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# PFAS fate and transport in semi-arid region soils, New Mexico, USA

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At Cannon Air Force Base (CAFB) in the state of New Mexico in the southwestern United States, per- and polyfluoroalkyl substances (PFAS) have been detected in soil on base and in groundwater from wells located both on and down gradient off base. The mechanisms controlling PFAS fate and transport are unknown, particularly transport through the thick (> 100m) vadose zone and what influences PFAS plume composition. The region is semi-arid receiving an average of 33 cm of precipitation per year—notably less than most areas where PFAS occurrence has been studied. PFAS sources at CAFB include current and former firefighting training areas where aqueous film forming foam (AFFF) has been released, wastewater treatment plant effluent, and irrigated regions that have used treated wastewater. As part of a larger study of the fate, transport, and source fingerprinting of PFAS in the groundwater, we collected seven soil cores, between 4.3 m and 6.4 m deep, from likely PFAS source areas around CAFB and one background site. Soil cores were analyzed for target PFAS compounds, total oxidizable precursor assay, protein content, $Cl^-$, $F^-$, $SO_4^-$, $NO_3^-$, total organic carbon, cation exchange capacity, and pH. Physical properties such as soil particle size distribution, oxide composition, moisture content, and water potential were also analyzed. All soils had relatively elevated pH (mean 9.1, n=33) and high $F^-/Cl^-$ mass concentration ratios (median 0.9) suggesting PFAS contributing $F^-$ to soils. PFAS composition differed markedly between AFFF release sites and the former sewage lagoon. Total PFAS soil concentrations were highest at CAFB's active and former fire training areas (up to 5,578 ng/kg) followed by a former sewage lagoon and a playa lake that receives treated effluent (~95 ng/kg). PFAS composition also differs between PFAS sources with the active firefighting area being dominated by 6:2 fluorotelomer sulfonic acid (FTS) while the former fire training area's PFAS composition is a mix of 6:2 FTS, 4:2 FTS, PFHxA, PFPeS, and PFHxS. Additional evaluation of controls on PFAS composition between source areas and modeled transport through soils is underway.