ACTION MEMORANDUM

for a

TIME-CRITICAL REMOVAL ACTION TREATMENT OF PFOS- and PFOA-CONTAMINATED WATER IN WATER SUPPLY WELLS

Near

JOINT BASE CAPE COD, MASSACHUSETTS

Prepared By

United States Air Force
Air Force Civil Engineer Center
JBCC, MA

19 July 2018

ACTION MEMORANDUM FOR A TIME-CRITICAL REMOVAL ACTION TREATMENT OF PFOS- AND PFOA-CONTAMINATED WATER IN WATER SUPPLY WELLS NEAR JOINT BASE CAPE COD, MASSACHUSETTS

I. PURPOSE

The purpose of this Action Memorandum is to document approval and decision by the U.S. Air Force (USAF) to conduct a Time-Critical Removal Action (TCRA) in response to the presence of per- and polyfluorinated alkyl substances (PFAS) in residential drinking water wells and public water supply wells near Joint Base Cape Cod (JBCC), Massachusetts. Although the United States Environmental Protection Agency's (EPA) Office of Water (OW) has classified PFAS as contaminants of emerging concern, there are currently no federal Safe Drinking Water Act (SDWA) maximum contaminant levels (MCLs) or promulgated cleanup levels regarding exposure levels. The EPA established health advisory (HA) values in 2016 that the USAF is using as benchmarks to determine if response actions are needed. The HA is in place since research has identified that there is potential risk to human health as a result of exposure to PFAS and regulatory standards are currently under consideration. HA values are developed to provide information in response to an urgent or rapidly developing situation. The HA values reflect reasonable, health-based hazard concentrations above which action should be taken to reduce exposure to unregulated contaminants in drinking water. The EPA will update HAs as additional information becomes available and can be evaluated.

The primary PFAS of concern for the JBCC and surrounding area are perfluorooctanesulfonic acid (PFOS), also known as perfluorooctane sulfonate, and perfluorooctanoic acid (PFOA). PFOS and PFOA were found in groundwater at and around JBCC at concentrations exceeding the HA. The actions planned as part of this TCRA are designed to prevent, limit, and/or mitigate an imminent and substantial threat to public health, welfare, or the environment.

This action memorandum is issued in accordance with, and satisfies the requirements of, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Title 42 United States Code (USC) §9604, as further implemented by the National Contingency Plan (NCP), Title 40 Code of Federal Regulations (CFR) §300.415. The USAF Installation Restoration Program (IRP) is authorized by the Defense Environmental Restoration Program (DERP) (10 USC 2701 et. seq.). The DERP is the environmental restoration program the military services use to conduct CERCLA response actions and satisfy CERCLA lead agency functions as delegated by Executive Order 12580.

II. SITE CONDITIONS AND BACKGROUND

A. Site Description

1. Physical Location and Description

JBCC, formerly referred to as the Massachusetts Military Reservation (MMR), is a multi-use base with government agencies including the Massachusetts Army National Guard (ARNG), operating Camp Edwards; Air National Guard/Massachusetts Air National Guard, operating Otis Air National Guard (ANG) Base, USAF, operating Cape Cod Air Force Station; U.S. Coast Guard (USCG), operating Air Station Cape Cod; and the Veterans Affairs (VA), operating the Massachusetts National Cemetery.

The JBCC is located in the upper western portion of Cape Cod in Barnstable County, Massachusetts, approximately 60 miles south of Boston, with Cape Cod Bay to the north, Buzzards Bay to the west, and Nantucket Sound to the south (Figure 1). The Cape Cod Canal is located immediately north of JBCC and connects Cape Cod Bay to the north with Buzzards Bay to the west. The JBCC occupies approximately 22,000 acres (34 square miles) within the towns of Bourne, Falmouth, Mashpee, and Sandwich. The northeastern corner of JBCC abuts the Shawme-Crowell State Forest, while the southern and southwestern boundary of JBCC is adjacent to the Frances A. Crane Wildlife Management Area.

JBCC is organized into four principal functional areas:

- ***Range Maneuver and Impact Area***—consists of approximately 15,000 acres occupying the northern 70 percent of JBCC used for training and maneuvers as part of the ARNG's Camp Edwards, and contains the 2,200-acre Impact Area and military training ranges.
- ***Cantonment Area***—consists of approximately 7,000 acres in the southern portion of JBCC and is the location for all or part of the administrative, operational, maintenance, housing, and support facilities; and the flight line for Otis ANG Base, USCG Air Station Cape Cod, and Camp Edwards.
- ***Massachusetts National Cemetery***—consists of approximately 750 acres along the western edge of JBCC and contains the VA cemetery and support facilities.
- ***Cape Cod Air Force Station***—occupies 100 acres of the northern portion of the Range Maneuver and Impact Area and consists of the USAF fixed-base phased array warning system known as the Precision Acquisition Vehicle Entry Phased Array Warning System (PAVE PAWS).

