



UNDER SECRETARY OF DEFENSE
4000 DEFENSE PENTAGON
WASHINGTON, D.C. 20301-4000

PERSONNEL AND
READINESS

FEB 14 2023

The Honorable Patty Murray
Chair
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Madam Chair:

The Department's response to House Report 117-88, page 65, accompanying H.R. 4432, the Department of Defense (DoD) Appropriations Bill, 2022, "Perfluorinated Chemicals Contamination and First Responder Exposure," is enclosed.

The report includes DoD firefighter population-level summation statistics for Fiscal Year 2021 and describes ongoing efforts to improve the Department's tracking and trending. The Department will continue to collaborate with various Federal agencies and others regarding analytical methods and to better understand exposure pathways and potential adverse health effects from perfluorinated chemicals.

Thank you for your continued strong support for the health and well-being of our Service members and DoD civilian workforce. I am sending a similar letter to the Committee on Appropriations of the House of Representatives.

Sincerely,

A large black rectangular redaction box covering the signature area.

Gilbert R. Cisneros, Jr.

Enclosure:
As stated

cc:
The Honorable Susan Collins
Vice Chair



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FEB 14 2023

The Honorable Kay Granger
Chair
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

Dear Madam Chair:

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cc:
The Honorable Rosa L. DeLauro
Ranking Member

Report to the Committees on Appropriations of the Senate and the House of Representatives



First Responder Exposure to Per- and Polyfluoroalkyl Substances

February 2023

The estimated cost of this report or study for the Department of Defense (DoD) is approximately \$11,000 for the 2021 Fiscal Year. This includes \$0 in expenses and \$11,000 in DoD labor.
Generated on 07/11/2022 (A-56B4230)

A. CONGRESSIONAL REPORT REQUEST

This report is in response to House Report 117–88, page 65, accompanying H.R. 4432, the Department of Defense (DoD) Appropriations Bill, 2022, which requests that the Assistant Secretary of Defense for Health Affairs provide a report to the House and Senate Appropriations Committees not later than 180 days after the enactment of the Appropriations Act on the Department’s ongoing efforts to test and track potential first responder exposure to perfluorinated chemicals (PFCs) [Per- and Polyfluoroalkyl Substances, PFAS] as part of existing, annual medical surveillance exams.

B. TEST AND TRACK POTENTIAL FIRST RESPONDER PFAS EXPOSURE

“First responders” include law enforcement, fire services, emergency medical services, and emergency management officials.¹ Of the first responders, only DoD firefighters regularly worked with aqueous film-forming foam (AFFF), known to contain PFAS. Other first responders (non-firefighters) likely experience very limited or no AFFF exposures. Occupational medical surveillance examination content and frequencies are based on exposure to recognized occupational health hazards.

DoD is currently focused on offering blood testing to its firefighters as required by section 707 of the National Defense Authorization Act (NDAA) for Fiscal Year (FY) 2020.

C. DOD FIREFIGHTER BLOOD TESTING AND TRACKING UPDATE

In FY 2021 (October 2020-September 2021), DoD records indicate 10,208 DoD firefighters were offered a blood test for PFAS as part of their existing annual firefighter occupational medical surveillance exam. Of these, 9,104 DoD firefighters chose to have their blood tested and 1,004 DoD firefighters opted not to have their blood tested. Firefighters who chose to have their blood tested were provided their test results and a medical fact sheet.

As described in House Report 117–88, “the Department is developing firefighter population-level summation statistics for PFCs [PFAS] blood sampling of firefighters.” These summary statistics are included for the FY 2021 blood testing for PFAS in DoD firefighters in the attached surveillance report (Attachment 1).

C.1. Overview of the DoD Exposure Surveillance Report

The Navy and Marine Corps Public Health Center (NMCPHC) used the DoD’s electronic health records (EHRs) to identify 6,715 firefighters who had their blood sampled and analyzed during FY 2021. Results not uploaded into one of the DoD EHRs were not captured in the surveillance report.

DoD firefighters were categorized into two groups for analyses: Active duty Service members, and other DoD personnel (DoD civilian employees and Reserve, and National Guard members).

¹ Source: Department of Homeland Security accessed at: <https://www.dhs.gov/science-and-technology/first-responders> on March 17, 2021

Samples were analyzed for the presence of six PFAS compounds: perfluorooctanoic acid (PFOA); perfluorooctane sulfonate (PFOS); perfluorohexanesulfonic acid (PFHxS); perfluorononanoic acid (PFNA); perfluoroheptanoic acid (PFHpA); and perfluorobutanesulfonic acid (PFBS). Individual PFAS blood (serum) levels are reported in micrograms per liter ($\mu\text{g/L}$), which is equivalent to nanograms per milliliter (ng/ml).

The PFAS detected most often in the serum was PFOS (95.6 percent of samples), followed by PFNA (95.5 percent), PFOA (92.8 percent), PFHxS (92.2 percent), PFHpA (17.4 percent), and PFBS (3.0 percent).

Overall PFAS geometric mean blood concentrations ranged from a high for PFOS at 3.1 nanograms per milliliter (ng/mL), followed by PFHxS (2.8 ng/mL), PFOA (1.1 ng/mL), and PFNA (0.42 ng/mL). Both PFHpA and PFBS were below the limit of detection at 0.05 ng/mL .

The spread of the sampling results (standard deviation) for each PFAS was relatively small. However, due to outlier values, the range for test results for individual PFAS was large, ranging from non-detectable ($<0.05 \text{ ng/mL}$) to a maximum of 340 ng/mL for PFHxS, 150 ng/mL for PFOS, 24 ng/mL for PFOA, 8.8 ng/mL for PFNA, 1.0 ng/mL for PFHpA, and 0.7 ng/mL for PFBS.

C.2. Discussion

The surveillance report identified 6,715 DoD firefighters through the DoD EHRs. This value is approximately 74 percent of the 9,104 DoD firefighters tested. This difference is likely related to the fact that EHRs exist for military members (not DoD civilian employees, who are often tracked solely with hard copy employee medical folders). In addition, there are challenges with the ability to efficiently access data within the medical files of DoD civilian employees and Reserve and National Guard members. This was also complicated due to the increased use of contractor support for occupational medicine services during the coronavirus disease 2019 pandemic.

Although blood sampling indicates the level of (or concentration of) PFAS present in an individual's blood at a point in time, it cannot by itself be used to define the source, timing, frequency, magnitude, or possible health effects of the exposures that led to the PFAS level. While the NMCPHC surveillance report provided information on overall PFAS levels in DoD firefighters, all of the results were combined (pooled together), because information on demographics (age, sex, etc.) and potential PFAS exposures (e.g., years working with AFFF) are unavailable. The DoD is developing a DoD firefighter PFAS exposure questionnaire that may allow us to obtain demographic and PFAS exposure related information with the objective of better evaluating whether results from the PFAS blood testing are associated with DoD firefighter activities.

There are differences between the analytical method used to analyze DoD blood samples and the method used by the Centers for Disease Control and Prevention (CDC) to determine PFAS levels in the general population through the National Health and Nutrition Examination Survey. Therefore, the DoD firefighter PFAS levels in blood cannot be directly compared to those found

in the general population. The DoD is currently planning to have future blood samples analyzed using the CDC's analytical method. This will also allow the DoD to reevaluate current PFAS being analyzed and consider additional PFAS analytes to better align with those being analyzed by the CDC and to consider PFAS most likely to be present in AFFF.

D. CONCLUSION

The DoD will continue to offer PFAS testing to DoD firefighters as required by section 707 of the NDAA for FY 2020 and will develop annual surveillance reports including firefighter population-level summation statistics for DoD firefighter PFAS blood sampling results. This information will be used to perform a trend analyses for changes in firefighter blood PFAS levels over time and assist in understanding whether DoD firefighters are experiencing PFAS exposures from their ongoing work with AFFF and other firefighting activities. Further, implementation of the DoD firefighter PFAS exposure questionnaire may assist in understanding whether current and possibly historical exposures are associated with DoD firefighting activities (e.g., use of AFFF).

