RECEIVED
Apr 27 2022
Independent Regulatory Review Commission

American Chemistry Council

April 27. 2022

Mr. Patrick McDonnell
Chair
Environmental Quality Board
Rachel Carson State Office Building
16th Floor
400 Market Street
Harrisburg, PA 17101-2301

Re: Safe Drinking Water PFAS MCL Rule, proposed amendments to 25 PA Code, Chapter 109 (Safe Drinking Water)

Secretary McDonnell:

The American Chemistry Council (ACC) submits the following comments on the proposed maximum contaminant levels (MCLs) for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS). ACC represents a number of companies with an interest in the use of the best scientific information to develop standards for PFAS such as the MCLs for PFOA and PFOS proposed by the Department of Environmental Protection (DEP). As described below, ACC has several concerns with the current proposal, including the following -

- the potential for conflict with national drinking water standards for these two substances,
- the inadequacy of the toxicity studies used to develop the proposed standards,
- the exaggerated estimates of public health protection to be achieved with the implementation of the proposed MCLs,
- the incomplete estimate of the costs of compliance monitoring, and
- the potential for confusion by providing both the MCL and MCL Goal (MCLG) in information to be provided to the public.

Conflict with National Drinking Water Standards

In its rationale for the proposed regulations, DEP states that the process for setting national drinking water standards for PFOA and PFOS "is expected to take several years to complete." [1] Yet the US Environmental Protection Agency (USEPA) has indicated that it will propose national drinking

[1] DEP. Regulatory Analysis Form – Safe Drinking Water PFAS MCL Rule. IRRC No. 3334 (February 15,2022), at 3.

water standards for these substances later this year and will promulgate national MCLs by the end of 2023.[2] Based on the available information, moreover, it appears that the MCLs to be proposed by USEPA will differ from those included in the DEP proposal. Differing standards could result in additional cost to water utilities if they are required to comply first with a state limit and subsequently with the national standard. Rather than risk the potential for conflicting standards, we urge the Board to postpone consideration of the current proposals pending the outcome of the federal rulemaking process. In the interim, we recommend that DEP use USEPA's Lifetime Health Advisories (LHAs) of 70 parts per trillion (ppt) as a guideline.

Inadequacy of the Selected Toxicity Studies

The proposed MCLs are based on an assessment of the available toxicity data by an advisory group composed of faculty of Drexel University engaged by DEP.[3] Although the members of the Drexel PFAS Advisory Group (DPAG) have impressive credentials, it is not clear whether there was sufficient expertise in the toxicological properties of PFAS or with regulatory risk assessment. For PFOA, the advisory group focused on the reports of developmental effects in laboratory animals exposed to a single dose which severely limits the ability to assess dose-response. For PFOS, the group selected a study reporting immune system effects in laboratory animals despite the fact the results conflict with the findings of other researchers.

PFOA

The proposed MCLG for PFOA is based on reports of altered activity and skeletal effects in the adult offspring of mice exposed to PFOA through gestation by Onishchenko *et al.* (2011)[4] and Koskela *et al.* (2016).[5] Although published 5 years apart, the studies are based on the same group of exposed mice. Both studies include a single-dose group which greatly limits their value as critical studies for evaluating low doses because of the inability to evaluate dose-response. Onishchenko *et al.* report mild sex-related differences in exploratory behavior patterns after 5 weeks of age in mice exposed *in utero*. PFOA-exposed males were more active, while PFOA-exposed females were less active, than their respective controls.

In the second publication, Koskela *et al.* reported mild alterations in bone morphometry and mineral density of femurs and tibias in mice while noting that the biomechanical properties

---

2 USEPA. PFAS Strategic Roadmap: EPA's Commitments to Action 2021-2024. EPA-100-K-21-002 (October 2021). https://www.epa.gov/pfas/pfas-strategic-roadmap-epas-commitments-action-2021-2024

3 Drexel PFAS Advisory Group. Maximum contaminant level goal drinking water recommendations for per- and polyfluoroalkyl substances (PFAS) in the Commonwealth of Pennsylvania (January 2021). (DPAG Report)

4 Onishchenko N *et al.* Prenatal exposure to PFOS or PFOA alters motor function in mice in a sex related manner. *Neurotox Res* 19(3):452-61 (2011).