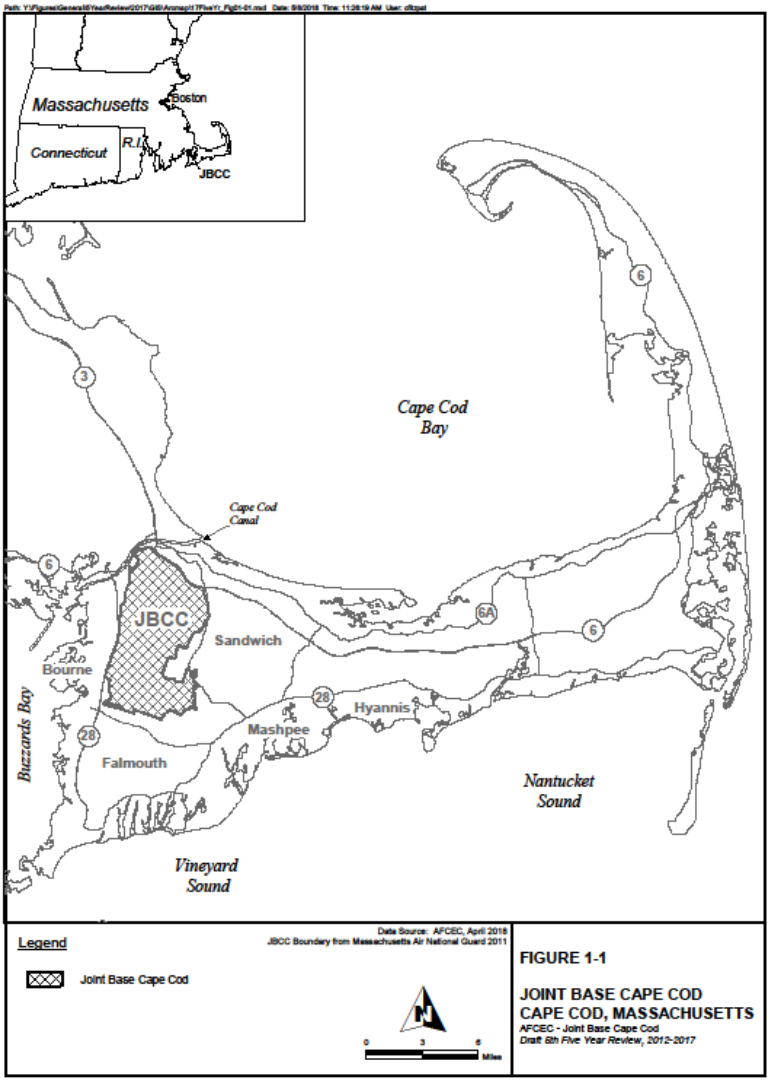

Figure 1
Joint Base Cape Cod

2. Site Operations History

Military use of portions of JBCC began as early as 1911, with the Massachusetts National Guard periodically camping and conducting maneuvers and weapons training in portions of the Shawme-Crowell State Forest. MMR was founded in 1935 when the Commonwealth of Massachusetts purchased the area now occupied by JBCC for permanent training facilities and started construction of buildings and two 500-ft wide turf runways. Camp Edwards was dedicated in 1938 and the landing field area at Camp Edwards was established as Otis Field. The most intensive U.S. Army activity occurred during World War II (1940–1944) and during demobilization following the war. Air operations at Otis Army Airfield were reportedly of a relatively low level of intensity during World War II. The first concrete runways were constructed in 1942, and lengthened and widened in 1943. During the last two years of World War II, the U.S. Navy used the JBCC runways, flight line, and housing areas for advanced naval aviation carrier-based flight training.

In 1946, Camp Edwards was deactivated as an Army post and returned to its original mission as a training site for the Massachusetts National Guard. During this time, the runway at Otis Army Airfield was extended to 8,000 feet (ft) to support larger, heavier aircraft. In 1948, the USAF obtained control of Otis Field, and the renamed Otis AFB operated as the world's largest Aerospace Defense Command Base until 1973. Camp Edwards was re-established in 1950 for troop training support during the Korean conflict. In 1954, the post was transferred from the Department of the Army to the Department of the Air Force for the purpose of operating a military airfield. In 1968, the Department of Defense allowed the U.S. Coast Guard to utilize Otis AFB for a new coast guard station. In 1970, Air Station Cape Cod was officially established and the airborne surveillance activity was phased out. In 1973, management of Otis AFB was transferred to the 102nd Fighter-Interceptor Wing of the Massachusetts Air National Guard, and the base was renamed Otis ANG Base. The Army began to withdraw from Camp Edwards, with the Massachusetts ARNG assuming operational control in 1975.

In 1978, the USAF established Cape Cod Air Force Station and began operation of the PAVE PAWS missile and space vehicle tracking system. Also in 1978, the VA developed the Massachusetts National Cemetery, which began operations in 1980. In March 1992, the 102nd was re-designated the 102nd Fighter Wing. In April 2008, under Base Realignment and Closure initiatives, the 102nd Fighter Wing was re-designated the 102nd Intelligence Wing. The mission of the 102nd was also revised to provide worldwide precision intelligence command and control, along with trained and experienced airmen for expeditionary combat support and homeland security. In 2013, MMR was renamed JBCC to more accurately reflect the ongoing missions and partnerships at the base.

Activities at JBCC that resulted in contaminating the environment included the storage, handling, and disposal of solvents and petroleum fuels as well as the leakage of these materials into storm water drainage systems and the sanitary sewer system. Landfill operations, firefighter training, coal and ash storage, sewage treatment, and numerous chemical and fuel spills have also resulted in environmental contamination of both soil and groundwater.

3. Removal Site Evaluation

3.1 JBCC Source Areas

Preliminary Assessment (PA)

HydroGeoLogic, Inc. (HGL) was contracted by the Air Force Civil Engineer Center (AFCEC) to perform preliminary assessment (PA) activities at Fire Training Areas (FTAs) and Non-FTAs at JBCC to determine locations of potential environmental releases of PFAS from Aqueous Film Forming Foam (AFFF) usage or storage areas. HGL conducted field activities associated with the PA at JBCC during the week of 26 January 2015, in accordance with the CERCLA PA Guidance. The *Final Preliminary Assessment Report for Perfluorinated Compounds at Joint Base Cape Cod, Massachusetts* (AFCEC 2015c) was submitted in June 2015 and evaluated 21 sites and identified 14 locations where the potential existed for AFFF/PFAS to have been released into the environment indicating further action through a Site Inspection (SI) was warranted.

