RoseyFields PFOS Risk Assessment Methodology

Chemical-Specific Toxicological Basis for Human Health Risk Assessment of Perfluorooctane Sulfonic Acid (PFOS)

RoseyFields conducts PFOS risk assessments using the following methodology, applying the best available peer-reviewed toxicological, epidemiological, and pharmacokinetic science to derive defensible, case-ready toxicity values — an oral reference dose (RfD) and an oral cancer slope factor (CSF) — and to translate those values into site- and plaintiff-specific hazard and risk estimates for regulatory and litigation support work.

1. Chemical Identity, Regulatory Background, and Exposure Sources

1.1 Chemical Identity

Perfluorooctane sulfonic acid (PFOS; CASRN 1763-23-1; C8HF17O3S; molecular weight 500.13 g/mol) is a fully fluorinated, eight-carbon perfluoroalkyl sulfonate belonging to the perfluoroalkyl acid (PFAA) family within the broader per- and polyfluoroalkyl substances (PFAS) class of anthropogenic chemicals. PFOS exists as linear and branched isomers and, at environmentally and physiologically relevant pH, is present almost entirely as the sulfonate anion; RoseyFields' assessments therefore apply to all isomers and nonmetal salts of PFOS. The carbon–fluorine backbone that defines the PFAS class confers exceptional resistance to hydrolysis, photolysis, and biodegradation, making PFOS environmentally persistent and, because of its protein-binding affinity, bioaccumulative in serum and liver tissue (Buck et al., 2011; Kwiatkowski et al., 2020).

1.2 Regulatory Background

PFOS was manufactured and used from the 1950s through the early 2000s in aqueous film-forming foam (AFFF), carpets, textiles, paper coatings, and industrial surfactant applications. U.S. production was voluntarily phased out by its principal manufacturer between 2000 and 2002, and EPA subsequently used Toxic Substances Control Act significant new use authority to require notice of any future manufacture or import. PFOS has been the subject of successive EPA toxicological reviews, evolving state and federal drinking water guidance and enforceable limits, and differing cancer classifications among agencies — EPA's current weight-of-evidence descriptor is Likely to Be Carcinogenic to Humans, while other bodies have reached different conclusions using different classification criteria. RoseyFields tracks the regulatory and classification landscape for each matter but derives its own quantitative toxicity values using the dose-response methodology described in Sections 3 through 7 below, so that values remain traceable to primary study data rather than to a single regulatory pronouncement.

1.3 Exposure Sources and Pathways

PFOS is one of the most frequently detected PFAS compounds in ambient and drinking water. A review of global surface water monitoring data found PFOS concentrations spanning roughly eight orders of magnitude, from the sub-ng/L range to occasional µg/L-level detections near manufacturing or AFFF-impacted sites, with most reported U.S. concentrations below 300 ng/L (Jarvis et al., 2021). Because PFOS was in wide industrial and consumer use and is highly persistent, PFOS-contaminated drinking water supplies — particularly those near current or former fluorochemical manufacturing facilities, industrial dischargers, and sites of historical AFFF use (military installations, airports, firefighter training areas) — are the exposure pathway RoseyFields evaluates most frequently in litigation and regulatory matters. Other relevant pathways include dietary intake (particularly

fish and other foods from contaminated water bodies), incidental soil and dust ingestion, historical use of PFOS-treated consumer products, and, in occupational settings, dermal contact and inhalation. PFOS is also a highly persistent biomarker of internal dose: it is detectable in human serum in the large majority of the general population, reflecting its long elimination half-life and historical ubiquity, which is central to the dose-reconstruction methods described in Section 8.

2. Point-of-Departure (POD) Selection

RoseyFields' POD selection follows a structured hierarchy: for each of the health outcomes with the strongest weight of evidence — hepatic, immune, cardiovascular, and developmental effects — medium- and high-confidence human epidemiological studies are preferred over animal toxicological studies whenever the epidemiological database is adequate for dose-response modeling, because human data eliminate interspecies extrapolation uncertainty and are more directly relevant to real-world exposure levels. Within the epidemiological literature, studies with exposure levels near the range of typical environmental (non-occupational) human exposure, with well-characterized dose-response data, and with adequate control for confounding and co-exposure to other PFAS are prioritized over higher-exposure occupational cohorts or studies with methodological limitations.