The Department will also continue to collaborate with various federal agencies and others to improve our understanding of potential occupationally-related PFAS exposures and health effects. DoD collaborates regularly with the Department of Veterans Affairs to discuss potential current and future PFAS exposures and health effects to Service members. The Department is reaching out to the CDC's National Center for Environmental Health and National Institute for Occupational Safety and Health regarding analytical methods and various occupational exposure and health effects inquiries. Additionally, DoD supports and relies on the Department of Health and Human Services's Agency for Toxic Substances and Disease Registry environmental exposure assessments and health studies to better understand exposure pathways and potential adverse health effects from PFAS.



NAVY AND MARINE CORPS PUBLIC HEALTH CENTER
IMPROVING READINESS THROUGH PUBLIC HEALTH ACTION

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DoD Firefighter Per- and Polyfluoroalkyl Substances (PFAS) Blood (Serum) Surveillance Report, 01 October 2020 to 30 September 2021

NMCPHC-EDC-TR-287-2022



Department of Navy
Navy and Marine Corps Public Health Center
The EpiData Center
Prepared August 2022

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Key Points

- DoD used electronic health records (EHR) to identify 6,715 firefighters who had their blood sampled and analyzed during the reporting period of October 1, 2020 through September 30, 2021.
 - Laboratory analyses of firefighter blood samples looked for the presence of six PFAS compounds: Perfluorooctanoic acid, PFOA; perfluorooctane sulfonate, PFOS; perfluorohexanesulfonic acid, PFHxS; perfluorononanoic acid, PFNA; perfluoroheptanoic acid, PFHpA; and perfluorobutanesulfonic acid, PFBS.
 - PFAS serum levels, reported in micrograms per liter ($\mu\text{g/L}$) is equivalent to nanograms per milliliter (ng/ml).
- This report only captures information uploaded into Composite Health Care System (CHCS) and Military Health System (MHS) GENESIS data sources.
- The PFAS detected most often in the serum was PFOS (95.6% of samples), followed by PFNA (95.5%), PFOA (92.8%), PFHxS (92.2%), PFHpA (17.4%), and PFBS (3.0%).
- The PFAS with the highest geometric mean blood concentration was PFOS (3.1 nanograms per milliliter; ng/mL), followed by PFHxS (2.9 ng/mL), PFOA (1.1 ng/mL), PFNA (0.42 ng/mL) with both PFHpA and PFBS below the limit of detection (LOD) of 0.05 ng/mL.
- The maximum level measured in an individual firefighter's blood was 340 ng/mL for PFHxS, 150 ng/mL for PFOS, 24 ng/mL for PFOA, 8.8 ng/mL for PFNA, 0.7 ng/mL for PFBS, and 1.0 ng/mL for PFHpA.
- Currently available information does not allow for differentiation between occupational and non-occupational exposures or the determination of the source, magnitude, frequency, of possible PFAS exposures.
- DoD firefighter serum PFAS levels are not directly comparable to the U.S. Centers for Disease Control and Prevention (CDC) National Health and Nutrition Examination Survey (NHANES) levels reported in the serum of the general public because of differences in the analytical methodologies employed^a. We cannot determine whether DoD firefighter

^a The analytical methodology NMS uses to assess PFAS levels in DoD firefighter blood (NMS PFAS Panel by negative ion electrospray/tandem mass spectrometry (LC-MS/MS, EDPFA01-02) is a proprietary method using HPLC separation with LC-MS/MS for detection and quantitation.

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blood PFAS levels are substantially different from those observed by the CDC in the general population.

Background

Per- and Polyfluoroalkyl Substances (PFAS) refers to a large and complex class of manmade chemicals. Of the multiple chemicals categorized as PFAS, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA) were historically the most widely used throughout the U.S. and are the best studied PFAS. Because PFAS increase resistance to heat, stains, water, and grease they have been used in many industrial and consumer products. Commercial and consumer use of PFAS, which began in the 1950s, included keeping food from sticking to cookware, certain food packaging, making sofas and carpets resistant to stains, and making clothes and mattresses waterproof. PFAS are not uniquely attributable to Department of Defense (DoD) activities.

In the 1970s, the DoD began using aqueous film forming foam (AFFF) fire suppressants that contained PFAS including PFOS and, in some formulations, PFOA. AFFF is mission critical for the DoD because it quickly extinguishes petroleum-based and liquid fuel fires, saving lives and materials. The DoD and industries, including the aerospace, automotive, building and construction, and electronics industries, use PFAS in a variety of products to reduce friction and insulate electrical systems.

Information concerning exposures to PFAS can be found on the United States Environmental Protection Agency's (EPA) website at: <https://www.epa.gov/pfas/basic-information-pfas#exposed> and on the Agency for Toxic Substances and Disease Registry (ATSDR) website at <https://www.atsdr.cdc.gov/pfas/pfas-exposure.html>.

Many PFAS compounds are known to be extremely persistent in the environment, which means they don't break down readily and can accumulate over time. Because of potential health concerns, PFOS and PFOA were voluntarily removed from commercial products more than 10 years ago and DoD adopted policy limiting the use of AFFF containing PFAs. Regardless, PFAS are present at low levels in some foods, consumer products, and in the environment (air, water,

While similar to the method used by the CDC, the current NMS analytical method uses different pre-analytical and analytical columns, mobile phases/gradients, and ion transitions. Most importantly, DoD firefighter sample analyses have not included use of solid phase extraction to reduce the impact of interfering compounds in determining target levels in blood.

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soil, etc.). CDC scientists have found four PFAS (PFOS, PFOA, PFHxS and PFNA) in the serum of nearly all the people tested.

Scientists are still studying the health effects of exposure to PFAS. A large research effort is underway to determine whether there are potential health effects for people from PFAS exposures. There are currently no established health-based reference levels for PFAS in blood, blood plasma, or blood serum. Although more research is needed, some observational studies have reported an association between high levels of certain PFAS in blood and the occurrence of adverse health outcomes (e.g., decreased vaccine efficacy, increases in cholesterol levels, thyroid disease, and certain cancers). While test results reporting the amount of PFAS in the blood are a useful measure of an individual's exposure to PFAS, scientists cannot identify the timing, magnitude, frequency, source of exposure, or determine the likelihood of developing any possible health effects. Additional information concerning PFAS health effects are available from the ATSDR website at: <https://www.atsdr.cdc.gov/pfas/PFAS-health-effects.html>

Purpose

This report summarizes PFAS blood (serum) analytical results collected from the CHCS and MHS GENESIS Health Level 7-formatted (HL7) databases^b from DoD firefighters tested between 01 October 2020 and 30 September 2021.

Methods

MHS laboratory serum sample results were obtained from the CHCS and MHS GENESIS laboratory databases. Serum samples, with a collection date occurring between 01 October 2020 and 30 September 2021, are the subject of this report. Tests ordered or test names indicating performance of a PFAS panel, were identified and retained for analysis. All DoD Firefighter blood PFAS sample analyses were performed by NMS Labs (NMS) to a LOD of 0.05 ng/mL.

PFAS serum levels, obtained from CHCS and MHS GENESIS laboratory records in which a PFAS test was performed and viable results recorded, using univariate statistics (total test

^b CHCS and MHS GENESIS fact sheets are available at CHCS - <https://www.health.mil/Reference-Center/Fact-Sheets/2020/10/26/Composite-Health-Care-System> and MHS Genesis - <https://www.health.mil/Reference-Center/Fact-Sheets/2019/07/30/MHS-GENESIS>.

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performed, geometric mean, $\pm 95\%$ confidence limits, the 95th percentile and maximum levels) for each of the six target PFAS compounds. CDC methods were used to determine statistical parameters reported in this analysis.⁴ Analytical results below the LOD (0.05 ng/mL) were reported as “< LOD.” To compute geometric means in a manner consistent with CDC methodology, concentrations less than the LOD (0.05 ng/mL) were assigned a value equal to the LOD divided by the square root of two (0.035 ng/mL). If 40% or more of the total proportion of results for each PFAS compound was below the LOD a geometric mean was not calculated.

In addition to reporting PFAS serum levels for all DoD firefighters, PFAS serum levels were also reported by service branch (Army, Air Force, Marine Corps, Navy, and Other). For each of the services, the serum levels of individual PFAS were reported for active duty (AD) and other adult DoD personnel (Appendix A – Appendix E).

A measure of total PFAS exposure to DoD firefighters is provided by the sum total of the six PFAS measured in each firefighter’s serum.

