Supporting Information

Per- and polyfluoroalkyl substances (PFAS) in facemasks: Potential source of human exposure to PFAS with implications for disposal to landfills

Derek J. Muensterman[1,‡], Liliana Cahuas[1,‡], Ivan A. Titaley[2,‡,*], Christopher Schmokel[1], Florentino B. De la Cruz[3], Morton A. Barlaz[3], Courtney C. Carignan[4,5], Graham F. Peaslee[6], Jennifer A. Field[2]

[1]Department of Chemistry, Oregon State University, Corvallis, Oregon 97331, United States

[2]Department of Environmental and Molecular Toxicology, Oregon State University, Corvallis, Oregon 97331, United States

[3]Department of Civil, Construction, and Environmental Engineering, North Carolina State University, Campus Box 7908, Raleigh, North Carolina 27695-7908, United States

[4]Department of Food Science and Human Nutrition, Michigan State University, East Lansing, Michigan 48824, United States

[5]Department of Pharmacology and Toxicology, Michigan State University, East Lansing, Michigan 48824, United States

[6]Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556, United States

[‡]Co-first authors.

[*]Corresponding Author: ivan.titaley@oregonstate.edu

Phone: +1 541 737 9208, Fax: +1 541 737 0497

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Materials and Methods

Materials. High performance LC (HPLC) grade water (>99%) and methanol for nonvolatile PFAS analysis (>99%) were purchased from Fisher Scientific (Hampton, NH). Methanol for volatile PFAS analysis (≥99.5%) and ammonium acetate for nonvolatile PFAS analysis (≥97%) were purchased from VWR (Radnor, PA). Ethylene glycol for nonvolatile PFAS was purchased from Sigma-Aldrich (St. Louis, MO).

Samples. Facemasks were purchased from local stores in Notre Dame, IN. Samples were shipped to OSU in re-closable plastic bags. Listed materials composition was based on information provided on the website of the samples. Both SUD and N95 facemasks are made of polypropylene (PP). Cellulose fiber, cotton, polyether (PE)-polyurea (PUR) copolymer; PP; and polyester (PES) make up the inner; middle; and outer layers of RC-1, respectively. The RC-2 sample is made of nylon, PE-PUR copolymer for inner layer, synthetic nylon for middle layer, and micro-PES, PE-PUR copolymer for outer layer. The RC-3 samples is made up of PES and PUR. All of the layers of RC-4 are made of cotton, but the outer layer is treated with '*stain resistant addition*'. The three layers of RC-5 are made of cotton and are also treated with '*stain resistant addition*'. The RC-6 sample is made of PES and PE-PUR copolymer. No information of material composition was provided for FF, but the middle layer is made of meta-aramid.

Total Fluorine Analysis by Particle-Induced Gamma Ray Emission. Facemasks were cut to 2 × 2 cm^2 pieces with methanol rinsed scissors and were mounted to a stainless steel target frame with 1 cm diameter. Ion beam analysis was performed *ex vacuo*. In Rodowa *et al.*,[1] an inorganic fluorine calibration curve was used to determine the total fluorine in materials. In this study, total fluorine was determined based on an organic fluorine calibration curve using known amounts of PFOA. The total fluorine in nmol F/cm^2 obtained from the conversion with organic fluorine calibration curve were compared with total fluorine in nmol F/cm^2 obtained based on the

inorganic fluorine calibration curve and density of the materials. The ratio of the total fluorine between the organic and inorganic calibration points ranged from 0.1 to 22× and the linearity of both calibration curves were good ($R^2 > 0.99$). Method accuracy was calculated to be between 96 and 106% and precision was calculated to be ±5.4%.[2,3] Based on the standard response of the external calibration curve, method limit of detection (LOD) was 6.8 nmol F/cm^2 and method limit of quantitation (LOQ) was 20 nmol F/cm^2.[4]

Nonvolatile PFAS Analysis by Liquid Chromatography Quadrupole Time-of-Flight Mass Spectrometry (LC-qTOF). Analysis of nonvolatile PFAS was based on the method outlined in Muensterman, *et al*.[5] Methanol-rinsed scissor was used to cut 2 × 2 cm^2 pieces of facemasks in order to allowed free movement of the material within the centrifuge tube. Mass-labeled surrogate standards (0.9 ng) were spiked into all 15 mL centrifuge tubes prior to extraction. Methanol was heated to 60-65°C in a water bath prior to extraction. Aliquot of 3.3 mL of methanol was transferred into a 10 mL graduated cylinder using glass Pasteur pipette before the solution was transferred to the 15 mL centrifuge tubes. The tubes were immediately capped to prevent loss of solvent and each tube was placed on a wrist action shaker at a 10° rotation for 10 min. (Burrell, Model 75, Pittsburgh, PA). Samples were then centrifuged (Thermo Scientific, model Sorvall Legend X1, Waltham, MA) at 2808 g for 10 min. at ambient temperature. The supernatant was transferred to a second centrifuge tube and the extraction was repeated twice more to generate a total volume of 10 mL extracts that were then frozen overnight in a -20°C freezer in order to precipitate any other particulates remaining in the extract. The extracts were taken out of the freezer and centrifuged again at 2808 g for 10 min., after which 30 µL of ethylene glycol was added to each centrifuge tube and concentrated under gentle stream of nitrogen (N-EVAP®, Organomation, Berlin, MA) to a final volume of 150 µL. Aliquot of 50 µL

of each extract was transferred into 150 µL conical vials with 0.30 ng of each mass-labelled internal standard spiked to the vials. Extracts were stored at -20°C until analysis.

Chromatographic separations were achieved using an Agilent 1260 HPLC (Santa Clara, CA). Aliquots of 100 µL were injected onto a Zorbax Eclipse XDB-C8 (Agilent, 4.6 × 20 mm, 3.5 µm) guard column fitted with a Zorbax Eclipse Plus analytical column (Agilent, 4.6 × 75 mm, 3.5 µm) as modified after Backe *et al.*[6] The aqueous mobile phase (A) was 10 mM ammonium acetate (Fisher Scientific, Hampton, NH) in 3% v/v HPLC-grade methanol in HPLC-grade water and the organic mobile phase (B) was HPLC-grade methanol.

An AB SCIEX X500R qTOF-MS/MS system (Framingham, MA) was operated in negative mode and in electrospray ionization (ESI-) mode. Data were collected under SWATH® data-independent acquisition for both TOF-MS and MS/MS modes. Both PFBA and MPFBA were analyzed in MS/MS mode to reduce background interferences. Over the entirety of the data acquisition period, precursor ion data (TOF-MS) were collected over an *m/z* range of 100 Daltons (Da; TOF start mass) to 1250 Da (TOF stop). The accumulation time was 200 ms and the ion spray voltage was -4500 V. The source and gas parameters were: 550 ^{o}C source temperature, 60 psi ion source gasses, 35 psi curtain gas, and 10 psi collision gas. The declustering potential was -20 V with 0 V spread and the collision energy was -5 V with 0 V spread. Product ion scan (TOF-MS/MS) data were collected over an *m/z* range from 50 Da (TOF start mass) to 1200 Da (TOF stop). The accumulation time for each SWATH® window was 50 ms. Identification and quantification of target PFAS was described in Schwichtenberg *et al*.[7]

Method accuracy and precision were determined by spiking four replicate of polypropylene films with 2.25 ng of all target analytes (Table S1) and extracted as outlined above. Polypropylene film was used as representative sample due to the known presence of polymers in facemasks. Whole method accuracy, determined as percent average recovery, and

precision, calculated based on percent relative standard deviation, as well as surrogate standard recoveries were determined for nonvolatile PFAS (Tables S4 and S5).