5 Koskela A *et al.* Effects of developmental exposure to perfluorooctanoic acid (PFOA) on long bone morphology and bone cell differentiation. *Toxicol Appl Pharmacol* 301:14-21 (2016).

of the bones were not affected. Based on the absence of an impact on mechanical function, the biological significance of bone geometry and mineral density alterations is uncertain and may not be a suitable basis for the MCLG calculation. Notably, no increases in the occurrence of malformations/variations were observed in similar studies conducted in rats.[6,7] Koskela *et al.* also appear to have conducted their statistical analysis on a per-fetus basis, rather than per-litter as advised by EPA's guidelines for assessing developmental toxicity.[8] If the advisory panel had conducted an independent systematic review and weighed the strengths and weaknesses of candidate primary studies alongside one another, these shortcomings likely would become readily apparent.

Lau *et al.* (2006)[9] also reported skeletal effects in the offspring of mice exposed to PFOA, but the effects did not increase in a dose-related manner.[10] Consequently, the skeletal effects noted by Lau *et al.* would generally not be considered biological significant.[11] Although USEPA used the results of the study by Lau *et al.* as the basis of the LHA for PFOA, it focused on developmental impacts other than the skeletal effects.[12]

In addition to developmental effects, a few states have used reports of liver effects in laboratory animals in developing their toxicity assessments. Although there is some question about the relevance of hepatic effects in animal studies to humans, the evidence of histological hepatic effects in rats coupled with increased liver weight and hypertrophy reported by Butenhoff *et al.* (2012)[13] provide an indication that the effects are adverse – rather than

---

6 Staples RE *et al.* The embryo-fetal toxicity and teratogenic potential of ammonium perfluorooctanoate (APFO) in the rat. *Fundam Appl Toxicol* 4(3 Pt 1): 429–440 (1984).

7 Butenhoff JL *et al.* The reproductive toxicology of ammonium perfluorooctanoate (APFO) in the rat. *Toxicol* 196(1–2):95–116 (2004).

8 EPA. Guidelines for developmental toxicity risk assessment. Risk Assessment Forum. EPA/600/FR-91/001(1991). (EPA Guidelines 1991). https://www.epa.gov/risk/guidelines-developmental- toxicity-risk-assessment

9 Lau C *et al.* Effects of perfluorooctanoic acid exposure during pregnancy in the mouse. *Toxicol Sci* 90:510–518 (2006).

10 Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for Perfluoroalkyls. US Department of Health and Human Services (2021), at 475. https://www.atsdr.cdc.gov/toxprofiles/tp200.pdf

11 EPA Guidelines 1991, at 13. The 1991 guidelines note that a dose-related increase in variations in skeletal ossification is interpreted as an adverse developmental effect but assessing the biological significance of the variation must consider what is known about the developmental stage.

12 USEPA. Drinking water health advisory for perfluorooctanoic acid (PFOA). Office of Water. EPA 822-R-16-005. (2016).

13 Butenhoff JL *et al.* 2012. Chronic dietary toxicity and carcinogenicity study with ammonium perfluorooctanoate in Sprague-Dawley rats. *Toxicol* 298:1–13 (2012).

adaptive.[14] This is consistent with the results in *Cynomolgus* monkeys reported by Butenhoff *et al.* (2004),[15] although the small size of the study may preclude using the non-human primate data for the MCLG calculation. Given the consistency in the rat and primate data, it is more appropriate to use evidence of adverse histological effects in the rat liver as the basis for the MCLG as was done by Health Canada.[16]

PFOS

The immune system effects in mice reported by Dong *et al.* (2011) [17] that are the basis of the proposed MCLG, conflict with the findings reported by other researchers. In addition, the decision to focus on immune effects in laboratory animals as the basis for the assessment runs counter to the specific concerns expressed about these data by both USEPA [18] in 2016 and Health Canada.[19] Sensitivity to immunological effects appears to be dependent on several factors.[20] The influence of species on effects is difficult to ascertain, as the only rat study specifically designed to measure immune effects reported a no observed adverse effect level (NOAEL) several orders of magnitude higher than the lowest observed adverse effect levels (LOAELs) from the studies in mice. [21] Even within a single species, differences in sensitivity have been reported among strains - effects on sheep red blood cell (SRBC)-specific IgM levels were

---

[14] Hall AP *et al.* Liver hypertrophy: a review of adaptive (adverse and non-adverse) changes—conclusions from the 3rd International ESTP Expert Workshop. *Toxicol Pathol* 40(7): 971–994 (2012).

[15] Butenhoff JL *et al.* 2004. Pharmacokinetics of perfluorooctanoate in Cynomolgus monkeys. *Toxicol Sci* 82:394–406 (2004).

