

# Estimating Safe Level of PFOA/PFOS in Human Blood Using Clinical Margins-of-Safety

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**Background/Objectives.** Compared to other environmental contaminants (e.g., heavy metals, formaldehyde, PCBs, etc.), PFOA and PFOS are relatively nontoxic to mammals and human studies that have found an epidemiological “link” to other diseases in humans (ulcerative colitis, testicular cancer, elevated cholesterol, hypertension) are weak. Despite this, the long half-life of PFOA/PFOS in humans has resulted in one of the lowest drinking water advisories ever issued by USEPA (70 ppt). This study estimates a “safe” level of PFOA/PFOS in human blood using conservative margins-of-safety identified for baseline levels of other ubiquitous environmental contaminants.

**Approach/Activities.** Using the NHANES (National Health and Nutrition Examination Survey) database, we identified “normal” background levels of environmental contaminants in human blood (heavy metals, BTEX, MTBE, PCBs, DDT). We then identified clinical “Reference Values” (i.e., what is the normal range in human blood) and “Critical Values” (i.e., what is the lowest blood concentration that necessitates a clinical intervention) for each contaminant (if available). We then divided the critical value for each contaminant by the average (mean) concentration observed in human blood to obtain a margin-of-safety. Using the calculated ranges for the resulting margin-of-safety, we then estimated a “safe” level of PFOA/PFOS in human blood. This assumption of safety is based on the concept that the inherent potency of PFOA/PFOS would always be less (lower toxicity given the same concentration) than the any of contaminants that have routinely been monitored in humans in the current NHANES database.

**Results/Lessons Learned.** For cyanide and heavy metals, the average (mean) values cited in the 2016 NHANES Report fell within the normal ranges cited for clinical Reference Values. The mean concentration of PFOA (~3 µg/L) was lower than a normal blood level for cyanide (~4 µg/L) and the mean concentration of PFOS (6.3 µg/L) was slightly lower than the normal blood level of lead (~11.2 µg/L). The lowest margin-of-safety identified for the range of contaminants evaluated was a factor of ~10. In the US, the levels of PFOA/PFOS measured in human blood for a “high-exposure community” following exposure to contaminated groundwater would be about 10 times the levels presented above. Based on our analysis, and knowing that heavy metals are clearly more potent than PFOA/PFOS in terms of either acute or chronic effects, we opine that the current levels of PFOA and PFOS in the bloodstream of the U.S. population would not present either a short-term nor a long-term risk.