Whole method LOD and LOQ were determined using the method of Vial and Jardy.[8] Ten 2 × 2 cm^2 polypropylene films were spiked with all nonvolatile target analytes ranging between 0.0045 to 0.45 ng and extracted and analyzed as described above. The LOD was calculated based on linear regression with 1/x weighting and method LOQ was calculated by multiplying LOD by 3.3. Once LOQs were calculated, the concentrations were compared to the lowest calibration check standard that passed the ± 30% of true value criteria. If the calculated LOQs were lower than the lowest passing calibration check standard, then the calibration check standard concentration was used as the LOQ. Both LOD and LOQ are listed in Table S4.

Nonvolatile PFAS Suspect Screening. Data from the LC-qTOF were screened for the presence of suspect nonvolatile PFAS based on the Suspect List of Possible PFAS collated by the National Institutes of Standards and Technology (NIST),[9] which were assumed to be present as the deprotonated molecular ion ($[M-H]^-$) in electrospray ionization (ESI) negative mode (ESI-), to identify suspect matches. Suspect matches were reported only if the area counts were three times higher than all instrument and method blank area counts. Only suspect nonvolatile PFAS with library and NIST list matches were reported. These tentatively identified compounds fell under Level 2b of the Schymanski confidence level.[10]

Volatile PFAS Analysis by Gas Chromatography-Mass Spectrometry. Analysis of volatile target and suspect PFAS was based on the method outlined in Muensterman, *et al*.,[5] with some modifications. Methanol-rinsed scissor was used to cut 1.5 × 1.5 cm^2 pieces of material. Samples were weighed and placed in 2 mL microcentrifuge tubes, mass-labeled surrogate standards and internal standard (150 ng) were spiked, and methanol was added to a final volume of 1500 µL. Samples were sonicated for 30 min at 25 °C and then passed through strong anion

exchange (SAX) solid phase extraction (SPE) (Phenomenex, Strata-X-A 33 μm). An aliquot (1 mL) of sample was added to a methanol-rinsed SAX SPE tube, allowed to elute by gravity flow, and collected. A 1 mL wash consisting of 90% methanol/10% isopropyl alcohol v/v was passed through the SAX SPE tube and collected with previous fraction. Strong anion exchange SPE cleaned extract was transferred to an autosampler vial and stored at -15°C until analysis.

Sample extracts were analyzed using GC-concurrent solvent recondensation large volume spitless injection coupled with mass spectrometry. Extracts (10 μL) was injected in splitless mode with an inlet temperature of 280 °C. A 4 mm i.d. single taper Topaz inlet liner with 15 mg deactivated quartz wool (Restek, Bellefonte, PA) was used. Helium was used as the carrier gas in a constant flow mode of 1 mL/min. Separations were performed using a deactivated, fused silica tubing capillary column (Agilent, 5 m × 0.53 mm i.d.) connected to an Rxi-624Sil MS capillary column (Restek, 30 m ×0.25 mm i.d., 1.40 μm film thickness). The GC oven temperature program was as follows: 50 °C for 2 min., ramped to 188 °C at a rate of 5 °C/min., then ramped to 300 °C at a rate of 15 °C/min. The Agilent 6890 GC was connected to an Agilent 5973N MS that was operated in positive chemical ionization mode in selected ion monitoring mode with methane as the reagent gas at a flow rate of 1 mL/min.

Method accuracy and precision for volatile PFAS were determined by spiking three polypropylene film replicates to give a final concentration of 50 pg/μL of FTOHs, FOSAs, and FOSEs target analytes and 5.0 pg/μL of FTAcs and FTMAcs target analytes. The LOD for volatile PFAS was determined also according to Vial and Jardy.[8] Ten 1.5 × 1.5 cm^2 polypropylene films were spiked with target volatile PFAS ranging between 0.037 to 150 ng of FTOHs, FOSAs, FOSEs and 0.00075 to 15 ng of FTACs and FTMAcs, and were extracted and analyzed as described above. The LOD was calculated based on linear regression with 1/x weighting and method LOQ was calculated by multiplying LOD by 3.3. Addition of mass-

labelled surrogate standards could result in the fragmentation in the MS leading to the presence of *m/z* ions corresponding to target volatile PFAS[11] and this has been taken into account in the LOQ determination.

Table S1: List of target nonvolatile PFAS analytes.[1]

Analyte	Acronym	Neutral Molecular Formula	Surrogate Standard
Perfluoro-n-butanoic acid	PFBA[2]	$C_4HO_2F_7$	MPFBA
Perfluoro-n-petnanoic acid	PFPeA	$C_5HO_2F_9$	M3PFPeA
Perfluoro-n-hexanoic acid	PFHxA	$C_6HO_2F_{11}$	M2PFHxA
Perfluoro-n-heptanoic acid	PFHpA	$C_7HO_2F_{13}$	M4PFHpA
Perfluoro-n-octanoic acid	PFOA	$C_8HO_2F_{15}$	M4PFOA
Perfluoro-n-nonanoic acid	PFNA	$C_9HO_2F_{17}$	M5PFNA
Perfluoro-n-decanoic acid	PFDA	$C_{10}HO_2F_{19}$	MPFDA
Perfluoro-n-undecanoic acid	PFUdA	$C_{11}HO_2F_{21}$	MPFUdA
Perfluoro-n-dodecanoic acid	PFDoA	$C_{12}HO_2F_{23}$	MPFDoA
Perfluoro-n-tridecanoic acid	PFTrDA	$C_{13}HO_2F_{25}$	MPFDoA
Perfluoro-n-tetradecanoic acid	PFTeDA	$C_{14}HO_2F_{27}$	M2PFTeDA
Perfluoro-n-hexadecanoic acid	PFHxDA	$C_{16}HO_2F_{31}$	M2PFHxDA
Perfluoropropane sulfonate	PFPrS	$C_3HO_3SF_7$	M3PFBS
Perfluorobutane sulfonate	PFBS	$C_4HO_3SF_9$	M3PFBS
Perfluoropentane sulfonate	PFPeS	$C_5HO_3SF_{11}$	M3PFBS
Perfluorohexane sulfonate	PFHxS	$C_6HO_3SF_{13}$	MPFHxS
Perfluoroheptane sulfonate	PFHpS	$C_7HO_3SF_{15}$	MPFHxS
Perfluorooctane sulfonate	PFOS	$C_8HO_3SF_{17}$	MPFOS
Perfluorononane sulfonate	PFNS	$C_9HO_3SF_{19}$	MPFOS
Perfluorodecane sulfonate	PFDS	$C_{10}HO_3SF_{21}$	MPFOS
Perfluorododecane sulfonate	PFDoS	$C_{12}HO_3SF_{25}$	MPFOS
8-chloro-perfluorooctane sulfonate	Cl-PFOS	$C_8HClF_{16}SO_3$	MPFOS
Perfluoroethylcyclohexane sulfonate	PFEtCHxS	$C_8HO_3SF_{15}$	MPFHxS
Perfluorobutane sulfonamide	FBSA	$C_4H_2O_2NSF_9$	M8FOSA
Perfluorohexane sulfonamide	FHxSA	$C_6H_2O_2NSF_{13}$	M8FOSA
Perfluorooctane sulfonamide	FOSA	$C_8H_2O_2NSF_{17}$	M8FOSA
N-methylperfluoro-1-octane sulfonamide	MeFOSA	$C_9H_4O_2NSF_{17}$	d-N-MeFOSA-M
N-ethylperfluoro-1-octane sulfonamide	EtFOSA	$C_{10}H_6O_2NSF_{17}$	d-N-EtFOSA-M
Perfluorooctane sulfonamido acetic acid	FOSAA	$C_{10}H_4O_4NSF_{17}$	d_3-N-MeFOSAA
N-methylperfluorooctane sulfonamido acetic acid	MeFOSAA	$C_{11}H_6O_4NSF_{17}$	d_3-N-MeFOSAA
N-ethylperfluorooctane sulfonamido acetic acid	EtFOSAA	$C_{12}H_8O_4NSF_{17}$	d5-N-EtFOSAA
4:2 fluorotelomer sulfonate	4:2 FTS	$C_6H_5O_3SF_9$	M2-4:2FTS
6:2 fluorotelomer sulfonate	6:2 FTS	$C_8H_5O_3SF_{13}$	M2-6:2FTS
8:2 fluorotelomer sulfonate	8:2 FTS	$C_{10}H_5O_3S_{F17}$	M2-8:2FTS