[16] Health Canada. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document — Perfluorooctanoic acid (PFOA). Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Ottawa, Ontario. Catalogue No. H144-13/8-2018E-PDF. (2018). https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-technical-document-perfluorooctanoic-acid/document.html

[17] Dong GH *et al.* Sub-chronic effect of perfluorooctanesulfonate (PFOS) on the balance of type 1 and type 2 cytokine in adult C57BL6 mice. *Arch Toxicol* 85(10): 1235–1244 (2011).

[18] USEPA. Drinking water health advisory for perfluorooctane sulfonate (PFOS). EPA 822-R-16-004 (May 2016). https://www.epa.gov/sites/production/files/2016-05/documents/pfos_health_advisory_final_508.pdf. The results from Dong *et al.* 2011 are not discussed in the 2021 draft analysis by the USEPA Office of Water (discussed on page 6).

[19] Health Canada. Guidelines for Canadian Drinking Water Quality: Guideline Technical Document — Perfluorooctane Sulfonate (PFOS). Water and Air Quality Bureau, Healthy Environments and Consumer Safety Branch. Ottawa, Ontario. Catalogue No. H144-13/9-2018E-PDF. (2018). https://www.canada.ca/en/health-canada/services/publications/healthy-living/guidelines-canadian-drinking-water-quality-guideline-technical-document-perfluorooctane-sulfonate.html

[20] Ibid, at 49.

[21] Lefebvre DE *et al.* Immunomodulatory effects of dietary potassium perfluorooctane sulfonate (PFOS) exposure in adult Sprague -Dawley rats. *J Toxicol Environ Health A* 71:1516-1525 (2008).

observed at lower levels in B6C3F1 mice[22] than in C57BL/6 mice,[23] despite a shorter duration of exposure (28 days vs. 60 days).

Although the studies reported immune effects, USEPA concluded in 2016 that the differences in the levels at which effects were reported (and conflicts in the direction of the effects) "highlight the need for additional research to confirm the NOAEL and LOAEL for the immunological endpoints."[24] Health Canada reached a similar conclusion noting that "[f]urther exploration should be performed to address the nearly two orders of magnitude difference in LOAELs in the studies before these endpoints can be reliably considered as a basis for risk assessment."[25]

The National Toxicology Program's systematic review of the animal immunotoxicity data concluded that it cannot be confident in the outcome assessment of the Dong *et al.* study selected by the DPAG.[26] NTP's lack of confidence is justified by the inability of benchmark dose (BMD) modeling of the plaque-forming cell response data to provide an acceptable fit to any of the dose-response models included in USEPA's BMD software. The inability of BMD modeling to yield a valid point of departure suggests that the response data reported by Dong *et al.* are not sufficiently robust to use for risk assessment.

As with the animal data, the human immunotoxicity data are inconsistent, as noted by Health Canada which concluded that "associations are observed between PFOS levels and decreases in antibodies against some (but not all) illnesses and the influence of PFOS exposure on clinical immunosuppression (i.e., incidence of illnesses) appears to be more tenuous."[27] Health Canada further noted that, while the available animal and human data may indicate immune system changes, "it is unclear whether small variations in these measures are sufficient to result in adverse health effects in humans."

---

22 Peden-Adams MM *et al.* Suppression of humoral immunity in mice following exposure to perfluorooctane sulfonate. *Toxicol Sci* 104(1): 144–154 (2008).

23 Dong GH *et al.* Chronic effects of perfluorooctanesulfonate exposure on immunotoxicity in adult male C57BL/6 mice. *Arch Toxicol* 83(9): 805–815 (2009).

24 USEPA. Health Effects Support Document for Perfluorooctane Sulfonate (PFOS). EPA 822-R-16-202 (May 2016), at 4-7.

25 Health Canada. Guidelines for Canadian drinking water quality - PFOS (2018), at 69.

26 NTP. Monograph on Immunotoxicity Associated with Exposure to Perfluorooctanoic acid (PFOA) or Perfluorooctanoic Sulfonate (PFOS). Office of Health Assessment and Translation. (September 2016). https://ntp.niehs.nih.gov/ntp/ohat/pfoa_pfos/pfoa_pfosmonograph_508.pdf

27 Health Canada. Guidelines for Canadian drinking water quality - PFOS (2018), at 69.

Results of associations between PFOS and childhood infection are mixed with studies reporting both increased and decreased associations with reported infections.[28] As a result, the National Toxicology Program (NTP) concluded that there is low confidence that exposure to either substance is associated with an increased incidence of infectious disease or a lower ability to resist or respond to infectious disease.[29]

Despite the absence of an association with childhood infection, a recent draft analysis by USEPA's Office of Water focuses on antibody levels in children of the Faroe Islands reporting an inverse relationship between antibodies and exposure to PFOS.[30] Budtz-Jorgensen and Grandjean (2018)[31] report two findings from the study of diphtheria and tetanus antibody concentrations associations among Faroe Islands children –

