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SUMMARY

Several cross-sectional epidemiologic studies have reported positive associations between low serum concentration levels of perfluorooctanoate (PFOA) and perfluorooctanesulfonate (PFOS) with increasing non-HDL cholesterol. However, this association is highly inconsistent across different exposure levels found in general and occupational population studies and thereby not supportive of a dose response. This inconsistent epidemiologic association is also not supported by a large body of toxicological data that indicates, in multiple species, that PFOA and PFOS are PPARα agonists that result in hypocholesterolemia in rodents (both PFOA and PFOS) and nonhuman primates (PFOS only). The concentrations of PFOA and PFOS measured in these toxicological studies are several orders of magnitude higher than observed in general human populations.

Because most of the epidemiologic studies cited have been cross-sectional investigations, they can not fundamentally address the issue of causality due to their inability to assess temporal relationships. Therefore, the purpose of this study was to measure the PFOA and PFOS serum concentrations (ng/mL) at baseline and end-of-project time periods for workers involved with the demolition and disposal of Buildings 2/48/49 at 3M Decatur. The change in PFOA and PFOS concentrations over this time period were then related to the change observed in several serum clinical chemistries including non-HDL cholesterol. The *a priori* research question was whether the cross-sectional positive associations reported at non-occupational serum levels of PFOA and PFOS with non-HDL can be observed in a longitudinal design of workers whose initial baseline serum concentrations mirrored those of the general population.

In 2008-2010, 3M and non-3M employees (referred to as contingent) workers were involved with the demolition and disposal of Buildings 2, 48, and 49 at the company's Decatur

(Alabama) manufacturing plant. A total of 126 workers participated in both baseline and end of project assessments that involved measuring serum perfluorooctanoate (PFOA) and perfluorooctanesulfonate (PFOS) concentrations, several lipid, renal, and hepatic clinical chemistries, and inquiring about a brief medical history. An additional 48 workers participated only in a baseline assessment because they either did not ultimately work on this project or failed to participate in an end of project examination.

Of the 126 workers who participated in both assessments, 19 were 3M employees (15%) and 155 were contingent workers (85%). Based on their PFOA and PFOS trends, the 126 workers were categorized into 4 groups: 1) workers (N = 57) who had their end of project PFOA and PFOS serum concentrations increase (or remain the same) over their baseline measurements; 2) workers (N = 43) who had their end of project PFOA and PFOS serum concentrations decrease over their baseline measurements; 3) workers (N = 16) who had their end of project serum concentrations of PFOA increase and PFOS decrease over their respective baseline measurements; and 4) workers (N = 10) who had their end of project PFOA decrease and PFOS increase over their respective baseline measurements.

The 57 workers, whose end of project PFOA and PFOS concentrations increased (or remained the same) had mean matched-pair concentration increases of 10.3 ng/mL and 12.0 ng/mL, respectively, from their mean baseline concentrations of 23.7 ng/mL and 24.0 ng/mL, respectively ($p < 0.0001$). This average increase in PFOA and PFOS is comparable to the magnitude of change that has been associated with increasing total cholesterol and non-HDL levels in cross-sectional studies of the U.S. general population as well as those reported in a mid-Ohio River valley population whose drinking water was contaminated with PFOA. For these 57 subjects, there were no statistically significant mean changes for total cholesterol (-1.4

mg/dL, p = 0.70) or non-HDL (-4.2 mg/dL, p = 0.22). There was a statistically significant increase in the mean HDL (2.8 mg/dL, p = 0.006) and significant decreases in the mean total cholesterol/HDL ratio (-0.3, p = 0.02) and triglycerides (-18.7 mg/dL, p = 0.05). However, since fasting was not a requirement, the triglyceride association can not be interpreted.

The 57 subjects were subsequently restricted to those individuals (N = 47) whose change in serum PFOA and PFOS concentrations was within the range (0 to 60 ng/mL) that has been associated with a linear increase in total cholesterol and non-HDL cholesterol levels as reported in the scientific literature for the general population. In addition, none of these 47 individuals self-reported they were taking cholesterol lowering medications. These 47 individuals had mean baseline concentrations of 7.0 ng/mL and 16.7 ng/mL PFOA and PFOS, respectively. At end of project the 47 workers had a mean matched-pair increase of 10.7 ng/mL for PFOA and 11.6 ng/mL for PFOS, respectively. The mean matched-pair change in clinical chemistries, associated with these 10.7 ng/mL and 11.6 ng/mL increases in PFOA and PFOS, respectfully, included the following: total cholesterol (-0.2 mg/dL, p = 0.97); non-HDL (-3.5 mg/dL, p = 0.34); HDL (3.4 mg/dL, p = 0.004), and total cholesterol/HDL ratio (- 0.4, p = 0.03). Using multiple regression to adjust for potential confounding factors (age, time interval, BMI, and alcohol), there were no statistically significant associations with their increasing PFOA and PFOS levels and the change in total cholesterol, non-HDL, HDL, total cholesterol/HDL ratio, or other clinical chemistries (e.g., renal, hepatic) in these analyses.

Among the 43 subjects whose PFOA and PFOS concentrations decreased from the baseline measurement, their mean matched-pair changes were -115.3 ng/mL and -62.0 ng/mL, respectively. These much larger decreases in serum concentrations seen in these 43 workers, compared to the increases discussed above among the 57 (or 47) workers, is the consequence of

the much higher baseline concentrations that were measured in the 18 3M employees in this group of 43 workers. These 3M employees had past work history experience in the production of perfluorochemicals. For these 43 workers with decreasing PFOA and PFOS concentrations, their statistically nonsignificant mean matched-pair changes were: total cholesterol (0.8 mg/dL, p = 0.82), non-HDL (0.3 mg/dL, p = 0.92), HDL (0.5 mg/dL, p = 0.72), and total cholesterol/HDL (0.02, p = 0.80). None of these variables was associated with decreasing PFOA and PFOS concentrations in regression analyses. There was a statistically significant negative association between PFOS and ALT. The biological plausibility of this inverse statistical association must be considered.

The present study's longitudinal assessment did not observe a 10 ng/mL increase in PFOA concentration resulted in an approximate 10 mg/dL increase in non-HDL cholesterol as was reported in an analysis of the Centers for Disease Control and Prevention (CDC) National Health and Nutrition Examination Survey (NHANES) database. This investigation had sufficient statistical power (76%) to detect thos magnitude of change. The lack of an association between PFOA and non-HDL cholesterol in the present study is supported by the recent report from a Phase III clinical trial. In this clinical trial, ammonium salt of PFOA was administered to 37 human patients diagnosed with refractory solid tumors. For some of these individuals, PFOA plasma concentrations increased to approximately 400,000 ng/mL. This PFOA plasma concentration is 3 times higher than any known recorded occupational exposure, let alone 4 orders of magnitude higher than that reported in the general population. PFOA concentrations in this clinical trial were significantly associated with hypo-, not hyper-, cholesterolemia. This is consistent with the toxicology data.

Collectively, the above results suggest that the positive associations between PFOA and PFOS concentrations with non-HDL cholesterol, as reported from epidemiological cross-sectional studies of non-occupationally exposed populations, are likely non-causal. Whether these positive associations are the consequence of other factors that jointly influence the absorption, distribution, metabolism, and/or elimination of PFOA and PFOS (or the entire class of perfluoroalkyls) with non-HDL cholesterol, will need to be the focus of other investigations.

INTRODUCTION

Beginning in 2008, several remediation projects were conducted regarding legacy perfluoroalkyls at the 3M Company. These projects involved either demolition and disposal of manufacturing facilities or remediation of landfills. Specifically, these projects have included the following: 1) the 3M Woodbury landfill remediation projects (main site and the northeast section); 2) the 3M Cottage Grove Building 25 re-roof project; 3) the 3M Cottage Grove D1, D2 and D9 excavation projects; 4) the 3M Cottage Grove Buildings 15 and 73 demolition and disposal project; and the Decatur Buildings 2/48/49 demolition and disposal project. Because of the unique work situations, the magnitude of potential occupational exposure at each of these locations was unknown. Therefore, baseline and end-of-project biomonitoring and medical assessments were required of 3M employees and non-3M employee workers (referred to as contingent workers) who entered specified work zones at each of these projects where potential exposure to two important legacy perfluoroalkyls, perfluorooctanoate (PFOA) and perfluorooctanesulfonate (PFOS), was possible.

The purpose of this report is to provide an analysis of the PFOA and PFOS serum concentrations (ng/mL) measured at baseline and end-of-project time periods for those workers involved with the demolition and disposal of Buildings 2/48/49 at 3M Decatur. As part of this project, trend analyses of the changes in PFOA and PFOS serum concentrations between baseline and end of project were related to the changes observed in serum clinical chemistries, in particular, non-HDL cholesterol and hepatic enzymes. The magnitude of the changes observed was compared to those reported in the epidemiologic literature.

As reviewed by Steenland et al. (2010), positive statistically significant associations have been reported between PFOA concentrations and non-HDL cholesterol levels in the general

population (Nelson et al. 2010), a community population affected with drinking water contaminated with PFOA (Emmett et al. 2006; Frisbee et al. 2010; Steenland et al. 2009), and in some (Costa et al. 2009; Olsen et al. 2003; Sakr et al. 2007a; 2007b), but not all occupational investigations (Olsen et al. 1999; 2000; 2007). However, as summarized by Steenland et al. (2010) in their review of this literature, "the magnitude of the cholesterol effect is inconsistent across different exposure levels." The strongest positive associations occurred in general populations with the lowest PFOA concentrations. The weakest associations, if present at all, were reported in occupational populations whose serum PFOA (and PFOS) concentrations were 2 to 3 orders of magnitude higher than the general population. And there is some inconsistency even among the general population studies as evidenced by the most recently published study of 723 adult Inuit living in northern Quebec. Château-Degat et al. (2010) that did not report any statistically significant association with non-HDL and serum PFOS concentration (geometric mean of 18.6 ng/mL (95% CI 17.8 – 19.5)). PFOS was positively associated with HDL and negatively associated with triglycerides and total cholesterol/HDL ratio.

Because most of the epidemiologic studies cited have been cross-sectional investigations, they can not fundamentally address the issue of causality due to their inability to assess temporal relationships. Furthermore, these epidemiologic results are contrary to what would be expected based on the toxicological literature. This inconsistent epidemiologic association is also not supported by a large body of toxicological data that indicates, in multiple species, that PFOA and PFOS are PPARα agonists that result in hypocholesterolemia in rodents (both PFOA and PFOS) and nonhuman primates (PFOS only). The concentrations of PFOA and PFOS measured in these toxicological studies are several orders of magnitude higher than those reported in the epidemiologic studies of general (non-occupational) populations discussed below.

Table 1 outlines the magnitude of the associations reported in the Centers for Disease Control and Prevention (CDC) National Health and Nutrition Examination Survey (NHANES) general population (Nelson et al. 2010) and in a mid-Ohio River community whose drinking water was contaminated with PFOA but not PFOS (Frisbee et al. 2010; Steenland et al. 2009). In the CDC NHANES study (Nelson et al. 2010), a 4.8 ng/mL increase in the median PFOA concentrations between Quartile 1 and Qurtartile 4 was associated with an 11 mg/dL increase in non-HDL cholesterol (Table 1). Likewise a 27.6 ng/mL increae in median PFOS concentrations was associated with a 13 mg/dL increase in non-HDL. Shallower positive dose response curves were seen with children (Frisbee et al. 2010) and adults (Steenland et al. 2009) in the mid-Ohio River studies (Table 1). For example, in children an approximate 20 ng/mL increase in PFOA was associated with a 5 mg/dL increase in LDL. These associations appear linear in the ranges described in Table 1. Associations above serum concentrations of 50 ng/mL PFOA or PFOS appear to be minimum.

Steenland et al. (2010) hypothesized that the above positive associations could be the consequence of a biological pathway with non-HDL cholesterol that may be saturated at relatively low (i.e., general population) PFOA and PFOS levels. Hence, an important research question is whether the *cross-sectional* associations reported by Nelson et al. (201), Frisbee et al. (2010) and Steenland et al. (2009) can be confirmed in a *longitudinal* design of workers whose initial baseline serum concentrations PFOA and/or PFOS was comparable to these studies. Potential occupational exposure to PFOA and PFOS among workers involved in the demolition and disposal of Decatur Buildings 2/48/49 offered the opportunity to examine this research question.

METHODS

1. Demolition and disposal process

The demolition and disposal plan for Buildings 2/48/49 addressed several issues related to potential exposures to PFOS, PFOS-related products, PFOA, and other perfluorochemicals that remained in Buildings 2/48/49. The plan considered potential exposure to workers engaged in the decommissioning of the buildings involved in the removal of process equipment and piping, the demolition of the buildings and their disposal, and the potential exposure to workers at the recycling and waste disposal facilities where the remains of the facilities would be sent. Prior to the start of decommissioning work, an exclusion zone was established which included decontamination facilities for anyone going into the work zone. All workers entering this zone were required to participate in the blood monitoring program and also have 40 hours of Hazwoper training.

The initial demolition work involved the decommissioning of the process piping and utility services that supported the perfluorochemical-related production operations in these buildings. All process piping going into and out of the buildings was drained of any free product prior to removal. Any piping that was going to be sent to a recycler was cleaned using a process that utilized high temperature and high pressure washing. All process piping not sent to a recycler was disposed at an industrial landfill. Following the severing of outside utilities and process lines, the process equipment inside the buildings was cleaned using the same process and sent to a recycler. All process equipment was destroyed through a smelting process. The same cleaning procedure was used on recycled metals prior to being sent to a smelter. The remainder

of the demolition debris, that was not metal, was disposed of at an industrial landfill. Different contractors were used throughout this process.

2. Informed consent

Workers entering the exclusion zone were required to participate in this biomonitoring project. The purpose of the project was explained in a written informed consent. Subjects read and signed this informed consent at both baseline and end-of-project assessments. Subjects were informed by their employer that they could not work on this specific project without such compliance.

3. Blood collection

The majority of blood collection was performed at the Occupational Health Group Clinic (Decatur, AL). In some instances, blood collection occurred at the 3M nurse's office at the Decatur manufacturing facility. Upon blood collection, serum was then obtained and split into two samples. One sample was shipped to Quest Diagnostics for clinical chemistry analysis. The other sample was shipped to 3M Corporate Occupational Medicine where it was then transferred to the 3M Strategic Toxicology Laboratory for analysis of PFOA and PFOS.

4. Clinical chemistries

Clinical chemistries included a lipid panel profile, blood glucose, BUN, creatinine, and liver enzyme tests. Fasting was not a requirement because of the logistics of collecting blood samples during various times of the day when contingent workers would arrive to be tested. Clinical chemistries were analyzed by Quest Diagnostics. The specific tests measured were:

Total Cholesterol (mg/dL)
Non-HDL Cholesterol (mg/dL)
HDL Cholesterol (mg/dL)
LDL Cholesterol (mg/dL – indirect calculation)
Triglycerides (mg/dL)
Total Cholesterol/HDL Ratio (calculated)
BUN mg/dL)
Creatinine (mg/dL)
Total Protein (g/dL)
Albumin (g/dL)
Globulin (g/dL – calculated)
Albumin/Globulin Ratio (calculated)
Total Bilirubin (mg/dL)
Alkaline Phosphatase (U/L)
AST (U/L)
ALT (U/L)

The individual's clinical chemistries at baseline and at end of project were medically reviewed by Dr. Buehrer. Values out of reference range were indicated with a notation for the subjects to follow up with their primary care physician if they had abnormal test results. Subjects were informed in writing that this examination program was not a full medical 'check-up.' However, questions could be directed to Dr. Buehrer regarding their clinical chemistry test results.

5. Brief Medical History Questionnaire

At both the baseline and end of project exams, subjects responded to the same health questionnaire that inquired about basic demographic data (age, height, and weight), a brief medical history, and current medication use (blood pressure, lipid lowering, and glucose lowering).

6. Analysis of PFOA and PFOS

Serum samples were analyzed for PFOA and PFOS by state-of-the-art high performance liquid chromatography mass spectrometry methods by the 3M Medical Department's Toxicology Laboratory under the direction of Dave Ehresman.. These samples were assigned unique identification numbers and randomized prior to the samples being delivered for analysis. The 3M Medical Department's Toxicology Laboratory was "blinded" to the identity of all samples received for analysis.

Sample extractions were performed using solid phase extraction (SPE) technique. The extraction and sample clean-up was based on a 100 uL sample size and utilized Waters (Milford, MA) Oasis® hydrophilic–lipophilic balance (HLB) 3.0mL cartridges (Ehresman et al. 2007).

The method used two stable labeled internal standards for quantitation. The internal standards used were a dual labeled PFOS where two ^{18}O molecules were included in the sulfonate group (internal standard, >99% purity, synthesized by Research Triangle Institute, Research Triangle Park, NC) and a dual labeled PFOA molecule, where the carboxyl and alpha carbons were labeled with ^{13}C stable isotope (greater than 97%, provided by DuPont, Wilmington, DE). All quantitations were based on matrix matched extracted standard curves.

A 5 uL injection of the sample eluate was introduced into the High Pressure Liquid Chromatograph (HPLC) which was directly interfaced into the triple quadrupole mass spectrometer (Applied Biosystems/MDS-Sciex Instrument Corporation, Forest City, CA). Standard curves covered the range from 1.0 - 150 ng/mL. Standard curves were evaluated using a quadratic regression model where the standards were weighted at 1/x, and each curve had an "R" value equal to or greater than 0.9998. Matrix spiked controls (QC samples) evaluated

during this study all had acceptable results "with-in" their previously established ranges. Matrix-matched dilutions were used for samples requiring dilution to bring the samples into the linear range of the assay. Extracted serum and aqueous blanks remained below the lower limit of quantitation established at 1.0 ng/mL (lowest standard fitted on the standard curve used for this project).

7. Communication of Results

After each blood collection (baseline and end of project), two separate letters were sent to the participant that provided their results. One letter addressed the worker's clinical chemistry results and the other letter provided PFOA and PFOS concentrations.

8. Data analysis

Baseline and end of project data were entered into an Excel™ spread sheet. Quality assurance checks were performed of the data entry process. Upon completion, the data were transferred to JMP-SAS (Cary, NC) for statistical analyses.

Because the data were paired samples, a matched-paired statistical analysis was performed where the mean difference was the average of the sum of the individual differences for the N subjects. See *Equation 1*.

Equation 1.

$$\text{Mean Difference} = \sum_{i=1}^{n}(\text{end-of-project} - \text{baseline})/n$$

Regression analyses were conducted for this study population's baseline and end of project cross-sectionally obtained data. Of much greater importance, however, were regression analyses of the change (i.e., difference) in the clinical chemistries between end-of-project and

baseline compared to the workers' change in PFOA and/or PFOS serum concentrations. For each dependent variable (i.e., change in clinical chemistry), the full hierarchical regression model (*Equation 2*) considered 7 independent variables that included the change (difference) in PFOA or PFOS serum concentrations (or both). The other independent variables were age at baseline, the number of days between baseline and end of project tests, BMI at end of project, alcohol use at end of project ($\geq$ 4 drinks per week), and lipid lowering medication use (yes/no).

Equation 2. $\Delta Y = \alpha + \beta\Delta PFOA + \sum\gamma X_i$

Where
Δ = difference between end-of-project minus baseline value
Y = the dependent clinical chemistry variable
X_i = the i = 1 thru 6 covariates described above
α= intercept
β = regression coefficient of ΔPFOA or ΔPFOS serum concentrations or both variables
γ = regression coefficient for covariates Xi

Backward regression procedures incorporated removal of any covariate at $p > 0.10$, except for PFOA or PFOS that remained (forced) in all models. Statistical significance of the regression coefficient (β) was considered at $p < 0.05$. 95% confidence intervals of the regression coefficient were calculated.

RESULTS

1. Overall Biomonitoring Analysis

As shown in Table 2, a total of 174 individuals were tested at baseline for serum PFOA and PFOS concentrations and the aforementioned clinical chemistries. The majority (89.1%) were contingent workers. Of the 174 individuals tested at baseline, 126 (72.4%) had end of project assessments. The 48 workers who did not participate at end of project were all contingent workers. Reasons for non-participation at the end of project were: 1) tested at baseline but never

entered the exclusion zone; 2) entered the exclusion zone and completed work assignment but did not return to the occupational medicine clinic for an end of project assessment despite the requirement to do so.

