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

CITY OF TUCSON
PFOS/PFOA IMPACTED PRIVATE DRINKING WATER WELLS

162ND WING
MORRIS AIR NATIONAL GUARD BASE
TUCSON, ARIZONA

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AFB	Air Force Base
ADEQ	Arizona Department of Environmental Quality
AFCEC	Air Force Civil Engineer Center
AFFF	Aqueous film forming foam
ANG	Air National Guard
ANGB	Air National Guard Base
ARAR	Applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
EE/CA	Engineering Evaluation/Cost Analysis
GAC	Granular activated carbon
HA	Health Advisory
IX	Ion exchange
MCL	Maximum contaminant level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NGB	National Guard Bureau
ng/L	nanograms per liter
No.	Number
NTCRA	Non-time critical removal action
O&M	Operations and maintenance
OUSD	Office of the Under Secretary of Defense for Acquisition and Sustainment
PA	Preliminary Assessment
PFAS	Per- and polyfluoroalkyl substances
PFBS	Perfluorobutane sulfonate
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonate
POET	Point-of-entry treatment
ppt	parts per trillion
RAO	Removal action objectives
RCRA	Resource Conservation and Recovery Act
RO	Reverse osmosis
RSL	Regional Screening Level

SI	Site Inspection
TCE	Trichloroethylene
TCRA	Time Critical Removal Action
TIAA	Tucson International Airport Authority
TMV	Toxicity, mobility, and volume
U.S.	United States
USAF	United States Air Force
USEPA	United States Environmental Protection Agency

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EXECUTIVE SUMMARY

National Guard Bureau (NGB) has prepared this Engineering Evaluation/Cost Analysis (EE/CA) to support a non-time-critical removal action (NTCRA) in response to the presence of perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) (two subsets of per- and polyfluoroalkyl substances (PFAS)) above relevant United States Environmental Protection Agency (USEPA) lifetime Health Advisory (HA) levels in drinking water wells on private residential properties downgradient and in the vicinity of Morris Air National Guard Base (ANGB), in the City of Tucson, Arizona (Pima County). 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 United States Environmental Protection Agency (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 alternative for the drinking water wells. The NGB applies the CERCLA process and the 2016 USEPA lifetime HA for PFOS/PFOA to guide cleanup actions and to respond to PFOS/PFOA drinking water impacts resulting from ANG mission-related activities.

Morris ANGB ("the Base") is home to the F-16 fighter pilot training unit, the 162nd Wing (162 WG), located in the City of Tucson and is situated on 94 acres on the northwestern portion of the Tucson International Airport. The purpose of this EE/CA is to develop and evaluate alternatives and associated costs to eliminate the human exposure pathway between drinking water receptors and confirmed PFAS releases, above the lifetime HA in groundwater, attributable to Morris ANGB mission activities.

A January 2016 Preliminary Assessment (PA) and subsequent 2019 Site Inspection (SI) confirmed PFAS releases above the screening level from environmental media at eight (8) of the identified 14 Potential Release Locations (PRLs) at Morris ANGB. In 2019, as a result of PFOS/PFOA detections in Tucson International Airport Authority (TIAA) trichloroethylene (TCE) Superfund Site monitoring and extraction wells, the Arizona Department of Environmental Quality (ADEQ) identified three (3) private wells having a use that could potentially result in the ingestion of PFOS/PFOA. In October 2019, ADEQ subsequently began providing bottled water to the three (3) affected well owners. Following NGB confirmation sampling, and identification of complete exposure pathway between on-base PFOS/PFOA release areas, NGB took over the distribution of bottled water (ongoing) and prepared a Time Critical Removal Action (TCRA) to document the determination of an ongoing provision to supply bottled water to the three (3) impacted well owners. One (1) location was subsequently determined to already be connected to the municipal water supply resulting in the discontinuation of bottled water.

Applicable or Relevant and Appropriate Requirements (ARAR) evaluation within the EE/CA concluded that using the USEPA lifetime HA is an appropriate protective level for human health in drinking water. As a result, the following RAO was developed for the EE/CA for the two (2) drinking water wells with PFOS/PFOA exceedances:

- Prevent human exposure via ingestion of water containing PFOS/PFOA above USEPA lifetime HA levels of 70 parts per trillion (ppt), either individually or combined.