Results

The results obtained from the DoD EHR, CHCS and MHS GENESIS laboratory databases, for the 6,715 firefighters whose blood were sampled and analyzed during the reporting period, is provided in Tables 1 through 3. Table 1 displays the unique number of participating DoD personnel tested for PFAS by service branch. Table 2 displays general information about the number of PFAS laboratory serum samples tested, the percentage of tests below and above the LOD, the percentage of tests identified as not performed (i.e., insufficient blood sample, defective test), and the number of tests uploaded into the Health Artifact and Image Management System (HAIMS), which were not available for inclusion in this report. The total number of DoD firefighters for which the laboratory reported analytical results, include both active duty and non-active duty personnel. Table 3 displays the number of serum samples with a numeric test result, which were then used to generate univariate statistics (geometric mean, $\pm 95\%$ confidence limits, a 95th percentile, and maximum concentration levels) for each of the six target PFAS compounds. For a variety of reasons, an individual’s blood PFAS levels may have been sampled and analyzed more than once during the reporting period, with both analytical results reported in the EHR. Figures 1 through 6 provide a graphical representation of the DoD firefighter blood testing results for each of the six PFAS compounds assayed. Figure 7 displays

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the distribution of the total PFAS concentration in an individual's blood serum sample (i.e., the sum of all six PFAS compounds measured in a participant's blood).

PFAS Testing by Branch

Table 1. Participating DOD Personnel Tested for PFAS by Service Branch, 01 October 2020 to 30 September 2021

Service Branch	Total Participants Tested	Percent (%)
Air Force	2,184	32.5
Army	334	5.0
Marine Corps	455	6.8
Navy	318	4.7
Other	3,424	51.0
Total	6,715	100.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 08 April 2022.

PFAS Univariate Statistics by Compound- Overall

Table 2. Total PFAS Laboratory Testing among Participating DoD Personnel, 01 October 2020 to 30 September 2021

Compound	Total Tests	Below Limit of Detection (%) ^a	Above Limit of Detection (%) ^b	Test Not Performed (%) ^c	Not Applicable (%) ^d
PFBS	7,021	93.6	2.9	2.6	0.9
PFHpA	7,017	78.7	17.4	3.1	0.9
PFHxS	7,018	0.1	92.2	6.8	0.9
PFNA	7,018	0.5	95.5	3.2	0.9
PFOA	7,108	3.8	92.7	2.5	0.9
PFOS	7,045	0.8	95.6	2.8	0.9

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a Percent of samples with a value below the limit of detection (0.05 ng/mL).

^b Percent of samples with a numeric value greater than the limit of detection (0.05 ng/mL).

^c Percent of samples with a value of "TNP" or "Test not performed".

^d Percent of samples where values could not be extracted; results were uploaded to the Health Artifact and Image Management Solution (HAIMS) and not CHCS.

Includes all serum samples regardless of availability of test results.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to NHANES or CDC Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

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PFAS Measures of Central Tendency by Compound- Overall

Table 3. Uni-variate Statistics for PFAS Blood Testing among Participating DOD Personnel, 01 October 2020 to 30 September 2021

Compound	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	6,785	*	<LOD	209	0.7
PFHpA	6,744	*	0.098	332	1.0
PFHxS	6,484	2.9 (2.8-2.9)	10.0	254	340.0
PFNA	6,737	0.42 (0.41-0.42)	1.0	281	8.8
PFOA	6,868	1.1 (1.1-1.2)	2.9	331	24.0
PFOS	6,795	3.1 (3.05-3.2)	11.0	296	150.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Percent Distribution of PFAS Analytical Results by Compound - Overall

Relative distributions of test result values within the participating population of firefighters are displayed in Figures 1 through 7. The percent distribution of individuals with a specific blood PFAS concentration were arbitrarily determined by concentration bin. For PFHxS, PFOS and Total PFAS levels, additional resolution of DoD firefighter blood levels around the LOD is provided in an expanded histogram.

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Figure 1. Percent Distribution of PFBS Analytical Results among Participating DOD Firefighters, 01 October 2020 to 30 September 2021 (n=6,780)

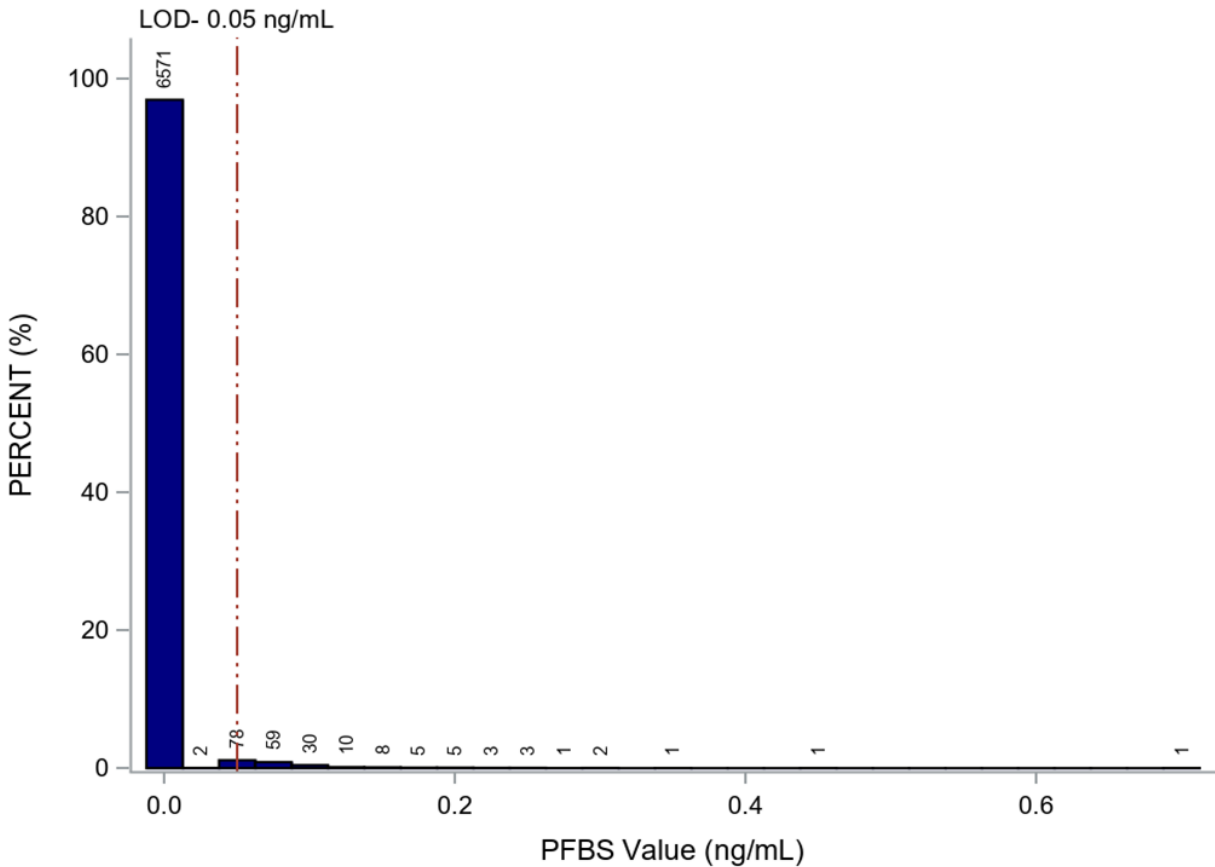


Figure contains both Active Duty and Non-Active Duty personnel.
Serum Concentrations are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.
Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.
Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 07 January 2022.

