ADDENDUM TO THE 2015 TREATMENT SUBCOMMITTEE MCL SUPPORT DOCUMENT

"RECOMMENDATION ON PERFLUORINATED COMPOUND TREATMENT OPTIONS FOR DRINKING WATER"

NEW JERSEY DRINKING WATER QUALITY INSTITUTE
TREATMENT SUBCOMMITTEE

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DWQI TREATMENT SUBCOMMITTEE

Commissioner Bob Martin of the New Jersey Department of Environmental Protection requested that the DWQI develop recommended maximum contaminant levels (MCL) for three long-chain perfluorinated compounds (PFC):

- Perfluorononanoic acid (PFNA)
- Perfluorooctanoic acid (PFOA)
- Perfluorooctanesulfonic acid (PFOS).

2015 RECOMMENDATION

The Treatment Subcommittee found that the best available treatment for all three compounds was the same.

Accordingly, in 2015, when the DWQI issued its recommended MCL for PFNA, the Treatment Subcommittee released one document to address treatment for these three compounds, entitled: *Recommendation on Perfluorinated Compound Treatment Options for Drinking Water*

REVIEW OF NEW AVAILABLE TECHNICAL INFORMATION

As the DWQI Subcommittees began to investigate PFOA, the Treatment subcommittee did the following to ensure that the 2015 document was still applicable, the Treatment Subcommittee:

- Reviewed the available *new* relevant literature
  - Water Research Foundations Web Reports #4322 and #4344
- Reviewed the 2015 document to ensure that the identified treatment methods could achieve the draft health-based MCl.

ADDENDUM

Purpose: To update and supplement the 2015 report.

- *PFNA Treatment Clarification*

The 2014 WRF report referenced throughout the Treatment Subcommittee report included a table that described the "assumed" removal rates for PFNA with respect to anion exchange and granular activated carbon (GAC) rather than observed removal rates. The referenced case studies for New Jersey American (Logan System Birch Creek) and Amsterdam demonstrated actual removal of PFNA using full-scale GAC installations.

ADDENDUM

- Treatment Design

As noted in the document, some treatment methods are more effective for long-chain PFCs than for short-chain PFCs. Further information on the removal of various PFASs is included in the 2016 WRF document (Dickenson & Higgins, 2016). The Treatment Subcommittee recommends that consideration should be given when designing the bench study evaluations if other PFASs are present in the source water, even if they are not currently being regulated.

ADDENCUM

- Anion Exchange
- In a 2015 WRF publication, Dudley et al. (2015) indicated that:
  - Anion exchange "demonstrated great promise for PFAS removal, provided that resins are regenerated in a manner that restores, at least periodically, the PFAS removal capacity of the resin."
  - "[a] possible alternative for PFAS removal could be a hybrid adsorption/anion exchange treatment approach, in which more strongly adsorbing PFASs are initially removed by activated carbon and more weakly adsorbing PFASs subsequently by anion exchange."
- The WRF Project #4322 referenced was referred to as an "ongoing" project. This project has been concluded, and the results note that anion exchange, among other treatment methods, "show promising results for the removal of these chemicals (Dickenson & Higgins, 2016).

ADDENDUM

Advanced Oxidation:

- The statement the 2015 report regarding the ineffectiveness of conventional oxidation is further supported by recent WRF publications, which concludes that these processes “proved mostly ineffective” and “unable to oxidize PFASs because of the strength of the carbon-fluorine bond” (Dickenson & Higgins, 2016 and Dudley et al., 2015).

ADDENDUM

- <u>Membrane Filtration:</u>
- Membrane filtration, specifically nanofiltration/reverse osmosis, was also evaluated by WRF and found to be effective (Dickenson & Higgins, 2016).

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- Granular Activated Carbon:
- In the 2016 WRF publication, GAC is considered to be an effective method of treatment, as two out of three sites that tested for PFAS concentration observed removal, with empty bed contact time ranging from 10-13 minutes (Dickenson & Higgins, 2016). However, consideration must be given to the background matrix of the source water. WRF refers to some instances where PFASs measured at higher concentrations in the effluent than in the influent. According to the WRF publication, "this is believed to be due to competitive effects with other sorbing species (perhaps longer chain PFASs and/or natural organic matter) leading to desorption …" (Dickenson & Higgins, 2016). Additionally, during rapid small-scale column tests, the effluent concentration for PFOS never reached more than 2% of influent concentration (Dickenson & Higgins, 2016).

CONCLUSIONS

- The Treatment Subcommittee concludes that it has been demonstrated that PFOA can be reliably and feasibly removed by carefully designed GAC treatment to below the recommended health-based MCL of 14 ng/L.