The EE/CA evaluated the following four (4) alternatives for achieving the RAO:

- Alternative 1, No Action, the baseline condition. No bottled water provided.
- Alternative 2, Municipal Water Supply
- Alternative 3, Treatment, whole-house treatment of well water
- Alternative 4, Bottled Water, is the current remedy

These alternatives provide a range of options to address the risks at the sites. Alternative 1 is required under CERCLA as a baseline for comparing other alternatives. Alternatives 2, 3 and 4 meet the RAOs, because they are protective of human health. The EE/CA includes an individual assessment of each proposed removal alternative based on the criteria of effectiveness, implementability, and cost. The proposed alternatives were then compared to each other on the same criteria and ranked from most desirable to least desirable.

Based on the comparative analysis, the recommended alternative is Alternative 2: Municipal Water Supply. This alternative protects protect human health by providing an alternate source of drinking water that undergoes routine testing by the municipality. An advantage of this alternative is that a permanent municipal source of potable water from a municipal water supplier is provided and maintenance is minimal.

The recommended alternative has an estimated capital cost of $46,277. No additional bottled water will be provided once complete and future water utility costs are not included. 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 provision of drinking water to the affected well owners.

1. INTRODUCTION

This document presents the Engineering Evaluation/Cost Analysis (EE/CA) completed to support non-time critical removal actions (NTRCAs) in response to the presence of perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA) (two subsets of per- and polyfluoroalkyl substances (PFAS)) above relevant United States Environmental Protection Agency (USEPA) lifetime Health Advisory (HA) levels in drinking water wells on private residential properties downgradient and in the vicinity of Morris Air National Guard Base (ANGB), in the city of Tucson, Arizona (Pima County). PFAS are not currently regulated at the federal level and are not regulated by the State of Arizona; however, the USEPA has established lifetime HA levels for PFOS/PFOA, both individually or combined, to protect against potential human exposure risk via drinking water.

1.1 Authority

Executive Order 12580 – Superfund Implementation (52 FR 2923, 3 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 U.S. Air Force (USAF) and State 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 Site SS010P (formerly Potential Release Area 5), located at the Building 12 - Maintenance Hangar located on Morris ANGB property.

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 drinking water receptors and Site SS010P, where PFAS releases attributable to Morris ANGB mission activities have been confirmed above screening levels in environmental media. This EE/CA develops removal action objectives (RAOs) for two (2) impacted drinking water 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 the CERCLA and as directed in the DERP