The 48 contingent workers with only baseline measurements had lower serum PFOA (Table 3) and PFOS (Table 4) concentrations than the 126 workers with paired measurements. The latter had significantly higher baseline serum PFOS and PFOA levels because a subset included 3M employees who had past perfluorochemical production experience at Decatur. These differences are seen in Tables 5 and 6 where the baseline geometric mean PFOA (Table 5) and PFOS (Table 6) concentrations for 3M employees were 228.4 ng/mL (95% CI 97.9 – 533.2) and 217.1 ng/mL (95% CI 112.2 – 420.2), respectively, compared to 10.0 ng/mL (95% CI 7.6 – 13.1) and 25.0 ng/mL, respectively, for the contingent workers.

2. Biomonitoring Employer Categorizations

Among the contingent workers, 4 employer categorizations are presented in Tables 5 and 6. CST was the primary demolition contractor and used various subcontractors. All subcontractors were included in the CST definition in Tables 5 and 6. Other major employers of contingent workers were Goss Electric that dealt with the electrical decommissioning of these buildings and Hubbard and Drake that decommissioned pipe lines as well as performed subcontractor demolition work. The fourth 'Other' category listed in Tables 5 and 6 involved a variety of niche applications (e.g., laboratory measurements, environmental monitoring, etc.).

The largest increase in serum PFOA concentrations occurred among the 47 CST workers who participated in the baseline and end of project assessments. As seen in Table 5, their geometric mean PFOA concentrations went from 4.0 ng/mL (95% CI 2.8 – 5.6) at baseline to

11.6 ng/mL (8.6 – 15.7) at end of project. Smaller increases were observed for Goss Electric and Hubbard & Drake workers for PFOA. For PFOS, CST workers' geometric mean concentration went from a geometric mean of 12.9 ng/mL at baseline to 22.3 ng/ml (95% CI 17.9 – 27.8) at end of project (Table 6). Goss Electric workers had a comparable increase in ng/mL concentration of PFOS (approximately 10 ng/ml) although their baseline concentrations were 2 to 3 times higher than CST workers.

Table 7 presents the arithmetic means of the matched-paired differences, 95% confidence intervals (95% CI), and p values from the Student's t tests for these employer categorizations. Statistically significant increases in PFOA and PFOS concentrations were found among the CST workers, especially when compared to the statistically significant decreases in PFOA and PFOS concentrations measured among the 3M employees involved in this project.

3. Biomonitoring Trend Categorizations

Figures 1 and 2 are scatter plots of the 126 individuals that participated in baseline and end of project assessments. As shown in both figures, the diagonal identity line displayed represents where the x value (baseline) is equal to the y value (end of project). For both PFOA and PFOS, the majority of individuals with concentrations measured at baseline at ≤ 60 ng/mL had higher concentrations measured at end of project. The majorit of workers with PFOA and FPOS measured > 60 ng/mL had subsequently lower PFOA and PFOS concentrations at end of project.

The above two trends observed in Figures 1 and 2 led to the creation of 4 independent biomonitoring trend categories defined for the 126 workers who had both baseline and end of project assessments. These 4 categories were (number of workers in parentheses): 1) both PFOA

and PFOS concentrations *increased* (or remained the same) over baseline (N = 57); 2) both PFOA and PFOS concentrations *decreased* over baseline (N = 43); 3) PFOA concentrations *increased* and PFOS concentrations *decreased* over baseline (N = 16); and 4) PFOA concentrations *decreased* and PFOS concentrations *increased* over baseline (N = 10). Stratifying these categories by employer (Table 8) revealed that 78.7% (n = 37) of CST workers had an increase in both PFOA and PFOS concentrations. These 37 CST workers represented 64.9% of this trend category (37 of 57). On the other hand, 94.7% of the 3M employees had lower PFOA and PFOS concentrations at end of project that represented 41.8% of this trend category (18 of 43). No 3M employees had PFOA and PFOS concentrations higher at end of project than baseline.

Other demographic characteristics of these 4 biomonitoring trend categories are found in Table 9. The 57 workers with an increase in PFOA and PFOS serum concentration from baseline were approximately 7 years younger than the 43 workers who experienced a decrease. This reflects the older 3M employees in the latter category. Very few females were accounted for in any of the 4 biomonitoring trend categorizations. The average BMI approached the level of obesity (BMI $\geq$ 30) levels in all 4 biomonitoring trend categorizations.

Tables 10 and 11 provide measures of central tendency of PFOA and PFOS at baseline and end of project for these 4 biomonitoring trend categorizations. Table 12 provides the arithmetic means of the matched-pair differences between baseline and end of project for each of these 4 trend categorizations. For example, the 57 workers with higher concentrations of PFOA and PFOS at end of project had mean increases of 10.3 ng/mL and 12.0 ng/mL, respectively.

4. Analysis of the 126 Workers with Baseline and End of Project Measurements

Demographics of the 126 workers that participated in baseline and end of project assessments are provided in Table 13. The average interval of time between assessments was 207 days (range 1 – 477). Table 14 provides the percentage of responses to the medical history questionnaire. Based on self-reported medication use, high blood pressure and high cholesterol were the highest prevalence.

Presented in Appendix A (Tables A1 – A8) are cross-sectional analyses conducted at baseline and at end of project assessments for these 126 workers. Because the distributions of PFOA and PFOS were log normal, both untransformed and log transformations were performed of these variables in the models. Few statistically significant associations ($p < 0.05$) were observed in these cross sectional analyses. None were observed for PFOA and/or PFOS with either total cholesterol, non-HDL, or HDL. A positive association was seen with creatinine measured at baseline and at end of project with both PFOA and PFOS. A positive association was also observed for PFOS with AST and ALT at end of project but not baseline. No statistically significant associations were observed with PFOA and AST or ALT for either assessment.

As seen in Table 15, the 126 workers had a mean matched-pair decline of 34.6 ng/mL PFOA and 15.5 ng/mL PFOS. The reason for this decline is attributable to the 19 3M workers. The unadjusted and adjusted regression analyses between the change in PFOA and PFOS concentrations between baseline and end of project and the respective change in clinical chemistry measurements for the 126 workers are presented in Table 16 for PFOA, Table 17 for PFOS, and Table 18 for including PFOA and PFOS in the model(s). Both unadjusted and adjusted regression coefficients of PFOA and PFOS are provided along with the 95% CIs and p

values. The change in PFOA or PFOS was normally distributed; thus log transformations were considered not necessary. Few statistically significant associations were observed. None were related to total cholesterol, non-HDL or HDL. There was a statistically significant negative association between ALT and PFOS in the unadjusted model but this was not observed when covariates were considered in the adjusted model.

5. Analysis of 57 Workers with Increased PFOA and PFOS Concentrations

The PFOA and PFOS geometric means were 10.3 ng/mL and 12.0 ng/mL, respectively, for the 57 subjects whose concentrations increased (or remained the same) between baseline and end of project. These increases were statistically significant ($p < 0.0001$, Table 19). Among these 57 workers, the average increase in PFOA and PFOS was comparable to the magnitude reported to be associated with increased total cholesterol and non-HDL concentrations in the CDC NHANES study (NHANES, Nelson et al. 2010) as outlined in Table 1. The unadjusted and adjusted regression analyses between the change in PFOA and PFOS concentrations between baseline and end of project and the respective change in clinical chemistry measurements for the 57 workers are presented in Table 21 for PFOA, Table 22 for PFOS, and Table 23 for PFOA and PFOS in the model(s). Both unadjusted and adjusted regression coefficients of PFOA and PFOS are provided along with the 95% CIs and p values. There were no regression coefficients that were statistically significant ($p < 0.05$) for the mean differences in clinical chemistries and PFOA (Table 20). There was 1 statistically significant association (total cholesterol/HDL ratio) for PFOS (Table 21). Statistical significance was observed for total cholesterol when both PFOA and PFOS were included in the regression model but the coefficient slope was negative for PFOA and positive for PFOS (Table 22).

The 57 subjects were then restricted to the subset of 47 workers whose magnitude of increase was within the range of change associated with increasing cholesterol trends reported in the literature reported in Table 1. None of these 47 individuals self-reported they were taking cholesterol lowering medications either at baseline or at end of project. These 47 individuals had a mean increase of 10.7 ng/mL PFOA and 11.6 mg/dL PFOS. Their mean change in total cholesterol was -0.2 mg/dL ($p = 0.97$) and for non-HDL cholesterol it was -3.5 mg/dL ($p = 0.34$). The mean change in HDL (3.4 mg/dL) was significantly ($p = 0.004$) increased over baseline whereas the total cholesterol/HDL ratio was significantly decreased ($p = 0.03$).

Presented in Tables 24 through 28 are the regression analyses for these 47 individuals. Also, Figures 3 through 12 are scatter plots that show the unadjusted regression trend line results for several of the clinical chemistries examined in Tables 24 and 25. There were no statistically significant associations regarding the change in total cholesterol, non-HDL, HDL, total cholesterol/HDL, or liver enzymes in these analyses for PFOA (Tables 24) or PFOS (Table 26). Tables 25 and 27 provide the adjusted PFOA and PFOS regression coefficients, respectively, when the only covariates included in the models were at $p < 0.10$. These models provide the better fit of the data. There were no statistically significant coefficients for PFOA or PFOS. In particular, for the change in non-HDL cholesterol, the PFOA coefficient was -0.30620 ($p = 0.26$) and for PFOS 0.24561 ($p = 0.41$). No significant coefficients were observed when both PFOA and PFOS were included in the model (Table 28) or when the only covariates included in the model were at $p < 0.10$ (Table 29). The coefficients when PFOA and PFOS were both in the non-HDL model were -0.39539 ($p = 0.20$) and 0.36238 ($p = 0.28$).

6. Analysis of 43 Workers with Decreased PFOA and PFOS Concentrations

Among the 43 subjects whose PFOA and PFOS concentrations decreased, the mean matched-pair decrease in PFOA and PFOS concentrations were -115.3 ng/mL and -62.0 ng/mL, respectively (Table 30). These much larger decline in serum concentrations over baseline reflect the considerably higher baseline concentrations of the 3M employees (18 of 43) included in this biomonitoring trend category. Of these 43 subjects, their mean matched-paired lipid-related differences were not significantly different (Table 30): total cholesterol 0.8 mg/dL; non-HDL 0.3 mg/dL; and HDL 0.5 mg/dL. There were statistically significant mean decrease with alkaline phosphatase (-5.1 IU/L); and increases in AST (1.8 IU/L) and ALT (3.3 IU/L), as well as decreases in total protein and globulin. Unadjusted and adjusted regression coefficients for PFOA and PFOS are presented in Tables 31 and 32, respectively, for these 43 subjects. Neither total cholesterol nor non-HDL was associated with decreasing PFOA and PFOS concentrations, nor when both are included in the regression model (Table 33). The only statistically significant coefficient (negative) was observed with PFOS in the ALT model (Tables 32 and 33).

The 43 subjects with decreased PFOA and PFOS concentrations were restricted to 29 individuals whose decrease was within the approximately 60 ng/mL range (but opposite in direction) reported in the literature (Table 34). These 29 workers had a mean change of -42.5 ng/mL PFOA and -29.6 ng/mL PFOS. These were not associated with significant lipid changes, including non-HDL (1.6 mg/dL, $p = 0.60$). Although the regression models are based on few subjects, there were no statistically significant regression coefficients for PFOA or PFOS with total cholesterol, non-HDL, HDL, or any other clinical chemistry (Tables 35 and 36). When PFOA and PFOS were both included in the model, the unadjusted coefficient for PFOS was negative ($p = 0.07$) whereas it was positive for PFOA ($p = 0.12$) (Table 37).

7. Other Analyses

Because of the small sample size, regression analyses were not done for the 16 subjects whose PFOA concentrations increased and PFOS concentrations decreased nor for the 10 workers whose PFOA concentrations decreased and PFOS concentrations increased.

DISCUSSION

The collection of baseline and end of project samples for analysis of serum concentrations of PFOA and PFOS provided an excellent method to assess each worker's exposure experience while involved with the 3M Decatur Building 2/48/49 Demolition and Disposal Project. Specific exposure tasks were not identified for each worker; thus it is not possible to ascertain which tasks yielded the highest potential for exposure.

Of the 126 workers who participated in both baseline and end of project assessments, a subset of 57 non-3M (contingent) workers, had their PFOA and PFOS concentrations increase an average of 10.3 ng/mL (range 0 – 61.1 ng/mL) and 12.0 ng/mL, (range 0 – 51.5 ng/mL), respectively. This range corresponds to that reported in three cross-sectional studies that associated increasing PFOA and PFOS levels across this range with a linear increase in non-HDL cholesterol (Nelson et al. 2010; Frisbee et al. 2010; Steenland et al. 2009). Analyses of these 57 workers, and a subset of 47 that had baseline serum concentrations less than 61 ng/mL and who did not take cholesterol lowering medications, resulted in no statistically significant associations between the change in PFOA or PFOS and the difference in total cholesterol or non-HDL.

Among the 47 workers, the mean average change in serum PFOA concentrations was 10.7 ng/mL and for PFOS 11.6 ng/mL. Based on the data presented in Table 1 from the cross-sectional study of Nelson et al. (2010) representing the NHANES population, we might have therefore expected an approximate 10 mg/dL increase in non-HDL for the 10.7 ng/mL increase in PFOA serum concentration and approximately a 5 mg/dL increase in non-HDL associated with the 11.6 mg/dL increase in PFOS serum concentration. The average non-HDL in these 47 workers *decreased* 3.5 ng/mL (95% CI (-10.8) – 3.8). Thus, the longitudinal data presented in this report are inconsistent with the cross-sectional associations reported by Nelson et al. The increased trends reported by Steenland (2009) (see Table 1) for non-HDL cholesterol are not as strong as those reported by Nelson et al. (2010). Nevertheless, we still might have expected increases in both total cholesterol and non-HDL cholesterol of at least a few mg/dL that would have been associated with the respective increases in PFOA and PFOS serum concentrations observed in this study.

Although our data are not consistent with the trends associated with PFOA in the cross-sectional studies by Nelson et al. (2010), Frisbee et al. (2010), and Steenland et al. (2009), the precision around our point estimates leads to less firm conclusions for PFOS. We estimate our sample size of 57 individuals would have had 84 percent power to detect a 10 mg/dL change in non-HDL but only a 32 percent power to detect a 5 mg/dL change in non-HDL based on a 1-sample t-test. Reducing the sample size to the 47 subjects, the power calculations were 76 percent and 27 percent, respectively. This agrees with our conclusion that the data do not support the hypothesis that PFOA concentrations increase non-HDL cholesterol at the dose response suggested by Nelson et a (2010). Because of the statistical power of our study, as well

as the actual study data, we can not rule out a more subtle trend, as suggested by Steenland (2009) et al. for PFOS concentrations, but offer no evidence in support of their trend for PFOA.

Increased PFOA exposure, determined by matched-pair biomonitoring analyses, has also been observed at one other 3M remediation site that involved contingent workers during Phase I of the Building 15 Demolition and Disposal project (Olsen et al. 2009). The baseline mean PFOA concentration was 22.6 ng/mL for 45 contingent workers which is approximately 4 times the general population average (Nelson et al. 2010). Serum PFOA concentrations increased an average of 133 ng/mL over a 3+ month time period for these 45 contingent workers involved with the Building 15 project. Their mean PFOA increase was not associated with any statistically significant increase in the workers' mean total cholesterol (-2.5 mg/dL, $p = 0.56$), non-HDL cholesterol (-4.1 mg/dL, $p = 0.36$), or HDL (2.0 mg/dL, $p = 0.34$).

The present study also did not indicate perturbations in renal function or hepatic clinical chemistries associated with the magnitudes of increased PFOA or PFOS concentrations. Therefore, the present study's longitudinal assessment does not support the findings by Lin et al. (2009) who conducted a cross-sectional analysis of NHANES data and reported a 1.86 unit increase in ALT with a 1 unit increase in log PFOA concentration. This did not occur in the present study. In fact, several of the statistical associations were in the negative direction. Nor have there been clinically relevant increases in hepatic clinical chemistries observed in a series of cross-sectional or longitudinal occupational studies of ammonium perfluorooctanoate production workers (Costa et al. 2009; Olsen et al. 1999; 2000; 2003; 2007; Sakr et al. 2007a; 2007b; Steenland et al. 2010). In a longitudinal assessment of 454 DuPont workers whose medical records were abstracted for many years, Sakr et al. reported a 1,000 ng/mL increase in serum PFOA concentration was statistically significantly associated with a 0.008 mg/dL decline in total

bilirubin (95% CI -0.014 to -0.002), a 0.35 U/L increase in AST (95% CI -10 to +0.60), and a non-significant 0.54 U/L increase in ALT (95% CI -0.46 to +1.54). These statistical associations do not have clinical relevance at occupational levels of PFOA, let alone extrapolated to the much lower concentrations of PFOA reported in the general population.

Besides the limitation of the study sample size, the present study also could not obtain fasting blood samples. This inability to request fasting blood samples was a logistical necessity because the contingent workers workforce had to participate in blood collection throughout the normal work day. The lack of fasting would bias the serum triglyceride and glucose measurements and could also affect the LDL cholesterol results due to its indirect calculation by the Friedewald formula. Consequently, these specific clinical chemistries can be difficult to interpret in this study. On the other hand, total cholesterol, non-HDL cholesterol, HDL cholesterol, renal function, and the liver enzymes would not be biased by the lack of fasting. Another possible limitation could be the result that the average assessment period of approximately 200 days between baseline and end-of-project may have been too short of follow-up time to observe an altered clinical chemistry profile due to organ pathology. However, increasing serum PFOA concentrations did not result in higher blood lipid values in male cynomolgus monkeys dosed daily for 6 months that resulted in steady serum concentrations ranging between 81,000 ng/mL and 156,000 ng/mL depending upon administered dose (range 3 to 20 mg/kg/day via oral capsule) (Butenhoff et al. 2002; 2004). Administered PFOS did result in hypocholesterolemia when serum concentrations approached 100,000 ng/mL (Seacat et al. 2002).

Most recently, a Phase III human clinical trial conducted in Europe, administered the ammonium salt of PFOA to 37 patients (21 males and 16 females) with advanced refractory solid

tumors (16 colorectal; 4 pancreatic; 17 "other")]. There were 9 different doses of ammonium PFOA ranging between 50 to 1200 milligrams that were administered once weekly (oral capsule) in group sizes of at least 3 patients per dose. Median duration of treatment was 9 weeks (range 2 - 40 weeks). The highest plasma PFOA concentrations reached approximately 1000 micromolar (≈ 413,000 ng/mL). Toxicities related to the treatment included fatigue, nausea, vomiting, and diarrhea. One of six patients treated at the 600 mg weekly dose level 1 individual experienced grade 5 renal failure and grade 4 elevated transaminases that the study investigators "attributed to progressive disease but contribution of study medication could not be excluded." There was strong association between increasing serum PFOA concentrations and hypocholesterolemia. This should not be unexpected due to the known PPARα agonist activity of PFOA. Thus, the findings from this Phase III trial do not support the assertion that PFOA would be causally associated with increasing cholesterol levels in the general population.

CONCLUSION

Based on two longitudinal assessments of workers involved in the demolition and disposal of legacy production facilities at 3M Cottage Grove (Building 15) and 3M Decatur (Buildings 2/48/49), workers' increased PFOA concentrations have not been associated with non-HDL cholesterol. Although the study samples were relatively small, these investigations had the statistical power to detect the magnitude of change suggested by the Nelson et al. (2010) cross-sectional NHANES data. There was no evidence that a 10 ng/mL increase in PFOA serum concentration resulted in an approximate 5 to 10 mg/dL increase in non-HDL cholesterol. This lack of a positive association between PFOA and non-HDL cholesterol in humans is strengthened considerably by data from a Phase III clinical trial of refractory solid tumor patients

who were administered the ammonium salt of PFOA. Plasma PFOA concentrations that ranged upwards to 400,000 ng/mL resulted in hypocholesterolemia which is not unexpected given the fact that PFOA has been shown to be a PPARα agonist in toxicological studies.