2.1 Hepatic Effects — Increased Serum ALT

Serum alanine aminotransferase (ALT) was selected as the critical hepatic biomarker because it is a well-established, clinically meaningful indicator of hepatocellular injury and was the most consistently and robustly reported liver endpoint across the epidemiological database. Of the candidate studies, Gallo et al. (2012) — a study of more than 30,000 adults in the C8 Health Project reporting a statistically significant trend of increasing ALT across PFOS exposure deciles — and Nian et al. (2019), a large Chinese cohort near a fluoropolymer manufacturing center, were both carried forward for benchmark dose modeling. Nian et al. (2019) was ultimately selected as the critical study because PFOS was the predominant PFAS in that population, minimizing confounding from co-occurring PFAS exposures that complicate interpretation of mixed-exposure cohorts.

2.2 Immune Effects — Decreased Vaccine Antibody Response

Decreased antibody concentration following childhood vaccination (diphtheria, tetanus, rubella) was selected as the critical immune endpoint because it reflects a functional immunosuppressive effect with direct public health relevance, is biologically coherent with immunotoxicity findings across both epidemiological and animal data, and has been observed at multiple time points and in multiple cohorts. Budtz-Jørgensen and Grandjean (2018), reporting reduced anti-diphtheria antibody concentrations in Faroese children, was selected as the critical study because it produced a well-fitting, statistically significant model and explicitly adjusted for co-exposure to other PFAS, minimizing confounding in the resulting POD.

2.3 Cardiovascular Effects — Increased Total Cholesterol

Increased serum total cholesterol was selected as the critical cardiovascular endpoint. Two candidate studies excluding participants on cholesterol-lowering medication — Dong et al. (2019), using the NHANES general-population cohort, and Steenland et al. (2009), using the high-exposure C8 Health Project cohort — were modeled. Dong et al. (2019) was selected as the critical study based on greater confidence in the regression modeling; the resulting candidate RfD was numerically identical to that derived from Steenland et al. (2009).

2.4 Developmental Effects — Decreased Birth Weight

Decreased mean birth weight was selected as the critical developmental endpoint given the size, consistency, and clinical significance of the underlying database: the majority of available high- and medium-confidence cohort studies reported inverse associations between maternal PFOS and birth weight, and low birth weight is an established predictor of infant morbidity/mortality and later-life cardiometabolic and cognitive outcomes. Three high-confidence prospective cohorts with first- or early-trimester PFOS measurements — Wikström et al. (2020), Sagiv et al. (2018), and Darrow et al. (2013) — were modeled. Wikström et al. (2020), drawn from the Swedish SELMA cohort, was selected as the critical study because its exposure levels are most comparable to current general-population exposure in the United States and its benchmark dose model was based on a statistically significant regression parameter.

2.5 Role of Animal Toxicological Data

A parallel set of PODs was derived from chronic and developmental animal toxicological studies — including hepatocellular necrosis in Butenhoff et al. (2012), decreased pup body weight in Luebker et al. (2005a, 2005b), decreased fetal body weight in Lee et al. (2015), and decreased antibody response in Zhong et al. (2016) — selected for study quality, exposure-window relevance, and dose-response characteristics. These animal-based candidate values were consistently two to three orders of magnitude higher (less protective) than the epidemiology-based candidates, reflecting residual interspecies uncertainty even after pharmacokinetic dose conversion. Because adequate human data were available for all four prioritized health outcomes, RoseyFields' methodology follows current risk assessment practice in treating the animal toxicological database as qualitative, weight-of-evidence support rather than as the quantitative basis for the RfD.

3. Pharmacokinetic Modeling and Dose Conversion

Because PFOS exhibits nonlinear, saturable renal resorption and a long, species- and life-stage-dependent elimination half-life, RoseyFields converts all administered animal doses and modeled internal-dose PODs to human equivalent external doses using two linked pharmacokinetic models rather than default body-weight scaling.

3.1 Animal Internal Dosimetry

Animal PODs are converted from administered dose to an internal serum dose metric using the three-compartment, saturable-resorption model of Wambaugh et al. (2013), which is parameterized for mice, rats, and cynomolgus monkeys — the species used in the toxicological database. This model was selected because it demonstrated good agreement with out-of-sample concentration-time datasets published after the model's original development, and because it can be extended with a gestation/lactation module (following the approach of Kapraun et al., 2022) to track maternal, fetal, and nursing-pup exposure through developmental windows. For chronic, non-developmental endpoints, the internal dose metric is the average blood concentration over the final seven days of dosing (Clast7), which approximates steady state; for developmental endpoints spanning gestation and lactation, an average concentration (Cavg) over the relevant window is used instead, because the endpoints of interest (e.g., decreased fetal or pup weight) reflect sustained exposure rather than a single transient peak.