Analyte	Acronym	Neutral Molecular Formula	Internal Standard
10:2 fluorotelomer sulfonate	10:2 FTS	$C_{12}H_5O_3SF_{21}$	M2-8:2FTS
6:2 fluorotelomer carboxylic acid	6:2 FTCA	$C_8H_3O_2F_{13}$	M6:2FTA
8:2 fluorotelomer carboxylic acid	8:2 FTCA	$C_{10}H_3O_2F_{17}$	M8:2FTA
10:2 fluorotelomer carboxylic acid	10:2 FTCA	$C_{12}H_3O_2F_{21}$	M10:2FTA
3:3 fluorotelomer carboxylic acid	3:3 FTCA	$C_6H_5O_2F_7$	M6:2FTA
5:3 fluorotelomer carboxylic acid	5:3 FTCA	$C_8H_5O_2F_{11}$	M8:2FTA
7:3 fluorotelomer carboxylic acid	7:3 FTCA	$C_{10}H_5O_2F_{15}$	M10:2FTA
2H-Perfluoro-2-octenoic acid (6:2)	6:2 UFTCA	$C_8H_2O_2F_{12}$	M6:2FTUA
2H-Perfluoro-2-decenoic acid (8:2)	8:2 UFTCA	$C_{10}H_2O_2F_{16}$	M8:2FTUA
Dodecafluoro-3H-4,8-dioxanoate	ADONA	$C_7H_2O_4F_{12}$	M5PFNA
9-chlorohexadecafluoro-3-oxanonane-1-sulfonate	9Cl-PF3ONS	$C_8HF_{16}ClSO_4$	MPFOS
11-chloroeicosafluoro-3-oxaundecane-1-sulfonate	11-PF3OUdS	$C_{10}HF_{20}ClSO_4$	MPFOS
hexafluoropropylene oxide-dimer acid	HFPO-DA	$C_6HF_{11}O_3$	MHFPO-DA
bis(1H,1H,2H,2H-perfluorooctyl)phosphate	6:2 diPAP	$C_{16}H_9F_{26}O_4P$	M4 8:2 diPAP
bis(1H,1H,2H,2H-perfluorodecyl)phosphate	8:2 diPAP	$C_{20}H_9F_{34}O_4P$	M4 8:2 diPAP
Bis-[2-(N-ethyleperflurooctane-1-sulfonamido)ethyl] phosphate	diSAmPAP	$C_{24}H_{19}F_{34}N_2O_8PS_2$	M4 8:2 diPAP

[1][M-H]$^-$ adducts were used for quantification

[2]MRM transitions of 213 → 169 and 217 → 172 were used for quantification of PFBA and MPFBA, respectively, to reduce background.

Table S2: List of target volatile PFAS analytes.

Analyte	Acronym	Neutral Molecular Formula	Surrogate Standard
4:2 fluorotelomer alcohol	4:2 FTOH	$C_6H_5OF_9$	MFBET
6:2 fluorotelomer alcohol	6:2 FTOH	$C_8H_5OF_{13}$	MFHET
8:2 fluorotelomer alcohol	8:2 FTOH	$C_{10}H_5OF_{17}$	M2FOET
10:2 fluorotelomer alcohol	10:2 FTOH	$C_{12}H_5OF_{21}$	MFDET
12:2 fluorotelomer alcohol	12:2 FTOH	$C_{14}H_5OF_{25}$	MFDET
N-methyl perfluorooctane sulfonamide	MeFOSA	$C_9H_4NO_2SF_{17}$	d_3-N-MeFOSA-M
N-ethyl perfluorooctane sulfonamide	EtFOSA	$C_{10}H_6NO_2SF_{17}$	d_5-N-EtFOSA-M
N-methyl perfluorooctane sulfonamidoethanol	MeFOSE	$C_{11}H_8NO_3SF_{17}$	d_7-N-MeFOSE-M
N-ethyl perfluorooctane sulfonamidoethanol	EtFOSE	$C_{12}H_{10}NO_3SF_{17}$	d_9-N-EtFOSE-M
4:2 fluorotelomer acrylate	4:2 FTAc	$C_9H_7F_9O_2$	d_3-6:2 FTAc
6:2 fluorotelomer acrylate	6:2 FTAc	$C_{11}H_7F_{13}O_2$	d_3-6:2 FTAc
8:2 fluorotelomer acrylate	8:2 FTAc	$C_{13}H_7F_{17}O_2$	d_3-6:2 FTAc
10:2 fluorotelomer acrylate	10:2 FTAc	$C_{15}H_7F_{21}O_2$	d_3-6:2 FTAc
6:2 Fluorotelomer methylacrylate	6:2 FTMAc	$C_{12}H_9F_{13}O_2$	d_5-6:2 FTMAc
8:2 Fluorotelomer methylacrylate	8:2 FTMAc	$C_{14}H_9F_{17}O_2$	d_5-6:2 FTMAc

Table S3: List of suspect volatile PFAS analytes.

Analyte	Acronym	Neutral Molecular Formula	Surrogate Standard
14:2 fluorotelomer alcohol	14:2 FTOH	$C_{16}H_5OF_{29}$	MFDET
N-methyl perfluoropropane sulfonamidoethanol	MeFPrSE	$C_6H_8NO_3SF_7$	d_7-N-MeFOSE-M
N-methyl perfluorobutane sulfonamidoethanol	MeFBSE	$C_7H_8NO_3SF_9$	d_7-N-MeFOSE-M
N-methyl perfluoropentane sulfonamidoethanol	MeFPeSE	$C_8H_8NO_3SF_{11}$	d_7-N-MeFOSE-M
N-methyl perfluorohexane sulfonamidoethanol	MeFHxSE	$C_9H_8NO_3SF_{13}$	d_7-N-MeFOSE-M
N-methyl perfluoroheptane sulfonamidoethanol	MeFHpSE	$C_{10}H_8NO_3SF_{15}$	d_7-N-MeFOSE-M
N-ethyl perfluoroethane sulfonamidoethanol	EtFEtSE	$C_6H_{10}NO_3SF_5$	d_9-N-EtFOSE-M
N-ethyl perfluoropropane sulfonamidoethanol	EtFPrSE	$C_7H_{10}NO_3SF_7$	d_9-N-EtFOSE-M
N-ethyl perfluorobutane sulfonamidoethanol	EtFBSE	$C_8H_{10}NO_3SF_9$	d_9-N-EtFOSE-M
N-ethyl perfluoropentane sulfonamidoethanol	EtFPeSE	$C_9H_{10}NO_3SF_{11}$	d_9-N-EtFOSE-M
N-ethyl perfluorohexane sulfonamidoethanol	EtFHxSE	$C_{10}H_{10}NO_3SF_{13}$	d_9-N-EtFOSE-M
N-ethyl perfluoroheptane sulfonamidoethanol	EtFHpSE	$C_{11}H_{10}NO_3SF_{15}$	d_9-N-EtFOSE-M
4:2 fluorotelomer iodide	4:2 FTI	$C_6H_4F_9I$	d_5-6:2 FTMAc
6:2 fluorotelomer iodide	6:2 FTI	$C_8H_4F_{13}I$	d_5-6:2 FTMAc
8:2 fluorotelomer iodide	8:2 FTI	$C_{10}H_4F_{17}I$	d_5-6:2 FTMAc
10:2 fluorotelomer iodide	10:2 FTI	$C_{12}H_4F_{21}I$	d_5-6:2 FTMAc
Perfluorobutyl iodide	PFBI	C_4F_9I	d_5-6:2 FTMAc
Perfluorohexyl iodide	PFHxI	$C_6F_{13}I$	d_5-6:2 FTMAc
Perfluorooctyl iodide	PFOI	$C_8F_{17}I$	d_5-6:2 FTMAc
Perfluorodecyl iodide	PFDI	$C_{10}F_{21}I$	d_5-6:2 FTMAc
6:2 fluorotelomer olefin	6:2 FTO	$C_8H_3F_{13}$	d_5-6:2 FTMAc
8:2 fluorotelomer olefin	8:2 FTO	$C_{10}H_3F_{17}$	d_5-6:2 FTMAc
10:2 fluorotelomer olefin	10:2 FTO	$C_{12}H_3F_{21}$	d_5-6:2 FTMAc
12:2 fluorotelomer olefin	12:2 FTO	$C_{14}H_3F_{25}$	d_5-6:2 FTMAc