The present study's data do not suggest a 10 ng/dL increase in PFOS would result in a 10 mg/dL increase in non-HDL cholesterol (as suggested by the Nelson et al. 2010 data). However, the study's statistical power can not rule out an association of a lesser magnitude. PFOS is also a PPARα agonist that resulted in hypocholesterolemia in toxicological studies involving rodents and non-human primates. This finding is observed at PFOS serum concentrations several orders of magnitude higher than reported by Steenland et al. (2009) or Frisbee et al. (2010).

Overall, these data argue against a causal association between PFOA and PFOS with non-HDL cholesterol. It does suggest that the statistical positive associations reported in the cross-sectional studies might be the consequence of a third factor that causes their correlation (Steenland et al. 2010). Additional research should focus on the binding, absorption, metabolism, and/or elimination characteristics of the class of long chain perfluoroalkyls and how this may be correlated with non-HDL cholesterol.

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Table 1. Summary of Findings from the NHANES (Nelson et al. 2010) and mid-Ohio River Population (Frisbee et al. 2010; Steenland et al. 2009) Studies

1. NHANES

Nelson et al. 2010

				Approximate *Change* (mg/dL) from Quartile 1		
	PFOA (ng/mL)			Total Cholesterol	Non-HDL	HDL
	Median	Mean	Range			
Quartile 1	2.1	1.9	0.1 – 2.7	-	-	-
Quartile 2	3.4	3.4	2.8 – 3.9	5	7	- 2
Quartile 3	4.6	4.6	4.0 – 5.4	7	9	- 1.5
Quartile 4	6.9	8.0	5.5 – 37.3	9.8	11	- 1.3
	PFOS (ng/mL)					
	Median	Mean	Range			
Quartile 1	9.9	9.6	1.4 – 13.6	-	-	-
Quartile 2	17.3	17.0	13.6 – 19.7	6	5	1.5
Quartile 3	23.5	23.6	19.8 – 28.1	5	5	<1.0
Quartile 4	37.5	44.8	28.2 – 392.0	13.4	13	0.9

Table 1. (continued)

2. Mid-Ohio River Studies

		Approximate *Change* (mg/dL) from Lowest Level			
	Total Chol (change)	**Non-HDL**	**LDL**	**HDL**	**T Chol/HDL**
Frisbee et al. (2010)					
PFOA (ng/mL)					
≈ 5	155	Not reported	82.5	48	Not reported
≈25	160 (5)	Not reported	87.5 (5)	49 (1)	Not reported
PFOS (ng/mL)					
≈ 7	154	Not reported	82	47	Not reported
≈30	162 (8)	Not reported	88 (6)	49 (2)	Not reported
≈50	166 (12)	Not reported	91 (9)	49 (2)	Not reported
Steenland et al. (2009)					
PFOA (ng/mL)					
≈ 5	199	153	114	44.6	4.47
≈50	208 (9)	161 (8)	121 (7)	45.4 (0.8)	4.60 (0.13)
PFOS (ng/mL)					
≈ 7	197	150	111	44.6	4.40
≈50	209 (12)	160 (10)	122 (11)	45.0 (0.4)	4.65 (0.25)

Table 2. Distribution of Workers by Company and Participation for the Buildings 2/48/49 Demolition and Disposal Project

Company	Baseline	End of Project (%)
Non-3M	155	107 (84.9)[1]
CST	62	47 (75.8)[2]
Goss Electric	25	14 (56.0)
Hubbard & Drake	36	26 (72.2)
Other	31	20 (64.5)
3M	19	19 (15.1)
Total	174	126

[1] Percent of individuals (n = 126) who participated in baseline and end of project.
[2] Percent of workers of each contractor who participated in baseline and end of project.

Table 3. PFOA Baseline and End of Project Concentrations (ng/mL) for Total (N = 174), *Both* Baseline and End of Project (N = 126), and *Only* Baseline (N = 48) Participants

Employer & Participant Status	Minimum	Q1	Median	Q3	90 %	Maximum	Arithmetic Mean	Arithmetic 95% CI	Geometric Mean	Geometric 95% CI
All Subjects (N = 174										
Baseline	LLOQ	5.0	10.0	39.0	237.0	4,280.0	113.4	(53.6 – 173.0)	15.9	(12.2 – 20.6)
End of Project[1]	1.6	9.5	17.4	40.7	203.0	2,930.0	98.3	(43.3 – 153.3)	23.0	(18.0 – 29.5)
Subjects (N = 126) with *Both* Measurements										
Baseline	LLOQ	4.6	10.8	39.3	294.0	4,280.0	132.8	(51.8 – 213.9)	23.0	(18.0 – 29.5)
End of Project	1.6	9.5	17.4	40.7	203.0	2,930.0	98.3	(43.3 – 153.3)	23.0	(18.0 – 29.5)
Subjects (N 48) with *Only* Baseline Measurements										
Baseline	1.9	5.2	8.5	37.5	144.6	659.0	62.2	(21.2 – 103.3)	15.4	(10.0 – 23.9)

[1] N = 126 for end of project for all subjects

Table 4. PFOS Baseline and End of Project Concentrations (ng/mL) for Total Baseline and End of Project Participants, and Only Baseline Participants

Employer & Time Period	Min	Q1	Median	Q3	90 %	Max	Arithmetic Mean	Arithmetic 95% CI	Geometric Mean	Geometric 95% CI
All Subjects (N = 174)										
Baseline	1.7	12.0	26.7	66.0	187.0	1,230.0	88.6	62.0 – 115.3	33.1	27.3 – 40.1
End of Project[1]	6.0	20.9	34.0	76.9	258.7	763.0	87.3	6.2 – 112.5	41.7	34.2 – 50.8
Subjects (N = 126) with Baseline & End of Project Measurements										
Baseline	1.7	12.0	27.7	76.4	332.5	1,230.0	102.8	67.2 – 138.3	34.7	27.2 – 44.3
End of Project	6.0	20.9	34.0	76.9	258.7	763.0	87.3	6.2 – 112.5	41.7	34.2 – 50.8
Subjects (N = 48) with Baseline Only Measurements										
Baseline	6.8	14.0	23.0	52.5	113.3	490.0	51.5	28.0 – 74.9	29.2	22.0 – 38.6

[1] N = 126 for end of project

Table 5. Distribution of PFOA Baseline and End of Project Concentrations (ng/mL) by Employer

Employer & Time Period	Min	Q1	Median	Q3	90 %	Max	Arithmetic Mean	Arithmetic 95% CI	Geometric Mean	Geometric 95% CI
3M (N = 19)										
Baseline	9.0	49.0	361.0	1,190.0	1,570.0	4,280.0	692.0	203.1 – 1,180.9	228.4	97.9 – 533.2
End of Project	7.7	39.4	241.0	795.0	1,010.0	2,930.0	458.1	128.2 – 788.0	160.3	71.4 – 359.9
Non-3M (N = 107)										
Baseline	LLOQ	3.9	8.0	24.0	76.8	815.0	33.6	16.0 – 51.1	10.0	7.6 – 13.1
End of Project	1.6	8.7	14.2	26.6	66.6	862.0	34.4	17.4 – 51.4	16.3	13.3 – 19.9
CST (N = 47)										
Baseline	LLOQ	2.2	3.6	6.4	11.7	815.0	22.3	0.0 – 57.0	4.0	2.8 – 5.6
End of Project	1.6	7.0	10.9	17.7	43.4	862.0	32.6	0.0 – 69.2	11.6	8.6 – 15.7
Goss Electric (N = 14)										
Baseline	5.0	8.2	23.0	57.3	237.0	250.0	56.1	9.5 – 102.7	24.7	11.6 – 52.5
End of Project	10.0	11.1	22.1	62.3	161.5	166.0	46.2	14.4 – 78.0	27.1	15.2 – 48.4
Hubbard & Drake (N = 26)										
Baseline	4.0	12.3	19.1	31.8	140.9	291.0	41.0	14.2 – 67.8	21.9	14.5 – 32.8
End of Project	9.0	15.8	20.5	32.1	115.2	224.0	37.4	17.0 – 57.8	24.6	17.8 – 33.8
Other (N = 20)										
Baseline	2.8	6.0	10.5	53.8	116.6	151.0	34.6	13.9 – 55.4	16.7	9.4 – 29.7
End of Project	3.2	7.3	11.1	42.2	91.1	93.7	26.2	12.3 – 40.2	15.1	9.2 – 24.8

Table 6. Distribution of PFOS Baseline and End of Project Concentrations (ng/mL) by Employer

Employer & Time Period	Min	Q1	Median	Q3	90 %	Max	Arithmetic Mean	Arithmetic 95% CI	Geometric Mean	Geometric 95% CI
3M (N = 19)										
Baseline	12.0	65.0	448.0	7100	897.0	1,230.0	409.8	234.5 – 585.0	217.1	112.2 – 420.2
End of Project	8.7	58.0	321.0	4360	759.0	763.0	299.7	178.1 – 421.4	171.0	91.7 – 319.1
Non-3M (N = 107)										
Baseline	1.7	10.8	23.0	54.0	124.2	497.0	48.3	33.9 – 62.6	25.0	20.2 – 31.0
End of Project	6.0	19.0	31.0	57.4	113.0	413.0	49.6	37.8 – 61.3	32.4	27.4 – 38.4
CST (N = 47)										
Baseline	1.7	7.0	11.1	20.6	54.4	146.0	21.5	12.9 – 30.0	12.9	9.8 – 17.1
End of Project	6.8	11.9	22.1	32.9	62.3	142.0	30.5	21.7 – 39.2	22.3	17.9 – 27.8
Goss Electric (N = 14)										
Baseline	10.0	19.0	41.0	77.0	156.5	180.0	55.1	26.5 – 83.8	38.5	23.0 – 64.6
End of Project	19.0	33.2	47.0	76.3	115.0	141.0	56.4	37.4 – 75.3	48.7	35.2 – 67.4
Hubbard & Drake (N = 26)										
Baseline	7.0	21.8	34.5	55.8	224.5	497.0	73.2	23.9 – 122.4	39.9	27.1 – 58.8
End of Project	6.0	23.4	35.6	64.3	180.3	413.0	68.4	27.7 – 109.2	40.7	27.9 – 59.6
Other (N = 20)										
Baseline	10.4	23.0	40.5	123.0	192.0	223.0	74.1	42.3 – 105.9	47.7	30.0 – 76.0
End of Project	7.3	23.1	34.5	115.8	155.7	173.0	65.2	39.3 – 90.9	43.7	28.0 – 68.7

Table 7. Arithmetic Mean of Matched Paired Differences and 95% Confidence Interval for PFOA and PFOS by Employer

	PFOA (ng/mL)			PFOS (ng/mL)		
Employer	Mean Difference	95% CI	p value	Mean Difference	95% CI	p value
3M	-233.9	(-399.8) – (-68.1)	0.008	-110.1	(-17.2) – (-4.9)	0.002
Non-3M Employee	-0.8	(-3.0) – 4.6	0.67	1.3	(-2.7) – 5.3	0.52
CST	10.4	6.0 – 14.8	<0.0001	9.0	5 – 12.9	< 0.0001
Goss Electric	-10.0	(-2.7) – 7.0	0.22	1.2	(-12.7) – 15.2	0.85
Hubbard & Drake	-3.6	(-10.4) – 3.2	0.28	-4.7	(-14.7) – 5.4	0.35
Other	-8.4	(-15.8) – (-1.0)	0.03	-9.0	(-18.9) – 4.8	0.07

Table 8. Distribution of 4 Trend Categories by Employer

Trend Categorization	3M Employees N	(%)	Non-3M Employees N	(%)	Non-3M Employees: CST N	(%)	Goss Electric N	(%)	Hubbard & Drake N	(%)	Other N	(%)
Subjects with *Increase* in PFOA & PFOS (N = 57)	0	(0.0)	57	(53.2)	37	(78.7)	7	(50.0)	10	(38.5)	3	(15.0)
Subjects with *Decrease* in PFOA and PFOS (N = 43)	18	(94.7)	25	(23.4)	2	(4.2)	4	(28.6)	8	(30.8)	11	(55.0)
Subjects with *Increase* in PFOA & *Decrease* in PFOS (N = 10)	0	(0.0)	16	(15.0)	6	(12.8)	0	(0.0)	7	(26.9)	3	(15.0)
Subjects with *Decrease* in PFOA & *Increase* in PFOS (N = 16)	1	(5.3)	9	(8.4)	2	(4.2)	3	(21.4)	1	(3.8)	3	(15.0)
Total	19	(100.0)	107	(100.0)	47	(100.0)	14	(100.0)	26 (100)		20 (100)	

Table 9. Demographic Characteristics of the 4 Trend Categorizations of PFOA and PFOS (N = 126)

	Increased PFOA & PFOS (N = 57)		*Decreased* PFOA & PFOS (N = 43)		*Increased* PFOA & *Decreased* PFOS (N = 16)		*Decreased* PFOA & *Increased* PFOS (N = 10)	
Parameter	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Age								
Baseline	37.8	34.8 – 40.7	45.3	42.3 – 8.3	37.6	31.9 – 43.4	41.3	33.7 – 48.9
End of Project	38.3	35.3 – 41.2	46.1	43.1 – 49.1	37.9	32.0 – 43.8	41.8	34.1 – 49.5
Self-reported BMI								
Baseline	30.9	29.2 – 32.6	29.5	27.8 – 31.1	28.1	26.3 – 30.0	29.0	26.6 – 31.4
End of Project	30.7	29.0 – 32.4	29.9	28.2 – 31.6	28.6	25.8 – 31.4	29.4	27.0 – 31.8
Days between Examinations	183	Range 2 - 477	183	Range 2 – 477	100	Range 6 – 446	191	Range 13 - 371
Sex	54 Males 3 Females		41 Males 2 Females		15 Males 1 Female		9 Males 1 Female	

Table 10. Measures of Central Tendency by Trend Categorization and Time Period for PFOA and PFOS Concentrations (ng/mL)

Trend Categorization & Time Period	Min	Q1	Median	Q3	90 %	Max	Arithmetic Mean	Arithmetic 95% CI	Geometric Mean	Geometric 95% CI
Subjects with *Increase* in PFOA & PFOS (N = 57)										
PFOA										
Baseline	0.7	2.9	5.0	10.0	29.2	815.0	23.7	0.0 – 52.2	127.1	86.9 – 186.1
End of Project	1.6	8.3	13.3	23.5	45.2	862.0	34.0	4.0 – 64.0	14.8	11.4 – 19.2
PFOS										
Baseline	1.7	7.7	14.5	28.5	63.2	118.0	24.0	17.3 0 30.7	15.3	11.8 – 19.7
End of Project	6.8	14.5	27.8	49.5	75.4	139.0	36.0	28.2 – 43.9	26.9	21.9 – 33.0
Subjects with *Decrease* in PFOA & PFOS (N = 43)										
PFOA										
Baseline	5.0	24.0	61.0	301.0	1,229.0	4,280.0	350.4	124.4 – 576.5	89.8	53.5 – 151.0
End of Project	4.0	19.0	46.3	224.0	823.2	2,930.0	235.2	83.4 – 386.9	65.5	39.8 – 107.7
PFOS										
Baseline	12.0	25.1	124.0	459.0	737.6	1,230.0	251.1	161.1 – 341.1	127.1	86.9 – 186.1
End of Project	8.7	44.9	89.5	329.0	461.8	763.0	189.1	125.2 – 253.0	102.5	71.4 – 147.3

Table 10. (continued)

Subjects & Time Period	Min	Q1	Median	Q3	90 %	Max	Arithmetic Mean	Arithmetic 95% CI	Geometric Mean	Geometric 95% CI
Subjects with *Increase* in PFOA & *Decrease* in PFOS (N = 16)										
PFOA										
Baseline	1.1	3.3	6.5	14.7	20.3	23.0	8.7	5.1 – 12.2	6.4	4.0 – 10.0
End of Project	2.2	2.1	9.4	15.0	24.2	27.2	11.4	7.8 – 14.9	9.6	6.8 – 13.5
PFOS										
Baseline	10.4	13.6	22.5	31.7	73.2	146.0	30.1	12.9 – 47.3	23.1	16.3 – 32.8
End of Project	6.0	11.9	20.2	29.3	69.2	142.0	27.7	10.7 – 44.7	20.2	13.6 – 30.0
Subjects with *Decrease* in PFOA & *Increase* in PFOS (N = 10)										
PFOA										
Baseline	6.0	10.0	18.0	25.2	35.3	36.0	18.3	11.1 – 25.6	15.6	9.9 – 24.5
End of Project	5.0	8.9	12.3	21.6	33.7	34.9	15.3	8.7 21.8	12.9	8.3 – 20.2
PFOS										
Baseline	9.7	21.3	25.5	36.8	64.8	66.0	30.5	18.4 – 42.6	26.9	18.4 – 39.3
End of Project	19.0	24.3	32.4	43.2	74.6	76.8	36.8	24.4 – 49.1	33.9	25.2 – 45.5

[1]Includes those instances where measured PFOA or PFOS concentration remained unchanged.

Table 11. Measures of Central Tendency of the Matched Pair Difference of PFOA and PFOS Concentrations (ng/mL) by Trend Categorization

Trend Categorization	Minimum	Q1	Median	Q3	90%	Maximum
Subjects (N = 57)						
Increase in						
PFOA	0.0	2.3	5.5	11.0	33.2	61.1
PFOS	0.0	1.9	7.7	20.8	27.2	51.5
Subjects (N = 43)						
Decrease in						
PFOA	-0.4	-7.0	-15.9	-107.0	-372.0	-1350.0
PFOS	-0.2	-3.7	-18.9	-53.0	-180.4	-467.0
Subjects (N = 16)						
Increase in PFOA	0.0	0.0	2.0	5.5	8.0	8.0
Decrease in PFOS	-0.1	-1.0	-2.0	-3.8	-4.9	-7.0
Subjects (N = 10)						
Decrease in PFOA	-0.3	-0.5	-1.0	-2.3	-17.4	-18.7
Increase in PFOS	0.0	0.5	2.1	11.1	27.8	29.5

Table 12. Arithmetic Mean of Matched Pair Differences, 95% Confidence Intervals, and p values from Student's t-test for PFOA and PFOS by the Four Trend Categorizations

Trend Categorization	Arithmetic Mean Difference	95% CI	p value
Subjects (N = 57)			
Increase in			
PFOA	10.3	6.7 – 13.8	<0.0001
PFOS	12.0	8.8 – 15.3	<0.0001
Subjects (N = 43)			
Decrease in			
PFOA	-115.3	(-192.2) – (-38.3)	0.004
PFOS	-62.0	(-91.5) – (-32.4)	0.0001
Subjects (N = 16)			
Increase in PFOA	8.7	1.1 – 4.3	0.002
Decrease in PFOS	-2.4	(-3.4) – (-1.4)	0.0001
Subjects (N = 10)			
Decrease in PFOA	-3.1	(-7.2) – 1.1	0.13
Increase in PFOS	6.3	(-0.3) – 12.9	0.06

Table 13. Demographics at Baseline and End of Project (N = 126)

	Baseline			End of Project			Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
Age	40.6	38.7 – 42.5	20.3 - 64	41.2	39.2 – 43.1	20.8 – 64.6	0.57	0.49 – 0.63	< 0.0001
BMI	29.9	28.9 – 30.9	17.3 – 53.6	30.0	29.0 – 31.0	17.4 – 52.1	0.14	-0.13 -0.40	0.30
Days Between Tests	-	-	-	-	-	-	207	182 – 231	Range (1 – 477)
Sex	Males: n = 119 Females: n = 7			Males: n = 119 Females: n = 7					

Table 14. Number of Responses to Self-reported Medical History and Alcohol Usage at Baseline and End of Project (N = 126)

	Baseline			End of Project		
	Yes	No	Missing	Yes	No	Missing
Medical History						
High blood pressure	20	106	0	22	104	0
Hepatitis	5	118	3	4	121	1
Cirrhosis	0	122	4	0	125	1
Other liver disease	0	123	3	1	124	1
Gall bladder disease	5	118	3	3	123	0
Diabetes	3	120	3	3	122	1
Medications						
High blood pressure	17	109	0	19	107	0
High cholesterol	16	109	1	14	111	1
Diabetes	2	121	3	3	120	3
Alcohol Usage						
< 1 drink/wk	75 (60)[1]			73 (58)		
1 – 3 drinks/wk	17 (13)			23 (18)		
4 – 7 drinks/wk	23 (18)			14 (11)		
8 – 14 drinks/wk	8 (6)			12 (10)		
> 14 drinks/wk	3 (3)			4 (3)		