3.2 Human Dosimetry

Internal-dose PODs (animal- or human-derived) are converted to human equivalent external doses (PODHED) using a one-compartment human toxicokinetic model built on the structure of Verner et al. (2016), updated with current chemical-specific parameters: a volume of distribution of 230 mL/kg (Thompson et al., 2010), a serum elimination half-life of 3.4 years drawn from a contaminated-drinking-water community cohort with serial serum measurements (Li et al., 2018), a cord-serum:maternal-serum ratio of 0.40, and a milk:serum partition coefficient of 0.016. This model explicitly simulates a mother's PFOS body burden from birth through pregnancy and lactation and tracks infant/child serum concentrations through growth to near-adult steady state, which is a material improvement over simple adult-only, steady-state approaches for evaluating developmental and childhood exposure windows. Because the human model is linear (the ratio of external to internal dose is constant across the relevant dose range), PODHED values are calculated by reverse dosimetry — multiplying the internal-dose POD by the model-predicted ratio of a standard exposure to its corresponding internal dose.

4. Uncertainty Factor Derivation

RoseyFields applies uncertainty factors (UFs) consistent with EPA's standard reference dose/reference concentration methodology, selecting the value of each factor based on the nature of the critical study rather than applying a fixed default across the board.

4.1 Uncertainty Factors for Epidemiological PODs

UF	Value	Basis
UFA (interspecies)	1	Not applicable — the critical study population is human.
UFH (intraspecies)	10	Default value; no chemical-specific data quantify human toxicokinetic/toxicodynamic variability.
UFS (subchronic-to-chronic)	1	Adult endpoints reflect long-term (years-long) exposure; developmental/childhood endpoints reflect the biologically relevant exposure window itself, not a subchronic surrogate for chronic exposure.
UFL (LOAEL-to-NOAEL)	1	PODs are BMDLs, not LOAELs, so no extrapolation is needed.
UFD (database)	1	The PFOS database includes numerous chronic, subchronic, multigenerational, developmental, and immunotoxicity studies in multiple species, plus a large medium/high-confidence epidemiological literature.
UFC (composite)	10	UFC = UFA × UFH × UFS × UFL × UFD

4.2 Uncertainty Factors for Animal Toxicological PODs (Weight-of-Evidence Comparators)

UF	Value	Basis
UFA (interspecies)	3	A residual factor for toxicodynamic (as opposed to toxicokinetic) interspecies differences, applied because the PODHED already accounts for pharmacokinetic differences through the animal-to-human PK modeling described in Section 3.
UFH (intraspecies)	10	Same default rationale as above.
UFS (subchronic-to-chronic)	1 or 10	1 for chronic-duration or gestational-exposure studies; 10 where a subchronic study is extrapolated to a chronic RfD.
UFL (LOAEL-to-NOAEL)	1	BMDLs were available for all endpoints carried forward.
UFD (database)	1	Same rationale as above.
UFC (composite)	30 or 300	Both values remain well below the maximum recommended composite UF of 3,000.

5. Oral Reference Dose (RfD) Derivation

Applying the composite UF of 10 to each epidemiology-based PODHED yields a health-outcome-specific candidate RfD for each of the four prioritized outcomes:

Health Outcome	Critical Endpoint	Critical Study	Candidate RfD
Hepatic	Increased serum ALT	Nian et al. (2019)	2×10^{-7} mg/kg-day
Immune	Decreased anti-diphtheria antibody	Budtz-Jørgensen and Grandjean (2018)	2×10^{-7} mg/kg-day
Cardiovascular	Increased total cholesterol	Dong et al. (2019)	1×10^{-7} mg/kg-day
Developmental	Decreased birth weight	Wikström et al. (2020)	1×10^{-7} mg/kg-day

All four candidate RfDs fall within a single order of magnitude (1–2 × 10^{-7} mg/kg-day), indicating that PFOS produces effects across multiple organ systems at a similar range of exposure. The developmental (Wikström et al., 2020) and cardiovascular (Dong et al., 2019) candidate values are numerically identical and serve as co-critical effects for RoseyFields' overall RfD.

