### **Air Force Civil Engineer Center**



Environmental Restoration Program Overview

Joint Base Cape Cod Cleanup Team Meeting 07 Dec 2022

Battle Ready...Built Right!



### **Overview**



- Background
- Site Status
  - Installation Restoration Program (IRP) sites
  - Massachusetts Military Response Program (MMRP) sites
  - Per- and Polyfluoroalkyl Substances (PFAS) sites









# Not a Conventional Joint Base



- Joint Base Cape Cod (JBCC), formerly called Massachusetts Military Reservation (MMR)
- JBCC was not created as a result of BRAC (base realignment and closure) such as DoD's other Joint Bases with a single lead component
- Instead, Governor Patrick's Executive Order in 2013 renamed the MMR to JBCC
- JBCC is a conglomeration of fee-owned (by AF) and leased property (owned by the Commonwealth) with tenants governed through a series of licenses and permits
- There is no single entity designated as the "Lead" and each DoD/USCG unit has its own commander; there is an Executive Commander who leads the Joint Oversight Group (JOG)



# **JBCC IRP Background**



- Installation Restoration Program (IRP) began in 1984
- Otis Air National Guard Base/Camp Edwards at MMR/JBCC added to National Priorities List (NPL) in 1989
- Mr. Tad McCall (SAF/IE) assigned AFCEC to take over the IRP in 1996
- Regulatory authority is CERCLA (i.e. Superfund)
- Federal Facilities Agreement (FFA) established in 1991
  - Signed by EPA, Air Force, and National Guard Bureau State (Mass DEB) is not a signatory
    - State (MassDEP) is not a signatory
  - USCG removed as party to the FFA in Amendment 3 (1999)
- AFCEC is the lead agency at JBCC per the FFA and 2004 MOU



#### **Review of the CERCLA Process**







• JBCC is located over the mound for the Sagamore Lens, which is the sole source drinking water aquifer for the Upper Cape. Groundwater flows radially away from the mound. Plumes have moved beyond base boundaries and underneath the surrounding communities.







- Geology primarily sand with heterogeneous areas of lower conductivity units clay/silt/silty-sand
  - Depth to groundwater ~ 40' 80', kettle hole ponds are groundwater, depth to bedrock ~300', unconfined sole-source aquifer



# Site Status



#### Sites include source areas and groundwater plumes

- Source areas: chemical spills, fuel spills, fire training areas, landfills, storm drains, MMRP sites, emerging contaminants, etc
  - > 73 IRP sites have been closed
  - > 10 MMRP sites (2 have been closed)
  - 8 open IRP source area sites (not including PFAS sites)
  - CS-10, FS-1, FS-10, FS-11, FS-12, FTA-1, LF-1, LF-2
- > 18 groundwater plumes
  - AV (FTA-1), CS-4, CS-10, CS-19, CS-20\*\*, CS-21, CS-23\*\*, FS-1\*\*, FS-10, FS-11, FS-12, FS-13\*, FS-28, FS-29\*\*, FTA-2, LF-1, LF-2, SD-5\* (\*no longer defined, \*\* closed)
- > 11 emerging contaminant sites (PFOS/PFOA, 1,4-Dioxane)
  - 10 PFOS/PFOA sites 2 are existing IRP sites (AV/FTA-1, LF-1); 8 new sites added
  - > 3 1,4-dioxane sites existing IRP sites (AV/FTA-1, CS-10, LF-1)

#### Where did the contamination come from?





Source areas (blue) on JBCC include:

- Chemical Spills
- Coal Yards
- Fuel Spills
- Landfills
- Storm Drains
- Dump Area
- Oil Water Separator
- MMRP sites (purple)
- PFOS/PFOA sites (call out boxes) such as FTA, fire depts., wwtp, landfill

•Note: 61 source areas were formally "delisted" from the EPA Superfund Program in October 2007





Groundwater areas (beige) on JBCC include:

- RDX (IAGWSP, IRP)
- HMX (IAGWSP)
- Perchlorate (IAGWSP)
- EDB (IRP)
- Chlorinated solvents (IRP)
- PFAS (IRP) (reddishpink)

Note: plume depictions used for informational purposes and may not reflect the current plume sizes.