Table S4: Whole method precision (% RSD), whole method accuracy (% average recovery), LOD, and LOQ based on polyehtylene film (sample matrix) spiked with nonvolatile PFAS. 5000 ng/L nonvolatile PFAS were spiked for whole method precision and whole method accuracy (n = 4). 10-1000 ng/L nonvolatile PFAS were spiked for LOD (n = 8) and LOQ was calculated by multiplying LOD with 3.3.

Analyte	Whole method precision (% RSD)	Whole method accuracy (% average recovery)	LOD (µg/m^2)	LOQ (µg/m^2)
PFBA	6.3	100	0.5	1.7
PFPeA	6.2	86	0.77	2.6
PFHxA	6.1	110	0.61	2
PFHpA	6	95	0.51	1.7
PFOA	5	93	0.5	1.7
PFNA	5.5	92	0.6	2
PFDA	7.8	120	0.5	1.7
PFUdA	2.5	120	0.5	1.7
PFDoA	2.7	100	1	3.4
PFTrDA	22	86	0.5	1.7
PFTeDA	3.9	100	0.5	1.7
PFHxDA	1.2	100	0.61	2
PFPrS	6.7	85	0.5	1.7
PFBS	3.2	91	0.5	1.7
PFPeS	5.5	81	0.5	1.7
PFHxS	3.2	83	0.5	1.7
PFHpS	6.1	81	0.5	1.7
PFOS	6	89	0.5	1.7
PFNS	7.2	98	0.5	1.7
PFDS	2.7	94	0.5	1.7
PFDoS	14	88	0.5	1.7
Cl-PFOS	7.2	98	0.5	1.7
PFEtCHxS	4.8	81	0.5	1.7
FBSA	4.5	95	0.74	2.5
FHxSA	9.7	88	0.55	1.8
FOSA	7.7	85	0.52	1.7
MeFOSA	11	100	0.81	2.7
EtFOSA	4.1	120	0.75	2.5
FOSAA	6.2	130	1.2	4.2
MeFOSAA	14	110	1.1	3.8
EtFOSAA	23	120	1.2	4.2
4:2 FTS	10	110	0.71	2.4
6:2 FTS	5.1	95	1	3.4
8:2 FTS	11	110	1.2	4.2

10:2 FTS	15	310	1.2	4.2
3:3 FTCA	30	96	2.2	7.3
5:3 FTCA	35	96	1.7	5.6
7:3 FTCA	32	120	2.5	8.2
6:2 FTCA	31	160	1.4	4.6
8:2 FTCA	23	82	2	6.6
10:2 FTCA	61	130	1.8	5.8
6:2 UFTCA	17	92	1.7	5.6
8:2 UFTCA	16	130	2	6.5
ADONA	8.4	80	0.56	1.9
9Cl-PF3ONS	9.8	96	0.5	1.7
11l-PF3OUdS	4.1	91	0.5	1.7
HFPO-DA	23	110	1.1	3.7
6:2diPAP	30	41	0.77	2.6
8:2diPAP	20	110	1.2	4.2
diSAmPAP	31	61	1.2	4.2

Table S5: Nonvolatile PFAS surrogate standards recovery on matrix blank, blank spike, and samples. The recovery of M4PFOA surrogate standard was determined based on the response of M4PFOA relative to the response of M8PFOA as the internal standard. The recovery of MPFOS surrogate standard was determined based on the response of MPFOS relative to the response of M8PFOS as the internal standard. Matrix Blank refers to a sample containing no matrix and no native target analytes. Blank Spike refers to a sample containing no matrix and spiked native target analytes. Data for SUD and RC-6 (n = 3) were provided in average±standard error.

Sample Name	M4PFOA (% recovery)	MPFOS (% recovery)
Matrix Blank	89	90
Blank Spike	91	98
SUD	71±2.7	71±1.4
N95	83	88
RC-1-I	94	101
RC-1-M	76	86
RC-1-O	89	94
RC-2-I	77	82
RC-2-M	85	92
RC-2-O	86	84
RC-3	94	100
RC-4-I	11	114
RC-4-M	90	96
RC-4-O	103	110
RC-5-I	85	85
RC-5-M	77	77
RC-5-O	118	129
RC-6	92±11.8	105±48.0
FF-I	84	85
FF-M	118	119
FF-O	49	55

Table S6: Whole method precision (% RSD), whole method accuracy (% average recovery), LOD, and LOQ based on polypropylene film (sample matrix) spiked with volatile PFAS. 50 pg/µL (FTOHs, Me- and Et-FOSA, and Me- and EtFOSE) and 5 pg/µL (FTAcs and FTMAcs) volatile PFAS were spiked for whole method precision and whole method accuracy (n = 3). 0.025-100 pg/µL (FTOHs, Me- and Et-FOSA, and Me- and EtFOSE) and 0.0005-10 pg/µL (FTAcs and FTMAcs) volatile PFAS were spiked for LOD (n = 10) and LOQ was calculated by multiplying LOD with 3.3.

Analyte	Whole method precision (% RSD)	Whole method accuracy (% average recovery)	LOD (µg/m^2)	LOQ (µg/m^2)
4:2 FTOH	0.62	75	6.6	22
6:2 FTOH	0.68	68	5.4	18
8:2 FTOH	5.2	62	14	48
10:2 FTOH	7.0	72	6.3	21
12:2 FTOH	4.1	67	12	38
MeFOSA	5.5	90	11	36
EtFOSA	3.4	100	12	39
MeFOSE	11	110	15	51
EtFOSE	11	66	15	49
4:2 FTAc	8.4	140	0.095	0.31
6:2 FTAc	4.1	100	0.23	0.75
8:2 FTAc	12	92	0.27	0.90
10:2 FTAc	13	95	0.39	1.3
6:2 FTMAc	6.4	100	0.27	0.75
8:2 FTMAc	6.6	87	0.32	1.0

Table S7: Volatile PFAS surrogate standards recovery on matrix spike and samples. The recovery of volatile surrogate standard was determined based on the response of each surrogate standard relative to the response of 7:1-FTOH as the internal standard. Matrix Spike refers to a sample containing matrix and spiked mass-labeled and native analytes. Data for Matrix Spike, SUD, RC-6 (n = 3) were provided in average±standard error.