Site Inspection (SI)

Two of the sites identified in the PA, Former Fire Training Area-1 (FTA-1) and Tanker Truck Rollover #3, were not included in the SI. The release of PFAS at Former FTA-1 had been confirmed through an SI-type investigation in 2014 as a result of a recommendation in the Final 4th Five Year Review and upon regulator request. Remedial Investigation (RI) activities are ongoing at FTA-1 as part of the Ashumet Valley groundwater plume site (AFCEC 2016a, 2013b). Tanker Truck Rollover #3 occurred on 25 March 2015 within the Bourne Rotary (Meyers 2015) and was included in the PA because the on-base Fire Department was called in to assist the Bourne Fire Department in response to this event. The on-base Fire Department has been operating under the management of the Commonwealth of Massachusetts since 2008 and the cleanup from Tanker Truck Rollover #3 is being completed by the Commonwealth of Massachusetts.

Several of the remaining 12 sites were located in close proximity to each other and may be related; for example, a building and the nearby drainage ditch where the potential release at the building infiltrated the ground surface are listed as two different sites in the PA. These co-located sites were investigated together as a single site during the SI for a total of seven sites/areas. Two additional sites, Fuel Spill-1 (FS-1) and the Runway 32 Approach area, were added to the SI program after the submittal of the PA. At the request of the EPA, AFCEC agreed to complete a direct push groundwater vertical profile boring at Hangar 2816, since portable fire extinguishers charged with AFFF have been stored at the hangar. EPA also requested AFCEC sample the Landfill-1 (LF-1) plume for PFAS since there was evidence of this contamination at other landfill sites (AFCEC 2016b).

The *Final Focused Site Inspection Work Plan for Perfluorinated Compounds at the Flight Line Area, Joint Base Cape Cod, MA* (AFCEC 2016b) was submitted in January 2016 and summarized the actions that would be taken to complete an SI for PFAS at 10 sites. The SI field investigation was completed between August and November 2015 and, as detailed in the *Final Focused Site Inspection Report for Perfluorinated Compounds at the Flight Line Area, Joint Base Cape Cod, MA* (AFCEC 2017b), nine of the ten flight line sites were identified to proceed to an RI to determine the nature and extent of contamination in groundwater and in the other potentially

impacted media (e.g., soil, sediment, and surface water). However, the decision was made by AFCEC management to proceed to an Expanded SI instead of an RI for these sites (AFCEC 2018d).

Remedial Investigation (RI)

During the SI, PFOS was detected above the EPA HA in three private drinking water wells located off base and downgradient of the Tanker Truck Rollover #1/Tanker Truck Rollover #2 sites (TTRS). The homeowners were notified and bottled water was delivered until whole-house water filtration systems, which are being operated and maintained by AFCEC, were installed in January 2017. The residential well sampling program in this area is ongoing.

Because PFOS was detected above the HA in off base private wells, an RI was initiated. The *Final Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances at Tanker Truck Rollover Sites, Joint Base Cape Cod, MA* (AFCEC 2018c) was submitted in May 2018 and detailed the actions to complete an RI for PFAS contamination in soil and groundwater at the TTRS. The RI is currently underway.

3.2 JBCC GROUNDWATER SITES

An initial recommendation for investigation of 1,4-dioxane at the existing chlorinated solvent sites and PFAS at the Ashumet Valley/FTA-1 site was presented in the *Final 4th Five-Year Review, 2007-2012, Massachusetts Military Reservation (MMR) Superfund Site Otis Air National Guard Base, MA* (AFCEC 2013a). As mentioned in Section 3.1, EPA also requested AFCEC sample the LF-1 plume for PFAS since there was evidence of this contamination at other landfill sites.

Site Inspection (SI):

A presence/absence (CERCLA SI equivalent) field investigation for 1,4-dioxane was completed between October 2013 and June 2014 at seven IRP chlorinated solvent plumes (Ashumet Valley, CS-4, CS-10, CS-20, CS-21, CS-23, and LF-1). The results of this investigation confirmed that 1,4-dioxane was present at four plumes (Ashumet Valley, CS-10, CS-20 and LF-1) and additional investigation was recommended (AFCEC 2014b).

A presence/absence (CERCLA SI equivalent) field investigation for PFAS was completed between October 2013 and September 2014 at Ashumet Valley due to a confirmed release of AFFF at the source area (FTA-1). As detailed in the *PFC Sample Results at Ashumet Valley Data Presentation Project Note* (AFCEC 2014a) and the *1,4-Dioxane Monitoring Well Sample Results Data Presentation Project Note* (AFCEC 2014b), PFAS and 1,4-dioxane were detected in groundwater at concentrations above the HA for PFOS/PFOA and above the MassDEP groundwater-1 (GW-1) standard for 1,4-dioxane at the Ashumet Valley site; additional investigation was recommended.