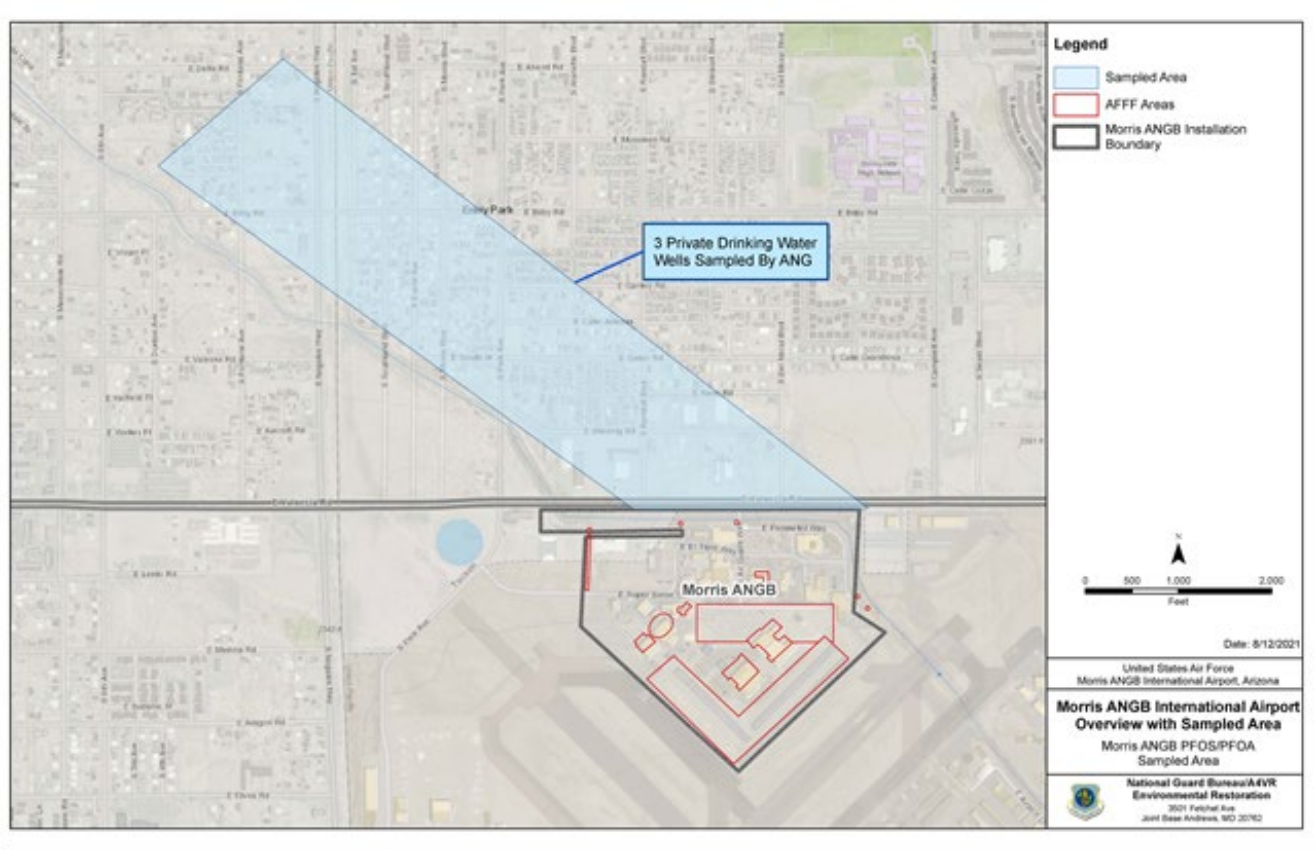
with a goal of protecting human health and the environment in a risk-based, fiscally-sound manner. PFAS, to include PFOS and PFOA, are addressed in the same manner as other contaminants of concern within the DERP. In May 2016, the USEPA published PFOS and PFOA lifetime HA values of 70 parts per trillion (ppt), both individually or combined (USEPA 2016b and 2016c). By the August 11, 2016 Memorandum "SAF/IE Policy Perflourinated 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 2016 USEPA lifetime HA for PFOS/PFOA to guide cleanup actions and to respond to PFOS/PFOA drinking water impacts resulting from ANG mission-related activities. Arizona has not promulgated state regulatory limits for PFOS/PFOA. When the NGB identifies PFOS/PFOA impacts to drinking water above the USEPA lifetime HA as a result of past ANG mission activities, NGB will initiate an immediate response action, such as providing an alternate drinking water source, while a long-term remedy is identified.

1.4 Installation Description and Mission

Morris ANGB ("the Base") is home to the F-16 fighter pilot training unit, the 162nd Wing (162 WG), located in the City of Tucson, Pima County, Arizona (Figure 1-1). The Base is situated on 94 acres on the northwestern portion of the Tucson International Airport. The 162 WG's federal mission is to maintain well-trained, well-equipped units available for prompt mobilization during war and to provide assistance during national emergencies. Currently, the 162 WG deploys its members as part of the Air and Space Expeditionary Force to provide combat forces in support of USAF missions. When 162 WG Guardsmen are not mobilized or under federal control, they report to the governor of Arizona and are led by the Adjutant General of the state. Under state law, the Wing provides protection of life and property and preserves peace, order, and public safety.

Figure 1-1. Location of Morris ANGB, AZ.



Potable water that is supplied to the Base is distributed by the City of Tucson Water Department (Tucson Water). The City of Tucson depends upon groundwater from subsurface water-bearing formations primarily within the Tucson Basin which is blended with Colorado River water to meet Tucson drinking water supply demands. Tucson Water pumps groundwater from a network of more than 175 wells spread out from the far east side of Tucson to Avra Valley, west of the Tucson Mountains. The basin's groundwater system is a USEPA-designated Sole Source Aquifer under the federal Safe Drinking Water Act since it supplies at least 50 percent of drinking water for the service area and there are no reasonably available alternative drinking water sources should water become impacted. The groundwater wells from which the City of Tucson obtains its municipal water are considered "suitable for potable use." The City does not draw water from the South Side well field supply wells because of trichloroethylene (TCE) impacted groundwater from the Tucson International Airport Authority (TIAA) Superfund Site which is located within the Well Field boundary. Tucson Water's South Side well field supply wells are maintained for emergency use.