1. Percent

Table 15. Baseline and End of Project Mean Values and the Mean Matched Pair Clinical Chemistry Differences Among Those Workers Whose PFOA and PFOS Concentrations (N = 126)

Clinical Parameter	Baseline			End of Project			Matched Pair Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
PFOA	132.8	51.8 – 213.9	0.7 -4280.0	98.3	43.3 – 153.3	1.6 – 2930.0	-34.6	(-62.2) – (-7.0)	0.02
PFOS	102.8	67.2 – 138.3	1.7 – 1230.0	87.3	62.1 – 112.5	6 – 763.0	-15.5	-27.1) – (-3.9)	0.009
Total Cholesterol	190	183 – 198	98 – 380	190	182 – 197	96 – 356	-1.0	(-5.2) – 3.2	0.64
Non-HDL Chol	144	136 – 151	60 – 351	141	134 – 148	62 – 305	-2.3	(-6.3) – 1.7	0.25
HDL	47	44 – 49	23 – 101	48	45 – 51	21 – 125	1.3	0.0 – 2.6	0.06
T Chol/HDL	4.4	4.1 – 4.6	1.9 – 13.1	4.2	4.0 – 4.5	1.7 – 7.4	-0.13	(-0.28) – 0.01	0.08
LDL	113	106 – 120	28 – 324	113	107 – 120	50 – 264	-0.3	(-4.0) – 3.4	0.86
Triglycerides	157	141 – 172	37 – 418	146	131 – 162	36 – 573	-9.8	(-21.4) – 1.8	0.10
Glucose	92	89 – 95	59 – 171	93	90 -96	45 – 173	1.4	(-1.1) – 4.0	0.28
BUN	14.5	13.8 – 15.2	5 – 26	15.0	14.3 – 15.8	7 – 30	0.5	(-0.1) – 1.2	0.12
Creatinine	0.98	0.95 – 1.01	0.7 – 1.7	0.98	0.94 – 1.01	0.6 – 2.2	0.0	(-0.02) – 0.02	0.73
Total Protein	7.2	7.2 – 7.3	6.3 – 7.4	7.2	7.1 – 7.2	6.3 – 8.2	-0.07	(-0.14) – (-0.01)	0.03
Albumin	4.55	4.51 – 4.60	4.0 – 5.2	4.52	4.47 – 5.57	3.9 – 5.2	-0.04	(-0.08) – 0.0	0.08
Globulin	2.69	2.63 – 2.74	2.0 – 3.8	2.65	2.59 – 2.71	1.9 – 3.7	-0.04	(-0.08) – 0.02	0.07
Albumin/Globulin	1.72	1.68 – 1.75	1.05 – 2.30	1.73	1.69 – 1.77	1.05 – 2.52	0.01	(-0.01) – 0.04	0.31
Total Bilirubin	0.64	0.58 – 0.70	0.2 – 1.8	0.63	0.58 – 0.69	0.2 – 1.7	0.0	(-0.04) – 0.04	0.88
Alkaline Phosphatase	75	72 – 78	28 – 129	73	70 – 77	31 – 145	-1.7	(-3.5) – 0.1	0.07

Table 15 (continued)

Clinical Parameter	Baseline			End of Project			Matched Pair Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
AST	21	20 – 23	11 – 78	22	20 – 23	11 – 50	0.4	(-0.9) – 1.7	0.56
ALT	27	24 – 30	8 – 121	28	25 – 30	10 – 80	0.5	(-1.7) – 2.7	0.68

Table 16. Unadjusted and Adjusted[1] PFOA Coefficients for Differences in Clinical Chemistry Measurements Among Workers in the Decatur Building 2/48/49 Demolition and Disposal Project (N = 126)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.00204	-0.02875	0.02468	0.88	-0.00131	-0.02994	0.02732	0.93
Non-HDL Chol	-0.00135	-0.02653	0.02383	0.92	-0.00100	-0.02793	0.02593	0.94
HDL	-0.00069	-0.00925	0.00787	0.87	-0.00030	-0.00932	0.00871	0.95
T Chol/HDL	-0.00002	-0.00099	0.00095	0.97	-0.00007	-0.00109	0.00095	0.89
LDL	-0.00726	-0.03059	0.01607	0.54	0.04398	-0.04147	0.12944	0.31
Triglycerides	0.02608	-0.05469	0.10685	0.52	-0.01049	-0.03543	0.01444	0.41
Glucose	0.01110	-0.00523	0.02743	0.18	0.00431	-0.01248	0.02109	0.61
BUN	-0.00161	-0.00608	0.00286	0.48	-0.00165	-0.00646	0.00316	0.50
Creatinine	-0.00007	-0.00019	-0.00005	0.27	-0.00008	-0.00021	0.00004	0.20
Total Protein	0.00023	-0.00019	0.00065	0.28	0.00026	-0.00018	0.00071	0.24
Albumin	-0.000004	-0.00026	0.00027	0.98	0.00005	-0.00022	0.00040	0.70
Globulin	0.00023	-0.00002	0.00048	0.07	0.00021	-0.00006	0.00048	0.12
Total Bilirubin	0.000005	-0.00026	0.00026	0.97	0.00008	0.00026	0.00028	0.96

Table 16 (continued)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.00237	-0.00940	0.01414	0.69	0.00036	-0.01183	0.01255	0.95
AST	-0.00530	-0.01346	0.00286	0.20	-0.00268	-0.01119	0.00583	0.53
ALT	-0.00743	-0.02154	0.00669	0.30	-0.00453	-0.01897	0.00990	0.54

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 17. Unadjusted and Adjusted[1] PFOS Coefficients for Differences in Clinical Chemistry Measurements Among Those Workers in the Decatur Building 2/48/49 Demolition and Disposal Project (N = 126)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.00746	-0.07110	0.05619	0.82	0.00108	-0.06750	0.06966	0.98
Non-HDL Chol	-0.00672	-0.00671	0.05327	0.82	0.00076	-0.06375	0.06527	0.98
HDL	-0.00074	-0.02113	0.01966	0.94	0.00032	-0.02127	0.02191	0.98
T Chol/HDL	-0.00003	-0.00235	0.00229	0.98	-0.00004	-0.00025	0.00240	0.98
LDL	-0.02945	-0.08500	0.02610	0.30	-0.02935	-0.08914	0.03044	0.33
Triglycerides	0.10633	-0.08551	0.29817	0.27	0.14412	-0.05980	0.34804	0.16
Glucose	0.01928	-0.01976	0.05832	0.33	0.01562	-0.02453	0.05576	0.44
BUN	-0.00242	-0.01307	0.00823	0.65	-0.00216	-0.01369	0.00937	0.71
Creatinine	-0.00013	-0.00042	0.00015	0.36	-0.00010	-0.00039	0.00020	0.10
Total Protein	0.00052	-0.00047	0.00152	0.30	0.00061	-0.00046	0.00167	0.26
Albumin	0.00012	-0.00051	0.00074	0.71	0.00024	-0.00042	0.00090	0.48
Globulin	0.00041	-0.00019	0.00100	0.18	0.00037	-0.00027	0.00101	0.26
Total Bilirubin	-0.00016	-0.00078	0.00045	0.60	-0.00009	-0.00074	0.00056	0.79

Table 17 (continued)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.02101	-0.00680	0.04883	0.14	0.01314	-0.01597	0.04226	0.37
AST	-0.00607	-0.02561	0.01348	0.54	0.00083	-0.01959	0.02126	0.94
ALT	-0.03844	-0.07152	-0.00536	0.02	-0.02858	-0.06283	0.00568	0.10

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 18. Unadjusted and Adjusted[1] Regression Coefficients for PFOA and PFOS For Differences in Clinical Chemistry Measurements Among Workers in the Decatur Building 2/48/49 Demolition and Disposal Project (N = 126)

Variable	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Total Cholesterol								
PFOA	0.00019	-0.03660	0.03700	0.99	-0.00289	-0.04139	0.03562	0.88
PFOS	-0.00778	-0.09546	0.07990	0.86	0.00568	-0.08657	0.09792	0.90
Non-HDL Chol								
PFOA	0.00110	-0.03359	0.03578	0.95	-0.00218	-0.03840	0.03404	0.91
PFOS	-0.00851	-0.09115	0.07414	0.84	0.00423	-0.08254	0.09100	0.92
HDL								
PFOA	-0.00900	-0.01269	0.01089	0.88	-0.00071	-0.01283	0.01142	0.91
PFOS	0.00073	-0.02736	0.02882	0.96	0.00145	-0.02759	0.03049	0.92
T Chol/HDL								
PFOA	-0.00002	-0.00136	0.00132	0.98	-0.00011	-0.00147	0.00126	0.88
PFOS	-0.000004	-0.00032	0.00320	0.99	0.00013	-0.00314	0.00341	0.94
LDL								
PFOA	0.00225	-0.02983	0.03432	0.89	-0.00422	-0.03776	0.02932	0.80
PFOS	0.03831	-0.10970	0.04345	0.39	-0.02261	-0.10310	0.05789	0.58
Triglycerides								
PFOA	-0.00842	-0.11933	0.10249	0.88	0.00710	-0.10741	0.12160	0.90
PFOS	0.12006	-0.14420	0.38432	0.37	0.13281	-0.14150	0.40710	0.34

Table 18 (continued)

Variable	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Glucose								
PFOA	0.01046	-0.01204	0.03295	0.36	-0.00006	-0.02260	0.02249	0.99
PFOS	0.00222	-0.05138	0.05582	0.93	0.01571	-0.03829	0.06971	0.57
BUN								
PFOA	-0.00173	-0.00788	0.00443	0.58	-0.00189	-0.00836	0.00458	0.56
PFOS	0.00039	-0.01426	0.01505	0.96	0.00085	-0.01464	0.01634	0.91
Creatinine								
PFOA	-0.00006	-0.00022	0.00011	0.51	0.00010	-0.00026	0.00007	0.26
PFOS	0.00004	-0.00043	0.00035	0.84	0.00005	-0.00035	0.00045	0.79
Total Protein								
PFOA	0.00015	-0.00042	0.00073	0.60	0.00017	-0.00043	0.00077	0.57
PFOS	0.00027	-0.00120	0.00165	0.69	0.00033	-0.00110	0.00177	0.64
Albumin								
PFOA	-0.00006	-0.00042	0.00030	0.75	-0.00002	-0.00039	0.00035	0.91
PFOS	0.00022	-0.00065	0.00107	0.62	0.00027	-0.00062	0.00116	0.55
Globulin								
PFOA	0.00021	-0.00013	0.00055	0.23	0.00019	-0.00017	0.00055	0.29
PFOS	-0.00006	-0.00075	0.00088	0.88	0.00006	-0.00800	0.00092	0.88
Total Bilirubin								
PFOA	-0.00010	-0.00026	0.00045	0.59	0.00006	-0.00031	0.00042	0.76
PFOS	-0.00032	-0.00117	0.00053	0.45	-0.00018	-0.00105	0.00700	0.69

Table 18 (continued)

Variable	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Alk Phos								
PFOA	-0.00690	-0.02294	0.00913	0.40	-0.00590	-0.02221	0.01041	0.48
PFOS	0.03228	-0.00593	0.07048	0.10	0.02255	-0.01653	0.06162	0.26
AST								
PFOA	-0.00669	-0.01793	-0.00454	0.24	-0.00522	-0.01665	0.00621	0.37
PFOS	0.00486	-0.02192	0.03163	0.72	0.00915	-0.01822	0.03653	0.51
ALT								
PFOA	0.00681	-0.01228	0.02590	0.48	0.00610	-0.01310	0.02531	0.53
PFOS	-0.04956	-0.09504	-0.00407	0.03	-0.03831	-0.08431	0.00770	0.10

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 19. Baseline and End of Project Mean Values and the Mean Matched Pair Clinical Chemistry Differences Among Those Workers Whose PFOA and PFOS Concentrations *Increased* (N = 57)

Clinical Parameter	Baseline			End of Project			Matched Pair Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
PFOA	23.7	0.0 – 52.2	0.7 – 815.0	34.0	4.0 – 64.0	1.6 – 862.0	10.3	6.8 – 13.8	<0.0001
PFOS	24.0	17.3 – 30.7	1.7 – 118.0	36.0	28.2 – 43.9	6.8 – 139.0	12.0	8.8 – 15.3	<0.0001
Age	37.8	34.8 – 40.7	20.3 – 64.0	38.3 – 35.3 – 41.2		20.8 – 64.2	0.50	0.41 – 0.59	<0.0001
BMI	30.9	29.2 – 32.6	19.0 – 53.6	30.7	29.0 – 32.4	19.5 – 52.1	-0.21	(-0.53) – 0.10	0.18
Days between tests	-	-	-	-	-	-	183	150 – 217	N/A
Total Cholesterol	196	182 – 209	126 – 380	195	181 – 208	114 – 356	-1.4	(-8.5) – 5.7	0.70
Non-HDL Chol	151	137 – 164	78 – 351	147	134 – 159	78 – 305	-4.2	(-10.8) – 2.5	0.22
HDL	45	42 – 48	24 – 58	48	44 – 52	28 – 87	2.8	0.8 – 4.8	0.006
T Chol/HDL	4.6	4.2 – 5.1	2.1 – 13.1	4.3	3.9 – 4.6	1.9 – 7.2	-0.3	(-0.6) – 0.0	0.02
LDL	119	106 – 131	43 – 324	118	107 – 130	56 – 264	-0.4	(-6.7) – 5.9	0.90
Triglycerides	165	142 – 188	37 – 418	142	121 – 161	42 – 142	-18.7	(-37.1) – (-0.3)	0.05
Glucose	91	87 – 94	68 – 171	93	89 – 97	56 – 160	2.1	(-1.6) – 5.8	0.26
BUN	14	13 – 14.8	7 – 24	15	14 – 16	7 – 26	0.8	-0.1 – 1.6	0.07
Creatinine	0.94	0.90 – 0.98	0.71 – 1.38	0.93	0.89 – 0.97	0.70 – 1.35	-0.01	(-0.03) – 0.01	0.34
Total Protein	7.3	7.2 – 7.4	6.5 – 8.4	7.3	7.2 – 7.4	6.3 – 8.2	-0.02	(-0.13) – 0.09	0.69
Albumin	4.6	4.5 – 4.7	4.0 – 5.2	4.6	4.5 – 4.7	4.0 – 5.2	-0.02	(-0.08) – 0.05	0.63
Globulin	2.7	2.6 – 2.8	2.1 – 34.	2.7	2.6 – 2.8	1.9 – 3.3	-0.0	(-0.07) – 0.06	0.87

Table 19 (continued)

Clinical Parameter	Baseline			End of Project			Matched Pair Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
Albumin/Globulin	1.7	1.7 – 1.8	1.3 – 2.1	1.7	1.7 – 1.8	1.3 – 2.5	0.0	(-0.04) – 0.05	0.84
Total Bilirubin	0.7	0.6 – 0.8	0.2 – 1.8	0.69	0.60 – 0.78	0.3 – 1.7	-0.01	(-0.08) – 0.06	0.74
Alkaline Phosphatase	78.8	73.2 – 84.4	28 – 129	78	72 – 85	31 – 145	-0.4	(-3.2) – 2.4	0.78
AST	22	20 – 25	13 – 78	22	20 – 24	14 – 50	-0.5	(-3.0) – 2.0	0.66
ALT	30	25 – 24	10 – 121	28	24 – 32	10 – 70	-1.7	(-5.6) – 2.2	0.38

Table 20. Unadjusted and Adjusted PFOA Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA and PFOS Concentrations *Increased* from Baseline (N = 57)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.45431	-0.97691	0.06830	0.09	-0.44256	-0.99966	0.11454	0.12
Non-HDL Chol	-0.43297	-0.92184	0.05589	0.08	-0.39760	-0.91107	0.11588	0.13
HDL	-0.02133	-0.17559	0.13293	0.78	-0.04496	-0.19931	0.10939	0.56
T Chol/HDL	0.00087	-0.02058	0.02231	0.94	0.00289	-0.01830	0.02394	0.79
LDL	-0.35956	-0.82534	0.10622	0.13	-0.32941	-0.82323	0.16442	0.19
Triglycerides	-0.25225	-1.82640	1.32190	0.75	-0.18793	-1.73399	1.35812	0.81
Glucose	-0.06875	-0.35324	0.21574	0.63	0.02005	-0.22486	0.26497	0.87
BUN	0.03387	-0.02896	0.09670	0.28	0.03319	-0.03355	0.09992	0.32
Creatinine	0.00071	-0.00107	0.00249	0.43	0.00110	-0.00068	0.00287	0.22
Total Protein	0.00202	-0.00611	0.01016	0.62	0.00206	-0.00647	0.01059	0.63
Albumin	0.00061	-0.00432	0.00554	0.80	0.00032	-0.00483	0.00548	0.90
Globulin	0.00141	-0.00344	0.00626	0.56	0.00174	-0.00330	0.00678	0.49
Total Bilirubin	-0.0010	-0.00607	0.00416	0.71	-0.00140	-0.06680	0.00385	0.59

Table 20 (continued)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-0.06093	-0.27434	0.15249	0.57	-0.04197	-0.25969	0.17575	0.70
AST	-0.03918	-0.23047	0.15211	0.68	-0.04072	-0.23877	0.15733	0.68
ALT	-0.18876	-0.48214	0.10462	0.20	-0.15719	-0.45721	0.14283	0.30

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 21. Unadjusted and Adjusted[1] PFOS Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA and PFOS Concentrations *Increased* from Baseline (N = 57)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	0.44180	-0.12993	1.01354	0.13	0.49681	-0.11682	1.11044	0.11
Non-HDL Chol	0.45963	-0.07298	0.99225	0.09	0.52649	-0.03352	1.08650	0.06
HDL	-0.01783	-0.18571	0.15005	0.83	-0.02968	-0.20023	0.14086	0.73
T Chol/HDL	0.01855	-0.00424	0.04133	0.11	0.02469	0.00247	0.04690	0.03
LDL	0.21135	-0.30329	0.72599	0.41	0.26189	-0.28694	0.81072	0.34
Triglycerides	1.42735	-0.24297	3.09766	0.09	1.52258	-0.12723	3.17238	0.07
Glucose	0.17520	-0.13136	0.48175	0.26	0.15882	-0.10748	0.42512	0.24
BUN	0.00052	-0.06856	0.06856	0.99	0.00250	-0.07180	0.07680	0.95
Creatinine	0.00057	-0.00137	0.00251	0.56	0.00030	-0.00168	0.00228	0.76
Total Protein	0.00033	-0.00854	0.00920	0.94	0.00104	-0.00838	0.01046	0.83
Albumin	-0.00044	-0.00580	0.00493	0.87	-0.00029	-0.00597	0.00539	0.92
Globulin	0.00077	-0.00452	0.00606	0.77	0.00133	-0.00424	0.00690	0.63
Total Bilirubin	0.00337	-0.00213	0.00886	0.22	0.00369	-0.00205	0.00941	0.20

Table 21 (continued)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.06938	-0.16275	0.30153	0.55	0.12204	-0.11585	0.35992	0.31
AST	0.13486	-0.07038	0.34009	0.19	0.13256	-0.08290	0.34801	0.22
ALT	0.16717	-0.15365	0.48799	0.30	0.16264	-0.16857	0.49385	0.33

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 22. Unadjusted and Adjusted[1] PFOA and PFOS Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA and PFOA and PFOS Concentrations *Increased* from Baseline (N = 57)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Total Cholesterol								
PFOA	-0.54912	-1.06795	-0.03288	0.04	-0.55578	-1.10744	-0.00412	0.05
PFOS	0.55321	-0.01127	1.11770	0.05	0.62015	0.01194	1.22835	0.05
Non-HDL Chol								
PFOA	-0.53018	-1.012012	-0.04835	0.03	-0.51457	-1.01774	-0.01173	0.05
PFOS	0.56720	0.042968	1.09143	0.03	0.64068	0.08630	1.19507	0.02
HDL								
PFOA	-0.01894	-0.17743	0.13955	0.81	-0.04121	-0.20038	0.11795	0.61
PFOS	-0.01340	-0.18642	0.15845	0.87	-0.02054	-0.19602	0.15494	0.82
T Chol/HDL								
PFOA	-0.00240	-0.02391	0.01912	0.82	-0.00176	-0.02255	0.01903	0.87
PFOS	0.01903	-0.00438	0.04244	0.11	0.02508	0.00216	0.04800	0.03
LDL								
PFOA	-0.40936	-0.88213	0.06341	0.09	-0.39222	-0.89330	1.0886	0.12
PFOS	0.29355	-0.22080	0.80790	0.26	0.34786	-0.20421	0.89992	0.21
Triglycerides								
PFOA	-0.51478	-2.08621	1.05665	0.51	-0.04856	-2.02335	1.05208	0.53
PFOS	1.53178	-0.17792	3.24149	0.08	1.63034	-0.06495	3.32562	0.06