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Figure 2. Percent Distribution of PFHpA Analytical Results among Participating DOD Firefighters, 01 October 2020 to 30 September 2021 (n=6,739)

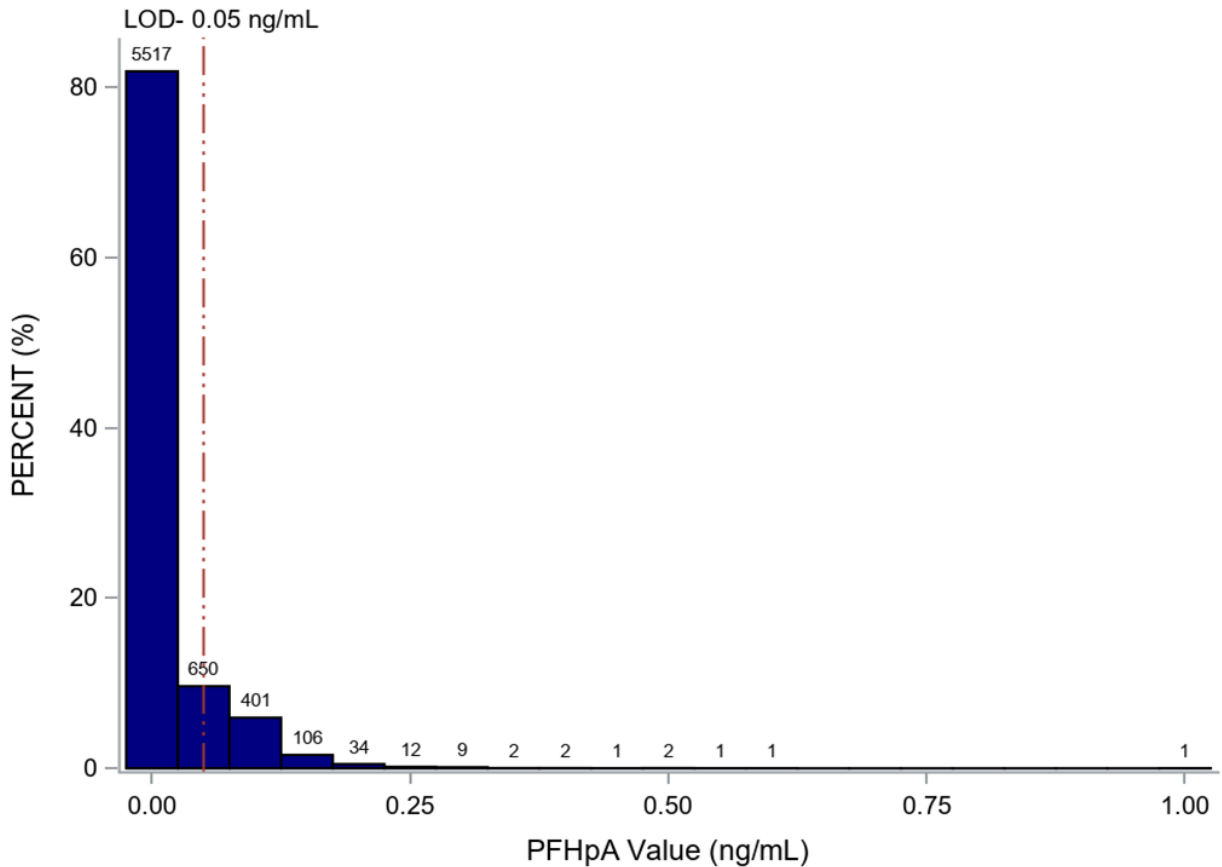


Figure contains both Active Duty and Non-Active Duty personnel.
Serum Concentrations are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.
Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.
Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 07 January 2022.

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Figure 3. Percent Distribution of PFHxS Analytical Results among Participating DOD Firefighters, 01 October 2020 to 30 September 2021 (n=6,479)

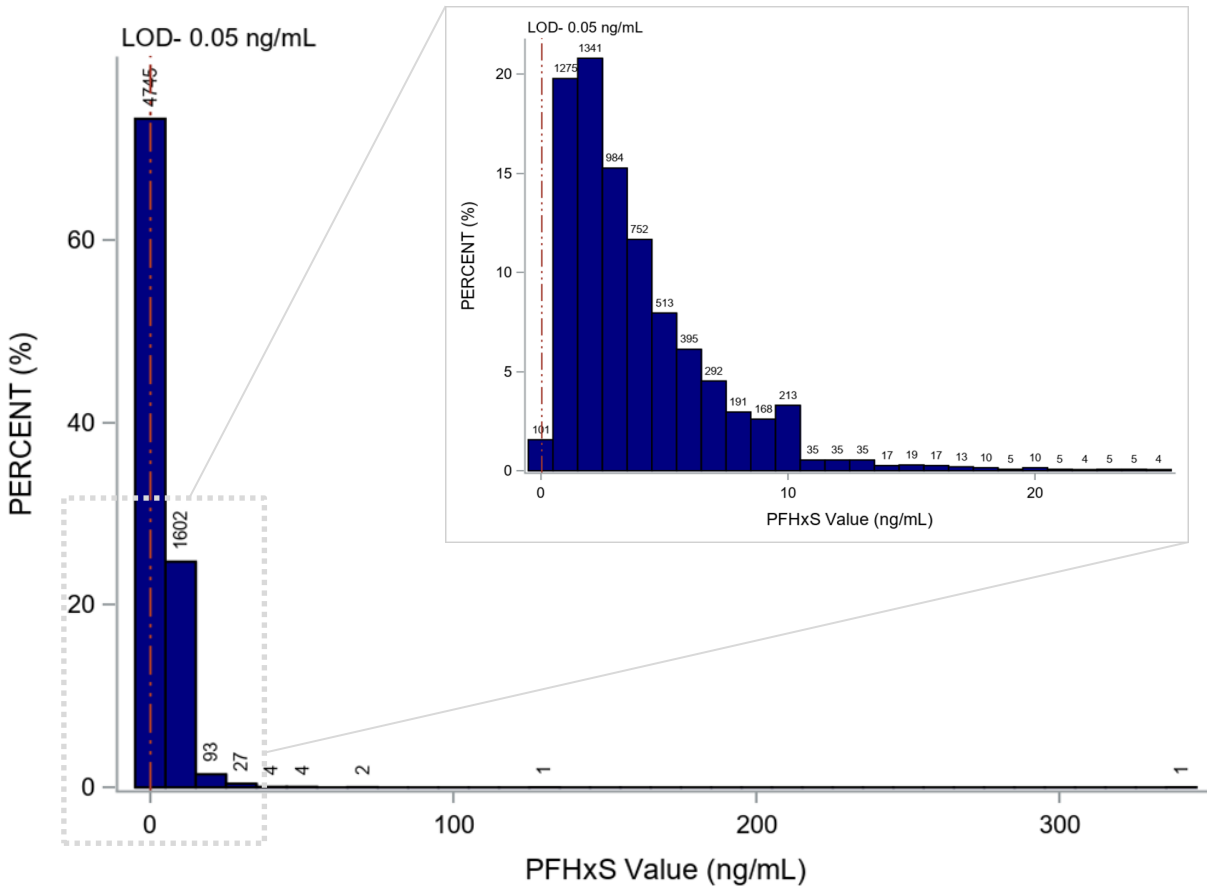


Figure contains both Active Duty and Non-Active Duty personnel.
The distribution of PFHxS result values equal to 25 ng/mL or less is provided in the expanded histogram.
Serum Concentrations are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.
Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.
Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 07 January 2022.

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Figure 4. Percent Distribution of PFNA Analytical Results among Participating DOD Firefighters, 01 October 2020 to 30 September 2021 (n=6,732)