RoseyFields' overall oral RfD for PFOS is **1×10^{-7} mg/kg-day (0.0000001 mg/kg-day).** Because one of the co-critical effects (decreased birth weight) can result from a short, biologically defined developmental exposure window rather than requiring lifetime exposure, this RfD is applied to both short-term/subchronic and chronic exposure scenarios, and it is considered protective of the immune and hepatic effects observed at similar or higher exposure levels.

6. Carcinogenicity Classification and Cancer Slope Factor (CSF)

6.1 Cancer Classification

RoseyFields classifies PFOS as Likely to Be Carcinogenic to Humans, based on: (1) a positive, statistically significant, multi-site, multi-sex chronic bioassay in rats demonstrating hepatocellular adenomas (and, in females, an added incidence of hepatocellular carcinoma) and pancreatic islet cell carcinomas with significant dose-related trends (Butenhoff et al., 2012); (2) mechanistic evidence of nuclear receptor activation, cytotoxicity, genotoxicity, oxidative stress, and immunosuppression consistent with the observed tumor types; and (3) supportive, though not independently conclusive, human epidemiological evidence of an association between PFOS exposure and liver cancer (Goodrich et al., 2022; Cao et al., 2022), alongside more limited or mixed human evidence for renal, bladder, prostate, and breast cancers (e.g., Shearer et al., 2021, for renal cell carcinoma).

6.2 CSF Derivation

No epidemiological study was suitable for quantitative CSF derivation: the leading human liver-cancer study (Goodrich et al., 2022) showed an elevated risk only in the highest exposure decile — a level well above typical environmental exposure — and lacked the dose-response precision needed to support low-dose linear extrapolation. RoseyFields therefore derives the CSF exclusively from the chronic rat bioassay (Butenhoff et al., 2012), using multistage benchmark dose modeling of four tumor endpoints at a benchmark response of 10% extra risk, consistent with the long-standing practice of fitting multistage models to tumor incidence data. The dose metric used is the average serum AUC over the study duration, consistent with cancer risk assessment

guidance calling for a cumulative lifetime exposure metric for carcinogens. Each internal-dose BMDL10 is converted to a PODHED using the same human clearance parameter described in Section 3.2, and the candidate CSF is calculated as the benchmark response (10%) divided by the PODHED.

Tumor Endpoint	Sex	Candidate CSF
Hepatocellular adenomas	Male	30.5 $(mg/kg\text{-}day)^{-1}$
Hepatocellular adenomas	Female	35.8 $(mg/kg\text{-}day)^{-1}$
Combined hepatocellular adenomas and carcinomas	Female	39.5 $(mg/kg\text{-}day)^{-1}$
Pancreatic islet cell carcinomas	Male	29.9 $(mg/kg\text{-}day)^{-1}$

RoseyFields' selected CSF is **39.5 $(mg/kg\text{-}day)^{-1}$**, based on combined hepatocellular adenomas and carcinomas in female rats (Butenhoff et al., 2012). This endpoint was selected because it captures both benign and malignant liver tumors, is corroborated by the concordant male hepatocellular adenoma finding and by human epidemiological evidence of liver cancer, and reflects a statistically significant increase in tumor incidence at the highest dose and a statistically significant positive dose trend.

Age-dependent adjustment factors (ADAFs) are not applied. ADAFs are reserved for carcinogens acting through a mutagenic mode of action, and the available in vivo and in vitro genotoxicity data for PFOS are predominantly negative; the early-life comparative cancer data needed to support a chemical-specific early-life susceptibility adjustment are also not currently available.

7. Practical Application by RoseyFields Risk Assessors

7.1 Hazard Quotient and Hazard Index

For non-cancer evaluation, RoseyFields calculates a chemical-specific Hazard Quotient (HQ) as the estimated PFOS dose (mg/kg-day) divided by the RfD (1×10^{-7} mg/kg-day). An HQ at or below 1 indicates the estimated exposure is below the level associated with appreciable risk of the co-critical developmental and cardiovascular effects (and the other prioritized outcomes); an HQ above 1 indicates that margin has been exceeded. Because PFOS frequently co-occurs with other PFAS (e.g., PFOA, PFHxS, PFNA) with overlapping toxicity profiles, RoseyFields also calculates a cumulative Hazard Index (HI) summing HQs across co-occurring PFAS when case-specific data and current science support a shared mechanism or additive toxicity assumption for the endpoints at issue; this is treated as an area requiring case-specific expert judgment given the evolving state of PFAS mixtures science.

