American Water Works Association

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Water Docket
U.S. Environmental Protection Agency
Mail Code 2821T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Comments on "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting", Docket ID No. EPA–HQ–OW–2015–0218

Dear Sir or Madam,

The American Water Works Association (AWWA) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA's) proposal for the Fourth Unregulated Contaminant Monitoring Rule (UCMR4) (80 Federal Register 76897). UCMRs have always been a critical component of the Safe Drinking Water Act (SDWA) regulatory decision-making process. AWWA supports a robust UCMR monitoring program to assist EPA in meeting its statutory requirements when determining whether or not a national regulation is needed and what an appropriate drinking water standard might be. Sound national occurrence information is critical to the regulatory determinations EPA must make in assessing whether a national regulation will provide a meaningful opportunity for risk reduction.

AWWA has previously recommended EPA include cyanotoxins and disinfection by-products (DBPs) on the Fourth Contaminant Candidate List (CCL4) in order to facilitate data collection and evaluation for potential additional risk management. AWWA agrees with the inclusion of both cyanotoxins and the nine haloacetic acids (HAAs) in the proposed UCMR4; however, revisions in the final UCMR4 for both of these groups are necessary to ensure that the monitoring data will appropriately inform future regulatory decisions.

For cyanotoxins, source water monitoring should not be included in the final UCMR4. Instead, UCMR4 monitoring for cyanotoxins should be at the Entry Point to the Distribution System (EPTDS). SDWA Section 1445(a)(2)(A) clearly states that "The

regulations shall require monitoring of ***"drinking water supplied by public water systems..."*** (emphasis added), therefore, AWWA recommends that all UCMR4 monitoring be taken at the EPTDS or at sampling locations in the distribution system. This recommendation also applies to future UCMRs.

AWWA continues to have serious concerns about the accuracy and the reliability of the enzyme-linked immunosorbent assay (ELISA) analytical method. Moreover, the Agency should not directly correlate or compare the ELISA and the LC/MS/MS data. For example, the ELISA test has not been adequately tested for matrix interferences, nor for the relative sensitivity of the vast majority of congeners and disinfection degradates. Inter-laboratory comparisons cited to-date only test for precision or reproducibility, and not for the accuracy of the method itself. Much is still unknown about how disinfection interfaces with ELISA tests, making interpretation of the information difficult. The toxicity of disinfection degradates is unknown relative to known microcystins (such as MC-LR), which is further complicated by the variability in the toxicity of the known microcystins. AWWA recommends that EPA proceed cautiously in developing its ELISA standard method. Recognizing the limitations of the ELISA methods, AWWA recommends its use for screening in the finished water with an EPTDS sample at 0.3 µg/l or at a level demonstrated as sound through EPA's ongoing method development efforts as a trigger for analysis using the LC/MS/MS method.

AWWA agrees that management of DBPs is an important regulatory issue that warrants additional research and resources, but the approach in the proposed UCMR4 is inappropriate. UCMR's mandated, national monitoring framework is not the most appropriate method to obtain reliable and robust monitoring data and meta-data for regulatory decision-making on the complex issues surrounding the formation and degradation of DBPs, assuring microbial protection, and maintaining disinfectant residuals. The meta-data that is proposed to be collected will confuse and confound future data analyses. AWWA recommends a simpler classification of treatment "bins" for UCMR4 meta-data, and EPA should better articulate the future intended use of any meta-data collected in the final UCMR4.

The monitoring frequency in the proposed UCMR4 is inappropriate. UCMR4 monitoring should be conducted quarterly as has been done in past UCMRs. Monitoring should not be "skipped" in December, January, or February. The time frame as proposed (March-November) unnecessarily constrains the monitoring with no benefit for future regulatory decisions. All nine species of HAAs and four species of THMs need to be collected from compliance samples at the same time (four quarters in one year) and at all of the Stage 2 DBPR compliance sampling locations,

and all 13 analyte results need to be reported. Additionally, disinfectant residual for these samples should be collected and analyzed at the same time.

Finally, AWWA and other stakeholders have observed the need to effectively integrate regulatory activity so that in setting new regulatory requirements, simultaneous compliance issues are not ignored and that the Agency does not inadvertently create new hazards. The management of disinfection and DBPs are a clear example where there is a long history of existing and interwoven regulatory requirements. Any monitoring and associated research on DBPs should both be robust and reliable, and be conducted in a manner that appropriately informs any potential future regulatory actions.

Attached are detailed comments that elaborate on the above, and also address other important UCMR4 issues. The ultimate goal of AWWA's recommendations is a well thought out, comprehensive and optimized UCMR4 data collection effort. Both the Agency and the water sector should move forward with reasonable expectations for UCMR4, and the monitoring effort should be complimentary with EPA's drinking water research program. Robust national occurrence data is not as meaningful for regulatory decision-making without additional research into the other considerations that must be taken into account in regulatory decision-making, especially health effects research.