Remedial Investigation (RI):

Ashumet Valley/FTA-1

The *Draft Pre-Remedial Investigation Sampling and Analysis Work Plan for Perfluorinated Compounds at Ashumet Valley* (AFCEC 2015b) was submitted in June 2015. The scope of this

work plan was to conduct sampling and analysis to evaluate the nature and extent of PFC contamination but did not meet the full intent of an RI. The *Draft Supplemental Remedial Investigation/Feasibility Study Work Plan for 1,4-Dioxane at Ashumet Valley, Chemical Spill-10, Chemical Spill-20, and Landfill-1* (AFCEC 2015a) was submitted in July 2015. This draft document detailed the actions that would be taken to complete Supplemental RI/Feasibility Study (FS) reports for 1,4-dioxane contamination in groundwater at these four plumes. The *Final Supplemental Remedial Investigation/Feasibility Study Work Plan for 1,4-Dioxane and Perfluorinated Compounds at Ashumet Valley, Joint Base Cape Cod, MA* (AFCEC 2016a) combined the investigation for both PFAS and 1,4-dioxane at Ashumet Valley into a single supplemental RI/FS work plan and was submitted in February 2016.

The *Ashumet Valley Emerging Contaminants Conceptual Site Model Technical Memorandum* (AFCEC 2017a) was submitted in March 2017 and included a summary of the nature and extent of the emerging contaminants based on the Supplemental RI data collected through December 2016 and identified the data gaps that will need to be addressed to complete the Supplemental RI. The *Final Supplemental Remedial Investigation Data Gap Work Plan for 1,4-Dioxane and Perfluorinated Compounds at Ashumet Valley, Joint Base Cape Cod, MA* (AFCEC 2018b) was submitted in January 2018.

PFAS was detected above the EPA HA in several private drinking water wells and two public water supply wells located downgradient of the FTA-1 source area. The private well owners were notified and bottled water was delivered until subsequent mitigation decisions (i.e. continued bottled water, whole-house water filtration systems, or connection to municipal water) were made. The residential well sampling program in this area is ongoing. One public water supply well serviced 73 residents at a trailer park. Those residents were provided bottled water until they were connected to Mashpee Water District. The other public water supply well located in Mashpee was shut down in Feb 2017 until a contract can be awarded to install wellhead treatment on the well.

The Supplemental RI/FS and mitigation activities associated with FTA-1/Ashumet Valley are currently ongoing.

Landfill-1 (LF-1)

In October 2015, the EPA requested AFCEC sample for PFAS at LF-1 since PFAS contamination has been associated with landfills at other sites. The initial presence/absence (SI equivalent) PFAS field effort for the LF-1 plume was completed between January and February 2016 and included the sampling of the extraction wells, influent and effluent plant sampling at the associated treatment plants, and six LF-1 monitoring wells. PFOS was detected at concentrations exceeding the HA of 0.07 µg/L in two extraction LF-1 wells and at three monitoring wells. PFOA was detected at concentrations exceeding the HA of 0.07 µg/L in one monitoring well.

Because PFOS/PFOA were detected above the HA and may have been migrating off base toward two public water supply wells, a Supplemental RI/FS was initiated. The RI was conducted between September 2015 and March 2017 and included sampling for 1,4-dioxane and PFAS. As part of the RI, the public water supply wells were sampled for PFOS/PFOA and 1,4-dioxane; results were below the HA and GW-1, respectively. In addition, outreach was conducted for private wells; no private wells were impacted by PFOS/PFOA or 1,4-dioxane. A summary of the results from the Supplemental RI and recommendations for further actions at LF-1 relative to

PFOS/PFOA and 1,4-dioxane are presented in the *Final Supplemental Remedial Investigation Report for 1,4-Dioxane and Perfluorinated Compounds at Landfill-1, Joint Base Cape Cod, MA* (AFCEC 2018a). EPA issued an FFA milestone of 31 Oct 2018 for the Supplemental FS; however, funding ran out and the FS has not moved forward. The FS is programmed for FY18.

4. Release or Threatened Release into the Environment of a Hazardous Substance, or Pollutant or Contaminant

Neither PFOS nor PFOA are listed CERCLA hazardous substances (40 CFR Part 302, Table 302.4). However, the USAF has determined that PFOS and PFOA are "CERCLA pollutants or contaminants." CERCLA defines pollutant or contaminant as essentially any chemical that "…upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformation in such organisms or their offspring…" (42 U.S.C. § 9601(33)). The EPA and the Agency for Toxic Substances and Disease Registry (ATSDR) have reviewed the large toxicity databases for both PFOS and PFOA, summarizing the adverse effects to animals and humans following exposure. The agencies concluded there is ample evidence of adverse effects, particularly in animals.

Based on the PA and subsequent SI/RI work conducted to date, the presence of PFOS and PFOA in groundwater confirms a release of a pollutant or contaminant has occurred. Although delineation of PFOS and PFOA in groundwater has not been completed except at LF-1, results of groundwater investigations and the private water well sampling program indicate the contamination is emanating from the base and is impacting drinking water. The residential well sampling program in these areas is ongoing. Results of this sampling will be evaluated and additional mitigation at residential and/or public water supply wells may be added to the TCRA scope as needed.

5. National Priorities List Status

The Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) number for the JBCC site is MA2570024487. The JBCC, then known as MMR, was formally added to the National Priorities List (NPL) in 1989. A Federal Facilities Agreement (FFA), which provided the legal framework for investigating and remediating numerous operable units at the JBCC, was signed in 1991. In 1996, the FFA was amended to add the USAF as the lead agency for the cleanup at JBCC. The FFA, as amended, requires the USAF to implement CERCLA requirements at JBCC. In addition to the USAF, the EPA and National Guard Bureau (NGB) are parties to the FFA for the JBCC. The AFCEC is managing the soil and groundwater contamination sites under the IRP and Military Munitions Response Program (MMRP) in accordance with CERCLA as required by the Defense Environmental Restoration Program. The Massachusetts Department of Environmental Protection (MassDEP) is not a signatory of the FFA, but is an active participant in the cleanup process and provides guidance and direction to the process.