RDX, HMX and perchlorate are explosives

IAGWSP = Impact Area Groundwater Study Program



### **IRP Plumes and Treatment Systems**



- Primarily PCE, TCE, and EDB (now PFAS)
- Concentrations generally less than 1 mg/L (except for TCE at CS-10)
- Plumes are typically deep (>100 ft) and thick (>100 ft)
- 5 treatment plants treating ~ 8 million gallons per day (down from 9 treatment plants treating 18 million gallons per day)
- Over 27 miles of pipeline
- Over 130 extraction and reinjection wells
- Over 3000 monitoring wells







### **How We Treat the Plumes**



PORCE CIVIL ENGINEER CONT



# **Current Activities – Remediation**



### Focus on Optimizing Systems (better, cheaper, faster):

- Maximizing mass removal
- Expediting aquifer restoration
- Minimizing costs (maintenance, electricity)

	2006	2018	2022
Pumping Rate (MGD – million gallons per day)	17	10	7.6
Extraction wells	87	35	31
Reinjection wells	49	34	28
Infiltration galleries	15	10	2
Carbon vessels (20,000 lb)	45	35	22

- Total volume treated through Feb 20 = 89,803 MG
- Total mass removed through Feb 20 = 10,529 lbs



### Largest Historical vs Current Groundwater Plumes







# **Plume Information**



- Detailed information on the IRP groundwater plumes can be found in our Plume Booklet, available online at <u>https://www.massnationalguard.org/JBCC/afcec.html</u>
- Includes a description of the plumes, contaminants of concern and figures





### JBCC Restoration Program Review Wind Turbines



- Operating and maintaining 5 utility scale wind turbines
  - AF/Army owns three 1.5 megawatt (MW) wind turbines
  - AFSPC-PAVE PAWS (Space Force) owns two 1.68 MW wind turbines



	Wind 1	Wind II	
Rating (MW)	1.5	1.5	
Hub Height (m) /Rotor Diameter (m)	80/77	80/77	
Cost of Construction	\$4.6M	\$9.3M	
Operational	2 Dec 09	9 Nov 11	
Production through Aug 2022 (MWhr)	106,825		
Credits to date (through Aug 2022)	\$16M		



#### **Review of the MMRP Process**





## **MMRP SITES**







# **MMRP SITES AND STATUS**



Site	Status
Former Otis Bomb Storage Magazines	Closed
Ordnance Area 1	CSE Phase II: Additional field investigation completed; no ordnance found. AF planning to close site but MassDEP wants additional investigation; AF agreed to do more work to close out the site, funding being sought for additional work.
Skeet Range	RI for lead completed. Draft FS report being prepared.
Otis Target Butt	Closed
Old Grenade Courts	CSE Phase II: Additional field work conducted to further investigate ordnance. Plan is to close the off base portion of the site and conduct a streamlined RI/FS for the on base MRS.
Otis Gun Club	Supplemental RI underway for lead; Draft Supplemental RI report tentatively scheduled for Dec 2022.
Mock Village	Record of Decision signed; site in long term management
Old K Range	RI/FS completed. Proposed Plan in review
Former Ammunition Supply Point West and East	EPA rescinded No Further Action concurrence – determining path forward with regulators; need input from ARNG as to future use of site