Table 22 (continued)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Glucose								
PFOA	-0.10234	-0.39054	0.18587	0.48	-0.00932	-0.25852	0.23988	0.94
PFOS	0.19596	-0.11761	0.50952	0.22	0.16088	-0.11386	0.43563	0.25
BUN								
PFOA	0.03500	-0.02955	0.09955	0.28	0.03411	-0.03473	0.10296	0.32
PFOS	-0.00658	-0.07681	0.06365	0.85	-0.00507	-0.08097	0.07083	0.89
Creatinine								
PFOA	0.00063	-0.00012	0.00246	0.49	0.00108	-0.00074	0.00291	0.24
PFOS	0.00044	-0.00155	0.00243	0.66	0.00006	-0.00195	0.00208	0.95
Total Protein								
PFOA	0.00204	-0.00632	0.01040	0.63	0.00195	-0.00685	0.01075	0.66
PFOS	-0.00008	-0.00918	0.00902	0.99	0.00061	-0.00910	0.01031	0.90
Albumin								
PFOA	-0.00071	-0.00435	0.00577	0.78	0.00039	-0.00492	0.00571	0.88
PFOS	-0.00058	-0.00609	0.00493	0.83	-0.00038	-0.00624	0.00549	0.90
Globulin								
PFOA	0.00133	-0.00366	0.00631	0.60	0.00156	-0.00364	0.00675	0.55
PFOS	0.00050	0.04920	0.05918	0.85	0.00098	-0.00475	0.00671	0.73
Total Bilirubin								
PFOA	-0.00159	-0.00676	0.00359	0.54	-0.00218	-0.00750	0.00315	0.42
PFOS	0.00369	-0.00194	0.00932	0.19	0.00417	-0.00170	0.01004	0.16

Table 22 (continued)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Alk Phos								
PFOA	-0.07544	-0.29373	0.14285	0.49	-0.06696	-0.28876	0.15483	0.55
PFOS	0.08469	-0.15281	0.32219	0.48	0.13690	-0.10763	0.38142	0.27
AST								
PFOA	-0.06454	-0.25759	0.12852	0.51	-0.06767	-0.26836	0.13304	0.50
PFOS	0.14796	-0.06209	0.35799	0.16	0.14757	-0.07370	0.36884	0.19
ALT								
PFOA	-0.22525	-0.52198	0.07149	0.13	-0.19478	-0.49966	0.11010	0.21
PFOS	0.21287	-0.10997	0.53572	0.19	0.20587	-0.13026	0.54200	0.22

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 23. Baseline and End of Project Mean Values and the Mean Matched Pair Clinical Chemistry Differences Among Those Workers Whose PFOA and PFOS Concentrations *Increased* (N = 47)

Clinical Parameter	Baseline			End of Project			Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
PFOA	7.0	4.7 – 9.4	0.7 – 40.0	17.8	13.6 – 21.9	1.6 – 64.8	10.7	6.8 – 14.6	<0.0001
PFOS	16.7	12.4 – 21.1	1.7 – 61.0	28.3	22.9 – 33.7	6.8 – 77.0	11.6	8.1 – 15.1	<0.0001
Age	36.4	33.2 – 39.6	20.3 – 64.0	37.0	33.7 – 40.2	20.8 – 64.2	0.53	0.43 – 0.63	<0.0001
BMI	29.7	28.0 – 31.4	19.0 – 42.8	29.6	28.0 – 31.2	19.5 – 42.4	-0.14	(-0.45) – 0.16	0.34
Days between tests	-	-	-	-	-	-	196	160 – 232	N/A
Total Cholesterol	194	178 – 210	126 – 380	195	179 – 210	114 – 356	-0.2	(-7.8) – 7.5	0.97
Non-HDL Chol	148	133 – 163	78 – 351	145	130 – 159	78 – 305	-3.5	(-10.8) – 3.8	0.34
HDL	46	42 – 50	27 – 85	50	46 – 55	28 – 87	3.4	1.1 – 5.6	0.004
T Chol/HDL	4.5	4.0 – 5.0	2.1 – 13.1	4.1	3.7 – 4.5	1.9 – 7.2	-0.4	(-0.7) – 0.0	0.03
LDL	119	105 – 134	62 – 324	119	106 – 132	64 – 264	-0.3	(-7.3) – 6.7	0.93
Triglycerides	150	126 – 175	37 – 418	124	108 – 149	42 – 320	(-15.9)	(-33.7) – 1.9	0.09
Glucose	91	89 – 93	76 – 105	90	87 – 93	56 – 118	-0.8	(-3.8) – 2.2	0.60
BUN	13	12 – 14	7 – 19	14	13 – 15	7 – 20	0.9	(-0.1) – 1.8	0.07
Creatinine	0.93	0.89 – 0.98	0.71 – 1.38	0.92	0.87 – 0.97	0.7 – 1.36	-0.01	(-0.05) – 0.01	0.20
Total Protein	7.3	7.2 – 7.4	6.5 – 8.4	7.3	7.2 – 7.5	6.3 – 8.2	0.01	(-0.11) – 0.13	0.83
Albumin	4.6	4.6 – 4.7	4.0 – 5.2	4.6	4.6 – 4.7	4.2 – 5.2	0.0	(-0.11) – 0.13	0.96
Globulin	2.7	2.6 – 2.8	2.1 – 3.4	2.7	2.6 – 2.8	1.9 – 3.3	0.01	(-0.06) – 0.08	0.77

Table 23 (continued)

Clinical Parameter	Baseline			End of Project			Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
Albumin/Globulin	1.74	1.68 – 1.79	1.32 – 2.13	1.74	1.67 – 1.81	1.34 – 2.53	0.0	(-0.04) – 0.05	0.89
Total Bilirubin	0.7	0.6 – 0.9	0.2 – 1.8	0.72	0.61 – 0.83	0.3 – 1.7	-0.02	(-0.10) – 0.06	0.59
Alkaline Phosphatase	78	72 – 84	28 – 129	77	70 – 84	31 – 145	0.8	(-3.9) – 2.4	0.69
AST	22	19 – 25	13 – 78	22	19 – 24	14 – 50	-0.4	(-3.4) – 2.6	0.78
ALT	30	24 – 35	10 – 121	28	24 – 32	10 – 70	-2.0	(-6.7) – 2.7	0.40

Table 24. Unadjusted and Adjusted[1] PFOA Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA Concentrations *Increased* ≤ 61 ng/mL From Baseline (N = 47)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.28759	-0.86248	0.28731	0.32	-0.26825	-0.86098	0.32449	0.37
Non-HDL Chol	-0.30620	-0.84484	0.23244	0.26	-0.26132	-0.81106	0.28841	0.34
HDL	0.01861	-0.15593	0.19316	0.83	-0.00692	-0.18746	0.17362	0.94
T Chol/HDL	0.00116	-0.02329	0.025611	0.92	0.00330	-0.02105	0.02764	0.79
LDL	-0.25150	-0.78076	0.27784	0.34	-0.23041	-0.76149	0.30066	0.39
Triglycerides	-0.09604	-1.73104	0.15390	0.91	0.02828	-1.62997	1.68652	0.97
Glucose	0.07254	-0.15762	0.30270	0.53	0.11352	-0.09541	0.32246	0.28
BUN	0.02916	-0.04439	0.10270	0.43	0.03101	-0.04769	0.10972	0.43
Creatinine	0.00109	-0.00100	0.00318	0.30	0.00149	-0.00051	0.00349	0.14
Total Protein	0.00174	-0.00761	0.11095	0.71	0.00244	-0.00690	0.01178	0.60
Albumin	0.00052	-0.0053	0.00636	0.86	0.00038	-0.00571	0.00647	0.90
Globulin	0.00123	-0.00435	0.00680	0.66	0.00207	-0.00306	0.00718	0.42
Total Bilirubin	-0.00010	-0.00614	0.00594	0.97	-0.00085	-0.00705	0.00535	0.78

Table 24 (continued)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-0.15335	-0.39336	0.08666	0.20	-0.12065	-0.35725	0.11595	0.31
AST	-0.03719	-0.26834	0.19396	0.75	-0.02202	-0.25884	0.21480	0.85
ALT	-0.17629	-0.53287	0.18030	0.32	-0.12526	-0.48692	0.23640	0.49

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 25. Unadjusted and Adjusted[1] PFOS Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOS Concentrations *Increased* ≤ 61 ng/mL From Baseline (N = 47)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	0.21809	-0.42244	0.85861	0.50	0.40156	-0.25927	1.06238	0.23
Non-HDL Chol	0.24562	-0.35507	0.84630	0.41	0.43305	-0.17651	1.04262	0.16
HDL	-0.02753	-0.22077	0.16571	0.78	-0.03150	-0.23416	0.17116	0.76
T Chol/HDL	0.01523	-0.01147	0.04192	0.26	0.02333	-0.00304	0.04970	0.08
LDL	0.05924	-0.53245	0.65093	0.84	0.22866	-0.36879	0.82611	0.44
Triglycerides	1.13767	-0.64096	2.91630	0.20	1.21866	-0.60480	3.04211	0.18
Glucose	-0.00230	-0.25836	0.25375	0.99	0.00174	-0.23647	0.23996	0.99
BUN	0.01907	-0.06276	0.10090	0.64	0.02140	-0.06747	0.11027	0.63
Creatinine	0.00044	-0.00190	0.00278	0.70	0.00021	-0.00209	0.00252	0.85
Total Protein	-0.00139	-0.01175	0.00898	0.79	0.00193	-0.00859	0.01244	0.71
Albumin	-0.00101	-0.00748	0.00545	0.75	-0.00016	-0.00701	0.00668	0.96
Globulin	-0.00037	-0.00656	0.00581	0.90	0.00209	-0.00368	0.00783	0.47
Total Bilirubin	0.00278	-0.00385	0.00942	0.40	0.00251	-0.00442	0.00944	0.47

Table 25 (continued)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.07948	-0.19014	0.34910	0.56	0.17430	-0.08933	0.43793	0.19
AST	0.18020	-0.07033	0.43073	0.15	0.17457	-0.08593	0.43506	0.18
ALT	0.18536	-0.21001	0.58072	0.35	0.20388	-0.19987	0.60763	0.31

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 26. Adjusted[1] PFOA Coefficients for All (N = 47) Subjects with Baseline and End of Project Measurements[2] which Included Only Covariates with $p < 0.10$ Coefficients.

Change in Variable	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted for in Model
T Cholesterol	0.00332	-0.02398	0.03062	0.81	BMI
LDL	-0.17930	-0.70441	0.34581	0.49	BMI
Triglycerides	-0.00171	-1.59735	1.59393	0.99	Age
Glucose	0.10201	-0.10454	0.30855	0.32	Age, BMI, alcohol
Creatinine	0.00140	-0.00058	0.00338	0.16	Days between tests
Globulin	0.00206	-0.00299	0.00710	0.42	Days between tests, alcohol
Alk Phos	-0.11007	-0.34238	0.12225	0.35	BMI
ALT	-0.14069	-0.49317	0.21179	0.43	Days between tests

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

[2]Subjects excluded those taking cholesterol lowering medications and with PFOA concentrations > 61 ng/mL.

Table 27. Adjusted[1] PFOS Coefficients for All (N = 47) Subjects with Baseline and End of Project Measurements[2] which Included Only Covariates with $p < 0.10$ Coefficients.

Change in Variable	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted for in Model
T Chol/HDL	0.01903	-0.00702	0.04509	0.15	BMI
LDL	0.13682	-0.44435	0.71800	0.64	BMI
Triglycerides	1.37590	-0.35325	3.10505	0.12	Age
Glucose	0.01248	-0.21951	0.24447	0.91	Age, BMI, alcohol
Creatinine	0.00001	-0.00215	-0.00235	0.93	Days between tests
Globulin	0.00164	-0.00397	0.00725	0.56	Days between tests, BMI
Alk Phos	0.12707	-0.12922	0.38335	0.32	BMI
ALT	0.14292	-0.24839	0.53423	0.47	Days between tests

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

[2]Subjects excluded those taking cholesterol lowering medications and with PFOS concentrations > 61 ng/mL.

Table 28. Unadjusted and Adjusted[1] PFOA and PFOS Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA and PFOS Concentrations *Increased* ≤ 61 ng/mL From Baseline (N = 47)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Total Cholesterol								
PFOA	-0.39539	-1.00348	0.21270	0.20	-0.43816	-1.05519	0.17887	0.16
PFOS	0.36238	-0.31116	1.03587	0.28	0.56729	-0.12612	1.26069	0.11
Non-HDL Chol								
PFOA	-0.42546	-0.99219	0.14271	0.14	-0.44099	-1.00736	0.12538	0.12
PFOS	0.40088	-0.22681	1.02856	0.20	0.59986	-0.03662	1.23633	0.06
HDL								
PFOA	0.03007	-0.15671	0.21684	0.75	0.00283	-0.19204	0.19687	0.98
PFOS	-0.03850	-0.24537	0.16836	0.71	-0.03257	-0.25062	0.18548	0.76
T Chol/HDL								
PFOA	-0.00378	-0.02959	0.02203	0.77	-0.00416	-0.02938	0.02105	0.74
PFOS	0.01661	-0.01197	0.04519	0.25	0.02490	-0.00343	0.05324	0.08
LDL								
PFOA	-0.30133	-0.86646	0.26380	0.29	-0.33624	-0.89819	0.22571	0.23
PFOS	0.16851	-0.45704	0.79406	0.59	0.35499	-0.27587	0.98584	0.26
Triglycerides								
PFOA	-0.48741	-2.20222	1.22739	0.57	-0.37975	-2.12142	1.36192	0.66
PFOS	1.31554	-0.58370	3.21478	0.17	1.36230	-0.59495	3.31953	0.17

Table 28 (continued)

Variable	Unadjusted Coefficien80	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Glucose								
PFOA	0.08215	-0.16438	0.32867	0.51	0.12744	-0.09698	0.35186	0.26
PFOS	-0.03228	-0.30532	0.24075	0.81	-0.04646	-0.29865	0.20574	0.71
BUN								
PFOA	0.02634	-0.05244	0.10512	0.50	0.02775	-0.05688	0.11237	0.51
PFOS	0.00946	-0.07779	0.09671	0.83	0.01090	-0.08420	0.10600	0.82
Creatinine								
PFOA	0.00107	-0.00116	0.00331	0.34	0.00161	-0.00054	0.00375	0.14
PFOS	0.00005	-0.00243	0.00253	0.97	-0.00039	-0.00281	0.00202	0.74
Total Protein								
PFOA	-0.00242	-0.07592	0.01242	0.62	0.00210	-0.00794	0.01214	0.67
PFOS	-0.00227	-0.01335	0.00882	0.68	0.00113	-0.01015	0.01241	0.84
Albumin								
PFOA	0.00092	-0.00533	0.00717	0.77	0.00048	-0.00607	0.00704	0.88
PFOS	-0.00135	-0.00827	0.00574	0.70	-0.00035	-0.00771	0.00702	0.93
Globulin								
PFOA	0.00145	-0.00447	0.00747	0.62	0.00162	-0.00387	0.00712	0.55
PFOS	-0.00092	-0.00753	0.00569	0.78	0.00148	-0.00470	0.00765	0.63
Total Bilirubin								
PFOA	-0.00104	-0.00746	0.00537	0.74	-0.00181	-0.00840	0.00480	0.58
PFOS	0.00316	-0.00394	0.01027	0.37	0.00320	-0.00423	0.01062	0.39

Table 28 (continued)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Alk Phos								
PFOA	-0.19855	-0.45239	0.05529	0.12	-0.19495	-0.43955	0.04966	0.12
PFOS	0.15194	-0.12921	0.43308	0.28	0.24803	-0.02685	0.52292	0.08
AST								
PFOA	-0.10185	-0.34231	0.13861	0.40	-0.08380	-0.33177	0.16417	0.50
PFOS	0.21737	-0.04895	0.48369	0.11	0.20626	-0.07240	0.48492	0.14
ALT								
PFOA	-0.25961	-0.63399	0.11476	0.17	-0.21013	-0.59083	0.17057	0.27
PFOS	0.28010	-0.13454	0.69474	0.18	0.28336	-0.14446	0.71118	0.19

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definition

Table 29. Adjusted[1] PFOA and PFOS Coefficients in Model for All (N = 47) Subjects with Baseline and End of Project Measurements[2] which Included Only Covariates with $p < 0.10$ Coefficients.

Change in Variable	Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted for in Model
T Chol/HDL					
PFOA	-0.00437	-0.02930	0.02057	0.73	days between tests, BMI
PFOS	0.02376	-0.00386	0.05138	0.09	
LDL					
PFOA	-0.32845	-0.87770	0.22081	0.23	days between tests, BMI
PFOS	0.32289	-0.28463	0.93041	0.29	
Triglycerides					
PFOA	-0.44969	-2.10371	1.20434	0.59	age
PFOS	1.53864	-0.30541	3.38270	0.10	
Glucose					
PFOA	0.08418	-0.13169	0.30005	0.44	age, BMI
PFOS	-0.06526	-0.30514	0.17461	0.59	
Creatinine					
PFOA	0.00156	-0.00058	0.00370	0.15	days between tests
PFOS	-0.00051	-0.00288	0.00186	0.67	
Globulin					
PFOA	0.00176	-0.00366	0.00718	0.52	days between tests, BMI
PFOS	0.00099	-0.00501	0.00698	0.74	
Alk Phos					
PFOA	-0.16213	-0.40447	0.08022	0.18	BMI
PFOS	0.18323	-0.08437	0.45084	0.17	
ALT					
PFOA	-0.25199	-0.61574	0.11175	0.17	Age
PFOS	0.32516	-0.08378	0.73069	0.11	

[1] Initally adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

[2]Subjects excluded those taking cholesterol lowering medications and with PFOS concentrations > 61 ng/mL.