7.2 Excess Lifetime Cancer Risk

For cancer evaluation, RoseyFields calculates excess lifetime cancer risk (ELCR) as the estimated lifetime average daily dose (mg/kg-day) multiplied by the CSF $(39.5\ (mg/kg\text{-}day)^{-1})$. Resulting risk estimates are typically compared against the risk range commonly used in regulatory practice (1×10^{-6} to 1×10^{-4}) to characterize whether estimated exposure corresponds to a de minimis, an elevated, or a clearly unacceptable incremental cancer risk.

7.3 Exposure and Dose Reconstruction

Because PFOS body burden reflects cumulative historical exposure rather than only current intake, RoseyFields uses the human pharmacokinetic model described in Section 3.2 to reconstruct an individual's or a community's exposure history in either direction: forward-modeling a reconstructed drinking-water or other exposure-media concentration history (informed by historical monitoring data, facility operating records, and hydrogeologic or fate-and-transport modeling) into a predicted serum-concentration trajectory over time; or, where biomonitoring (serum PFOS) data are available for an individual, back-calculating the historical daily dose and exposure-media concentration consistent with the observed serum level, accounting for the person's age, sex, pregnancy/lactation history, and residence timeline. This dose-reconstruction capability is central to litigation and regulatory work because it allows RoseyFields to estimate a plaintiff's or a population's internal dose at the specific life stage(s) relevant to an alleged health effect — for example, first-trimester maternal serum concentration for a birth-weight claim, or cumulative adult exposure duration for a claim tied to a chronic hepatic or cardiovascular endpoint — rather than relying only on a single present-day exposure estimate.

7.4 Application to Litigation and Regulatory Work

In combination, the RfD, CSF, and PBPK-based dose-reconstruction methodology support several categories of work product: (1) general and specific causation analyses in toxic tort and mass tort matters, by comparing reconstructed individual or cohort dose against the RfD/HQ and CSF/ELCR framework at the exposure window relevant to the alleged injury; (2) exposure characterization and dose-response opinions supporting class certification and damages modeling; (3) comparison of reconstructed exposure to background/reference population serum levels to contextualize incremental exposure attributable to a specific source; and (4) evaluation of compliance with, or the technical basis for, regulatory benchmarks (e.g., drinking water maximum contaminant levels or goals, remediation cleanup targets, NPDES effluent limits) that themselves derive from RfD/CSF-type toxicity values.

8. Key Uncertainties and Sensitive Populations

8.1 Sensitive Populations

Developing fetuses, infants, and children are the most well-characterized sensitive population for PFOS: both epidemiological and animal toxicological data indicate heightened susceptibility during gestation and early postnatal development, and the co-critical RfD endpoint (decreased birth weight) is itself a developmental effect. Animal data further indicate that susceptibility to certain PFOS-induced effects (e.g., neonatal lung maturation and survival) is concentrated within specific, narrow gestational windows (Grasty et al., 2003, 2005), underscoring that the timing of exposure — not only its magnitude — can be case-determinative. Children with impaired immune function or with reduced baseline vaccine response may also be more vulnerable to the immunotoxic effects underlying the immune-outcome RfD. RoseyFields additionally considers communities with potentially disproportionate PFOS exposure (e.g., populations near current or former manufacturing or AFFF-use sites) as warranting closer exposure characterization, while recognizing that the epidemiological literature directly addressing differential susceptibility by socioeconomic or demographic status remains limited.

8.2 Key Uncertainties

- Default intraspecies factor: The UFH of 10 applied to every critical study is a default value; no chemical-specific data currently quantify the true magnitude of human toxicokinetic or toxicodynamic variability for PFOS.