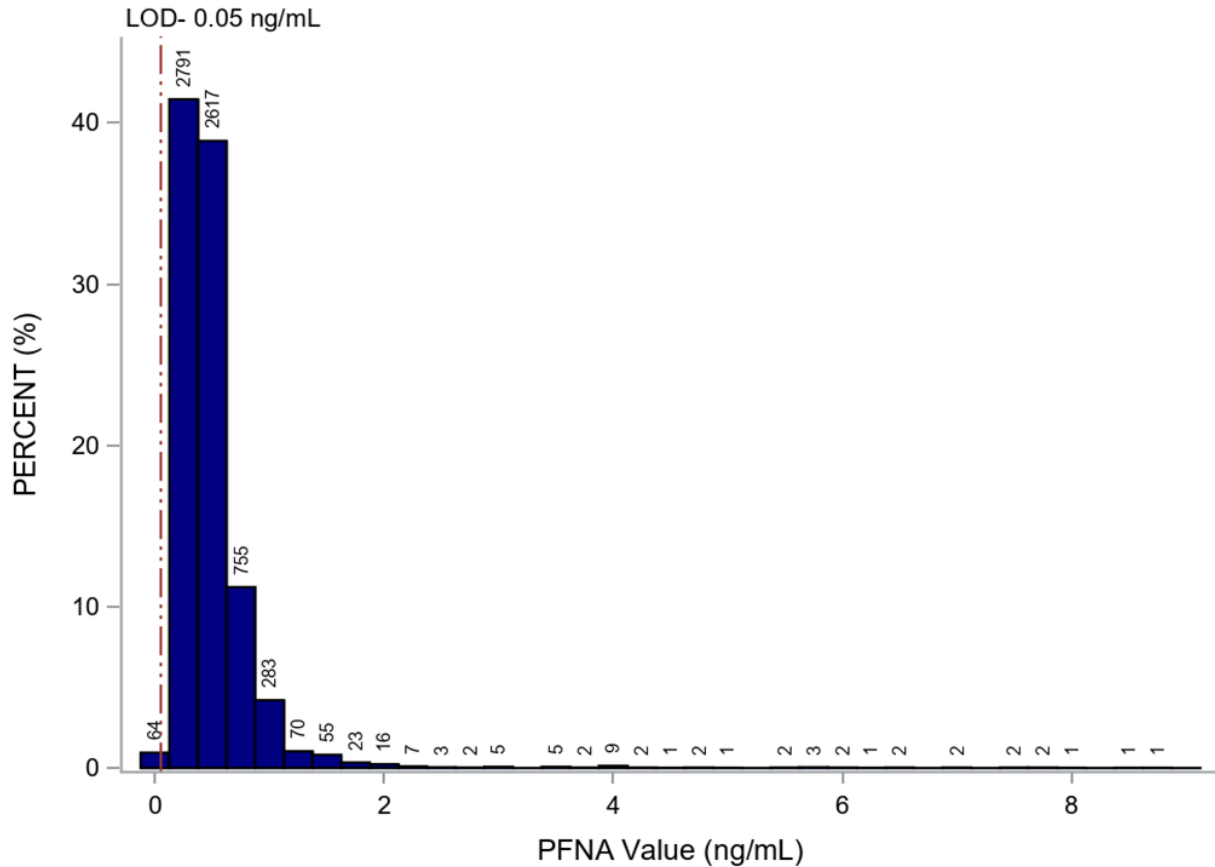


Figure contains both Active Duty and Non-Active Duty personnel.
Serum Concentrations are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.
Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.
Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 07 January 2022.

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Figure 5. Percent Distribution of PFOA Analytical Result Values among Participating DOD Firefighters, 01 October 2020 to 30 September 2021 (n=6,863)

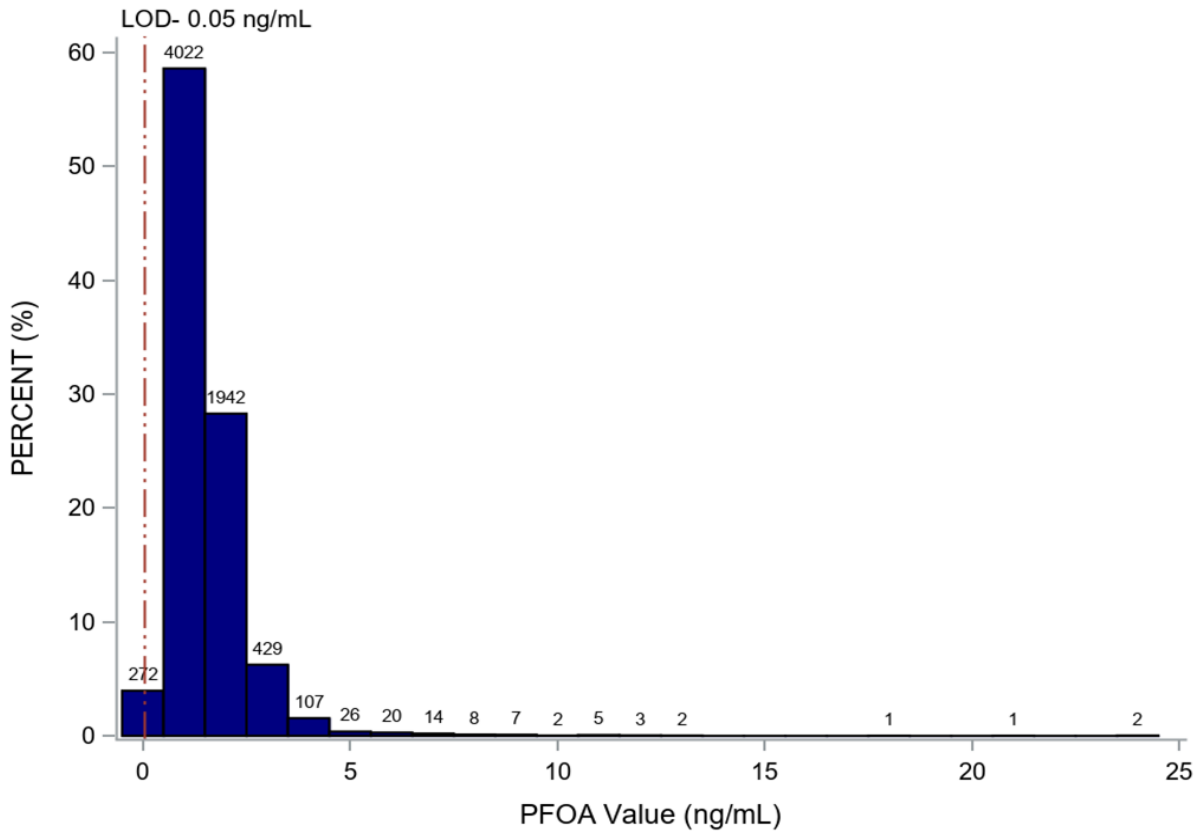


Figure contains both Active Duty and Non-Active Duty personnel.
Serum Concentrations are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.
Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.
Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 07 January 2022.

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Figure 6. Percent Distribution of PFOS Analytical Results among Participating DOD Firefighters, 01 October 2020 to 30 September 2021 (n=6,790)