B. Other Actions to Date

1. Previous Actions

Previous PFAS CERCLA actions are described in Sections 3.1 and 3.2. Specific mitigation actions conducted to date include providing bottled water, filtration systems, treatment system modifications, and connections to municipal water supplies as identified as follows for Ashumet Valley/FTA-1 and TTRS. There were no mitigation actions required at LF-1.

Ashumet Valley/FTA-1 (Mashpee and Falmouth)

- System modification of the Ashumet Valley pump and treat system. The pump and treat system was installed in 1999 to remove chlorinated solvents using three extraction wells pumping at 1200 gallons per minute (gpm) and two parallel trains of 20,000 pound granular activated carbon (GAC) vessels arranged in series. The treated water was discharged through two shallow infiltration trenches arranged parallel to the axis of the plume. During the early years of operation, the carbon was changed out frequently due to breakthrough of chlorinated solvents. Over the years, the system was optimized as the solvent plume was remediated and the carbon exchanges occurred less frequently. In 2015, the system was operating at 350 gpm with one extraction well, one carbon treatment train, and the effluent discharging to the two infiltration trenches at 175 gpm each. While the carbon exchanges were being conducted frequently, PFOS/PFOA would have been removed and not discharged through the trench. But, as the exchanges became less frequent, it is likely PFOS/PFOA were discharged through the infiltration trenches. This was not apparent until sampling of private wells near one of the trenches was conducted. On 29 Sep 2015, the Currier Road infiltration trench was shut down after effluent sampling results showed PFOS/PFOA being discharged near private wells. Private wells were sampled and results showed HA exceedances; the only source of the PFOS/PFOA would have been from the infiltration trench. The treatment system flow rate was reduced to 215 gpm and all effluent was moved to the other infiltration trench which is not located near any private wells. In addition, treatment system sampling was instituted and carbon exchanges are conducted to prevent the discharge of PFOS/PFOA. To date, one carbon exchange has been conducted.
- Bottled water provided to a total of 98 residents in Falmouth and Mashpee as a result of HA exceedances in individual private wells. The 98 residents include 73 residents at a trailer park in Mashpee where their well (considered a public water supply well) was contaminated by PFOS/PFOA. The rest include individual residents near the Currier Road infiltration trench that discharged PFOS/PFOA to shallow groundwater and individual residents living downgradient of Ashumet and Johns Ponds which have HA exceedances as a result of contamination migrating from the source area (FTA-1) into the ponds.
- Whole house carbon filtration systems installed at ten residents near the Currier Road infiltration trench. Carbon filtration systems, rather than municipal water connections, were selected as an interim measure for two reasons: (1) there was no easy way to connect private homes to municipal water since there is no water main in the area; and, (2) the PFOS/PFOA contamination that came from the trench would eventually migrate through the area and be replaced with native groundwater since the Currier Road trench was shut down.
- Municipal water connections were conducted at a trailer park servicing 93 units (73 units were occupied at the time of the connection) and at 10 other private residences that are

located downgradient of Ashumet and Johns Ponds. The public water supply well at the trailer park was shut down once the municipal water connection was completed. Municipal water connections, rather than whole house filtration systems, were selected for these residents for two reasons: (1) water mains were located near each resident making a connection relatively easy; and (2) the PFOS/PFOA contamination that came from Ashumet and Johns Ponds (that were contaminated by FTA-1) is expected to last for several decades given contamination is still leaching from the source area and migrating through the ponds.

- The Mashpee Village public water supply well was shut down in Feb 2017 due to HA exceedances of PFOS/PFOA emanating from the FTA-1 source area into Ashumet and Johns ponds and downgradient to the public water supply well.

Tanker Truck Rollover Sites (Bourne)

- Bottled water provided to a total of four residents in Bourne as a result of HA exceedances in individual private wells.
- Whole house carbon filtration systems installed at three residents. Carbon filtration systems, rather than municipal water connections, were selected for these residents for two reasons: (1) there was no easy way to connect private homes to municipal water since there is no water main in the area; and, (2) the PFOS/PFOA contamination that came from the source area is relatively close to the private wells and the groundwater could be remediated quickly if a treatment system can be installed in the future.

2. Current Actions

Current PFAS actions include the following activities:

- Continued sampling of on- and off-base monitoring wells, residential wells, and/or municipal wells to evaluate the potential for additional users of groundwater containing PFOS/PFOA above the HA.
- Continued outreach efforts to identify any potential users of groundwater containing PFOS/PFOA above the HA.
- Bottled water currently provided to five residences associated with the Ashumet Valley contamination and to one residence associated with the TTRS contamination.
- Six whole house carbon filtrations systems being monitored and maintained in Ashumet Valley and three systems in TTRS area.
- Periodic resampling of residential wells.
- Carbon exchanges at the Ashumet Valley treatment system to prevent discharge of PFOS/PFOA at concentrations above the HA.

3. Planned Actions

Planned PFAS actions include the following.

- Wellhead treatment planned for FY18 on the Mashpee Village public water supply well that has been shut down since Feb 2017 due to PFOS/PFOA contamination emanating from JBCC.