Table 30. Baseline and End of Project Mean Values and the Mean Matched Pair Clinical Chemistry Differences Among Those Workers Whose PFOA and PFOS Concentrations *Decreased* (N = 43)

Clinical Parameter	Baseline			End of Project			Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
PFOA 350 ~~61.0~~		124.4 – 576.5	5.0 – 4280.0	235.2	83.4 – 386.9	235.2 – 493.2	-115.3	(-192.2) – (-38.3)	0.004
PFOS	251.1	161.1 – 341.1	12.0 – 1230.0	189.1	125.2 – 253.0	8.7 – 763.0	-62.0	(-91.5) - -32.4)	<0.0001
Age	53.3	42.3 – 48.3	20.8 – 63.7	46.1	43.1 – 49.1	21.8 – 64.6	0.8	0.7 – 0.9	<0.0001
BMI	29.5	27.8 – 31.1	17.3 – 41.8	29.9	28.2 – 31.6	17.4 – 43.2	0.4	0.1 – 0.8	0.02
Days between tests	-	-	-	-	-	-	281.0	245 – 317	N/A
Total Cholesterol	190	179 – 201	113 – 259	191	182 – 199	134 – 247	0.8	(-6.1) – 7.7	0.82
Non-HDL Chol	142	131 – 152	70 – 199	142	132 – 152	79 – 210	0.3	(-6.0 – 6.6	0.92
HDL	48	43 – 53	24 – 101	49	43 – 54	26 – 125	0.5	(-2.1) – 3.1	0.72
T Chol/HDL	4.2	3.8 – 4.6	2.0 – 7.6	4.3	3.9 – 4.7	1.7 – 7.4	0.02	(-0.16) – 0.21	0.80
LDL	112	102 – 122	52 – 183	114	105 – 123	64 – 194	2.2	(-3.3) – 7.8	0.42
Triglycerides	152	125 – 180	38 – 403	144	118 – 170	36 – 445	-9.5	(-27.0) – 8.1	0.28
Glucose	97	91 – 103	59 – 159	96	90 – 102	69 – 173	-0.7	(-5.2) – 3.9	0.77
BUN	15	14 – 17	7 – 26	16	14 – 17	7 – 30	0.6	(-0.9) – 2.1	0.43
Creatinine	1.00	0.95 – 1.06	0.68 – 1.65	1.01	0.93 – 1.09	0.68 – 2.21	0.0	(-0.04) – 0.04	0.85
Total Protein	7.2	7.0 – 7.3	6.3 – 8.3	7.1	6.9 – 7.2	6.3 – 7.9	-0.1	(-0.2) – (0.0)	0.04
Albumin	4.5	4.4 – 4.6	4.0 – 5.0	4.5	4.4 – 4.5	3.9 – 4.8	-0.03	(-0.10) – 0.03	0.28
Globulin	2.7	2.6 – 2.8	2.0 – 3.8	2.6	2.5 – 2.7	2.0 – 3.7	-0.07	(-0.14) – (-0.01)	0.03

Table 30 (continued)

Clinical Parameter	Baseline			End of Project			Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
Albumin/Globulin	1.7	1.6 – 1.8	1.1 – 2.3	1.7	1.7 – 1.8	1.1 – 2.4	0.03	(-0.01) – 0.08	0.17
Total Bilirubin	0.6	0.5 – 0.7	0.2 – 1.4	0.6	0.5 – 0.7	0.2 – 1.6	0.03	(-0.03) – 0.08	0.38
Alkaline Phosphatase	76	71 – 81	36 – 105	71	66 – 76	32 – 105	-5.1	(-8.5) – (-1.6)	0.005
AST	21	18 – 23	13 – 46	23	20 – 25	11 – 47	1.8	0.30 – 3.4	0.02
ALT	25	21 – 30	8 – 76	29	23 – 34	10 – 80	3.3	0.0 – 6.6	0.05

Table 31. Unadjusted and Adjusted[1] PFOA Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA Concentrations *Decreased* From Baseline (N = 43)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	0.00208	-0.02575	0.02990	0.88	0.01136	-0.01969	0.04240	0.46
Non-HDL Chol	0.00500	-0.02020	0.03020	0.69	0.01294	-0.01617	0.04206	0.37
HDL	0.00293	-0.01339	0.00754	0.58	-0.00159	-0.01384	0.01067	0.79
T Chol/HDL	0.00034	-0.00040	0.00108	0.36	0.00046	-0.00044	0.00135	0.31
LDL	-0.00226	-0.02486	0.02034	0.84	0.00511	-0.02026	0.03048	0.69
Triglycerides	0.03964	-0.03014	0.10942	0.26	0.03951	-0.04573	0.12476	0.35
Glucose	0.00895	-0.00954	0.02744	0.33	0.01037	-0.01248	0.03322	0.36
BUN	-0.00199	-0.00803	0.00406	.51	-0.00135	0.00862	0.00593	0.71
Creatinine	-0.00007	-0.00023	0.00010	0.43	-0.00008	-0.00028	0.00012	0.41
Total Protein	0.00019	-0.00023	0.00060	0.36	0.00041	-0.00005	0.00087	0.08
Albumin	0.00000005	-0.00026	0.00026	0.99	0.00015	-0.00015	0.00044	0.31
Globulin	0.00019	-0.00007	0.00045	0.15	0.00026	-0.00041	0.00057	0.09
Total Bilirubin	0.00006	-0.00017	0.00030	0.58	0.00015	-0.00007	0.00037	0.18

Table 31 (continued)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-0.00373	-0.0179	0.01042	0.60	-0.00066	-0.01614	0.01482	0.93
AST	-0.00309	-0.00941	0.00324	0.33	-0.00463	-0.01168	0.00243	0.19
ALT	-0.00198	-0.01566	0.01171	0.77	-0.00438	-0.02057	0.01182	0.59

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 32. Unadjusted and Adjusted[1] PFOA Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOS Concentrations *Decreased* from Baseline (N = 43)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.01164	-0.08407	0.06078	0.75	0.00762	-0.07238	0.08763	0.85
Non-HDL Chol	-0.00162	-0.06741	0.06418	0.96	0.01560	-0.05954	0.09074	0.68
HDL	-0.01003	-0.03722	0.01717	0.46	-0.00798	-0.03924	0.02329	0.61
T Chol/HDL	0.00094	-0.00098	0.00286	0.33	0.00098	-0.00133	0.00329	0.40
LDL	-0.02749	-0.08588	0.03091	0.35	-0.01320	-0.07810	0.05171	0.68
Triglycerides	0.13803	-0.04148	0.31754	0.13	0.14020	-0.07541	0.35581	0.20
Glucose	0.00788	-0.04080	0.05655	0.75	0.01155	-0.04746	0.07057	0.69
BUN	-0.00035	-0.01933	0.01226	0.65	-0.00013	-0.01878	0.01852	0.99
Creatinine	-0.00013	-0.00056	0.00031	0.56	-0.00009	-0.00061	0.00042	0.71
Total Protein	0.00036	-0.00072	0.00145	0.50	0.00073	-0.00049	0.00194	0.23
Albumin	0.00136	-0.00055	0.00082	0.69	0.00050	-0.00024	-0.00124	0.18
Globulin	0.00023	0.00046	0.00092	0.51	0.00023	-0.00058	0.00103	0.58
Total Bilirubin	-0.00010	-0.00072	0.00051	0.74	0.00003	-0.00054	0.00061	0.90

Table 32 (continued)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.00258	-0.03441	0.03957	0.89	-0.01120	-0.05062	0.02823	0.57
AST	0.00022	-0.01645	0.01690	0.98	-0.00132	-0.01981	0.01717	0.89
ALT	-0.03400	-0.06804	0.00005	0.05	-0.04232	-0.08219	-0.00428	0.03

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 33. Unadjusted and Adjusted[1] PFOA and PFOS Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA and PFOS Concentrations *Decreased* from Baseline (N = 43)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Total Cholesterol								
PFOA	0.00805	-0.02803	0.00441	0.65	0.01477	-0.02430	0.05384	0.45
PFOS	-0.02481	-0.11828	0.06921	0.60	-0.01483	-0.11470	0.08520	0.77
Non-HDL Chol								
PFOA	0.00889	-0.02385	0.04163	0.59	0.01437	-0.02230	0.05104	0.43
PFOS	-0.01616	-0.10147	0.06915	0.70	-0.00617	-0.09999	0.08764	0.89
HDL								
PFOA	-0.00084	-0.01442	0.01274	0.90	0.00040	-0.01500	0.01580	0.96
PFOS	-0.00865	-0.04403	0.02674	0.62	-0.00858	-0.04797	0.03081	0.66
T Chol/HDL								
PFOA	0.00018	-0.00078	0.00114	0.70	0.00035	-0.00078	0.00148	0.53
PFOS	0.00064	-0.00186	0.00314	0.61	0.00044	-0.00245	0.00334	0.76
LDL								
PFOA	0.00712	-0.02185	0.00361	0.62	0.01257	-0.01910	0.04424	0.43
PFOS	-0.03912	-0.14478	0.03654	0.30	-0.03224	-0.11327	0.04879	0.42
Triglycerides								
PFOA	0.01054	-0.07905	0.10014	0.81	0.01088	-0.09523	0.11698	0.84
PFOS	0.12079	-0.11267	0.35424	0.30	0.12372	-0.14774	0.39518	0.36

Table 33 (continued)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Glucose								
PFOA	0.01164	-0.01239	0.03567	0.33	0.01185	-0.01692	0.04062	0.41
PFOS	-0.01163	-0.07377	0.05144	0.72	-0.00640	-0.08002	0.06721	0.86
BUN								
PFOA	-0.00188	-0.00974	0.00599	0.63	-0.00203	-0.01119	0.00713	0.66
PFOS	-0.00047	-0.02097	0.02003	0.96	0.00294	-0.02049	0.02637	0.80
Creatinine								
PFOA	-0.00006	-0.00028	0.00016	0.58	-0.00009	-0.00034	0.00016	0.45
PFOS	-0.00003	-0.00059	0.00054	0.92	-0.00047	-0.00059	0.00069	0.88
Total Protein								
PFOA	0.00017	-0.00037	0.00071	0.54	0.00038	-0.00209	0.00096	0.20
PFOS	-0.00009	-0.00132	0.00150	0.90	0.00016	-0.00134	0.00165	0.83
Albumin								
PFOA	-0.00005	-0.00040	0.00029	0.75	-0.00050	-0.00032	0.00042	0.78
PFOS	0.00022	-0.00070	0.00111	0.61	0.00042	-0.00051	0.00136	0.36
Globulin								
PFOA	0.00022	-0.00012	0.00056	0.19	0.00032	-0.00057	0.00071	0.09
PFOS	-0.00013	-0.00101	0.00074	0.76	-0.00027	-0.00125	0.00071	0.58

Table 33 (continued)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Bilirubin								
PFOA	0.00015	-0.00016	0.00045	0.33	0.00022	-0.00006	-0.00049	0.12
PFOS	-0.00035	-0.00114	0.00045	0.38	-0.00300	-0.00100	0.00041	0.40
Alk Phos								
PFOA	-0.00718	-0.02551	0.01115	0.43	0.00298	-0.01641	0.02236	0.76
PFOS	0.01432	-0.03345	0.06209	0.55	-0.01571	-0.06531	0.03389	0.52
AST								
PFOA	-0.00518	-0.01335	0.00298	0.21	-0.00665	-0.01547	0.00216	0.13
PFOS	0.00900	-0.01257	0.02997	0.41	0.00876	-0.01378	0.03131	0.44
ALT								
PFOA	0.01025	-0.00644	0.02694	0.22	0.00867	-0.01028	0.02762	0.36
PFOS	-0.05076	-0.09424	-0.00728	0.02	-0.05636	-0.10485	-0.00788	0.02

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 34. Baseline and End of Project Mean Values and the Mean Matched Pair Clinical Chemistry Differences Among Those Workers Whose PFOA and PFOS Concentrations *Decreased* ≤ 61 ng/mL from Baseline (N = 29)

Clinical Parameter	Baseline			End of Project			Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
PFOA	161.7	6.1 – 263.3	5.0 – 1190.0	119.0	39.4 – 198.7	4.0 – 1010.0	-42.5	(-17.0) – (-68.3)	0.002
PFOS	164.2	89.5 – 238.9	12.0 – 897.0	134.6	72.2 – 197.0	8.7 – 759.0	-29.6	(-44.4) – (-14.7)	0.0003
Age	43.4	39.5 – 47.3	20.8 – 63.7	44.1	40.2 – 48.0	21.8 – 64.6	0.7	0.59 – 0.86	<.0001
BMI	29.0	27.3 – 30.7	20.0 – 38.6	29.2	27.5 – 30.9	20.4 – 38.7	0.18	(-0.20) – 0.55	0.34
Days between tests	-	-	-	-	-	-	268	220 – 316	N/A
Total Cholesterol	194	182 – 207	134 – 259	192	181 -203	134 – 247	-1.8	(-9.1) – 5.6	0.63
Non-HDL Chol	144	132 – 156	94 – 197	142	129 – 155	79 – 210	-1.6	(-7.9) – 4.7	0.60
HDL	50	44 -57	24 – 101	50	43 – 57	26 – 125	-0.1	(-4.0) – 3.7	0.96
T Chol/HDL	4.2	3.7 – 4.3	2.0 – 7.6	4.3	3.7 – 4.8	1.7 – 7.4	0.05	(-0.16) – 0.27	0.62
LDL	117	104 – 130	69 – 183	116	104 – 128	64 – 194	-0.7	(-6.7) – 5.4	0.82
Triglycerides	139	104 – 174	38 – 403	136	100 – 173	36 - 445	-4.3	(-28) – 19	0.71
Glucose	91	86 – 97	59 – 142	91	86 – 95	69 – 135	-1.0	(-5.2) – 3.3	0.65
BUN	15	13 – 17	8 – 23	16	14 – 18	7 – 25	0.5	(-1.2) – 2.2	0.54
Creatinine	0.98	0.93 – 1.03	0.71 – 1.32	0.97	0.91 – 1.02	0.72 – 1.28	-0.01	(-0.05) – 0.03	0.54
Total Protein	7.2	7.0 – 7.4	6.3 – 8.3	7.1	6.9 – 7.2	6.3 – 7.9	-0.1	(-0.22) - -0.03	0.12
Albumin	4.5	4.4 – 5.6	4.0 – 5.0	4.4	4.4 – 4.5	3.9 – 4.8	-0.04	(-0.13) – 0.04	0.26
Globulin	2.7	2.5 – 2.7	2.0 – 3.8	2.6	2.5 – 2.8	2.0 – 3.7	-0.06	(-0.13) – 0.02	0.16

Table 34 (continued)

Clinical Parameter	Baseline			End of Project			Difference		
	Mean	95% CI	Range	Mean	95% CI	Range	Mean	95% CI	p value
Albumin/Globulin	1.7	1.6 – 1.8	1.1 – 2.3	0.6	0.5 – 0.7	0.2 – 1.4	0.017	(-0.04) – 0.07	0.54
Total Bilirubin	0.6	0.5 – 0.7	0.2 – 1.4	0.6	0.5 – 0.7	0.2 – 1.2	-0.01	(-0.08) – 0.06	0.85
Alkaline Phosphatase	75	69 – 82	36 – 105	72	64 – 79	32 – 105	-3.9	(-8.2) – 0.4	0.07
AST	21	18 – 24	13 – 46	22	19 – 25	11 – 47	1.2	(-0.6) – 3.0	0.19
ALT	27	21 – 32	8 – 76	28	21 – 34	10 – 80	1.0	(-2.3) – 4.3	0.54

Table 35. Unadjusted and Adjusted[1] PFOA Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA Concentrations *Decreased* ≤ 61 ng/mL From Baseline (N = 29)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.02652	-0.13625	0.08320	0.62	0.01943	-0.08861	0.12748	0.71
Non-HDL Chol	-0.00549	-0.09936	0.08838	0.91	0.03617	-0.06386	0.13620	0.46
HDL	-0.02103	-0.07770	0.03563	0.45	-0.01674	-0.08421	0.05073	0.61
T Chol/HDL	0.00125	-0.00195	0.00446	0.43	0.00156	-0.00251	0.00562	0.44
LDL	-0.02787	-0.11915	0.06340	0.54	0.01216	-0.07659	0.10091	0.78
Triglycerides	0.12500	-0.22770	0.47771	0.47	0.10729	-0.33845	0.55302	0.62
Glucose	0.06764	0.00770	0.12758	0.03	0.08493	0.01377	0.15609	0.02
BUN	0.01060	-0.01568	0.03689	0.42	0.02198	-0.00903	0.05299	0.16
Creatinine	-0.00013	-0.00076	0.00051	0.69	-0.00020	-0.00101	0.00060	0.61
Total Protein	-0.00044	-0.00243	0.00154	0.65	0.00046	-0.00168	0.00260	0.66
Albumin	-0.00057	-0.00179	0.00065	0.35	0.00006	-0.00133	0.00145	0.93
Globulin	0.00013	-0.00109	0.00134	0.83	0.00040	-0.00097	0.00176	0.55
Total Bilirubin	-0.00010	-0.00121	0.00100	0.85	0.00037	-0.00054	0.00129	0.41

Table 35 (continued)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.01526	-0.05040	0.08092	0.64	-0.00267	-0.07819	0.07285	0.94
AST	-0.00249	-0.03024	0.02526	0.86	-0.00019	-0.03109	0.02735	0.90
ALT	0.00199	-0.04855	0.05254	0.94	0.001603	-0.05515	0.05836	0.95

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 36. Unadjusted and Adjusted[1] PFOS Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOS Concentrations *Decreased* ≤ 61 ng/mL From Baseline (N = 29)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.10227	-0.28808	0.08354	0.27	-0.00047	-0.18593	0.184979	0.99
Non-HDL Chol	-0.07005	-0.22965	0.08955	0.38	0.00819	-0.16503	0.18141	0.92
HDL	-0.03222	-0.13020	0.06576	0.51	-0.00867	-0.12472	0.10740	0.88
T Chol/HDL	0.00151	-0.00405	0.00706	0.58	0.00172	-0.00529	0.00873	0.62
LDL	-0.09019	-0.24529	0.06492	0.24	0.00700	-0.14549	0.15950	0.93
Triglycerides	0.13783	-0.47415	0.74980	0.65	0.04725	-0.71938	0.81388	0.90
Glucose	0.11896	0.01596	0.22196	0.03	0.15032	0.02967	0.27096	0.02
BUN	0.01133	-0.03437	0.05703	0.62	0.02228	-0.03237	0.07693	0.41
Creatinine	-0.00006	-0.00116	0.00104	0.91	-0.00017	-0.00160	0.00121	0.80
Total Protein	-0.00075	-0.00418	0.00268	0.66	0.00119	-0.00245	0.00484	0.50
Albumin	-0.00131	-0.00338	0.00077	0.21	-0.00026	-0.00264	0.00213	0.83
Globulin	0.00056	-0.00153	0.00265	0.59	0.00145	-0.00082	0.00372	0.20
Total Bilirubin	-0.00082	-0.00270	0.00106	0.38	0.00032	-0.00126	0.00190	0.68

Table 36 (continued)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.00569	-0.10804	0.11941	0.92	-0.03535	-0.16371	0.09300	0.57
AST	-0.00491	-0.05276	0.04295	0.84	-0.00129	-0.05131	0.04874	0.96
ALT	-0.01578	-0.10276	0.07120	0.71	-0.02451	-0.12106	0.07204	0.60

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Table 37. Unadjusted and Adjusted[1] PFOA and PFOS Coefficients for Differences Between Clinical Chemistry Measurements Among Those Workers Whose PFOA and PFOS Concentrations *Decreased* ≤ 61 ng/mL From Baseline (N = 29)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Total Cholesterol								
PFOA	0.14074	-0.10470	0.38618	0.25	0.08890	-0.14392	0.32171	0.44
PFOS	-0.32071	-0.74414	0.10270	0.13	-0.13472	-0.53314	0.26370	0.49
Non-HDL Chol								
PFOA	0.16295	-0.04323	0.36912	.12	0.14435	-0.06675	0.35545	0.17
PFOS	-0.32296	-0.67864	0.03271	0.07	-0.20979	-0.57105	0.15146	0.24
HDL								
PFOA	-0.02221	-0.15474	0.11033	0.73	-0.05545	-0.20115	0.09026	0.44
PFOS	0.00225	-0.22639	0.23089	0.98	0.075076	-0.17429	0.32444	0.54
T Chol/HDL								
PFOA	0.00246	-0.00501	0.00993	0.50	0.00303	-0.00580	0.01185	0.48
PFOS	-0.00232	-0.01520	0.010567	.71	-0.00285	-0.01795	0.01225	.70
LDL								
PFOA	0.10028	-0.10582	0.30637	0.33	0.04010	-0.1568	0.23699	0.68
PFOS	-0.24658	-0.60360	0.11045	0.17	-0.05403	-0.39180	0.28374	0.74
Triglycerides								
PFOA	0.27882	-0.54323	1.10087	0.49	0.374630	-0.58724	1.33650	0.43
PFOS	-0.29494	-1.71308	1.12321	0.67	-0.51848	-2.16456	1.12760	0.52

Table 37 (continued)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Glucose								
PFOA	0.02937	-0.10978	0.168513	0.67	0.03353	-0.11936	0.18642	.65
PFOS	0.07338	-0.16665	0.313418	0.54	0.09968	-0.16196	0.36131	0.44
BUN								
PFOA	0.02462	-0.03653	0.08578	0.42	0.04738	-0.01897	0.11373	0.15
PFOS	-0.02689	-0.13239	0.07862	0.60	-0.04927	-0.16281	0.06427	0.38
Creatinine								
PFOA	-0.00048	-0.00196	0.00099	0.51	-0.00052	-0.00226	0.00123	0.55
PFOS	0.00069	-0.00186	0.00324	0.58	0.00061	-0.00238	0.00360	0.68
Total Protein								
PFOA	-0.00027	-0.00491	0.00438	0.91	-0.00070	-0.00533	0.00393	0.76
PFOS	-0.00033	-0.00835	0.00768	0.93	0.00225	-0.00567	0.01736	0.56
Albumin								
PFOA	0.00060	-0.00221	0.00340	0.67	0.00088	-0.00213	0.00388	0.55
PFOS	-0.00223	-0.00707	0.00260	0.35	-0.00158	-0.00672	0.00357	0.53
Globulin								
PFOA	-0.00086	-0.00368	0.00195	0.53	-0.00158	-0.00438	0.00122	0.26
PFOS	0.00190	-0.00296	0.00676	0.43	0.00383	-0.00964	0.00862	0.11
Total Bilirubin								
PFOA	0.00170	-0.00075	0.00416	0.17	0.00095	-0.00103	0.00292	0.33
PFOS	-0.00345	-0.00771	0.00077	0.10	-0.00110	-0.00448	0.00227	0.50

Table 37 (continued)

Variable	Unadjusted Coefficients	95% Confidence Interval Lower	Upper	p value	Adjusted Coefficients	95% Confidence Interval Lower	Upper	p value
Alk Phos								
PFOA	0.06453	-0.08745	0.21651	0.39	0.07030	-0.09013	0.23072	0.37
PFOS	-0.09447	-0.35665	0.16772	0.47	-0.14151	-0.41605	0.13303	0.30
AST								
PFOA	0.00035	-0.06454	0.06523	0.99	-0.00545	-0.06910	0.05819	0.86
PFOS	-0.00545	-0.11738	0.10649	0.92	0.00695	-0.10197	0.11587	0.90
ALT								
PFOA	0.05365	-0.06227	0.16957	0.35	0.06434	-0.05524	0.18393	0.28
PFOS	-0.09905	-0.29903	0.10094	0.32	-0.12168	-0.32633	0.08297	0.23

[1] Adjusted for age, days between tests, BMI, alcohol, and lipid lowering medications. See text for definitions.

