance Monitoring	2	Month	\$4,100	\$8,200	3 samples/system/month
TOTAL CAPITAL COST				\$26,200	

ANNUAL O&M COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Sampling and Analysis					
Quarterly Effluent Sampling,	8	EA	\$300	\$2,400	1 sample/system
Quarterly O&M Site Visit	4	EA	\$600	\$2,400	
Annual Influent Sampling,	2	EA	\$300	\$600	1 samples/system
Annual O&M Site Visit	1	EA	\$2,000	\$2,000	
SUBTOTAL				\$7,400	
Project Management	5%			\$600	
ANNUAL O&M COST				\$8,000	

PERIODIC COSTS:

DESCRIPTION	YEAR	QTY	UNIT	UNIT COST	TOTAL	NOTES
Media Replacement	5, 10, 15, 20, 25, 30	2	EA	\$2,000	\$4,000	2 change-outs/5 years
Changeout Site Visit	5, 10, 15, 20, 25, 30	2	EA	\$1,000	\$2,000	2 change-outs/5 years
Startup Performance Monitoring	5, 10, 15, 20, 25, 30	2	EA	\$4,100	\$8,200	3 samples/system
Media Disposal	5, 10, 15, 20, 25, 30	2	EA	\$200	\$400	Landfill disposal
SUBTOTAL					\$14,600	
Project Management	5%				\$1,160	
PERIODIC COST					\$15,760	

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR - 0.4%	PRESENT VALUE	NOTES
Capital Cost	0	\$26,200	\$26,200	1.00	\$26,200	
Annual O&M Cost	1-30	\$240,000	\$8,000	14.53	\$240,348	
Periodic Cost	5	\$15,760	\$15,760	0.98	\$15,445	
Periodic Cost	10	\$15,760	\$15,760	0.96	\$15,130	
Periodic Cost	15	\$15,760	\$15,760	0.94	\$14,814	
Periodic Cost	20	\$15,760	\$15,760	0.92	\$14,499	
Periodic Cost	25	\$15,760	\$15,760	0.90	\$14,184	
Periodic Cost	30	\$15,760	\$15,760	0.88	\$13,869	
		\$360,760			\$354,489	
TOTAL PRESENT VALUE OF ALTERNATIVE					\$354,489	

**Alternative 4
Replacement Well**

COST ESTIMATE SUMMARY

Site: McEntire JNGB
Location: Eastover, SC
Phase: EE/CA
Base Year: 2023
Date: June 20232

Description: Alternative 4 consists of the drilling of two replacement well into the deeper confined aquifer. Capital costs occur in Year 0 with no O&M costs required for this Alternative. Owner will need to get well permit and water right if needed to drill well.

CAPITAL COSTS:

DESCRIPTION	QTY	UNIT	UNIT COST	TOTAL	NOTES
Replacement Well (Per Well)					
Mobilization/Demobilization	10%	LS		\$115	10% of Construction Cost
Drilling with complete well installation	200	LF	\$45	\$9,000	
Piping	150	LF	\$15	\$2,250	
Fittings and valves	1	LS	\$250	\$250	
SUBTOTAL				\$11,615	
SUBTOTAL				\$11,615	
Contingency	20%			\$2,323	10% scope + 10% bid
SUBTOTAL				\$13,938	
Project Management	5%			\$670	
Construction Management	6%			\$836	
SUBTOTAL				\$15,444	

TOTAL CAPITAL COST (2 Wells) **\$30,888**

PRESENT VALUE ANALYSIS:

COST TYPE	YEAR	TOTAL COST	TOTAL COST PER YEAR	DISCOUNT FACTOR-	0.4%	PRESENT VALUE	NOTES
Capital Cost	0	\$30,888	\$30,888	1.000		\$30,888	
TOTAL PRESENT VALUE OF ALTERNATIVE							