1.5 Previous PFOS/PFOA Investigations and Response Actions

The January 2016 Morris ANGB Preliminary Assessment (PA) included a review of 16 documented areas suspected or known to have had a release of aqueous film forming foam

(AFFF) (a source of PFAS) into the environment. Of the 16 Potential Release Locations (PRLs) evaluated in the PA, sufficient evidence of a potential release warranting additional investigation was found at 14 of the 16 PRLs. The March 2019 Morris ANGB Site Inspection (SI) evaluated 14 PRLs that were carried forward from the PA. Laboratory sampling results from the SI confirmed the release of PFAS in environmental media above screening levels at eight (8) PRLs. Laboratory sampling results from the SI did not confirm the release of PFAS in environmental media above screening levels at six (6) PRLs.

In 2019, a sampling program was initiated by the Arizona Department of Environmental Quality (ADEQ) in response to the detection of PFOS/PFOA in TIAA TCE Superfund Site monitoring and extraction wells. Their findings were documented in *Letter Report Providing Results of Groundwater Sampling for PFOS/PFOA in 9 Private Wells* (Hargis and Associates, Inc., 2020). ADEQ identified a total of nine (9) active, private wells having a use that could potentially result in the ingestion of PFOS/PFOA. PFOS/PFOA were detected in three (3) of these private drinking water wells at concentrations exceeding the USEPA lifetime HA. In October 2019, ADEQ began providing bottled water to the three (3) affected well owners.

In March 2020, NGB identified a complete exposure pathway between on-base PFOS/PFOA release areas and the three (3) previously sampled off-base drinking water wells located downgradient and in the vicinity of the Base. As a result, NGB subsequently took over the distribution of bottled water, which is ongoing. In May 2020, NGB conducted confirmatory sampling at the three (3) drinking water wells and laboratory results confirmed PFOA/PFOS exceedances above the USEPA lifetime HA. In June 2020, the NGB prepared a Time Critical Removal Action (TCRA) to document the determination of an ongoing provision to supply bottled water to the three (3) impacted well owners. In July 2021, the City of Tucson reported to NGB that one (1) of the three (3) impacted drinking water wells was already connected to municipal water. As a result, this EE/CA will only evaluate alternatives for two (2) drinking water wells.

1.6 Streamlined Risk Evaluation

NGB is required to reduce exposure risk to human health resulting from USEPA lifetime exceedances for PFOS/PFOA in drinking water attributable to ANG mission-related activities. Laboratory data confirmed that PFOS/PFOA concentrations were above screening levels in environmental media at site SS010P and poses an immediate risk to public health via drinking water.

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

2. 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 drinking water wells.

2.1 Justification for the Proposed Removal Action

NGB identified the existence of an unacceptable risk to human health due to the presence of PFOS/PFOA above the USEPA lifetime HA in drinking water in two (2) off-base private drinking water wells attributable to Morris ANGB mission-related activities. As such, a removal action is warranted based on the following factors listed in 40 CFR 300.415(b)(2) of the NCP associated with PFOS and/or PFOA exposure via drinking water ingestion:

- "Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;" and

- "Actual or potential contamination of drinking water 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. There are no promulgated chemical-specific ARARs for PFOS and PFOA in Arizona. 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 the USEPA lifetime HA as protective levels for human health in drinking water.

2.3 Removal Action Objectives

The following RAO was developed for the EE/CA for the two (2) drinking water wells with PFOS/PFOA exceedances:

- Prevent human exposure via ingestion of water containing PFOS/PFOA above USEPA lifetime HA levels of 70 ppt, either individually or combined.

As discussed in Section 2.2, while ARARs and TBC criteria are important in evaluating removal actions, because the NGB is merely trying to prevent exposure to PFOS/PFOA in drinking water versus removing PFOS/PFOA from the environment, ARARs and TBC criteria are not germane to the removal action objective.

3. 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 used for drinking water purposes hydraulically connected to the two (2) drinking water wells downgradient from the Base.