Figure 1. Scatter plot of Matched PFOA Concentrations (ng/mL) at Baseline and End of Project (N = 126), Decatur Buildings 2/48/49 Demolition and Disposal Project

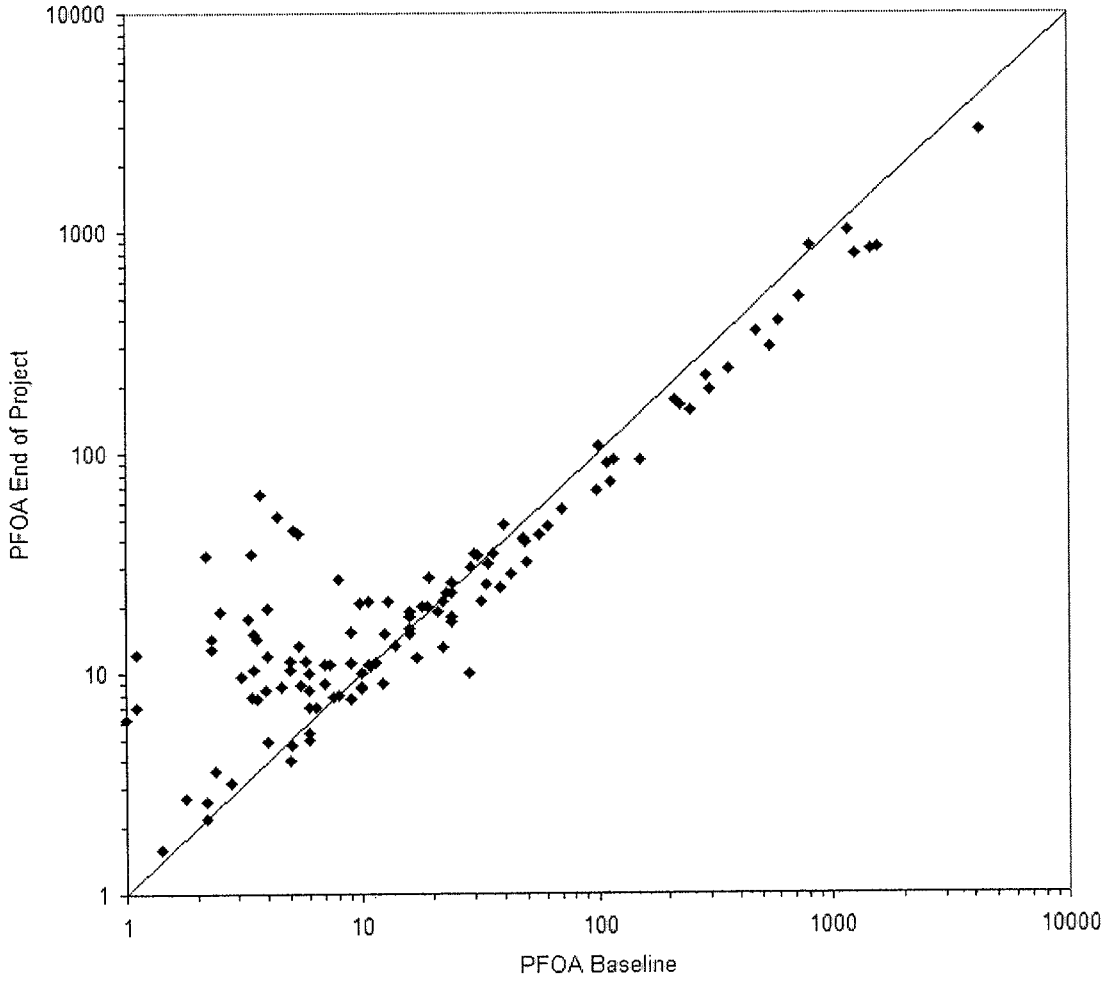


Figure 2. Scatter plot of Matched PFOS Concentrations (ng/mL) at Baseline and End of Project (N = 126), Decatur Buildings 2/48/49 Demolition and Disposal Project

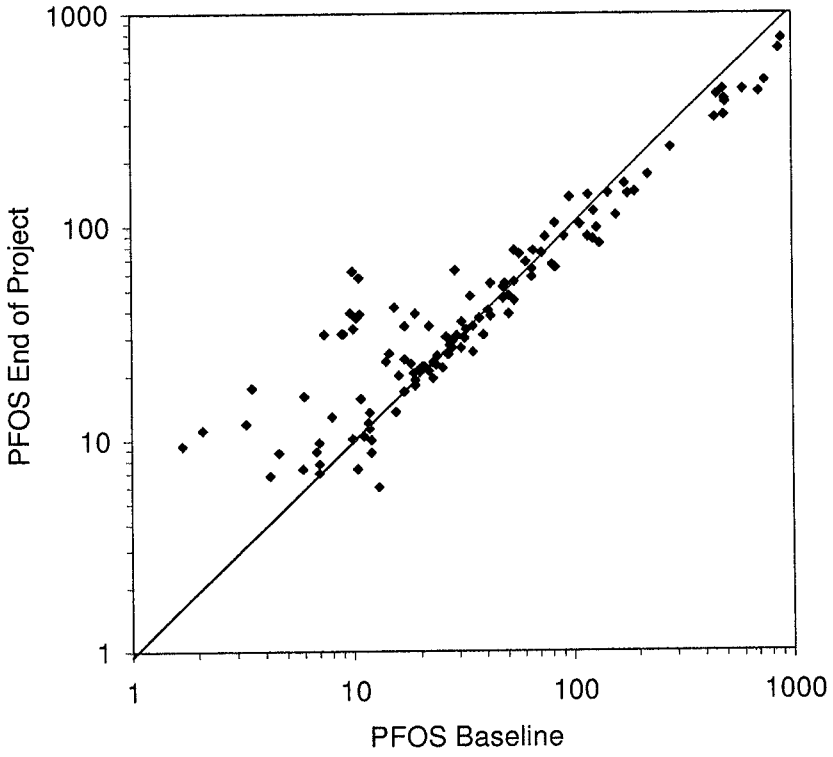
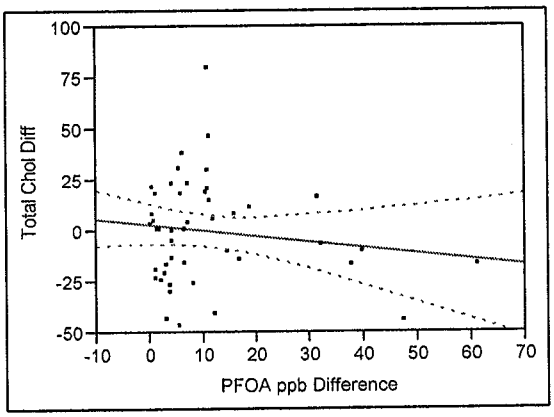


Figure 3. End of Project vs. Baseline Difference in Total Cholesterol (mg/dL) vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOS

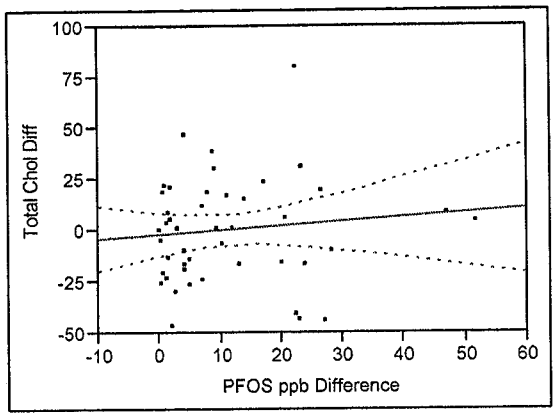
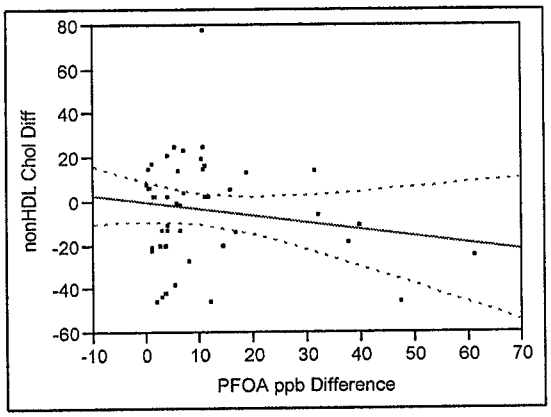


Figure 4. End of Project vs. Baseline Difference in Non-HDL (mg/dL) vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOS

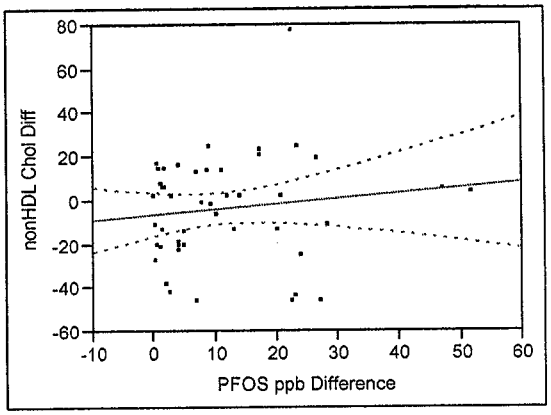
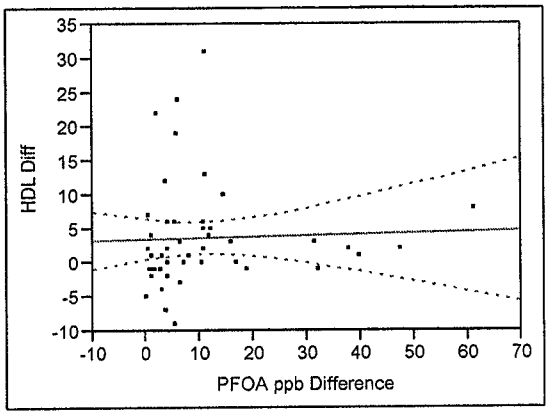


Figure 5. End of Project vs. Baseline Difference in HDL (mg/dL) vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOS

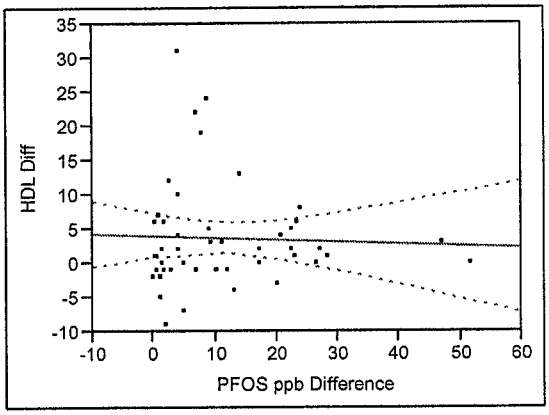
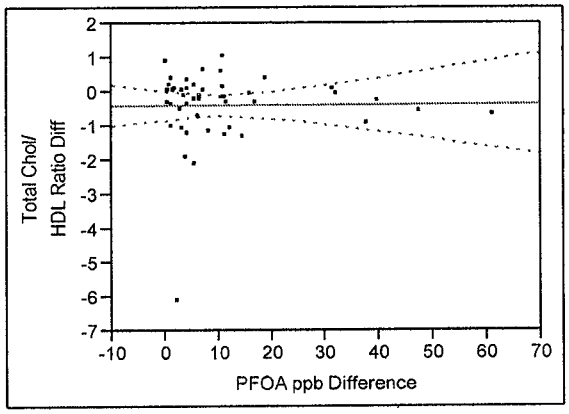


Figure 6. End of Project vs. Baseline Difference in Total Cholesterol/HDL Ratio vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



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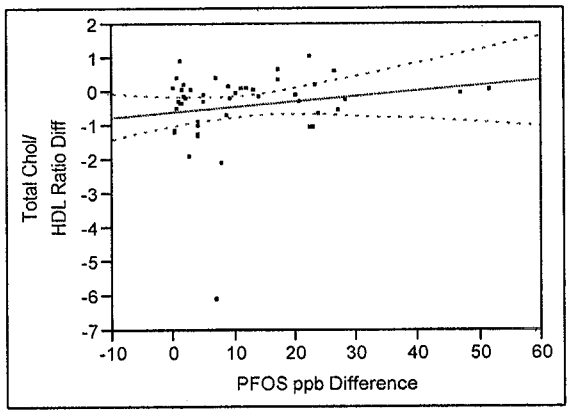
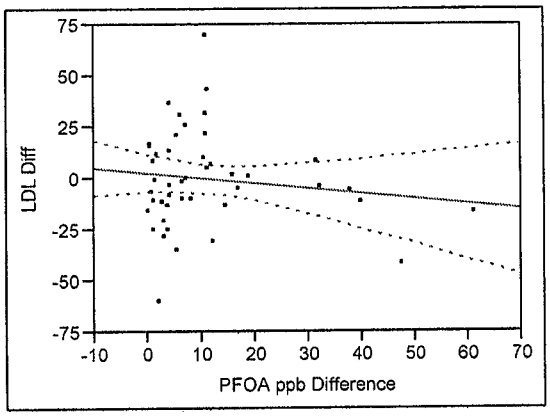


Figure 7. End of Project vs. Baseline Difference in LDL (mg/dL) vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOS

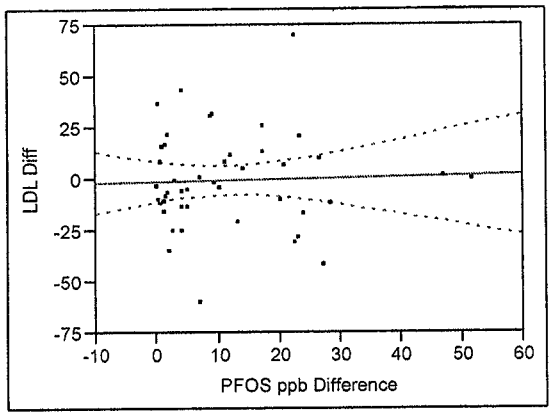
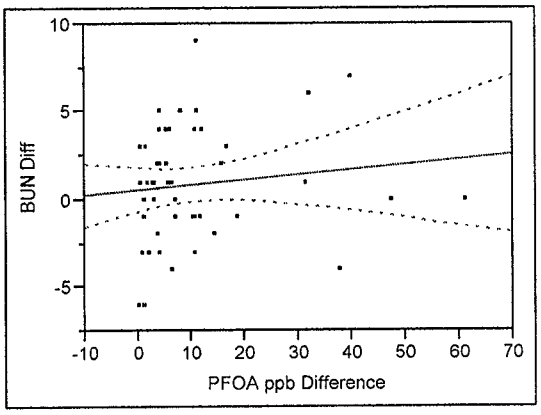


Figure 8. End of Project vs. Baseline Difference in BUN (mg/dL) vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOS

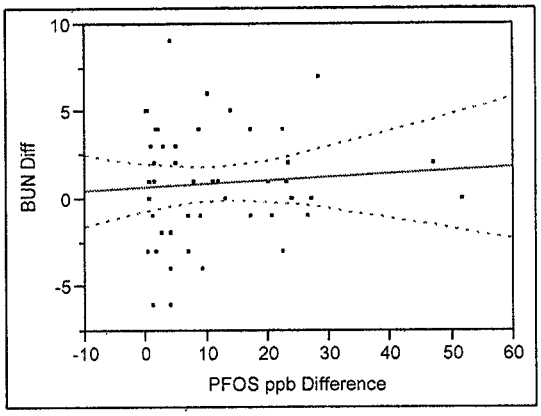
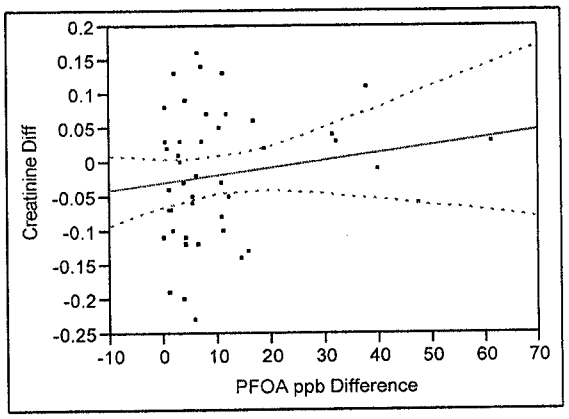


Figure 9. End of Project vs. Baseline Difference in Creatinine (mg/dL) vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOA

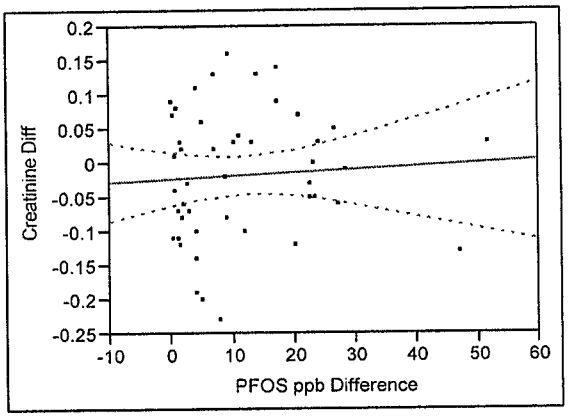
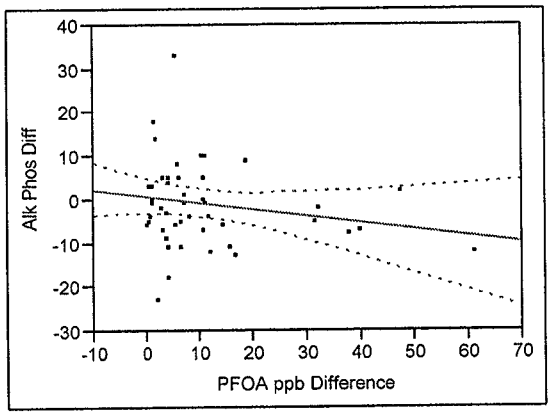


Figure 10. End of Project vs. Baseline Difference in Alkaline Phosphatase vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOS

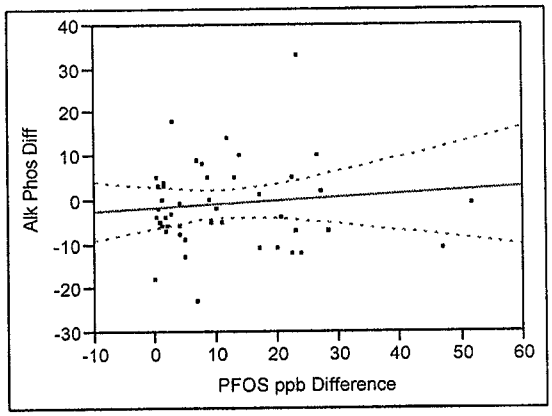
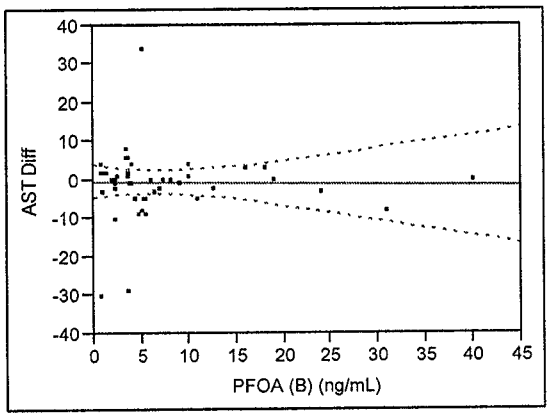


Figure 11. End of Project vs. Baseline Difference in AST (IU/L) vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOS

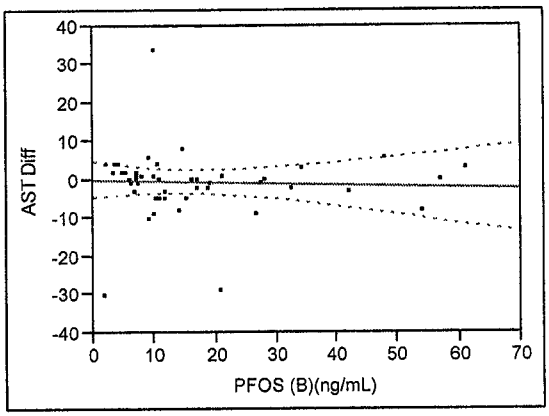
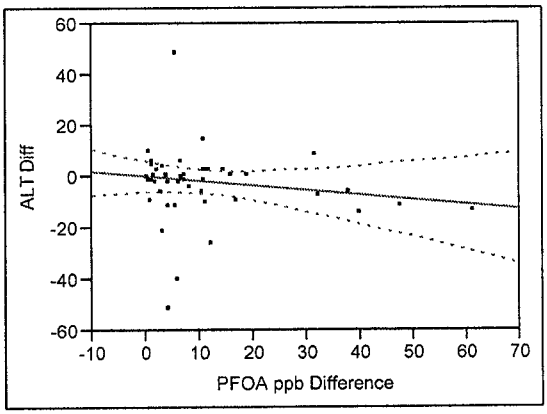


Figure 12. End of Project vs. Baseline Difference in ALT (IU/L) vs. Perfluorochemical Concentration (ng/mL = ppb).