- An association between prenatal exposure to PFOS and diphtheria antibody concentrations at 5 years of age, and
- An association between PFOS serum concentrations at age 5 and diphtheria antibody concentrations at age 7.[32]

In an earlier publication by Grandjean et al. (2012),[33] however, this research group did not observe an association between maternal PFOS serum concentrations and antibody concentrations at age 5 in a cohort of children born between 1997 and 2000. Although the researchers reported an association in a cohort of Faroe Islands children born from 2007 and 2009,[34] serum concentrations were significantly lower than in the earlier cohort at age 5 (4.7 versus 16.7 nanograms per milliliter, or ng/mL). Maternal concentrations were not reported for the later cohort. A recent study in the Faroe Islands, moreover, did not report an association

---

[28] Steenland K *et al.* Review: Evolution of evidence on PFOA and health following the assessments of the C8 Science Panel. *Environ Int* 145: 106125 (2020).

[29] NTP Monograph (2016), at 37.

[30] USEPA. Proposed approaches to the derivation of a draft maximum contaminant level goal for perfluorooctane sulfonic acid (PFOS) (CASRN 1763-23-1) in drinking water – External Peer Review Draft. EPA 822D21002. Office of Water (November 2021).

[31] Budtz-Jorgensen E and Grandjean P. Application of benchmark analysis for mixed contaminant exposures: mutual adjustment of perfluoroalkyl substances associated with immunotoxicity. *PLoS ONE* 13:e0205388 (2018).

[32] USEPA Water Office 2021 draft selects the benchmark dose modeling results for the serum levels at age 5 and antibody levels at age 7 from the cohort of children born between 1997-2000 to calculate the reference doses.

[33] Grandjean P *et al.* Serum vaccine antibody concentrations in children exposed to perfluorinated compounds. *J Amer Med Assn* 307(4):391-397 (2012).

[34] Grandjean P *et al.* Estimated exposures to perfluorinated compounds in infancy predict antibody concentrations at age 5 years. *J Immuno* 14(1):188-195 (2017). Maternal serum concentrations are not provided.

between PFOS levels measured at birth and at ages 7, 14, 22, and 28 and hepatitis type A and B, diphtheria, or tetanus antibody concentrations.[35]

Among 7-year olds, the Faroe Islands researchers did not find an association between serum concentrations at 7 and antibody levels after excluding children suspected of receiving additional antibodies (*i.e.*, no booster, ER visit, or unexplained antibody increase).[36] Although the 2012 publication reports an association between serum levels of PFOA at age 5 and tetanus antibody concentrations at age 7,[37] the analysis does not control for children receiving additional immunizations between ages 5 and 7. Given the results of the prior analysis, this would appear to be a significant oversight that raises additional questions about the broad conclusion that exposure to PFOS reduces vaccine response in children.

The relevance of these findings among the Faroe Islands children to other populations is limited since the dominant source of PFAS is from marine food contamination and the population of the island is largely homogenous (in terms of ethno-racial characteristics).

DEP Exaggerates the Increase in Public Health Protection to be Achieved

The regulatory analysis for the MCL proposal indicates that it would achieve a 90 percent increase in health protection from PFOA exposure, and a 93 percent increase from PFOS exposure, compared to the compliance with USEPA's lifetime Health Advisories (LHAs), but provides no explanation of how those estimates were derived. The values appear to be based on a simple calculation of the difference between the proposed MCL and DAPG's MCLG when compared to the LHAs. For the reasons outlined below, equating these numbers to a level of health protection is unscientific and misleading.

As is the case with all estimates of non-cancer risks,[38] both the USEPA and DAPG values include a significant margin of safety. In the case of PFOA, a total safety factor of 300 was used by both groups to account for uncertainties associated with the

---

[35] Shih YH *et al.* Serum vaccine antibody concentrations in adults exposed to per- and polyfluoroalkyl substance: A birth cohort in the Faroe Islands. *J Immunotox* 18(1):85-92 (2021).

[36] Grandjean P *et al.* Serum vaccine antibody concentrations in adolescents exposed to perfluorinated compounds. *Environ Health Perspect* 125:077018 (2017b).

[37] No association is observed between PFOS serum concentrations at age 5 and diphtheria antibody concentrations at age 7, after adjusting for the antibody concentration at age 5.