# **PFAS Regulations**



- May 2016 EPA issued final <u>Lifetime Drinking Water Health Advisory (HA) values</u> for Perfluorooctane Sulfonic Acid (PFOS) and Perfluorooctanoic Acid (PFOA) of 70 nanograms per liter (ng/L) (0.07 micrograms per liter [µg/L]) for each and combined.
- Jun 2018 MassDEP issued an <u>Office of Research and Standards Guideline (ORSG)</u> of 70 ng/L (0.07 ug/L) for five combined PFAS compounds (PFOS, PFOA, PFNA, PFHxS, and PFHpA).
- Apr 2019 MassDEP issued a <u>Groundwater-1 (GW-1) standard of 20 ng/L</u> (0.02 ug/L) for six combined PFAS compounds (PFOS, PFOA, PFNA, PFHxS, PFHpA, PFDA).
- Oct 2020 MassDEP issued a <u>Massachusetts Maximum Contaminant Level (MMCL)</u> drinking water standard of 20 ng/L (0.02 μg/L) for the sum of six PFAS (PFAS6) (PFOS, PFOA, PFNA, PFHxS, PFHpA, PFDA).
- May 2022 EPA published <u>Regional Screening Levels (RSLs)</u> updates to some PFAS; impacts to the JBCC program are being assessed.
- Jun 2022 EPA issued Interim Updated Drinking Water HAs for PFOS and PFOA and Final HAs for Perfluorobutane Sulfonic Acid (PFBS) and GenX; EPA noted that Superfund sites should use updated RSLs since Interim HAs are still undergoing EPA Science Advisory Board review.



# **PFAS Sites**



- Ten PFAS sites
- Two are existing IRP sites
  - Ashumet Valley/Fire Training Area 1 (FTA-1): RI/FS ongoing
  - Landfill-1 (LF-1): RI completed; FS ongoing
- Seven new sites
  - Tanker Truck Rollover Sites: RI/FS ongoing
  - Flightline Operable Unit: USCG Hangars, Former Fire Department (Bldg 122), Army Helicopter Hangar, Lower 40 Ramp Area, Wastewater Treatment Plant, ANG Motor Pool, Building 118: RI ongoing



### **PFAS Plumes**







# **Distribution of PFAS at FTA-1**









de.



# **Flight Line PFAS Sites**







### **Response Actions Public/Community Wells**



- Eight public/community water supply wells sampled by AFCEC; two had PFOS+PFOA concentrations greater than the 2016 HA.
  - Mashpee Village Public Water Supply Well (PWSW) was shut down in Feb 2017;
    AFCEC/USACE installed a wellhead treatment system, operational 14 Feb 2020.
  - Community Water Supply Well for a neighborhood in Mashpee was disconnected and AFCEC connected 93 residences to municipal water supply in 2018.
- Two Mashpee PWSWs, Turner Road #2 and #5, have PFAS6 concentrations greater than the MMCL but below the 2016 HA; both wells have been taken offline (Feb 2019 and Jul 2020).
  - AFCEC is installing wellhead treatment on the two Mashpee PWSWs; scheduled for completion in Mar 2023.
- The Falmouth Fresh Pond PWSW had PFAS6 concentrations greater than the MMCL but below the 2016 HA in May 2019; well was taken offline in Apr 2017 for perchlorate (unrelated to JBCC).
  - AFCEC completed installation of wellhead treatment on the Falmouth PWSW; the well was restarted on 16 Jun 2022 (operated seasonally through Nov)



### **Wellhead Treatment**



#### Falmouth Fresh Pond



#### Mashpee Turner Road





### Response Actions Private Wells



- 119 private wells sampled in Mashpee, Falmouth, and Bourne; currently no private wells with PFOS+PFOA concentrations greater than the 2016 HA and one private well with PFAS6 concentrations greater than the MMCL (bottled water being provided).
- 13 residential point-of-entry filtration systems were installed by AFCEC.
  - Seven removed when connections to municipal water were completed.
  - Six are no longer maintained by AFCEC since concentrations decreased below the 2016 HA and PFAS6 MMCL; these systems have been turned over to the property owners.
- 123 total connections made to municipal water supply.
  - 93 residences where water was supplied by a private community water supply well and 30 single-family residential properties in Falmouth and Mashpee