- Two additional municipal water connections in FY18 at private residences located downgradient of Ashumet and Johns Ponds.
- Conduct long-term operations and maintenance of the treatment systems at Ashumet Valley and LF-1 including performance sampling to ensure the systems are effective in removal of PFOS/PFOA to concentrations below the HA.
- Conduct sampling of private wells not previously sampled that are within the area thought to be impacted by PFOS/PFOA emanating from the base.
- Continue providing bottled water as needed.
- Continue installation, monitoring and operation of filtration systems as needed.
- Continue municipal water connections where needed.
- Contract for Supplemental FS at LF-1 for PFAS and 1,4-dioxane (FFA Milestone of 31 Oct 2018)
- Complete RI/FS at Ashumet Valley and TTRS
- Prepare Proposed Plans and Decision Documents for Ashumet Valley, TTRS, and LF-1.
- Conduct source removal/remediation and install an extraction well just downgradient of the FTA-1 source area to prevent PFOS/PFOA contamination from continuing to contaminate Ashumet and Johns Ponds and downgradient water supplies.
- Conduct source removal/remediation and install a treatment system for removing PFOS/PFOA emanating from the TTRS.

C. Federal, State and Local Roles

1. Federal Agencies

PFOA and PFOS are determined to be CERCLA pollutants and/or contaminants. The EPA's OW issued the lifetime drinking water HAs for PFOS, PFOA, and the summation of PFOS and PFOA. EPA Region 1 staff was involved in development of the SI scope of work, as well as the off-base residential well sampling. The EPA has also provided input to the subsequent RI residential sampling, monitoring, and municipal well sampling, and is providing input for ongoing and planned sampling events. The EPA will continue to be involved in JBCC activities.

2. State Agencies

The MassDEP was involved in the development of the SI and RI activities and will continue to be involved in JBCC activities. In addition, MassDEP' s Office of Research and Standards (ORS) has recently established a drinking water guideline for five chemicals that are part of a larger group of PFAS. MassDEP established its guideline to include the following three additional PFAS chemicals: perfluorononanoic acid (PFNA), perfluorohexanesulfonic acid (PFHxS), and perfluoroheptanoic acid (PFHpA). The ORS Guideline (ORSG) is 0.07 ug/L, and applies to the total summed level of all five compounds. MassDEP has stated they plan on issuing a GW-1 standard for these five PFAS compounds this fall.

3. Local Authorities

Local authorities have been notified and include the towns of Mashpee, Falmouth, Bourne and Sandwich.

III. THREATS TO PUBLIC HEALTH OR WELFARE OR THE ENVIRONMENT,

STATUTORY AND REGULATORY AUTHORITIES

A. Threats to Public Health or Welfare

The USAF identified the existence of an immediate risk to public health or welfare due to the presence of PFOS/PFOA above the HA in active public and private residential drinking water wells.

Based on the current sampling data, the route of exposure is limited to ingestion of groundwater (drinking or using for cooking). Dermal absorption from PFAS in water (washing/bathing) is not considered a pathway of concern. Although Ashumet and Johns Ponds have PFOS/PFOA concentrations above the HA in the surface water, the surface water is not used for drinking water and the Massachusetts Department of Public Health (MassDPH) has stated the ponds are safe for recreational purposes, including swimming, boating, and catch-and-release fishing. Groundwater is the only pathway of concern at this time. Soil exposures are not currently believed to be a concern for the following reasons: 1) the only expected impact to soil above the EPA regional screening level of 1.6 parts per million (ppm) would be from surface releases of AFFF that occurred within the boundaries of the installation in areas with restricted access; and, 2) dermal soil absorption from PFAS is not a pathway of concern.

Some epidemiological studies have been conducted as part of human occupational studies. These efforts attempted to correlate PFOS blood serum levels to health characteristics (e.g., cholesterol, thyroid function, and reproductive and developmental health). In all cases, the results were inconclusive although suggestive that some relationship exists. Due to the limited extent of the studies and lack of sufficient data, the health effects from PFOS are not known in humans. Studies in animals have shown significantly different profiles between species. In general, there is evidence for immunological effects, increased liver weight, and a risk for low birth weight at exposures in the ppm range.

The USAF is continuing to provide bottled drinking water, infiltration treatment systems and municipal water connections to the affected private residences. In addition, the USAF intends to install wellhead treatment on the Mashpee Village public water supply well.

The initial assessment concludes that residents in the vicinity of JBCC have drinking water with PFOS/PFOA above the HA. A TCRA is warranted to address public and private well systems based on the following factors listed in 40 CFR 300.415(b)(2) of the NCP:

- "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."

This TCRA is required to provide a longer term supply of clean drinking water to residents with private wells and to the Town of Mashpee so the public water supply well can be restarted.

B. Threats to the Environment

The threats to the environment posed by the PFAS contamination have not been quantified. This TCRA interrupts the currently known residential water supply human pathways for PFOS/PFOA exposure.

C. Statutory and Regulatory Authorities

PFOA and PFOS are not currently identified as hazardous substances as determined by CERCLA; however, application of CERCLA criteria suggests that it is appropriate to consider them to be pollutants and/or contaminants. The concentrations of PFOS/PFOA in the groundwater at off-base residential and municipal wells present a threat to public health or welfare or the environment because they exceed the EPA HA of 0.07 ug/L, individually or combined. The TCRA presented in this memorandum is consistent with 40 CFR §300.415(e)(9), which states a removal action is warranted for "Provision of alternative water supply - where necessary immediately to reduce exposure to contaminated household water and continuing until local authorities can satisfy the need for a permanent remedy."

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of pollutants and contaminants from JBCC may present an imminent and substantial endangerment to public health, or welfare, or the environment.