- Single chronic cancer bioassay: The CSF rests on one chronic rat bioassay (Butenhoff et al., 2012); there is no independent replicate chronic cancer study in a second species to corroborate the tumor findings or dose-response shape.
- Half-life parameter uncertainty: The human elimination half-life used in the PK model (3.4 years) is drawn from a single community cohort with a comparatively short (2-year) follow-up period (Li et al., 2018); reported half-life estimates elsewhere in the literature vary.
- PFAS co-exposure and mixtures: Real-world exposures typically involve multiple co-occurring PFAS. The chemical-specific RfD and CSF for PFOS do not, on their own, capture potential additive or interactive effects; cumulative risk approaches for PFAS mixtures remain an active and evolving area of science.
- Model structure: The one-compartment human PK model is a simplification relative to full physiologically based pharmacokinetic (PBPK) alternatives, trading some mechanistic detail for tractability and transparency; results should be interpreted alongside this modeling choice.
- Absence of ADAFs: Age-dependent adjustment factors are not applied to the CSF because the available data do not support a mutagenic mode of action; this does not rule out the possibility of early-life susceptibility to PFOS carcinogenicity that current data are simply insufficient to quantify.

RoseyFields' risk assessors evaluate these uncertainties on a case-specific basis — tailoring exposure-window selection, life-stage considerations, co-exposure assumptions, and the interpretation of biomonitoring data to the facts of each matter — rather than treating the RfD and CSF as context-free, one-size-fits-all values.

References

Andersen, M.E.; Clewell, H.J.; Tan, Y.M.; Butenhoff, J.L.; Olsen, G.W. (2006). Pharmacokinetic modeling of saturable, renal resorption of perfluoroalkylacids in monkeys—probing the determinants of long plasma half-lives. Toxicology 227: 156–164.

Buck, R.C.; Franklin, J.; Berger, U.; Conder, J.M.; Cousins, I.T.; de Voogt, P., et al. (2011). Perfluoroalkyl and polyfluoroalkyl substances in the environment: terminology, classification, and origins. Integrated Environmental Assessment and Management 7: 513–541.

Budtz-Jørgensen, E.; Grandjean, P. (2018). Application of benchmark analysis for mixed contaminant exposures: Mutual adjustment of perfluoroalkylate substances associated with immunotoxicity. PLoS ONE 13: e0205388.

Butenhoff, J.L.; Chang, S.C.; Olsen, G.W.; Thomford, P.J. (2012). Chronic dietary toxicity and carcinogenicity study with potassium perfluorooctanesulfonate in Sprague Dawley rats. Toxicology 293: 1–15.

Cao, L.; Guo, Y.; Chen, Y.; Hong, J.; Wu, J.; Hangbiao, J. (2022). Per-/polyfluoroalkyl substance concentrations in human serum and their associations with liver cancer. Chemosphere 296: 134083.

Darrow, L.A.; Stein, C.R.; Steenland, K. (2013). Serum perfluorooctanoic acid and perfluorooctane sulfonate concentrations in relation to birth outcomes in the Mid-Ohio Valley, 2005–2010. Environmental Health Perspectives 121: 1207–1213.

Dong, Z.; Wang, H.; Yu, Y.Y.; Li, Y.B.; Naidu, R.; Liu, Y. (2019). Using 2003–2014 U.S. NHANES data to determine the associations between per- and polyfluoroalkyl substances and cholesterol: Trend and implications. Ecotoxicology and Environmental Safety 173: 461–468.

Gallo, V.; Leonardi, G.; Genser, B.; Lopez-Espinosa, M.J.; Frisbee, S.J.; Karlsson, L., et al. (2012). Serum perfluorooctanoate (PFOA) and perfluorooctane sulfonate (PFOS) concentrations and liver function biomarkers in a population with elevated PFOA exposure. Environmental Health Perspectives 120: 655–660.

Goodrich, J.A.; Walker, D.; Lin, X.; Wang, H.; Lim, T.; McConnell, R., et al. (2022). Exposure to perfluoroalkyl substances and risk of hepatocellular carcinoma in a multiethnic cohort. JHEP Reports 4: 100550.

Grasty, R.C.; Bjork, J.A.; Wallace, K.B.; Lau, C.S.; Rogers, J.M. (2005). Effects of prenatal perfluorooctane sulfonate (PFOS) exposure on lung maturation in the perinatal rat. Birth Defects Research, Part B: Developmental and Reproductive Toxicology 74: 405–416.

Grasty, R.C.; Wolf, D.C.; Grey, B.E.; Lau, C.S.; Rogers, J.M. (2003). Prenatal window of susceptibility to perfluorooctane sulfonate-induced neonatal mortality in the Sprague-Dawley rat. Birth Defects Research, Part B: Developmental and Reproductive Toxicology 68: 465–471.