PFOA



PFOS

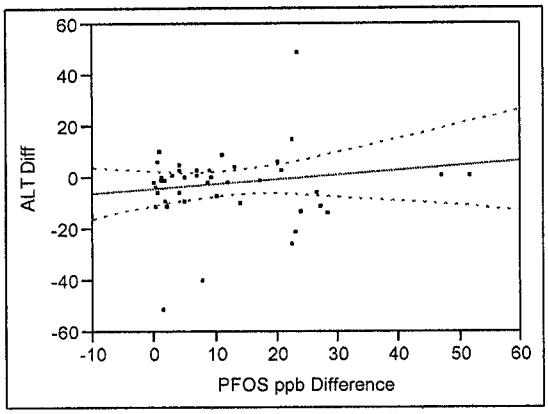


Table A1. Unadjusted and Adjusted PFOA Coefficients for Clinical Chemistry Measurements at Baseline (N = 126)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.00951	-0.02586	0.00683	0.25	-0.01151	-0.02855	0.00554	0.18
Non-HDL Chol	-0.00860	-0.02515	0.00795	0.31	-0.00959	-0.02686	0.00768	0.27
HDL	-0.00091	-0.00631	0.00449	0.74	-0.00191	-0.00697	0.00314	0.45
T Chol/HDL	-0.00020	-0.00078	0.00038	0.50	-0.00017	-0.00077	0.00042	0.55
LDL	-0.00828	-0.02373	0.00718	0.29	-0.01147	-0.02758	0.00465	0.16
Triglycerides	-0.00295	-0.03657	0.03067	0.86	0.00823	-0.02526	0.04173	0.63
Glucose	0.00464	-0.00145	0.01072	0.13	0.00350	-0.00236	0.00936	0.24
BUN	-0.00071	-0.00220	0.00079	0.35	-0.00079	-0.00230	0.00073	0.31
Creatinine	0.00002	-0.00004	-0.00009	0.45	-0.00003	-0.00004	0.00009	0.41
Total Protein	-0.00012	-0.00029	-0.00003	0.11	-0.00006	-0.00022	0.00010	0.46
Albumin	-0.00012	-0.00021	-0.00002	0.02	-0.00007	-0.00016	0.00002	0.13
Globulin	-0.00001	-0.00013	0.00011	0.82	-0.000009	-0.00012	0.00013	0.88
Alb/Glob	-0.00005	-0.00012	-0.00004	0.35	-0.00004	-0.00012	0.00004	0.35
Total Bilirubin	-0.00008	-0.00021	0.00005	0.24	-0.00007	-0.00021	0.00006	0.28

Table A1 (continued)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.00046	-0.00666	0.00758	0.90	-0.00009	-0.00075	0.00734	0.98
AST	-0.00062	-0.00040	0.00271	0.71	-0.00027	-0.00372	0.00318	0.88
ALT	-0.00151	-0.00770	0.00469	0.48	-0.00058	-0.00688	0.00572	0.86

Table A2. Unadjusted and Adjusted Ln PFOA Coefficients for Clinical Chemistry Measurements at Baseline (N = 126)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-3.12191	-7.18139	0.93776	0.13	-4.58063	-8.96089	-0.20036	0.04
Non-HDL Chol	-2.21077	-6.33571	1.91417	0.29	-3.75013	-8.20513	0.70487	0.10
HDL	-0.91104	-2.24770	0.42562	0.18	-0.83049	-2.13734	0.47636	0.21
T Chol/HDL	0.00081	-0.14491	0.14653	0.99	-0.04011	0.19397	0.11376	0.61
LDL	-3.15249	-7.04512	0.74015	0.11	-4.66791	-8.88273	-0.45309	0.03
Triglycerides	2.66165	-5.70895	11.03224	0.53	2.25549	-6.43931	10.95029	0.61
Glucose	2.34532	0.87146	3.81919	0.002	1.26841	-0.24465	2.78148	0.10
BUN	0.22517	-0.14739	0.59773	0.23	0.08209	-0.31324	0.47742	0.68
Creatinine	0.02239	0.00690	0.03788	0.005	0.02210	0.00529	0.03891	0.01
Total Protein	-0.04147	-0.08079	-0.00215	0.04	-0.02341	-0.06468	0.01785	0.26
Albumin	-0.03849	-0.06254	-0.01444	0.002	-0.01657	-0.04014	0.00700	0.17
Globulin	-0.00298	-0.03302	0.02707	0.84	-0.00684	-0.03908	0.02539	0.67
Alb/Glob	-0.00992	-0.02999	0.01015	0.33	0.00053	-0.02041	0.02147	0.96
Total Bilirubin	-0.03626	-0.06768	-0.00483	0.02	-0.03126	-0.06569	0.00318	0.07

Table A2 (continued)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-0.42135	-2.19484	1.35214	0.64	-0.87304	-2.79631	1.05023	0.37
AST	-0.02004	-0.85128	0.81120	0.96	-0.11348	-1.00961	0.78265	0.80
ALT	-0.08876	-1.63512	1.45759	0.91	-0.02383	-1.66034	1.61269	0.98

Table A3. Unadjusted and Adjusted PFOS Coefficients for Clinical Chemistry Measurements at Baseline (N = 126)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.01960	-0.05689	0.01770	0.30	-0.02371	-0.06275	0.01532	0.23
Non-HDL Chol	-0.01668	-0.05444	0.02109	0.38	-0.02396	-0.06342	0.01550	0.23
HDL	-0.00292	-0.01522	0.00938	0.64	0.00025	-0.01134	0.01184	0.97
T Chol/HDL	-0.00030	-0.00164	0.00103	0.65	-0.00065	-0.00200	0.00070	0.34
LDL	-0.02274	-0.05791	0.01243	0.20	-0.02882	-0.06565	0.00801	0.12
Triglycerides	0.02492	-0.05159	0.10143	0.52	0.02000	-0.05659	0.09660	0.61
Glucose	0.02202	0.00858	0.03547	0.002	0.01453	0.00131	0.02775	0.03
BUN	0.00146	-0.00196	0.00487	0.40	0.00029	-0.00319	0.00378	0.87
Creatinine	0.00020	-0.00006	0.00034	0.006	0.00019	0.00004	0.00034	0.01
Total Protein	-0.00018	-0.00055	0.00018	0.33	0.00007	-0.00043	0.00030	0.72
Albumin	-0.00012	-0.00034	0.00011	0.32	0.00001	-0.00020	0.00022	0.90
Globulin	-0.00007	-0.00034	0.00021	0.63	-0.00008	-0.00036	0.00020	0.58
Alb/Glob	-0.000003	-0.00018	0.00019	0.98	0.00006	-0.00013	0.00024	0.56
Total Bilirubin	-0.00019	-0.00048	0.00010	0.20	-0.00015	-0.00046	0.00015	0.33

Table A3 (continued)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-0.00280	-0.01901	0.01342	0.73	-0.00635	-0.02331	0.01061	0.46
AST	0.004224	-0.00334	0.01179	0.27	0.00407	-0.00379	0.01194	0.31
ALT	0.00214	-0.01199	0.01627	0.76	0.00261	-0.01180	0.01702	0.72

Table A4. Unadjusted and Adjusted Ln PFOS Coefficients for Clinical Chemistry Measurements at Baseline (N = 126)

Variable	Unadjusted Ln PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-2.24399	-7.68253	3.19454	0.42	-3.69467	-9.62542	2.23609	0.22
Non-HDL Chol	-0.70292	-6.21626	4.81042	0.80	-2.46750	-8.48409	3.54909	0.42
HDL	-1.54107	-3.31199	0.22984	0.09	-1.22717	-2.97429	0.51995	0.17
T Chol/HDL	0.05656	-0.13711	0.25024	0.56	-0.00408	-0.21031	0.20214	0.97
LDL	-2.12956	-7.38482	3.12570	0.42	-3.59449	-9.35859	2.16960	0.22
Triglycerides	3.83262	-7.30480	14.97004	0.50	1.87049	-9.77818	13.51916	0.75
Glucose	3.16304	1.20358	5.12251	0.002	1.55677	-0.47267	3.58620	0.13
BUN	0.66233	0.17774	1.14692	0.008	0.48690	-0.035386	1.00919	0.07
Creatinine	0.03913	0.01902	0.05925	0.0002	0.04004	0.01807	0.06200	0.0005
Total Protein	-0.02959	-0.08257	0.02339	0.27	-0.00607	-0.06160	0.04946	0.83
Albumin	-0.03724	-0.06986	-0.00462	0.03	-0.00889	0.04066	.022880	0.58
Globulin	0.00765	-0.03232	0.04762	0.71	0.00282	-0.04036	0.04600	0.90
Alb/Glob	-0.01517	-0.04185	0.01151	0.26	-0.00169	-0.02973	0.02635	0.91
Total Bilirubin	-0.05795	-0.09939	-0.01652	0.007	-0.05319	-0.09891	-0.00747	0.02

Table A4 (continued)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-0.85624	-3.21378	1.50131	0.47	-1.61671	-4.18370	0.95028	0.21
AST	0.24399	-0.86147	1.34945	0.66	0.12394	-1.07592	1.32380	0.84
ALT	-0.06386	-2.12198	1.99426	0.95	-0.02806	-2.21906	2.16295	0.98

Table A5. Unadjusted and Adjusted PFOA Coefficients for Clinical Chemistry Measurements at End of Project (N = 126)

Variable	Unadjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.01737	-0.04026	0.00552	0.14	-0.02136	-0.04477	0.00205	0.07
Non-HDL Chol	-0.01568	-0.03847	0.00712	0.18	-0.01817	-0.04143	0.00510	0.12
HDL	-0.00170	-0.01043	0.00704	0.70	-0.00313	-0.01164	0.00526	0.46
T Chol/HDL	-0.00026	-0.00101	0.00049	0.49	-0.00026	-0.00010	0.00048	0.49
LDL	-0.01266	-0.03314	0.00781	0.22	-0.01544	-0.03656	0.00567	0.15
Triglycerides	-0.01915	-0.06806	0.02976	0.44	-0.01753	-0.06706	0.03201	0.48
Glucose	0.00066	-0.00878	0.01009	0.89	0.00129	-0.00751	0.01010	0.77
BUN	-0.00012	-0.00258	0.00219	0.87	-0.00030	-0.00271	0.00210	0.80
Creatinine	0.00006	-0.00005	0.00017	0.26	0.00008	-0.00004	0.00019	0.19
Total Protein	-0.00029	-0.00052	-0.00006	0.01	-0.00022	-0.00045	0.00001	0.07
Albumin	-0.00017	-0.00031	-0.00003	0.01	-0.00015	-0.00028	-0.000008	0.04
Globulin	-0.00012	-0.00030	0.000065	0.20	-0.00007	-0.00026	0.00011	0.43
Alb/Glob	0.000006	-0.00012	0.00014	0.93	-0.00001	-0.00014	0.00017	0.86
Total Bilirubin	-0.00012	-0.00029	0.00005	0.18	-0.00012	-0.00030	0.00005	0.17

Table A5 (continued)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	0.00031	-0.01157	0.01219	0.96	0.00007	-0.01234	0.01248	0.99
AST	0.00224	-0.00231	0.00678	0.33	0.00182	-0.00286	0.00650	0.44
ALT	0.00125	-0.00739	0.00990	0.77	0.00091	-0.00781	0.00964	0.84

Table A6. Unadjusted and Adjusted Ln PFOA Coefficients for Clinical Chemistry Measurements at End of Project (N = 126)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-3.37026	-8.45594	1.71543	0.19	-4.75087	-10.03239	0.53067	0.07
Non-HDL Chol	-1.95710	-7.03646	3.12227	0.45	-3.68356	-8.94021	1.57310	0.17
HDL	-1.41316	-3.33412	0.50781	0.15	-1.06731	-2.96761	0.83299	0.27
T Chol/HDL	0.06131	-0.10482	0.22762	0.47	0.00038	-0.16594	0.16670	0.99
LDL	-2.67691	-7.24235	1.88853	0.25	-3.77536	-8.57157	1.02086	0.12
Triglycerides	2.71918	-8.14102	13.57938	0.62	-0.51969	-11.71360	10.67418	0.93
Glucose	1.88252	-0.18257	3.94761	0.07	0.75650	-1.22552	2.73852	0.45
BUN	0.35465	-0.17083	0.88017	0.18	0.15810	-0.38390	0.70009	0.56
Creatinine	0.03191	0.00795	0.05587	0.01	0.02756	0.00258	0.05254	0.03
Total Protein	-0.04293	-0.09445	0.00860	0.10	-0.03145	-0.08464	0.02174	0.24
Albumin	-0.02628	-0.05752	0.00497	0.10	-0.01108	-0.04244	0.02029	0.49
Globulin	-0.01665	-0.05725	0.02394	0.42	-0.02038	-0.06185	0.02110	0.33
Alb/Glob	0.00412	-0.02456	0.03281	0.78	0.01252	-0.01637	0.04140	0.39
Total Bilirubin	-0.00801	-0.04598	0.02995	0.68	0.00035	-0.03949	0.04019	0.99

Table A6 (continued)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-0.85817	-3.48798	1.77163	0.52	-1.31309	-4.10219	1.47601	0.35
AST	0.72069	-0.28350	1.72488	0.16	0.40372	-0.65092	1.45835	0.45
ALT	1.45005	-0.44624	3.35425	0.13	0.83484	-1.12736	2.79703	0.40

Table A7. Unadjusted and Adjusted Ln PFOS Coefficients for Clinical Chemistry Measurements at End of Project (N = 126)

Variable	Unadjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-0.02130	-0.07154	0.02895	0.40	-0.02868	-0.08082	0.02346	0.28
Non-HDL Chol	-0.01739	-0.06739	0.03261	0.49	-0.03010	-0.08170	0.02150	0.25
HDL	-0.00391	-0.02296	0.01514	0.69	0.00142	-0.01728	0.02012	0.88
T Chol/HDL	-0.00024	-0.00188	0.00140	0.77	-0.00084	-0.00246	0.00078	0.31
LDL	-0.02170	-0.06650	0.02308	0.34	-0.02783	-0.07466	0.01900	0.24
Triglycerides	0.01435	-0.09258	0.12129	0.79	-0.01786	-0.12742	0.09171	0.75
Glucose	0.02180	0.00159	0.04202	0.03	0.00995	-0.00942	0.02932	0.31
BUN	0.00267	-0.00251	0.00786	0.31	0.00081	-0.00450	0.00612	0.76
Creatinine	0.00035	0.00012	0.00059	0.004	0.00031	0.00006	0.00055	0.01
Total Protein	-0.00040	-0.00091	0.00011	0.12	-0.00032	-0.00084	0.00020	0.22
Albumin	-0.00020	-0.00051	0.00011	0.20	-0.00009	-0.00039	0.00022	0.58
Globulin	-0.00020	-0.00060	0.00020	0.33	-0.00024	-0.00064	0.00017	0.25
Alb/Glob	0.00005	-0.00023	0.00034	0.72	0.00012	-0.00016	0.00040	0.41
Total Bilirubin	-0.000082	-0.00045	0.00029	0.66	-0.00002	-0.00041	0.00037	0.92

Table A7 (continued)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-0.01424	-0.04003	0.01156	0.28	-0.01842	-0.04563	0.00879	0.18
AST	0.01249	0.00278	0.02220	0.01	0.01021	-0.00002	0.02039	0.05
ALT	0.02282	0.00439	0.04124	0.02	0.01764	-0.00137	0.03665	0.07

Table A8. Unadjusted and Adjusted Ln PFOS Coefficients for Clinical Chemistry Measurements at End of Project (N = 126)

Variable	Unadjusted Ln PFOS Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOS Coefficient	95% Confidence Interval Lower	Upper	p value
Total Cholesterol	-1.66693	-8.09366	4.75980	0.61	-3.59734	-10.42688	3.23219	0.30
Non-HDL Chol	0.41805	-5.9779	6.81401	0.90	-2.08136	-8.86439	4.70167	0.54
HDL	-2.08498	-4.49055	0.32058	0.09	-1.51599	-3.94952	0.91755	0.22
T Chol/HDL	0.12964	-0.07837	0.33765	0.22	0.33596	-0.17956	0.24675	0.76
LDL	-1.78254	-7.52965	3.96458	0.54	-3.29147	-9.45539	2.87245	0.29
Triglycerides	12.00119	-1.48878	25.49125	0.08	7.38982	-6.90018	21.67981	0.31
Glucose	2.96849	0.39370	5.54329	0.02	0.95427	-1.58709	3.49563	0.46
BUN	0.65628	0.00168	1.31087	0.05	0.35570	-0.33719	1.04858	0.31
Creatinine	0.05983	0.03078	0.08887	<0.0001	0.05392	0.02275	0.08509	0.0008
Total Protein	-0.03537	-0.10051	0.02976	0.28	-0.02375	-0.09220	0.04470	0.49
Albumin	-0.02877	-0.06813	0.01059	0.15	-0.00548	-0.04576	0.03480	0.79
Globulin	-0.00660	-0.05773	0.04452	0.80	-0.01827	-0.07155	0.03502	0.50
Alb/Glob	-0.00344	-0.03948	0.03261	0.85	0.01318	-0.02389	0.05025	0.48
Total Bilirubin	-0.01591	-0.06355	0.03174	0.51	-0.00099	-0.05207	0.05009	0.97

Table A8 (continued)

Variable	Unadjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value	Adjusted Ln PFOA Coefficient	95% Confidence Interval Lower	Upper	p value
Alk Phos	-1.64636	-4.94290	1.65018	0.32	-2.48278	-6.04347	1.07791	0.17
AST	1.76521	0.53268	2.99773	0.005	1.41966	0.08878	2.75054	0.04
ALT	3.11356	0.76863	5.45848	0.01	2.36521	-0.12149	4.85191	0.06