Sample Name	d_4-4:2 FTOH (% recovery)	$^{13}C_2$-d_2-6:2 FTOH (% recovery)	$^{13}C_2$-8:2 FTOH (% recovery)	$^{13}C_2$-d_2-10:2 FTOH (% recovery)	d_3-N-MeFOSA-M (% recovery)	d_5-N-EtFOSA-M (% recovery)	d_7-N-MeFOSE-M (% recovery)	d_9-N-EtFOSE-M (% recovery)
Matrix Spike	99±2.9	110±4.3	110±4.6	120±4.6	200±9.2	200±8.1	160±4.0	160±5.3
Blank Spike	67	76	72	65	29	28	38	57
SUD	66±3.3	70±2.7	64±4.3	55±3.8	26±1.7	26±2.3	26±3.2	55±4.4
N95	62	65	60	60	26	24	27	55
RC-1-I	65	68	63	63	23	22	35	45
RC-1-M	77	74	74	72	34	34	32	68
RC-1-O	72	71	72	70	37	36	32	61
RC-2-I	64	72	65	62	30	30	31	55
RC-2-M	78	85	73	75	36	38	37	65
RC-2-O	68	78	73	79	160	150	72	120
RC-3	61	66	64	67	140	150	54	110
RC-4-I	70	77	73	84	150	150	94	120
RC-4-M	61	73	74	87	190	180	78	150
RC-4-O	83	88	84	110	210	200	100	210
RC-5-I	71	79	77	79	180	170	65	130
RC-5-M	64	71	68	75	170	160	59	120
RC-5-O	67	74	70	75	180	170	89	130
RC-6	64±3.9	73±3.2	72±4.1	80±3.9	180±9.2	170±12	77±4.8	135±12
FF-I	63	70	66	70	140	140	81	110
FF-M	65	74	71	71	160	150	57	110
FF-O	70	79	74	79	170	160	64	130

Table S8: Exposure model parameter inputs. Dermal loading was estimated for each PFAS analyte by applying leachable fractions, then the concentrations were summed into a single total PFAS dermal loading (µg/cm^2) for each mask. For each receptor (child, woman, and man), total PFAS dermal loading was multiplied by 90% of their mask surface area (cm^2) and then divided by body weight (kg) to produce the total amount of PFAS (µg/kg-day). Absorption across the lungs (inhalation), gastrointestinal tract (ingestion), and skin (dermal) was assumed to be 100% for this preliminary assessment. Risk was calculated as a hazard index by dividing each exposure estimate by a reference dose.

Parameter	Description	Input Value(s)			Units
		Child	Adult Female	Adult Male	
PFAS Concentration	Sum of the maximum detected concentrations of PFAS analytes.	0.0046 (SUD), 0.909 (RC-6), and 0.2465 (FF)			µg/cm^2
Body Weight	Average body weight and normal distribution based on the standard deviation.[12,13]	Mean=13.8 SD=1.6	Mean=65.0 SD=15.2	Mean=74.8 SD=15.9	kg
Product Surface Area	Measured mask surface area.	170	230	240	cm^2
Product Thickness	Measured mask thickness.	1			mm
Inhalation: Emission from solid material					
Product Density	Measured mass of the mask per cubic centimeter.	0.085 (SUD), 0.470 (RC-6), and 0.193 (FF)			g/cm^3
Diffusion Coefficient	Recommended default value.[14]	0.00000001			m^2/sec
Weight Fraction Substance	Total measured amount of PFAS per unit weight of the mask.	0.0001 (SUD), 0.0002 (RC-6), and 0.00128 (FF)			%

Product/Air Partition Coefficient	Based on the octanol-air partition coefficient (K_{oa}) reported by ChemSpider[15] for 6:2 FTOH (anayte measured at the highest concentration in all of the mask samples) using EpiSuite as this value is not available for PFAS.	4.812			log_{10}
Room Volume	The volume of air between the mask and face would be approximately 0.0002 m^3 for a mask 1 cm from the face. However, the program requires a minimum value of 0.001 m^3.	0.001			m^3
Ventilation Rate	Number of total air exchanges per hour. Assumed the air between the mask and face exchanges fully every 10 breaths. Calculated based on breaths per minute of 30 for children and 20 for adults.[12,13]	180	120	120	per hour
Inhalation Rate	Volume of air inhaled per unit time. Assumed mean moderate intensity activity level of moderate. Sensitivity analysis used the 95th% for high intensity.[12,13]	mean=1.26 high=3.18	mean= 1.39 high=3.80	mean=1.74 high=4.98	m^3/hour
Mass Transfer Coefficient	Diffusion rate constant that relates the mass transfer rate, mass transfer area, and concentration change as driving force. Calculated using Langmuir's equation.[14]	1.05			meters per hour
Incidental Ingestion: Product Mouthing					
Weight fraction substance	Measured amount of PFAS per unit mass of the mask.	0.0001 (SUD), 0.0002 (RC-6), and 0.00128 (FF)			%
Product amount	Total mass of the mask.	1.44 (SUD), 8.03 (RC-6), 3.28 (FF)	1.94 (SUD), 10.9 (RC-6), 4.44 (FF)	2.03 (SUD), 11.3 (RC-6), 4.63 (FF)	g

Exposure duration	Amount of time mask is worn per unit time. Assumed to be a full day in daycare or at work, plus two hours in shared indoor spaces.	10			hours/day
Contact area	Amount of the mask that is mouthed. Estimated assuming that accounts for 1/3 of the mask.	56	76	79	cm^2
Initial migration rate	Amount of PFAS migrating from the mask per unit time. Amount of PFAS that migrates out of the mask per unit amount of material. Based on the maximum value of 90% derived by Wu *et al*. (2020) for PFAS treated upholstery soaked in synthetic sweat for 2 hours period.[16] This converts to 0.025% per second, which was then multiplied by the mass of PFAS per cm^2 of mask fabric.	0.0057			g/cm^2 per second
Dermal: Direct Product Contact					
Exposed Area	Amount of skin covered by the mask.	170	230	240	cm^2
Leachable Fraction	Fraction of available PFAS that migrates to the skin per unit amount of material. Based on the maximum value derived by Wu *et al*. (2020) for PFAS treated upholstery soaked in synthetic sweat for 2 hours period.[16]	Analyte specific, ranges from 0 to 90%.			%
Dermal Loading	Amount of PFAS that contacts the skin per unit amount of material. Calculated for each mask and analyte using analyte specific leachable fractions.	0.0032 (SUD), 0.0434 (RC-6), 0.1033 (FF)			$\mu g/cm^2$
Skin Contact Factor	Percentage of the mask that touches the face.	90			%

Table S9: Disposal scenario to estimate mass release of PFAS due to pandemic-related surge in use of face covering. Mask area was assumed to be 160 cm^2.

Input	Value	Justification
U.S. Population	328 million[17]	
Children who are likely not required to wear masks (<5 years)	6%	Based on the U.S. Census[17]
People who do not follow mask rules	40% (Likely Case)[a] 0% (Extreme Case)[a]	
Landfill Disposal Rate for Mask	81%	Estimated from a U.S. EPA Report[18]
Mask use Frequency	3.6 units/week (Likely Case)[a] 7 units/week (Extreme Case)[a]	Estimated based on the result on the type and frequency of mask usage survey[19]
Types of Facemasks SUD N95 RC Other	 48.3% 16.3% 34% 1.5%	Adapted from ref.[19]
Mass of PFAS in Each Facemask SUD N95 RC Other	 0.75 µg/mask 0.25 µg/mask 5.3 µg/mask (median value) 56 µg/mask	Calculated from data in the current study (Tables S8 and S9) assuming facemask area of 165 cm^2
% PFAS Leaching	1% (Likely Case)[a] 100% (Extreme Case)[a]	Amount of PFAS that would potentially be released into the leachate
Volume of leachate generated in the US	61.5 million m^3	Estimate from Lang *et al*.[20]

[a]Likely Case refers to likely disposal conditions, while Extreme Case refers to upper bound of the leaching potential by varying the input parameters to maximize the PFAS input to landfill.