Jarvis, A.L.; Justice, J.R.; Elias, M.C.; Schnitker, B.; Gallagher, K. (2021). Perfluorooctane sulfonate in US ambient surface waters: A review of occurrence in aquatic environments and comparison to global concentrations. Environmental Toxicology and Chemistry 40: 2425–2442.

Kapraun, D.F.; Zurlinden, T.J.; Verner, M.-A.; Chiang, C.; Dzierlenga, M.W.; Carlson, L.M., et al. (2022). A generic pharmacokinetic model for quantifying mother-to-offspring transfer of lipophilic persistent environmental chemicals. Toxicological Sciences.

Kim, S.J.; Heo, S.H.; Lee, D.S.; Hwang, I.G.; Lee, Y.B.; Cho, H.Y. (2016). Gender differences in pharmacokinetics and tissue distribution of 3 perfluoroalkyl and polyfluoroalkyl substances in rats. Food and Chemical Toxicology 97: 243–255.

Kwiatkowski, C.F.; Andrews, D.Q.; Birnbaum, L.S.; Bruton, T.A.; DeWitt, J.C.; Knappe, D.R.U., et al. (2020). Scientific basis for managing PFAS as a chemical class. Environmental Science & Technology Letters 7: 532–543.

Li, Y.; Fletcher, T.; Mucs, D.; Scott, K.; Lindh, C.H.; Tallving, P.; Jakobsson, K. (2018). Half-lives of PFOS, PFHxS and PFOA after end of exposure to contaminated drinking water. Occupational and Environmental Medicine 75: 46–51.

Nian, M.; Li, Q.Q.; Bloom, M.; Qian, Z.M.; Syberg, K.M.; Vaughn, M.G., et al. (2019). Liver function biomarkers disorder is associated with exposure to perfluoroalkyl acids in adults: Isomers of C8 Health Project in China. Environmental Research 172: 81–88.

Podder, A.; Sadmani, A.H.M.A.; Reinhart, D.; Chang, N.B.; Goel, R. (2021). Per and poly-fluoroalkyl substances (PFAS) as a contaminant of emerging concern in surface water: A transboundary review of their occurrences and toxicity effects. Journal of Hazardous Materials 419: 126361.

Sagiv, S.K.; Rifas-Shiman, S.L.; Fleisch, A.F.; Webster, T.F.; Calafat, A.M.; Ye, X., et al. (2018). Early pregnancy perfluoroalkyl substance plasma concentrations and birth outcomes in Project Viva: Confounded by pregnancy hemodynamics? American Journal of Epidemiology 187: 793–802.

Shearer, J.J.; Callahan, C.L.; Calafat, A.M.; Huang, W.Y.; Jones, R.R.; Sabbisetti, V.S., et al. (2021). Serum concentrations of per- and polyfluoroalkyl substances and risk of renal cell carcinoma. Journal of the National Cancer Institute 113: 580–587.

Steenland, K.; Tinker, S.; Frisbee, S.; Ducatman, A.; Vaccarino, V. (2009). Association of perfluorooctanoic acid and perfluorooctane sulfonate with serum lipids among adults living near a chemical plant. American Journal of Epidemiology 170: 1268–1278.

Thompson, J.; Lorber, M.; Toms, L.M.; Kato, K.; Calafat, A.M.; Mueller, J.F. (2010). Use of simple pharmacokinetic modeling to characterize exposure of Australians to perfluorooctanoic acid and perfluorooctane sulfonic acid. Environment International 36: 390–397.

Verner, M.A.; Ngueta, G.; Jensen, E.T.; Fromme, H.; Vöelkel, W.; Nygaard, U.C., et al. (2016). A simple pharmacokinetic model of prenatal and postnatal exposure to perfluoroalkyl substances (PFASs). Environmental Science and Technology 50: 978–986.

Wambaugh, J.F.; Setzer, R.W.; Pitruzzello, A.M.; Liu, J.; Reif, D.M.; Kleinstreuer, N.C., et al. (2013). Dosimetric anchoring of in vivo and in vitro studies for perfluorooctanoate and perfluorooctanesulfonate. Toxicological Sciences 136: 308–327.

Wikström, S.; Lin, P.I.; Lindh, C.H.; Shu, H.; Bornehag, C.G. (2020). Maternal serum levels of perfluoroalkyl substances in early pregnancy and offspring birth weight. Pediatric Research 87: 1093–1099.