[38] This estimate is typically referred to as the reference dose or RfD for oral exposure. See USEPA Integrated Risk Information System (IRIS) glossary for additional information (https://sor.epa.gov/sor_internet/registry/termreg/searchandretrieve/glossariesandkeywordlists/search.do?details=&glossaryName=IRIS%20Glossary).

limitations of the data used for the calculation.[39] For PFOS, USEPA applied a total uncertainty factor of 30 while the DAPG used an uncertainty factor of 100. USEPA estimates that the uncertainty in the risk estimate may span an order of magnitude,[40] which means that there may be little to no difference in the level of health protection between the HAL, MCLG, and proposed MCL. To suggest otherwise is to imply a level of certainty that does not exist.

A more appropriate approach to assessing the level of protection to be achieved with the implementation of the proposed MCLs is to evaluate the available data from the drinking water surveys that have been conducted in the state. Although the state has conducted a more recent survey, the survey used to justify the proposed MCLs focused on water sources "located within a half mile of a potential source of PFAS contamination, such as military bases, fire training sites, landfills, and manufacturing facilities."[41] As such these data are not representative of all PFOA and PFOS levels in the state. Despite this limitation, DEP indicates that only 5.7 percent of the sources tested were over the proposed MCLs for PFOA and 5.1 percent exceeded the MCL proposal for PFOS. Considering these numbers, the predicted level of health protection is significantly lower than the DEP estimates.

DEP's estimates become even more suspect when considering the data from USEPA's survey of public drinking water sources in the state under the 3rd iteration of Unregulated Contaminant Monitoring Rule (UCMR3). As part of UCMR3, USEPA sampled all large public water sources in the state and a representative sample of small sources between 2013 and 2015. According to these data, only 28 of the 1360 samples (2 percent) contained reportable levels of PFOA and/or PFOS.[42] All of these samples were collected from six of the 177 public water supplies sampled (3.4 percent).

DEP's Cost Estimate for Compliance Monitoring is Incomplete

In its cost analysis for this rulemaking, DEP assumes that no public water systems will be required to conduct quarterly sampling after the initial monitoring has been conducted during the first year. However, the proposed regulations would require any system exceeding the MCLs to continue monitoring for a minimum of four consecutive

---

[39] These include animal-to-human extrapolation, human variability, and a conversion of the lowest observed adverse effect level (LOAEL) to the no observed adverse effect level (NOAEL).

[40] Dourson ML *et al.* Evolution of science-based uncertainty factors in noncancer risk assessment. *Regul Toxicol Pharmacol* 24:108–120 (1996).

[41] DEP. Wolf Administration Announces Final PFAS Statewide Sampling Results. Press Release. June 3, 2021. According to the release, 372 of the 412 sites samples met this criterion. https://www.ahs.dep.pa.gov/NewsRoomPublic/articleviewer.aspx?id=21961&typeid=1

[42] The minimum reportable levels for UCMR3 were 20 ppt for PFOA and 40 ppt for PFOS.

quarters, or until the Department determines the system is "reliably and consistently" below the MCLs. In addition, systems installing PFAS removal treatment would be required to conduct quarterly monitoring for the PFAS subject to treatment. For these systems, quarterly sampling would likely extend beyond the initial monitoring period.

The proposal also would require systems that detect PFOA or PFOS to conduct quarterly sampling until DEP has determined that the levels are "reliably and consistently" below the MCLs and the Department has indicated that the system may conduct annual sampling. It appears likely that sampling at some of these systems would extend beyond the initial monitoring period as well.

Although the available survey data do not suggest a widespread presence of PFOA and PFOS in the state's drinking water, they do suggest that a percentage of public water systems will have detections. It also appears that a few systems may exceed the proposed MCLs and will be required to install treatment technology. For those systems with exceedances and detections, it is likely that the requirement for quarterly sampling will extend beyond the first year. DEP's cost estimate of monitoring should reflect this likelihood.

Communicating both the MCL and MCLG Would Create Public Confusion

The proposed regulation would require that public water suppliers provide both the proposed MCL and MCLG for PFOA and PFOS in their annual Consumer Confidence Reports (CCRs), as well as the levels of the substances detected. Inclusion of the MCLG, in addition to the MCL, would result in significant confusion about the applicable level and potentially expose the water utilities to unwarranted criticism. The proposed regulation would not, and should not, require public water systems to act, beyond continued monitoring, if samples exceed the MCLG, but not the MCL. Requiring them to report that they exceed the MCLG, while in compliance with all regulatory requirements, is inappropriate and should be deleted.

Please feel free to contact me at srisotto@americanchemistry.com or at 202-249-6727 if you have questions about the above information.

Sincerely,

Steve Risotto

Stephen P. Risotto
Senior Director