Equation S1: Estimation of mass PFAS released to landfill leachate or wastewater:

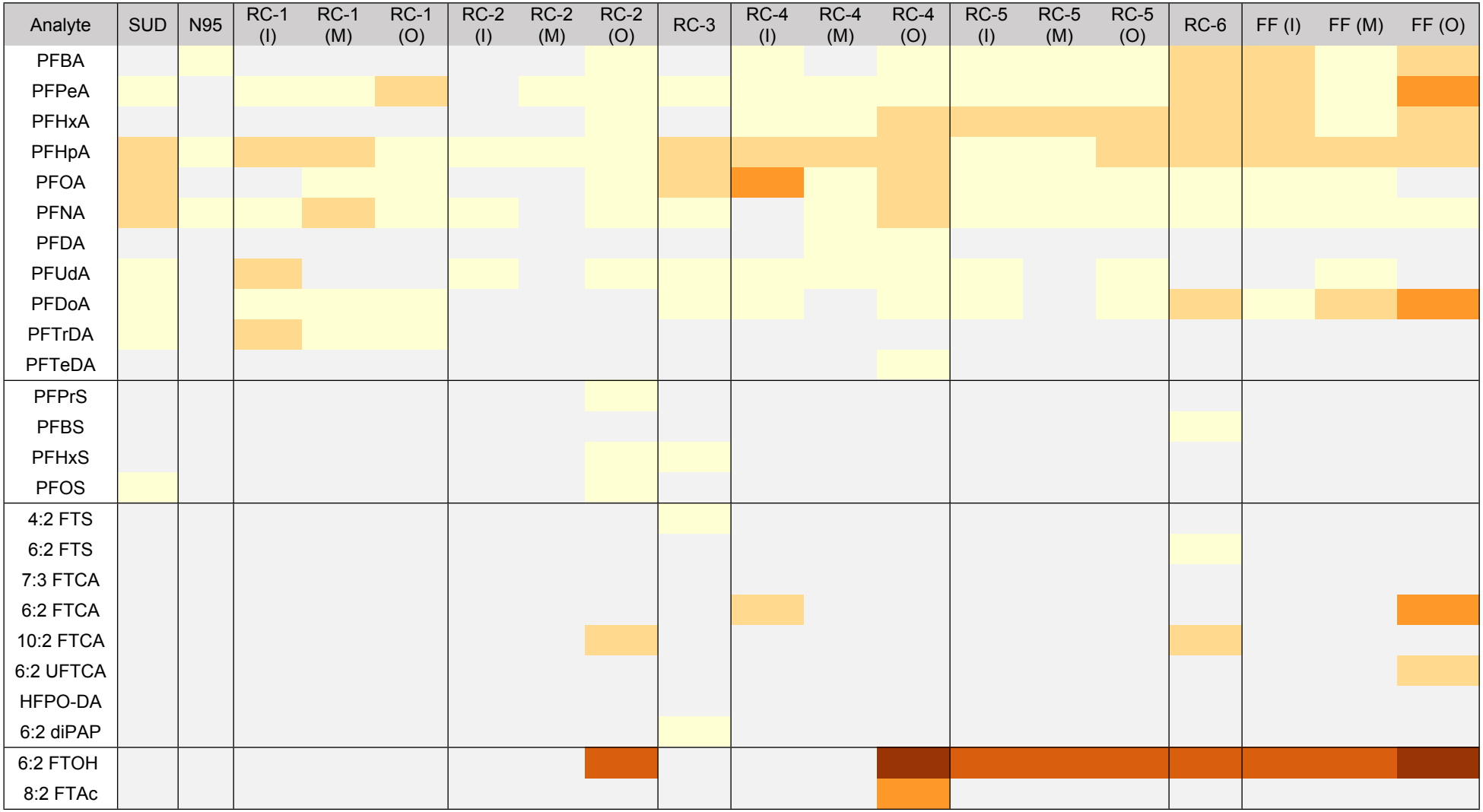
$$U.S.\ Population \times (1 - \%\ of\ Children\ not\ required\ to\ wear\ masks) \times (1 - \%\ who\ do\ not\ follow\ mask\ rumes) \times Mask\ Use\ Frequency \times Landfill\ disposal\ rate \times \%\ of\ total\ masks\ as\ SUD\ or\ N95 \times Mass\ of\ PFAS\ per\ mask\ (for\ SUD\ and\ N95) \times\ fraction\ of\ PFAS\ released\ to\ leachate \times Volume\ of\ leachate$$

Table S10: Facemasks by type, numbers of layers, material composition, price per unit, total fluorine, and summed concentrations of nonvolatile and volatile PFAS fluorine per-layer. Nonvolatile and volatile PFAS data were provided in the same unit as total fluorine for comparison purposes. Samples SUD and RC-6 were analyzed in triplicates and the data are provided as average±standard error when applicable. The material composition was based on information provided on the website of the facemasks. Only information about the middle layer of the FF mask was available (*e.g.*, meta-aramid).

Type of facemask[1]	Layers	Listed material composition	Price per unit[2]	Total Fluorine (nmol F/cm^2)[3]	Nonvolatile PFAS (nmol F/cm^2)	Volatile PFAS (nmol F/cm^2)[4]
SUD	One	Polypropylene (PP)	$	<LOD	0.0016±0.00043	<LOD
N95	One	PP	$	<LOD	0.00054	<LOD
RC-1	inner (I)	Cellulose fiber, cotton, polyether (PE)-polyurea (PUR) copolymer	$	<LOD	0.0027	<LOD
	middle (M)	PP		<LOQ	0.00081	<LOD
	outer (O)	Polyester (PES)		<LOD	0.0013	<LOD
RC-2	I	Nylon, PE-PUR copolymer	$$$	<LOQ	0.00067	<LOD
	M	Synthetic nylon		<LOD	0.00080	<LOD
	O	Micro-PES, PE-PUR copolymer		7,100	0.00351	0.079
RC-3	One	PES, PUR	$	<LOD	0.0055	<LOD
RC-4	I	Cotton	$	<LOQ	0.0041	0.029
	M	Cotton		<LOQ	0.0019	<LOD
	O	Cotton with stain resistant addition		7,600	0.0043	0.82
RC-5	I	Cotton with stain resistant addition	$$	7,700	0.0022	0.38
	M	Cotton with stain resistant addition		1,500	0.0013	0.39
	O	Cotton with stain resistant addition		8,100	0.0028	0.40
RC-6	One	PES, PE-PUR copolymer	$$	40,000±18,000	0.024±0.0041	0.90±0.057
FF	I	Proprietary	$$$$	160	0.013	0.17
	M	Meta-aramid		23	0.00066	0.094
	O	Proprietary		460	0.028	4.4