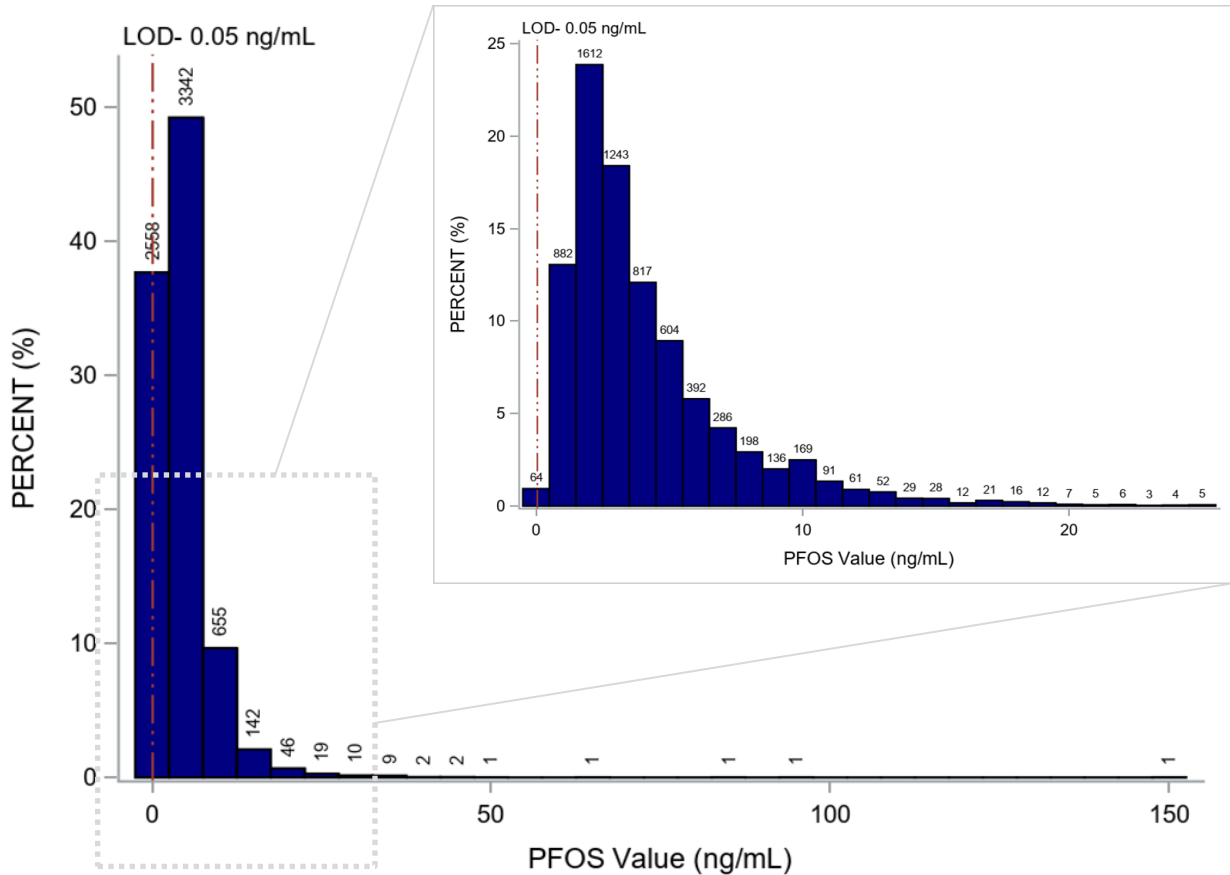


Figure contains both Active Duty and Non-Active Duty personnel.
The distribution of PFOS result values equal to 25 ng/mL or less is provided in the expanded histogram.
Serum Concentrations are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.
Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.
Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 07 January 2022.

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Figure 7. Percent Distribution of Total PFAS Analytical Results among Participating DOD Firefighters, 01 October 2020 to 30 September 2021 (n=6,564)

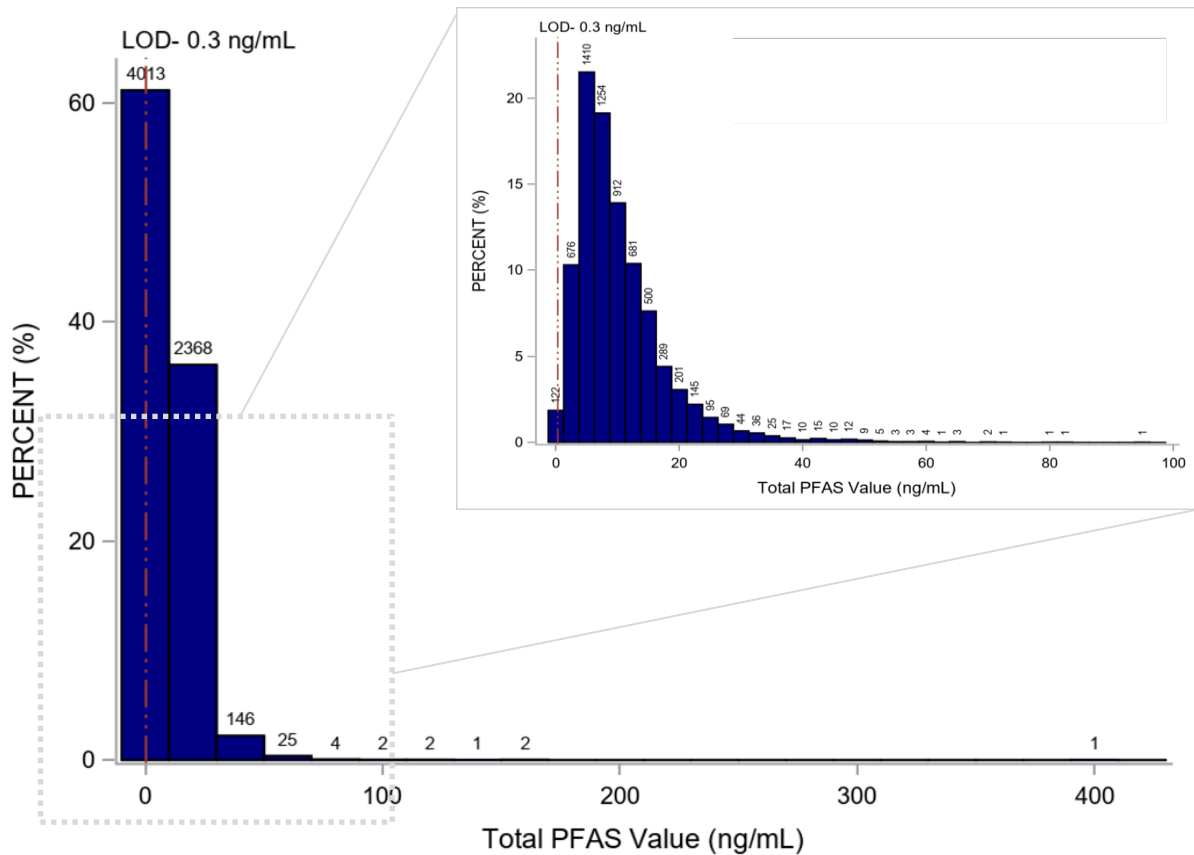


Figure contains both Active Duty and Non-Active Duty personnel.
The distribution of total PFAS result values equal to 100 ng/mL or less is provided in the expanded histogram.
Serum Concentrations are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.
Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.
Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 07 January 2022.

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Discussion

The Figures, which represent the analytical results from DoD firefighter records in CHCS and MHS GENESIS, show undetectable (below the LOD) or low levels of individual PFAS in blood. While the geometric mean PFAS levels reported in DoD firefighters should not be directly compared to the those identified in the general population (CDC's NHANES), they are generally of the same order of magnitude. While methodological differences between NMS and CDC blood PFAS analyses may result in an under reporting of the actual level of the PFAS in DoD firefighter blood, the results may not be substantially different from those of the general population.

The Figures in this report depict the distribution of blood PFAS levels in DoD firefighters. This includes DoD firefighters that have PFAS serum levels that exceed the 95th percentile blood concentration in the DoD firefighters tested. The reason why individual firefighters would have higher serum PFAS levels cannot be determined from the available analytical data alone. Higher PFAS exposures may come from the workplace (e.g., historical use of AFFF) or from some other source (e.g., use of a commercial PFAS products at home or from the consumption of PFAS-impacted drinking water).

DoD plans to implement a firefighter questionnaire for the purpose of collecting demographic information to allow for a more detailed analysis of firefighter PFAS exposures.

Conclusions

The DoD firefighter blood PFAS analytical results do not allow determination of the magnitude, frequency, or likely source of the DoD firefighter PFAS exposures. Annual surveillance reports will track and trend levels of PFAS in DoD firefighter serum. When coupled with future firefighter exposure questionnaires, annual surveillance reports may support more refined PFAS exposure analyses.

Limitations

The laboratory data alone does not allow for specific identification of individual PFAS exposures. While this report references "firefighters," an individual's occupation could not be confirmed. As a result, this report may include analyses from some beneficiaries or individuals from other occupations, who were included in blood PFAS testing based on potential exposure

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concerns and increased media attention. The available records do not contain any information about the individual's potential for exposure to PFAS (e.g., job duties, length of employment, or contact with AFFF) or other information required to provide more information on an individual's contact with PFAS.

The EpiData Center (EDC) routinely generates, formats, and maintains laboratory data collected from MHS GENESIS and CHCS. The CHCS laboratory records originate from MTFs that were using the legacy CHCS/Armed Forces Health Longitudinal Technology Application EHR system. The MHS began transitioning MTFs to a new EHR system in February 2017, named MHS GENESIS. The EDC is now receiving a feed of MHS GENESIS data and is investigating concerns regarding its reliability and integrity. As a result, the EDC analyzed these laboratory records with caution. CHCS and MHS GENESIS data do not include records from HAIMS, shipboard facilities, battalion aid stations, purchased care providers, in-theater facilities or for many of the Reserve and National Guard firefighters.

PFAS laboratory samples from across the DoD were sent to NMS for analytical analysis. The MTF received and uploaded the analytical results into CHCS. Where this did not occur, or was performed incorrectly, those results are not included in this report. Classifying chemistry tests involves extensive searching of free-text test result fields. The EDC used search terms to capture data on PFAS analyses for inclusion in this report. The EDC used validation steps to reduce potential misclassification errors in the available data. The accuracy of the laboratory data records in CHCS and MHS GENESIS depend on correct, accurate, and uniform uploading practices. The data presented in this report and the conclusions derived from the EDC's analysis are based on one fiscal year of data. Trend analysis is not possible at this time.