Based on the guidelines presented in the Guidance on Conducting Non-Time-Critical Removal Actions (NTCRA) Under CERCLA (USEPA 1993), only the most qualified technologies that apply to the media or source of contamination should be discussed in the EE/CA. Limiting the number of alternatives to those that have been selected in the past at similar sites or for similar contaminants provides an immediate focus to the discussion and selection of alternatives. Technologies are 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 continued supply of bottled water. Each alternative is identified along with its advantages, limitations, and potential for being retained for further evaluation.

3.1 No Action (Alternative 1)

Alternative 1 is a 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 would no longer be provided and there would be a continued human exposure risk resulting from potential ingestion of PFOS/PFOA-impacted drinking water above USEPA lifetime HA derived from the two (2) private drinking water wells. There would be no cost or implementation required for this alternative. This alternative would not remove or remediate groundwater impacted by PFOS/PFOA.

3.2 Municipal Water Supply (Alternative 2)

Alternative 2 involves connecting the two (2) impacted drinking water wells to the City of Tucson municipal water system for an ongoing permanent source of potable water. This action would involve disconnecting and capping the existing piping between the well and the dwelling(s). This alternative protects protect human health by providing an alternate source of drinking water that undergoes routine testing by the municipality. An advantage of this alternative is that a permanent municipal source of potable water from a municipal water supplier is provided and maintenance is minimal.

The nearest connection points are approximately 25 feet from each of the two (2) properties where the wells are installed. Other considerations include addressing potential safety risks for personnel performing construction activities, managing administrative requirements (e.g., annexation for municipal connection if not already in the municipal boundaries), 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 Treatment (Alternative 3)

Alternative 3 involves installing a point-of-entry treatment (POET) system at each of the two

(2) impacted properties that would treat PFOS/PFOA-impacted well water prior to entering the household. 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. The primary treatment technology is typically either by granular activated carbon (GAC) or ion exchange (IX). An Advantage of the POET is that it can serve as a permanent source of treated water for the entire household and has a reasonable overall cost.

Other considerations include addressing potential safety risks for personnel performing construction activities to include professional design and installation of the treatment system, piping, and potentially a shed with lights if indoor space is not available. Infrastructure upgrades may also be required if existing piping and electrical are not compliant with existing codes. This alternative will also necessitate periodic maintenance of the treatment system which will generate waste in the form of used water filters and treatment vessel change-out. Recurring sampling of treated water over the lifetime of the system will be required to identify the potential for breakthrough of PFOS/PFOA in drinking water and to monitor system performance. Material and installation costs for a single POET unit vary but are approximately $15,000 for single family residences and estimated at $45,000 for the multi-residential property associated with this NTCRA. Each of the POET system components contribute to ongoing operations and maintenance costs, which is estimated at approximately $7,000 per year.

3.4 Bottled Water (Alternative 4)

Alternative 4 involves the continued provision of bottled water as a replacement for drinking water from the two (2) private drinking water wells; one (1) well services one (1) address, and the other well services 65 addresses for a total of 66 locations receiving bottled water. This alternative would continue to eliminate the human exposure risk resulting from potential ingestion of PFOS/PFOA-impacted drinking water above USEPA lifetime HA. The cost to implement this alternative on a yearly basis is approximately $27,425.00. This alternative would not remove or remediate groundwater impacted by PFOS/PFOA.

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 are 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 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 Overall Protection of Human Health and the Environment

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 any protection of human health.

Alternative 2, Municipal Water Supply, provides protection of human health for effected well owners by obtaining potable water from a municipal source that undergoes regular water quality testing.

Alternative 3, Treatment, a POET provides whole-house treatment of water supplied by impacted water well protects human health by removing PFOS/PFOA originating from the drinking water well.

Alternative 4, Bottled Water, is the current method of supplying drinking water for the affected well owners. This option provides protection of human health by providing an alternate drinking water source.

3.6.2 Compliance with ARARs

As noted previously, because the removal action is focused on preventing exposure to PFOS/PFOA in drinking water versus removing PFOS/PFOA from the environment, ARARs and TBC criteria are not germane to the removal action objective. However, PFOS/PFOA concentrations in drinking water will adhere to the USEPA's lifetime HA advisory levels under 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, does not effectively remove PFOS/PFOA impacts to drinking water supplied by impacted wells and does not prevent human ingestion of PFOS/PFOA. This alternative does not satisfy the statutory requirement to be protective of human health.