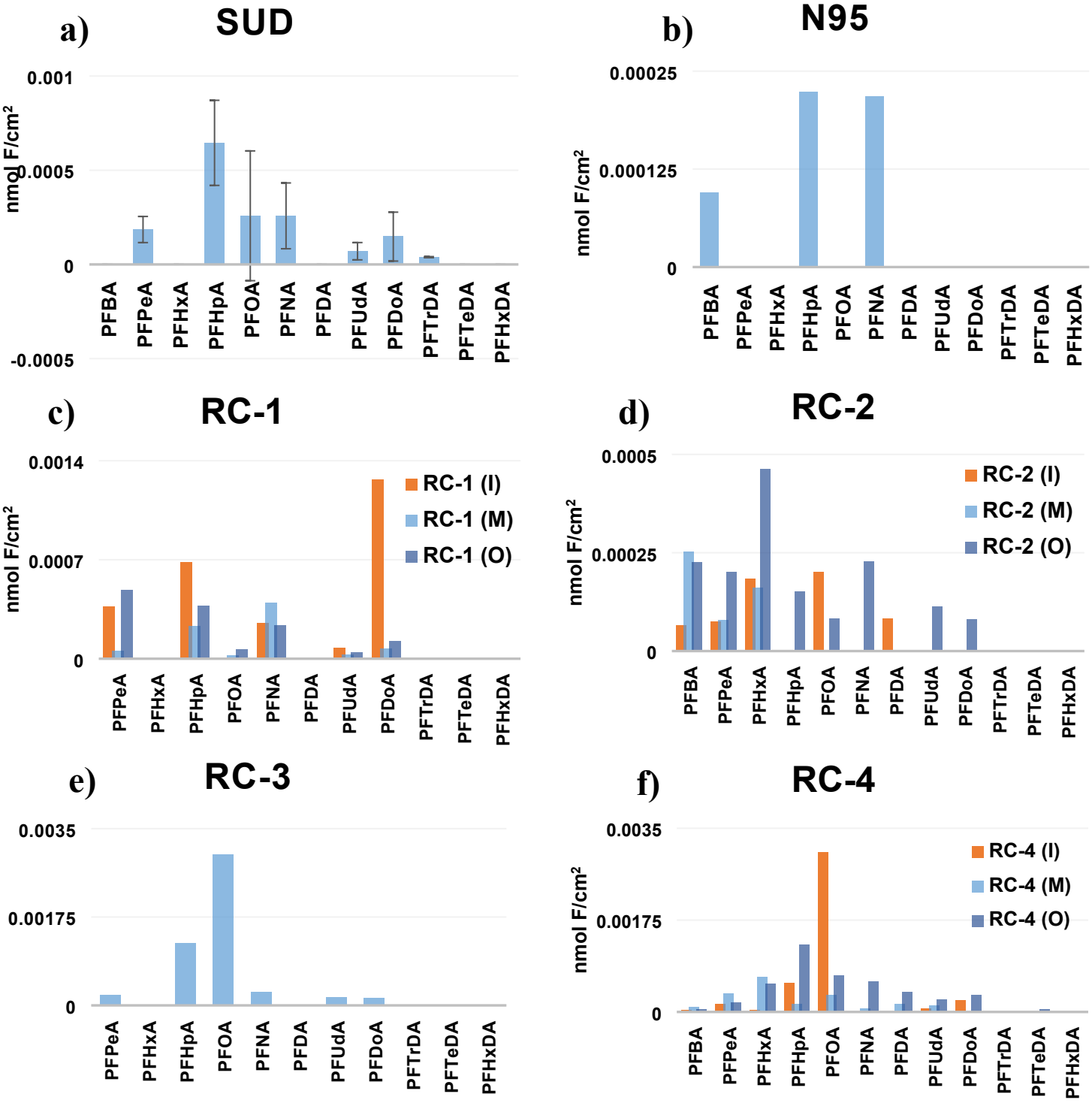
[1]SUD = surgical single-use disposable; N95 = N95; RC = reusable cloth facemasks; FF = facemask advertised to firefighters. [2]Price per unit (US dollars): $ = <1-14; $$ = 14-28; $$$ = 28-42; $$$$ = 42-56, as of Dec 2021. [3]LOD = limit of detection (6.8 nmol F/cm^2); LOQ = limit of quantification (20 nmol F/cm^2). [4]LOD = 0.00027-0.047 nmol F/cm^2.

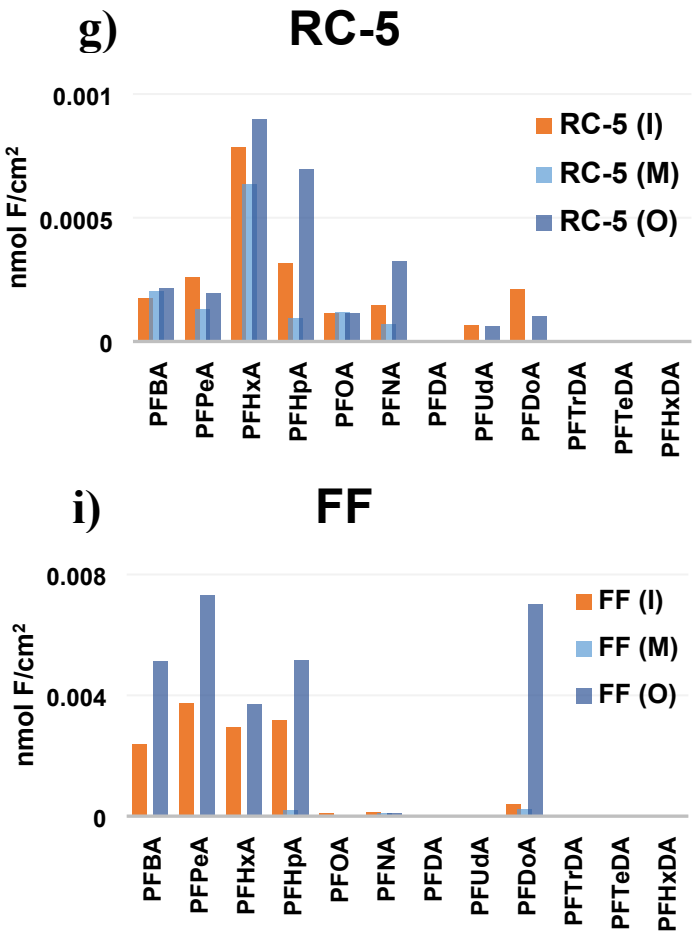
Figure S1: Heat map of nonvolatile and volatile PFAS (ng/g) in facemasks per layer.[1]

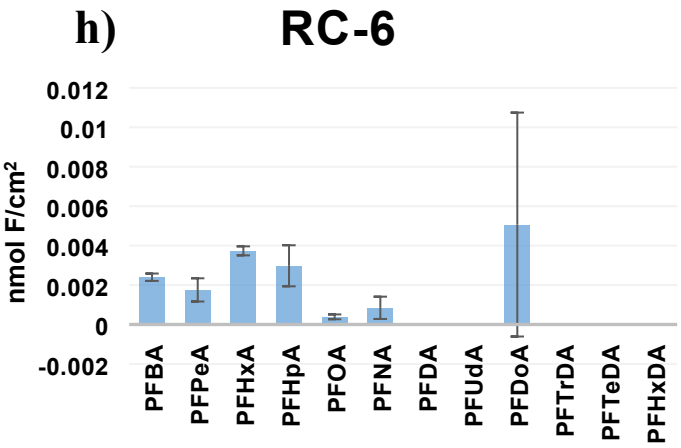


[1]Only PFAS with at least one > LOQ concentration included

Figure S2: Profiles of detectable PFCAs (C4-C14) for a) surgical single-use disposable (SUD); b) N95, c) Reuseable cloth-1 (RC-1), d) RC-2, e) RC-3, f) RC-4, g) RC-5, h) RC-5; and i) specialty facemask advertised to firefighters (FF). RC-1 , -2, -4, -5, and FF include an inner, outer and middle layer and error bars represent standard deviation from $n = 3$ replicates.




g)
RC-5
0.001
0.0005
0
nmol F/cm²
RC-5 (I)
RC-5 (M)
RC-5 (O)
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUdA
PFDoA
PFTrDA
PFTeDA
PFHxDA


h)
RC-6
0.012
0.01
0.008
0.006
0.004
0.002
0
-0.002
nmol F/cm²
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUdA
PFDoA
PFTrDA
PFTeDA
PFHxDA

i)
FF
0.008
0.004
0
nmol F/cm²
FF (I)
FF (M)
FF (O)
PFBA
PFPeA
PFHxA
PFHpA
PFOA
PFNA
PFDA
PFUdA
PFDoA
PFTrDA
PFTeDA
PFHxDA

Table S11: Target analyte concentrations (μg/m^2) of individual nonvolatile PFASs analyzed by LC-qTOF. Data for SUD and RC-6 (n = 3) were provided in average±standard error.

