

Status report

Serum PFOA and Markers of Thyroid Function in Children in the Mid-Ohio Valley

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This report summarizes findings relating PFOA (C8) and other perfluoroalkyl acids, including PFOS and PFNA, in the serum of children in the Mid-Ohio Valley, and serum measurements of two clinical markers of thyroid function and thyroid disease prevalence.

We have analyzed data from the questionnaires and blood tests collected in the C8 Health Project in 2005-06 for 10,725 children aged 1-18 years.

The analysis focused on two blood tests: thyroid-stimulating hormone (TSH) and total thyroxine (TT₄), as indicators of thyroid function. Other analyses focused on the number of children for whom a diagnosed thyroid disease was reported, and on sub-clinical hypo/hyperthyroidism categories based on the hormone levels of the children being outside the normal ranges.

Disturbances to the thyroid system particularly in children, may have a number of negative effects, as thyroid hormones play important roles in regulating metabolism, growth, and development, especially in normal brain maturation and development. Shifts in hormone levels or the risk of thyroid disease were analyzed in relation to both the child's PFOA measured at the same time as the hormones, and the modeled PFOA in the child's mother's blood at the time of her pregnancy with that child. Additional analyses looked at these same outcomes in relation to the other contaminants, PFOS and PFNA, in the child's blood. In each case account was taken of other potential explanatory factors such as age, race, length of gestation, race, body mass index, and smoking habits of the mother. This is the first Science

Panel study comparing health markers in children to the estimated C8 exposure during their pregnancy.

The main finding for PFOA and disease was that reported thyroid disease (based on 61 cases) was positively associated with measured PFOA serum levels in the child, with borderline statistical significance. Most of the 61 reported cases were for hypothyroidism, which was also positively associated with measured PFOA serum levels. We found a 50% higher risk for hypothyroidism (39 cases) for those with higher levels of PFOA versus lower levels of serum PFOA measured in 2005-2006, that is comparing those with 67.7 to 13.1 ng/mL. A similar association with reported thyroid disease was found in relation to the estimated mothers' levels of PFOA during pregnancy, but it is hard to distinguish the effects of these two different exposures, because they are correlated.

The main finding for PFOA and thyroid hormones was that overall there was no association in children aged 1-18 years. There were associations for both PFOS and PFNA with increases of about 8% in Thyroxine levels comparing higher versus lower serum levels of PFOS and PFNA. However, the changes seen in thyroid hormones in relation to PFOS and PFNA, while statistically significant, would not be considered clinically significant.

There have been other published studies suggesting that either PFOA or PFOS may be associated with disturbances in markers of thyroid function.

Caution is needed interpreting these findings as the results based on measured chemicals are cross-sectional and one cannot be sure that the hormones are actually affected by levels of PFOA (or PFOS or PFNA). For the estimated PFOA during pregnancy, there is extra uncertainty from estimating past exposures. Also the disease data are based on small numbers, and there is not a consistent pattern for each contaminant between the hormone findings and the disease results.

These results suggest that exposure during childhood to two perfluoroalkyl acids, PFOS and PFNA, may be capable of disturbing thyroid hormone levels. Reported thyroid disease in children was found to be associated with PFOA but not PFOS or PFNA, but the results are not sufficient to prove that PFOA is leading to increased thyroid disease. Taken together, these new findings suggest that normal thyroid function may be affected by exposure to one or more of the family of perfluoroalkyl acids.