CERCLA and the NCP along with the EPA's Office of Solid Waste and Emergency Response (OSWER) guidance equate "threat" and "danger" with "unacceptable risk" (see 42 U.S.C. § 9604(a)(1) and (b)(1), 40 C.F.R. § 300.430(d) and OSWER 9355.0-30, Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions, April 22, 1991. Normally under the NCP and the EPA's guidance, an unacceptable human health risk is present when cumulative human health cancer risk exceeds 1 x 10^{-4} or the non-cancer hazard index exceeds one, or in drinking water if an MCL is exceeded. Risk-based cleanup levels under CERCLA and the EPA's OW health advisories are set at levels below these unacceptable risk levels. Accordingly, if PFOS or PFOA exist in a drinking water supply above these risk-based HAs, such levels could present an unacceptable risk, threat, and danger to human health. Specifically, in the case of PFOA and PFOS, because sampling shows exceedance of the respective HAs in actual drinking water, there are sufficient grounds to find that an imminent and substantial danger to human health may exist.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed Action Description

The Removal Action Objective (RAO) of the TCRA is to eliminate the imminent and substantial danger to human health or the environment posed by PFOS/PFOA-contaminated water used as drinking water through provision of bottled water, installation of a residential treatment system, municipal connection for impacted residences, and wellhead treatment on the Town of Mashpee public water supply well. The treatment systems include the use of GAC to treat water from the impacted wells.

2. Contribution to Remedial Performance

JBCC is listed on the NPL of Federal Superfund sites by the EPA. The AFCEC and the EPA entered into the FFA for JBCC under CERCLA Section 120, which was signed in 1991. The FFA established the procedural framework and schedule for developing, implementing, and monitoring CERCLA response actions. The completed and proposed TCRA activities achieve the general RAO associated with the groundwater by mitigating the immediate potential threat to human health and the environment. The objective has been met and will continue to be met by eliminating the direct exposure of PFOS/PFOA ingestion from domestic water use by providing bottled water, treating water at affected private/public wells or connecting private homes to a municipal water supply. These actions ensure protectiveness; however, the USAF anticipates additional CERCLA related activities and is in the process of implementing an expanded SI, and supplemental RI/FSs. The planned removal actions shall, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action with respect to the release concerned. Data collected during the course of this TCRA will be included in the overall analysis of the groundwater extent and ultimately used in determining a long-term solution.

3. Applicable or Relevant and Appropriate Requirements (ARARS)

There are no promulgated federal or Massachusetts chemical specific ARARs for PFAS. In the absence of an ARAR, the HA value is being used to establish protective levels in drinking water. In the absence of ARARs, cleanup levels are based upon "…other reliable information…" (See 40 C.F.R. § 300.430(e)(2)(i)). Reliable information is derived from other to-be-considered (TBC) criteria, advisories, or guidance (40 C.F.R. § 300.400(g)(3)). The 2016 HA value issued by the EPA's OW for both PFOA and PFOS is a TBC and is based upon the OW's calculated reference dose, which is a tier 3 toxicity value. Therefore, in the absence of an ARAR, the HA value can be used as a protective level for human health in drinking water.

4. Project Schedule

TCRA activities have been completed, are on-going, and are planned for private and public water supplies. The completed and on-going activities have been reported frequently and approved by AFCEC. There are two remaining carbon filtration system installation at private residences are scheduled to be completed by the end of Jul 2018. The Mashpee Village public water supply wellhead treatment was programmed for FY18; however, the USAF has determined that the programmed Defense Environmental Restoration Account funds cannot be used for PFOS/PFOA contamination and that Air National Guard Operations & Maintenance (O&M) funds are required. Since ANG O&M funds for this TCRA were not programmed for FY18, the schedule for this work is "to be determined". Other efforts such as outreach, monitoring, and mitigations are being done under current contracts. Evaluation of long-term options, including new treatment systems and/or system modifications, will be conducted over the next several months as information from the Expanded SI and RI/FSs become available.

B. Costs

This TCRA applies to mitigation activities associated with providing bottled water to 102 residences ($60K); installing and maintaining carbon filtration systems on 13 residences ($62K), municipal water connections for 103 residences ($1.5M), and planning for wellhead treatment on the Mashpee Village public water supply well ($1.9M). If additional residences are identified

having private wells with HA exceedances during the on-going outreach effort, then costs will increase.

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

Due to completed and ongoing TCRAs including providing bottled water, installing filtration systems, connecting residences to municipal water supplies, and shutting down the Mashpee Village public water supply well, there is no known ongoing exposure to human receptors. Additional sampling that may result in detection of PFOS/PFOA above HAs in water being used by residents for drinking and/or cooking will trigger provision of clean water by the AFCEC. If the actions proposed in this Action Memorandum are not taken, private residents will be exposed to PFOS/PFOA concentrations exceeding the HAs.

VII. OUTSTANDING POLICY ISSUES

As noted in Section 4, the Mashpee Village public water supply wellhead treatment was programmed for FY18; however, the USAF has determined that the programmed Defense Environmental Restoration Account funds cannot be used for PFOS/PFOA contamination and that Air National Guard O&M funds are required. Since ANG O&M funds for this TCRA were not programmed for FY18, the schedule for this work is "to be determined".

VIII. PUBLIC PARTICIPATION

The AFCEC is maintaining close communications with the local community and regulators. Several public meetings have been conducted including two neighborhood meetings in Falmouth, one neighborhood meeting in Bourne, nine Restoration Advisory Boards, five discussions with the local Boards of Health (Mashpee, Falmouth, and Bourne), and a presentation at the Falmouth Board of Selectmen. As part of the outreach and investigation activities, AFCEC personnel meet with individuals to explain the on-going work. In addition, there have been several news articles published regarding the on-going work. This TCRA Action Memorandum will be included in the Administrative Record (AR) and a subsequent 30-day public comment period will be held.