Unclassified



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4. Centers for Disease Control and Prevention. Fourth National Report on Human Exposure to Environmental Chemicals. Accessed January 7, 2022. .

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Appendix A - Air Force

Appendix A1. Total PFAS Laboratory Testing among Participating Air Force Personnel, 01 October 2020 to 30 September 2021

Compound	Total Tests	Below Limit of Detection (%) ^a	Above Limit of Detection (%) ^b	Test Not Performed (%) ^c	Not Applicable (%) ^d
PFBS	2,310	92.8	2.3	3.3	1.65
PFHpA	2,307	80.6	14.15	3.6	1.65
PFHxS	2,307	0.15	90.05	8.1	1.7
PFNA	2,306	0.55	93.65	4.1	1.65
PFOA	2,313	4.1	91	3.05	1.8
PFOS	2,310	1.0	94.05	3.35	1.65

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a Percent of samples with a value below the limit of detection (0.05 ng/mL).

^b Percent of samples with a numeric value greater than the limit of detection (0.05 ng/mL).

^c Percent of samples with a value of "TNP" or "Test not performed".

^d Percent of samples where values could not be extracted; results were uploaded to the Health Artifact and Image Management Solution (HAIMS) and not CHCS.

Includes all serum samples regardless of availability of test results.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to NHANES or CDC Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

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Appendix A2. Univariate Statistics for PFAS Blood Testing in Participating Air Force Personnel, 01 October 2020 to 30 September 2021

Compound	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	2,197	*	<LOD	55	0.3
PFHpA	2,186	*	0.09	106	0.3
PFHxS	2,081	2.96 (2.86-3.07)	10.0	78	130.0
PFNA	2,173	0.38 (0.37-0.39)	0.87	103	8.6
PFOA	2,200	1.04 (1.0-1.08)	2.6	100	12.0
PFOS	2,195	3.17 (3.06-3.3)	11.0	98	96.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix A3. Uni-variate Statistics for PFAS Blood Testing among Participating Air Force Personnel, 01 October 2020 to 30 September 2021

Compound	Type	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	ACTIVE DUTY	1,357	*	<LOD	35	0.24
	NON-ACTIVE DUTY	840	*	<LOD	20	0.3
PFHpA	ACTIVE DUTY	1,352	*	0.09	66	0.3
	NON-ACTIVE DUTY	834	*	0.088	41	0.33
PFHxS	ACTIVE DUTY	1,261	2.63 (2.52-2.77)	9.8	63	130.0
	NON-ACTIVE DUTY	820	3.5 (3.4-3.7)	10.0	38	30.0
PFNA	ACTIVE DUTY	1,339	0.34 (0.33-0.35)	0.69	65	8.6
	NON-ACTIVE DUTY	834	0.45 (0.43-0.46)	1.0	38	8.1
PFOA	ACTIVE DUTY	1,359	0.94 (0.9-0.99)	2.3	61	8.9
	NON-ACTIVE DUTY	841	1.23 (1.17-1.3)	2.8	42	12.0
PFOS	ACTIVE DUTY	1,354	2.98 (2.84-3.12)	11.0	61	35.0
	NON-ACTIVE DUTY	841	3.5 (3.32-3.7)	11.0	37	96.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix B - Army

Appendix B1. Total PFAS Laboratory Testing among Participating Army Personnel, 01 October 2020 to 30 September 2021

Compound	Total Tests	Below Limit of Detection (%) ^a	Above Limit of Detection (%) ^b	Test Not Performed (%) ^c	Not Applicable (%) ^d
PFBS	349	96.3	2	0.85	0.85
PFHpA	350	78.3	19.45	1.45	0.85
PFHxS	350	0.85	91.45	6.85	0.85
PFNA	350	1.7	95.7	1.7	0.85
PFOA	354	5.1	93.2	0.85	0.85
PFOS	351	1.7	96.3	1.15	0.85

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a Percent of samples with a value below the limit of detection (0.05 ng/mL).

^b Percent of samples with a numeric value greater than the limit of detection (0.05 ng/mL).

^c Percent of samples with a value of "TNP" or "Test not performed" .

^d Percent of samples where values could not be extracted; results were uploaded to the Health Artifact and Image Management Solution (HAIMS) and not CHCS.

Includes all serum samples regardless of availability of test results.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to NHANES or CDC Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

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Appendix B2. Uni-variate Statistics for PFAS Blood Testing among Participating Army Personnel, 01 October 2020 to 30 September 2021

Compound	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	343	*	<LOD	7	0.14
PFHpA	342	*	0.1	16	0.42
PFHxS	323	2.27 (2.06-2.5)	7.8	16	51.0
PFNA	341	0.4 (0.38-0.43)	0.92	17	2.5
PFOA	348	1.13 (1.02-1.25)	3.2	17	24.0
PFOS	344	2.42 (2.2-2.7)	9.4	17	26.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix B3. Uni-variate Statistics for PFAS Blood Testing among Participating Army Personnel, 01 October 2020 to 30 September 2021

Compound	Type	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	ACTIVE DUTY	152	*	<LOD	3	0.14
	NON-ACTIVE DUTY	191	*	<LOD	4	0.12
PFHpA	ACTIVE DUTY	150	*	0.11	6	0.42
	NON-ACTIVE DUTY	192	*	0.1	8	0.29
PFHxS	ACTIVE DUTY	143	2.03 (1.72-2.4)	8.7	7	39.0
	NON-ACTIVE DUTY	180	2.5 (2.2-2.8)	7.65	9	51.0
PFNA	ACTIVE DUTY	150	0.39 (0.35-0.43)	0.99	7	1.8
	NON-ACTIVE DUTY	191	0.41 (0.38-0.45)	0.83	9	2.5
PFOA	ACTIVE DUTY	152	1.11 (0.95-1.3)	4.0	7	7.0
	NON-ACTIVE DUTY	196	1.15 (1.0-1.32)	3.0	9	24.0
PFOS	ACTIVE DUTY	152	2.3 (1.96-2.69)	10.0	6	17.0
	NON-ACTIVE DUTY	192	2.53 (2.3-2.8)	8.2	9	26.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix C - Marine Corps

Appendix C1. Total PFAS Laboratory Testing among Participating Marine Corps Personnel, 01 October 2020 to 30 September 2021

Compound	Total Tests	Below Limit of Detection (%) ^a	Above Limit of Detection (%) ^b	Test Not Performed (%) ^c	Not Applicable (%) ^d
PFBS	478	94.35	3.55	1.45	0.65
PFHpA	478	74.7	22.2	2.7	0.4
PFHxS	478	0.2	90.8	8.6	0.4
PFNA	478	0.2	97.5	1.9	0.4
PFOA	479	2.3	95.8	1.45	0.4
PFOS	478	0.65	97.5	1.45	0.4

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a Percent of samples with a value below the limit of detection (0.05 ng/mL).

^b Percent of samples with a numeric value greater than the limit of detection (0.05 ng/mL).

^c Percent of samples with a value of "TNP" or "Test not performed" .

^d Percent of samples where values could not be extracted; results were uploaded to the Health Artifact and Image Management Solution (HAIMS) and not CHCS.

Includes all serum samples regardless of availability of test results.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to NHANES or CDC Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix C2. Uni-variate Statistics for PFAS Blood Testing among Participating Marine Corps Personnel, 01 October 2020 to 30 September 2021

Compound	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	468	*	<LOD	17	0.1
PFHpA	463	*	0.1	23	0.45
PFHxS	435	2.21 (2.04-2.4)	8.7	21	340.0
PFNA	467	0.39 (0.37-0.4)	0.82	22	1.7
PFOA	470	1.09 (1.03-1.16)	2.3	19	8.3
PFOS	469	2.83 (2.6-3.04)	9.9	23	65.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for

Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix C3. Uni-variate Statistics for PFAS Blood Testing among Participating Marine Corps Personnel, 01 October 2020 to 30 September 2021

Compound	Type	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	ACTIVE DUTY	407	*	<LOD	16	0.1
	NON-ACTIVE DUTY	61	*	<LOD	1	0.08
PFHpA	ACTIVE DUTY	403	*	0.1	23	0.45
	NON-ACTIVE DUTY	60	*	0.078	3	0.1
PFHxS	ACTIVE DUTY	376	2.2 (2.03-2.4)	8.7	18	340
	NON-ACTIVE DUTY	59	2.19 (1.77-2.7)	9.4	2	20
PFNA	ACTIVE DUTY	406	0.38 (0.36-0.4)	0.77	19	1.7
	NON-ACTIVE DUTY	61	0.45 (0.4-0.51)	0.94	3	1.3
PFOA	ACTIVE DUTY	409	1.09 (1.02-1.16)	2.2	20	8.3
	NON-ACTIVE DUTY	61	1.12 (0.92-1.37)	2.5	3	4.8
PFOS	ACTIVE DUTY	408	2.8 (2.6-3.05)	10.0	17	65
	NON-ACTIVE DUTY	61	2.9 (2.5-3.5)	7.4	3	24

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

All result values are in ng/mL.

