

MEMORANDUM

TO: Chuck Schwer, Director, Waste Management, DEC

CC: Matt Chapman, General Counsel, DEC
David Englander, Senior Policy and Legal Advisor, VDH

FROM: Sarah Vose, State Toxicologist

SUBJECT: Perfluorooctanoic acid (PFOA) and Perfluorooctanesulfonic acid (PFOS)
Vermont Drinking Water Health Advisory

DATE: June 22, 2016

The Department of Health (Department) has derived a revised drinking water health advisory (DWHA) of 20 parts per trillion (ppt) applicable to the sum of PFOA and PFOS. This DWHA replaces the drinking water health advisories for PFOA and PFOS that were provided on March 7, 2016 and April 12, 2016, respectively.

The concentration of PFOA and PFOS combined is not to exceed the DWHA based on the following recommendation presented in the May 2016 U.S. Environmental Protection Agency's (EPA) Drinking Water Health Advisory for PFOA: "The effects that serve as the basis for the RfDs [oral reference dose] for both PFOA and PFOS are developmental endpoints (reduced ossification and accelerated puberty in males for PFOA and decreased pup birth weight for PFOS). Because the RfDs for both PFOA and PFOS are based on similar developmental effects and are numerically identical, where these two chemicals co-occur at the same time and location in a drinking water source, a conservative and health protective approach that EPA recommends would be to compare the sum of the concentrations ([PFOA] + [PFOS]) to the HA [health advisory]." ¹

The DWHA of 20 ppt for PFOA and PFOS combined is based on a non-cancer endpoint and derived using the oral reference dose of 0.00002 mg/kgBW-d provided in EPA's 2016 Health Effects Support Document for PFOA² and PFOS³. The Department calculated a drinking water advisory based on the cancer endpoint using the information provided in EPA's 2016 Health Effects Support Document for PFOA² and PFOS³ and determined that derivation of the DWHA based on the noncancer endpoint is more protective.

The DWHA for PFOA and PFOS combined is based on direct exposure via ingestion of drinking water only. As is standard practice, a relative source contribution is incorporated in the development of the advisory value to account for potential exposure to these chemicals from other sources.



Details of the derivation of the Drinking Water Health Advisory of 20 ppt for PFOA and PFOS combined follow.

Drinking Water Health Advisory - Noncancer

1. The general equation used to derive a noncancer-based Drinking Water Health Advisory:

$$DWHA = (HQ)(RfD_o)(1/BW_{AIR})(CF)(RSC)$$

DWHA = Drinking Water Health Advisory

HQ= Hazard Quotient

RfD_o= chronic oral reference dose

BW_{AIR}= Body Weight adjusted Water Intake Rate

CF= Units Conversion Factor

RSC= Relative Source Contribution

2. Derivation of the DWHA for [PFOA + PFOS] combined

$$\begin{aligned} DWHA &= (HQ)(RfD_o)(1/BW_{AIR})(CF)(RSC) \\ &= (1)(2 \times 10^{-5} \text{ mg/kg BW-day})(1/0.175 \text{ L/kg BW-day})(1000 \text{ } \mu\text{g/mg})(0.2) \\ &= 0.02285 \text{ } \mu\text{g/L (ppb)} \\ &= 0.02285 \text{ } \mu\text{g/L (ppb)} \times 1000 \text{ ng/ } \mu\text{g} = 22.9 \text{ ng/L (ppt)} \approx 20 \text{ ppt} \end{aligned}$$

Exposure Assumptions, Parameter Values and Descriptions

HQ = 1

Target Hazard Quotient employed in the development of Department of Health Drinking Water Guidance Values

RfD_o = 2x10⁻⁵ mg/kgBW-d

Oral reference dose provided in EPA's 2016 Health Effects Support Document for PFOA² and PFOS³

BW_{AIR} = 0.175 L/kgBW-d

The 2016 EPA Drinking Water Health Advisories for PFOA¹ and PFOS⁴ state that "the developing fetus and newborn are particularly sensitive to PFOA- and PFOS-induced toxicity." EPA has recommended that fine age groupings be used in the assessment of potential exposure to children⁵. A series of ten ranges between birth and 21 years of age is recommended for consideration as appropriate. The 95th percentile Body Weight Adjusted Water Intake Rate for the first year of life based on combined direct and indirect water intake from community water supplies for consumers only is 0.175 L/kgBW-d^{6,7}.

CF= 1000 μg/mg

Unit conversion from milligrams to micrograms

RSC = 0.2 (20%)

Consistent with EPA guidance^{8,9}, an RSC is incorporated in the development of DWHAs that are based upon a threshold type, primarily noncarcinogenic, health effect. The RSC represents the portion of an individual's total daily exposure to a specific chemical that is attributed to or allocated to drinking water. An RSC of 20% is incorporated to account for exposure to PFOA and PFOS from other sources. This follows EPA's recommendation to use an RSC of 20% when quantitative data on other sources of exposure are not available. The 2016 PFOA Health Advisory states "In cases where environmental or exposure data are lacking, the Exposure Decision Tree approach results in a recommended RSC of 20%. This 20% RSC value may be replaced where sufficient data are available to develop a scientifically defensible alternative value."¹

References

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