IX. ENFORCEMENT

There are no enforcement activities related to this TCRA.

X. APPROVALS

This Action Memorandum documents the decision for the TCRA for PFOA and PFOS contaminated water in residential and public water supply wells near JBCC. This decision is developed in accordance with CERCLA as amended and is not inconsistent with the National Contingency Plan.

This decision is based on the AR file for the site. Conditions at the site meet the NCP section 300.415(b)(2) criteria for determining that the proposed removal action is appropriate. The EPA

and MassDEP have participated in the planning of these actions and support the recommended actions.

XI. REFERENCES

Air Force Civil Engineer Center (AFCEC). 2018a (January). *Final Supplemental Remedial Investigation for 1,4-Dioxane and Perfluorinated Compounds at Landfill-1, Joint Base Cape Cod, MA.* 658003-EC-LF1- RPT-002. Prepared by CH2M for AFCEC/JBCC, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2018b (January). *Final Supplemental Remedial Investigation Data Gap Work Plan for 1,4-Dioxane and Perfluorinated Compounds at Ashumet Valley, Joint Base Cape Cod, MA.* 658003-EC-AV-QAPP-005. Prepared by CH2M HILL for AFCEC/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2018c (May). *Final Remedial Investigation Work Plan for Per- and Polyfluoroalkyl Substances at Tanker Truck Rollover Sites, Joint Base Cape Cod, MA.* 696027-EC-TTRS-QAPP-002. Prepared by CH2M HILL for AFCEC/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2018d (June). *Draft Expanded Site Inspection Work Plan for Per- and Polyfluoroalkyl Substances at the Flight Line Area Sites.* Prepared by CH2M HILL for AFCEC/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2017a (March). *Ashumet Valley Emerging Contaminants Conceptual Site Model technical memorandum.* 658003-EC-AV-CSM 001. Prepared by CH2M HILL for AFCEC/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2017b (April). *Final Focused Site Inspection Report for Perfluorinated Compounds at the Flight Line Area, Joint Base Cape Cod, MA.* 658003-EC-FL-RPT 002. Prepared by CH2M HILL for AFCEC/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2016a (February). *Final Supplemental Remedial Investigation/Feasibility Study Work Plan for 1,4-Dioxane and Perfluorinated Compounds at Ashumet Valley, Joint Base Cape Cod, MA.* 658003-EC-AV-QAPP-003. Prepared by CH2M for AFCEC/JBCC, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2016b (January). *Final Focused Site Inspection Work Plan for Perfluorinated Compounds at the Flight Line Area, Joint Base Cape Cod, MA.* Prepared by CH2M for AFCEC/JBCC, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2015a (July). *Draft Supplemental Remedial Investigation/Feasibility Study Work Plan for 1,4-Dioxane at Ashumet Valley, Chemical Spill-10, Chemical Spill-20, and Landfill-1, Joint Base Cape Cod, MA.* 658003-EC-Multiple-QAPP-001. Prepared by CH2M HILL for AFCEC/JBCC, Installation Restoration Program, Otis ANG Base, MA

_____. 2015b (June) *Draft Pre-Remedial Investigation Sampling and Analysis Work Plan for Perfluorinated Compounds at Ashumet Valley*. Prepared by CH2M HILL for AFCEC/JBCC, Installation Restoration Program, Otis ANG Base, MA

_____. 2015c (June). *Final Preliminary Assessment Report for Perfluorinated Compounds at Joint BaseCape Cod, Massachusetts.* Prepared by HGL for AFCEC/JBCC, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2014a (November). *PFC Sample Results at Ashumet Valley Data Presentation Project Note*. 473147-SPEIM-AVP-PRJNOT-004. Prepared by CH2M HILL for AFCEC/JBCC, Installation Restoration Program, Otis Air National Guard Base, MA

_____. 2014b (August). *1,4-Dioxane Monitoring Well Sample Results Data Presentation Project Note.* 473147-SPEIM-MULTIPLE-PRJNOT-007. Prepared by CH2M HILL for AFCEC/JBCC, Installation Restoration Program, Otis Air National Guard Base, MA.

_____. 2013a (October). *Final 4th Five-Year Review, 2007-2012 Massachusetts Military Reservation (MMR) Superfund Site, Otis Air National Guard Base, MA.* Prepared by CH2M HILL for AFCEC/MMR, Installation Restoration Program, Otis ANG Base, MA.

_____. 2013b (January). *Ashumet Valley Groundwater Plume Conceptual Site Model.* 437075-SPEIM-AVP-CSM-001. Prepared by CH2M HILL for AFCEC/MMR, Installation Restoration Program, Otis Air National Guard Base, MA.

Meyers, K.C. 2015. Crews contend with gasoline cleanup after Bourne rollover. Cape Cod Times. Local Media Group, Inc., 25 March 2015. Web. 25 March 2015. http://www.capecodtimes.com/ article/20150325/NEWS11/150329646.

XII. SIGNATURES

The signature documents the decision made to conduct the TCRA. The decision may be reviewed and modified in the future if new information becomes available that indicates the presence of pollutants or contaminants or exposures that may cause unacceptable risk to human health or the environment.

Time-Critical Removal Action Memorandum Approval

_____

SUZANNE W. BILBREY, P.E., GS-15, DAF DATE
Director, Environmental Management Directorate