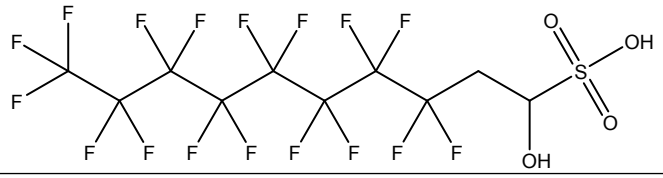
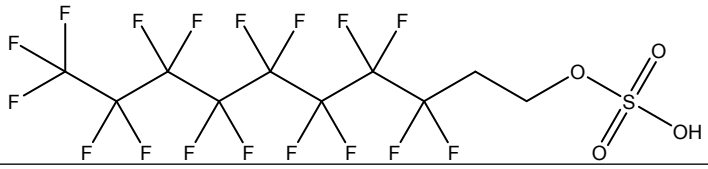
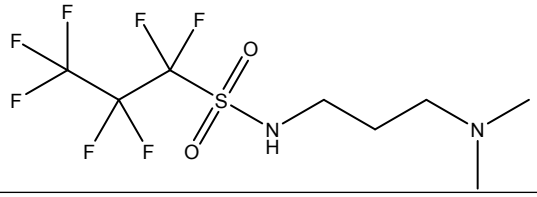
Analyte	SUD	N95	RC-1			RC-2			RC-3	RC-4			RC-5			RC-6	FF			LOQ
			I	M	O	I	M	O		I	M	O	I	M	O		I	M	O	
PFBA	<LOD	**2.9**	<LOD	<LOQ	<LOQ	<LOD	<LOQ	**6.9**	<LOQ	<LOQ	<LOQ	<LOQ	**5.4**	**6.2**	**6.6**	**73±3.2**	**72**	<LOQ	**160**	**1.7**
PFPeA	**5.4±1.1**	<LOQ	**11**	**1.6**	**14**	<LOQ	**7.4**	**5.9**	**5.9**	**4.3**	**2.9**	**5.4**	**7.6**	**3.9**	**5.7**	**52±9.8**	**110**	<LOQ	**210**	**2.6**
PFHxA	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**2.1**	**2.2**	**13**	<LOQ	<LOQ	**9.8**	**15**	**22**	**18**	**26**	**110±3.7**	**84**	<LOQ	**110**	**2**
PFHpA	**18±3.8**	**6.3**	**19**	**6.4**	**10**	**5.2**	**4.5**	**4.2**	**35**	**16**	**19**	**36**	**8.9**	**2.7**	**19**	**82±16**	**89**	**5.2**	**140**	**1.7**
PFOA	**7.1±5.5**	<LOQ	<LOQ	<LOQ	**1.8**	<LOQ	<LOQ	**2.3**	**82**	**84**	**4.1**	**19**	**3.1**	**3.3**	**3.1**	**11±1.8**	**2.4**	<LOD	<LOQ	**1.7**
PFNA	**7.2±2.9**	**6**	**6.9**	**11**	**6.4**	**5.5**	<LOQ	**6.2**	**7.3**	<LOD	**8.7**	**16**	**4**	<LOQ	**8.9**	**23±8.7**	**3.9**	**2.7**	**2.5**	**2**
PFDA	<LOQ	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	**1.8**	**10**	<LOD	<LOQ	<LOQ	<LOD	<LOD	<LOD	<LOD	**1.7**
PFUdA	**1.9±0.85**	<LOD	**2**	<LOQ	<LOQ	**2.2**	<LOQ	**3.1**	**4.1**	<LOQ	**4.2**	**6.3**	**1.8**	<LOQ	**1.7**	<LOD	<LOQ	<LOQ	<LOQ	**1.7**
PFDoA	**3.9±2.0**	<LOD	**34**	<LOQ	<LOQ	<LOQ	<LOD	<LOQ	**3.9**	**6.1**	<LOQ	**8.7**	**5.7**	<LOD	<LOQ	**140±87**	**10**	**6.4**	**190**	**3.4**
PFTrDA	**1±0.053**	<LOD	<LOQ	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOQ	<LOD	**1.7**
PFTeDA	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.3**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
PFHxDA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**2**
PFPrS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**9.4**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
PFBS	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**26±17**	<LOQ	<LOD	<LOD	**1.7**
PFPeS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
PFHxS	<LOQ	<LOQ	<LOQ	<LOQ	<LOD	<LOQ	<LOQ	**2.1**	**4.5**	<LOQ	<LOQ	<LOQ	<LOQ	<LOD	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**1.7**
PFHpS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
PFOS	**1.1±0.16**	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**4**	<LOQ	<LOD	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	<LOQ	**1.7**
PFNS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
PFDS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
PFDoS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
Cl-PFOS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
PFEtCHxS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
FBSA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**2.5**
FHxSA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.8**
FOSA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
MeFOSA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**2.7**

EtFOSA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**2.5**
FOSAA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**4.2**
MeFOSAA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**3.8**
EtFOSAA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**4.2**
4:2 FTS	<LOQ	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	**9.9**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**2.4**
6:2 FTS	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOQ	<LOQ	<LOQ	<LOQ	**21±0.33**	<LOQ	<LOD	<LOD	**3.4**
8:2 FTS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**4.2**
10:2 FTS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**4.2**
3:3 FTCA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**7.3**
5:3 FTCA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**5.6**
7:3 FTCA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**11**	<LOD	<LOD	<LOD	**8.2**
6:2 FTCA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**11**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOQ	**390**	**4.6**
8:2 FTCA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**6.6**
10:2 FTCA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**30**	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOQ	<LOQ	**110±24**	<LOD	<LOD	<LOD	**5.8**
6:2 UFTCA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**59**	**5.6**
8:2 UFTCA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**6.5**
ADONA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.9**
9Cl-PF3ONS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
11l-PF3OUdS	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.7**
HFPO-DA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**2.5**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**3.7**
6:2 diPAP	<LOQ	<LOD	<LOD	<LOD	<LOQ	<LOQ	<LOD	<LOD	**2.5**	<LOD	<LOD	<LOQ	<LOQ	<LOD	<LOQ	<LOD	<LOD	<LOQ	<LOD	**2.6**
8:2 diPAP	<LOQ	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	**4.2**
diSAmPAP	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**4.2**

Table S12: Target analyte concentrations (μg/m^2) of individual volatile PFAS analyzed by GC-MS. Data for RC-6 (n = 3) were provided in average±standard error.

Analyte	SUD	N95	RC-1			RC-2			RC-3	RC-4			RC-5			RC-6	FF			LOQ
			I	M	O	I	M	O		I	M	O	I	M	O		I	M	O	
4:2 FTOH	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**22**
6:2 FTOH	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**22**	<LOD	<LOQ	<LOD	**220**	**100**	**110**	**110**	**250±17**	**48**	**26**	**1200**	**18**
8:2 FTOH	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**48**
10:2 FTOH	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOQ	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**21**
12:2 FTOH	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**38**
MeFOSA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**36**
EtFOSA	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**39**
MeFOSE	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**51**
EtFOSE	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**49**
4:2 FTAc	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**0.31**
6:2 FTAc	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**0.75**
8:2 FTAc	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**14**	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**0.90**
10:2 FTAc	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.3**
6:2 FTMAc	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**0.75**
8:2 FTMAc	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	<LOD	**1.0**

Table S13: Electrofluorination (ECF)- and fluorotelomer (FT)-based suspect nonvolatile PFAS and their NIST numbers,[9] structures (Level 2b), and reports of occurrence in the literature.

Suspect	Facemask	NIST Number	Structure	Reported Occurrence in Literature
1-OH-8:2 FTS (FT)	RC-4-O	3195		Barzen-Hanson *et al.*, 2017[21]
8:2 FTOS (FT)	RC-4-O	3517		Inferred by Tseng *et al.*, 2014[22]
AmPr-FPrSA (ECF)	RC-6	3455		D'Agostino and Mabury, 2014[23]

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