Alternative 2, Municipal Water Supply, will permanently eliminate human exposure to PFOS/PFOA-impacted drinking water originating from water supply well.

Alternative 3, Treatment, a POET will effectively remove PFOS/PFOA impacts to drinking water supplied by impacted wells for as long as the system is properly maintained.

Alternative 4, Bottled Water, will effectively prevent the risk of ingestion of PFOS/PFOA. This alternative satisfies the statutory requirement to be protective of human health.

3.6.4 Reduction of Toxicity, Mobility and 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 slightly reduces TMV through whole-house removal of PFOS/PFOA supplied by well water.

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/PFOS concentrations in the drinking water well and impact would remain as is.

Alternative 2, Municipal Water, would require bottled water to be provided during the time at which the household is connected to the municipal system and would entail some construction, which is estimated to take two to three weeks for completion of work.

Alternative 3, Treatment, would require bottled water to be provided during the time to install treatment systems and would entail some construction, which is estimated to take two to three weeks for completion of work.

Alternative 4, Bottled Water, would not require changes to the current remedy in the short term and would continue to be an effective replacement of drinking water.

Since bottled water is currently being provided, Alternatives 2 and 3 would not pose a significant risk to the residents or community. However, alternatives 2 and 3 may pose some physical hazards for workers but not an exposure hazard to PFOS/PFOA. Hazards would be reduced by following a properly implemented health and safety program.

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, does not require an action to implement. Alternatives 2 (Municipal Water Supply) and 3 (Treatment) would require an advance notice for equipment, supplies, and vendors to be contracted to execute the installation, along with coordination with property owners. No technical or administrative feasibility concerns associated with the alternatives are anticipated. These Alternatives are similar to other actions performed for other clients or at other sites. There are also no anticipated availability of services and materials concerns associated with the alternatives. Alternative 1 has no actions to be performed. Services and materials for Alternatives 2 and 3 are readily available with a 2-3 weeks advance notice. Alternative 4 is easily implemented but presumes that funding and supply sources for the ongoing provision of drinking water will be available in perpetuity.

3.7.1 Regulatory Acceptance

The USEPA and Arizona Department of Environmental Quality (ADEQ) will conduct a review of the Draft Final EE/CA Report, with comments incorporated into the Final EE/CA Report

following USEPA/ADEQ concurrence. Since the action is minor in nature and prevents exposure to PFOS/PFOA, there are no anticipated issues with the regulators accepting either Alternative 2 or 3.

3.7.2 Community Acceptance

Since the public has not yet been provided an opportunity to review the detailed analysis of removal action alternatives, no formal comments are available for evaluation of community acceptance at this time. However, the public will be provided a 30-day comment period to review the Final EE/CA Report. Following the 30-day review period, the Project Team will review and provide a written response to significant comments in the Administrative Record file and will incorporate these comments into the Action Memorandum, as needed, to provide sufficient detail to justify the selected alternative. It is believed that either Alternative 2 or Alternative 3 will be acceptable to the community since they prevent exposure to PFOS/PFOA at the impacted residences. Alternative 4 equally prevents exposure to PFOS/PFOA but is not likely to be viewed favorably due to the lack of permanence compared to Alternatives 2 or 3.

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.

ADEQ initiated a sampling program in 2019 for private wells located in the vicinity of the Base that were potentially impacted by PFOS/PFOA. As a part of that initiative, ADEQ issued PFOS/PFOA information and questionnaires to 90 members of the community. ADEQ also provided technical guidance during the NGB's PFOS/PFOA SI through the review and comment on the NGB's PFOS/PFOA SI Work Plan (ADEQ, 2018) and Report (ADEQ, 2019). Drinking water impacted by PFOS/PFOA has also been discussed at meetings of the Unified Community Advisory Board (UCAB), the local USEPA-sponsored community advisory board that provides oversight for the overall cleanup of groundwater contamination at the TIAA Superfund Site. The UCAB meets quarterly in a virtual or off-base setting that is open to the community.

3.8 Cost

All alternative costs are based on either estimates provided by Tucson Water, standard cost estimating data, previous experience with similar projects, or current costs (bottled water). These costs represent the total worst-case cost scenario to NGB for both locations over a 30 year period.