Rose Forbes, rose.forbes@us.af.mil, 508-968-4670 x 5613

Doug Karson, douglas.karson.@us.af.mil, 508-968-4678 x 2

Visit our webpage for more information on our program including upcoming public meeting opportunities:

https://www.massnationalguard.org/JBCC/afcec.html









# LF-1 Plume: Legacy Contaminants of Concern (COCs)





# PFAS and 1,4-Dioxane Boundaries Within the LF-1 Plume









- Perfluorooctane Sulfonic Acid (PFOS)
- Perfluoroctanoic Acid (PFOA)
- Perfluorononanoic Acid (PFNA)
- Perfluorohexane Sulfonic Acid (PFHxS)
- Perfluoroheptanoic Acid (PFHpA)
- Perfluorodecanoic Acid (PFDA)



### Aqueous Film Forming Foam



#### AFFF

- Development began in 1960s by 3M and
- U.S. Navy for use on Class B fires (flammable liquids)
- AF started using in 1970, per finalization of the MILSPEC in 1969
- Contains fluorosurfactants (and other compounds) per MILSPEC
- MIL-F-24385F(SH)
  - PFOS-based foams
  - Long chain telomer-based foams
  - Short chain telomer-based foams
  - Other FC technology foams?
  - Mixtures are likely common
- Continued use of stockpiled PFOS-based AFFF not currently restricted under U.S. regulations
- AFFF now produced using smaller chain PFCs (less than 6 carbon atoms long, <C<sub>6</sub>)







# **PFAS Compounds**



There are thousands of compounds within the broader PFAS group. Compounds of interest include the following:

Perfluorohexane sulfonic acid (PFHxS)



Perfluoroheptanoic acid (PFHpA)



Perfluorooctane sulfonic acid (PFOS)



Perfluoroctanoic acid (PFOA)



Perfluorononanoic acid (PFNA)



Perfluorodecanoic acid (PFDA)





PFAS = Per- and Polyfluoroalkyl Substances

PFBS = Perfluorobutane Sulfonic Acid



			EPA F	SLs for PFAS - HQ = 0.1					
		New PFOS	Old PFOS	New PFOA	Old PFOA	New PFNA	New PFHxS	New GenX	PFBS (no change)
Resident (ingestion + dermal)	Groundwater (µg/L)	0.00602	0.04	0.00401	0.04	0.00589	0.0394	0.00602	0.601
	Groundwater (ng/L)	6.02	40	4.01	40	5.89	39.4	6.02	601
Resident (ingestion + dermal)	Soil (µg/kg)	19	126	12.6	126	19	126	23.5	1,900
	Soil (ng/kg)	19000	126000	12600	126000	19000	126,000	23500	1900000
Recreator (Swimm (ingestion + dermal)	<sup>ier)</sup> Surface Water (µg/L)	0.304	0.38	0.203	0.38	0.256	1.75	0.304	30.2
	Surface Water (ng/L)	304	380	203	380	256	1750	304	30200
Recreator (Swimm (ingestion + dermal)	<sup>ier)</sup> Sediment (μg/kg)	88.5	737	59	737	88.5	590	110	8.85
	Sediment (ng/kg)	88500	737000	59000	737000	88500	590000	110000	8850
Notes:									
Screening Values for resident potable use of groundwater, resident contact with soil, and recreator contact with soilment and surface water are based on an HQ of 0.1 and CR of 1E-06 and were obtained from EPA's RSL table or generated using the EPA RSL calculator (https://epaprgs.orml.gov/cgi-bin/chemicals/csi_search).									
Shaded values are the updated May 2022 RSL values.									
Key:									
CR = Cancer Risk			PFHxS = Perfluorohexane Sulfonic Acid						
EPA = U.S. Environmental Protection Agency		PFNA = Perfluorononanoic Acid							
GenX = HFPO-DA			PFOA = Perfluorooctanoic Acid						
HQ = Hazard Quotient				PFOS = Perfluorooctane Sulfonic Acid					
JBCC = Joint Base Cape Cod			RSL = EPA Regional Screening Level						
ng/kg = nanogram per kilogram			µg/kg = microgram per kilogram						
ng/L = nanogram per liter				µg/L = microgram per liter					