Includes number of serum samples with a numeric test result.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and

Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix D - Navy

Appendix D1. Total PFAS Laboratory Testing among Participating Navy Personnel, 01 October 2020 to 30 September 2021

Compound	Total Tests	Below Limit of Detection (%) ^a	Above Limit of Detection (%) ^b	Test Not Performed (%) ^c	Not Applicable (%) ^d
PFBS	331	96.35	0.6	3.0	0.0
PFHpA	331	82.8	13.9	3.3	0.0
PFHxS	331	0.0	91.25	8.75	0.0
PFNA	331	0.6	95.75	3.65	0.0
PFOA	332	3.6	93.35	3.0	0.0
PFOS	332	0.6	96.4	3.0	0.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a Percent of samples with a value below the limit of detection (0.05 ng/mL).

^b Percent of samples with a numeric value greater than the limit of detection (0.05 ng/mL).

^c Percent of samples with a value of "TNP" or "Test not performed" .

^d Percent of samples where values could not be extracted; results were uploaded to the Health Artifact and Image Management Solution (HAIMS) and not CHCS.

Includes all serum samples regardless of availability of test results.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to NHANES or CDC Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Unclassified

Appendix D2. Uni-variate Statistics for PFAS Blood Testing among Participating Navy Personnel, 01 October 2020 to 30 September 2021

Compound	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	321	*	<LOD	2	0.27
PFHpA	320	*	0.08	16	0.3
PFHxS	302	2.5 (2.33-2.77)	10.0	10	26.0
PFNA	319	0.4 (0.38-0.42)	0.79	14	1.4
PFOA	322	1.1 (1.0-1.2)	2.8	14	9.2
PFOS	322	2.76 (2.53-3.0)	11.0	13	40.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix D3. Uni-variate Statistics for PFAS Blood Testing among Participating Navy Personnel, 01 October 2020 to 30 September 2021

Compound	Type	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	ACTIVE DUTY	235	*	<LOD	1	0.26
	NON-ACTIVE DUTY	86	*	<LOD	1	0.27
PFHpA	ACTIVE DUTY	234	*	0.085	11	0.30
	NON-ACTIVE DUTY	86	*	0.08	4	0.27
PFHxS	ACTIVE DUTY	217	2.42 (2.2-2.7)	8.1	9	16
	NON-ACTIVE DUTY	85	2.86 (2.4-3.42)	12.0	4	26
PFNA	ACTIVE DUTY	234	0.399 (0.38-0.42)	0.74	11	1.4
	NON-ACTIVE DUTY	85	0.4 (0.37-0.45)	0.79	4	1.4
PFOA	ACTIVE DUTY	235	1.1 (0.99-1.2)	2.6	11	6.4
	NON-ACTIVE DUTY	87	1.1 (0.91-1.34)	3.0	4	9.2
PFOS	ACTIVE DUTY	235	2.7 (2.44-2.9)	10.0	10	27.0
	NON-ACTIVE DUTY	87	2.98 (2.45-3.63)	14.0	3	40.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix E - Other

Appendix E1. Total PFAS Laboratory Testing among Participating Other Personnel, 01 October 2020 to 30 September 2021

Compound	Total Tests	Below Limit of Detection (%) ^a	Above Limit of Detection (%) ^b	Test Not Performed (%) ^c	Not Applicable (%) ^d
PFBS	3,553	93.55	3.6	2.4	0.5
PFHpA	3,551	77.6	19	2.95	0.5
PFHxS	3,552	0.1	93.9	5.5	0.5
PFNA	3,553	0.3	96.3	2.9	0.5
PFOA	3,630	3.7	93.35	2.5	0.5
PFOS	3,574	0.65	96.15	2.7	0.5

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a Percent of samples with a value below the limit of detection (0.05 ng/mL).

^b Percent of samples with a numeric value greater than the limit of detection (0.05 ng/mL).

^c Percent of samples with a value of "TNP" or "Test not performed" .

^d Percent of samples where values could not be extracted; results were uploaded to the Health Artifact and Image Management Solution (HAIMS) and not CHCS.

Includes all serum samples regardless of availability of test results.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to NHANES or CDC Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

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Appendix E2. Uni-variate Statistics for PFAS Blood Testing among Participating Other Personnel, 01 October 2020 to 30 September 2021

Compound	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	3,451	*	<LOD	128	0.7
PFHpA	3,428	*	0.1	145	1.0
PFHxS	3,338	3.04 (2.95-3.12)	10.0	156	67.0
PFNA	3,432	0.46 (0.45-0.46)	1.1	153	8.8
PFOA	3,523	1.22 (1.19-1.26)	3.2	167	24.0
PFOS	3,460	3.2 (3.15-3.32)	11.0	162	150.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes serum samples with a numeric test result.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

Prepared by the EpiData Center, Navy and Marine Corps Public Health Center on 06 June 2022.

Appendix E3. Uni-variate Statistics for PFAS Blood Testing among Participating Other Personnel, 01 October 2020 to 30 September 2021

Compound	Type	Count	Geometric Mean ^a	95th Percentile ^b	No. > 95th Percentile	Maximum Test Result Value
PFBS	ACTIVE DUTY	--	--	--	--	--
	NON-ACTIVE DUTY	3,451	*	<LOD	128	0.7
PFHpA	ACTIVE DUTY	--	--	--	--	--
	NON-ACTIVE DUTY	3,428	*	0.1	145	1.0
PFHxS	ACTIVE DUTY	--	--	--	--	--
	NON-ACTIVE DUTY	3,338	3.04 (2.95-3.12)	10.0	156	67.0
PFNA	ACTIVE DUTY	--	--	--	--	--
	NON-ACTIVE DUTY	3,432	0.46 (0.45-0.46)	1.1	153	8.8
PFOA	ACTIVE DUTY	--	--	--	--	--
	NON-ACTIVE DUTY	3,523	1.22 (1.19-1.26)	3.2	167	24.0
PFOS	ACTIVE DUTY	--	--	--	--	--
	NON-ACTIVE DUTY	3,460	3.24 (3.15-3.32)	11.0	162	150.0

Data from Composite Health Care System (CHCS) Chemistry and Military Health System (MHS) GENESIS laboratory databases.

^a±95% Confidence Limits were calculated for the geometric mean.

^bRepresents the point at which 5% of the serum samples in the cohort exceeds that value.

<LOD means less than the limit of detection (0.05 ng/mL).

*Not calculated: proportion of results below limit of detection was too high to provide a valid result.

Includes number of serum samples with a numeric test result.

All result values are in ng/mL.

Includes Active Duty and Non-Active Duty Personnel.

Values are not directly comparable to National Health and Nutrition Examination Survey (NHANES) or Centers for Disease Control (CDC) Per- and Polyfluoroalkyl reporting.

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Contact Us

For more than a decade, the EpiData Center (EDC) has provided timely, actionable data surveillance and analysis for the Department of the Navy and Department of Defense in support of military health and readiness. The EDC's epidemiological and technical expertise informs a comprehensive, evidence-based suite of public health products regarding reportable and emerging infections, health care associated infections and patient safety, behavioral and operational health, exposure and injury analysis, and application development and data systems support.

For questions about this report or to inquire about project support, please contact the EDC at usn.hampton-roads.navmcpubhlthcenpors.list.nmcphc-epi-plls@mail.mil.