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

Alternative 2, Municipal Water Supply, cost to connect the dwelling to municipal water will be funded by the NGB. NGB will NOT pay for recurring water costs associated with procuring water. Prior to connection, the owner will agree to bear all water costs in perpetuity.

Alternative 3, Treatment, cost to connect a POET to the dwelling will be funded by the NGB. If a municipal supply connection is reasonably available to the well owner, the NGB will not fund long-term operation and maintenance of the system if the well owner opts to install a POET.

Alternative 4, Bottled Water, cost to provide bottled water will be funded by ANG on an ongoing basis.

3.8.1 Alternative 2 - Municipal Water Supply

Capital Costs: $46,277 (Costing provided by Tucson Water)

Annual Operation & Maintenance Costs: Provided by Tucson Water on behalf of customer

Water Usage Costs: Paid by customer

Total Present Value = $46,277

3.8.2 Alternative 3 - Point-of-Entry Treatment System (estimated at present value costs)

Capital Costs: $60,000

Annual Operation & Maintenance Costs: $210,000 (Years 1-30 total)

Periodic Costs: $30,000 (Years 5, 10, 15, 20, 25, 30 total)

Total Present Value = $300,000

3.8.3 Alternative 4 - Bottled Water (estimated at present value costs)

Capital Costs: $0

Annual Costs: $822,750 (Years 1-30 total)

Total Present Value = $822,750

4. COMPARATIVE ANALYSIS OF ALTERNATIVES

In this section, the four assembled alternatives are compared to one another relative to the RAOs, following the NTCRA Guidance. A comparative analysis of the removal action alternatives is summarized below in Table 4-1.

Table 4-1. Comparative Analysis of Alternatives

Criterion	Alternative			
	1. No Action	2. Mun. Water	3. POETs	4. Bot. H2O
Protection of Human Health & the Environment	4	1	2	3
Compliance with ARARs	4	1	1	1
Long-Term Effectiveness & Permanence	4	1	2	3
Short-Term Effectiveness	4	1	1	1
Reduction of Toxicity, Mobility or Volume	4	4	1	4
Implementability	1	2	4	3
Present Value	1	2	3	4
TOTAL SCORE	**22**	**12**	**14**	**19**

(NOTE: Alternatives 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.)

5. RECOMMENDED ALTERNATIVE

Four alternatives were evaluated to achieve the RAOs for the impacted private drinking water wells with the Alternative 1 provided as a baseline for comparison. These alternatives consist of the following:

- Alternative 1 — No Action
- Alternative 2 — Municipal Water Supply
- Alternative 3 — Treatment (POET)
- Alternative 4 — Bottled Water

5.1 Selected Alternative

The recommended response action is Alternative 2, the establishment of a municipal connection as a permanent drinking water supply replacement for the two impacted wells. NGB is currently providing bottled water to the affected well owners and will provide a permanent alternative water supply via individual connections to the Tucson public water municipal system. Option 2 presents a long term effective and permanent solution at a low cost. As the entity responsible for ensuring that consumers are provided with drinking water, the Tucson Water Department maintains and operates the City of Tucson public water system. The groundwater wells from which the City of Tucson obtains its water are considered "suitable for potable use," making it a safe alternative water supply for owners of private drinking water wells impacted by PFOA/PFOS attributable to Morris ANGB mission-related activities. Because a municipal supply is reasonably available, if the well owner chooses not to connect to

the municipal source but rather chooses to maintain their existing water well or drill a new water well at their own cost, NGB will pay only the cost to install a POET system to an operating drinking water well.

In accordance with Section 2701(d) of DERP, NGB is authorized to enter into prospective agreements with identified eligible entities to provide funds to assist NGB in implementing its cleanup actions. NGB will work with the City of Tucson to implement the selected action pending regulatory and community acceptance of the recommendation.

5.2 Scope of Removal Action

The scope of the removal action alternative includes design and provision of the municipal connection meeting the following performance specifications:

- Peak instantaneous flow rate of at least 10 gallons per minute (gpm)
- Typical service flow rate of 5 gpm
- Pressure drop from pre-existing conditions (as measured at a drinking water fixture) not greater than 3 psi

Depending on the conditions of each property, additional work elements may include:

- Trenching from the main building to the distribution line
- Installation of meters, backflow prevention and/or pressure control devices
- Repair of pavements and landscaping
- Piping upgrades.

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