Please feel free to contact AWWA if you have any questions regarding the attached or would like to discuss mechanisms to more actively engage stakeholders in crafting a cohesive strategy to collect the complete suite of data needed to support drinking water regulation development.

Best regards,

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Executive Director of Government Affairs
AWWA

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***What is the American Water Works Association?***

*The American Water Works Association is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes over 3,900 utilities that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our nearly 50,000 total memberships represent the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.*

Comments of the American Water Works Association
on
"Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting"

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Comments of the American Water Works Association
On
"Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting"

The following are the American Water Works Association's (AWWA's) comments on the Environmental Protection Agency's (EPA's) proposed "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting", Docket ID No. EPA–HQ–OW–2015–0218 (80 Federal Register 76897, December 11, 2015). AWWA's comments are organized into general overarching comments, specific comments with respect to cyanotoxin monitoring, specific comments on haloacetic acid monitoring, responses to EPA's requests for comment, feedback on EPA's presentation of the burden and logistics of UCMR implementation, and a brief summary.

## Overarching Comments

AWWA supports the Proposed Fourth Unregulated Contaminant Monitoring Rule (UCMR4) as part of the suite of activities to inform regulatory decision-making; however, several important revisions need to be made in the final UCMR4.

1. Disinfection byproducts (DBPs) are an important regulatory issue that warrant additional research and resources, but the approach in the proposed UCMR4 is not an appropriate mechanism to accomplish this goal. The drinking water community needs robust and reliable UCMR monitoring data and meta-data to be collected in order to appropriately inform regulatory decision-making on the complex issues surrounding the formation and degradation of DBPs and maintaining microbial protection, disinfectant residual, and optimized corrosion control.

2. The proposed UCMR4 would collect meta-data in such a way as to confuse and confound effective analysis in the future. A simpler classification of treatment "bins" for UCMR4 meta-data would be more effective. EPA should clearly articulate the future intended use of any meta-data collected in the final UCMR4.

3. Source water monitoring for cyanotoxins should not be included in the final UCMR4. Instead, enzyme-linked immunosorbent assays (ELISAs) of finished water should first be run against a low-level calibration curve (designed specifically for values below 1µg/l), (2) re-calculated for a higher level calibration curve for values that fall above 1µg/l on the low-level calibration curve. The value reported should be the value calculated using the correct calibration curve. If the sample continues to demonstrate occurrence greater than the MRL using the correct calibration curve, then the additional analysis using EPA Method 544 should also be conducted. See



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the section "Microcystins ELISA development..." for more details on calibration curves.

4. Reconsider the proposed contaminants and revise the sampling framework for UCMR4 samples. AWWA recommends:
    a. Retaining year-round monitoring,
    b. Monitoring for the nine haloacetic acids (HAA9) in conjunction with compliance monitoring and data submittal,
    c. Reducing ground water monitoring to a single event for each EPTDS, based on our analysis of UCMR3 data that shows similar concentrations between the two sampling events, and
    d. Eliminating monitoring of the proposed alcohols and germanium to keep the total number of UCMR4 contaminants under 30 with the inclusion of the 13 species of DBPs (four trihalomethanes (THMs) and HAA9).

### Integrating SDWA Policy Development

A very positive development in the UCMR4 proposal is the forethought EPA utilized to integrate data needs across both Section 1412(b)(1)(B) (regulation of unregulated contaminants) and Section 1412(b)(9) (six-year review). The cost incurred by water systems and EPA to implement unregulated contaminant monitoring is substantial and unequitable for some systems. Consequently, the contaminants included should be carefully selected so as to make the best use of limited available resources. Equally importantly, the logistics of a national data collection effort require time yet is critical to national regulatory decisions, which cannot be made without a sound understanding contaminant occurrence. Therefore, the time spent on UCMR should not be wasted monitoring for contaminants that are unlikely to be observed, and if they are observed, unlikely to pose a significant national health consequence or to provide a "meaningful opportunity for risk reduction" through a national drinking water regulation. Thousands of non-detects in past UCMRs that have not been used to make negative regulatory determinations have not been an effective use of the drinking water community's fiscal resources.

### EPA Research Agenda Should Support SDWA Contaminant Evaluation

EPA's "Safe and Sustainable Water Resources Strategic Research Action Plan 2016 – 2019" is the latest in a series of EPA research plans that do not support the Agency's mission and mandatory duties under SDWA.[1] The lack of a cohesive and robust research plan to support regulatory actions being considered under SDWA sections 1412(b)(1)(B) and

[1] EPA, Safe and Sustainable Water Resources Strategic Research Action Plan 2016 – 2019, 2015 [http://www.epa.gov/sites/production/files/2015-10/documents/strap_2016_sswr_508.pdf]



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1412(b)(9) have resulted in the UCMR4 proposal including "make do" solutions for data collection that will pose serious challenges to data interpretation. Effectively targeted research projects could much more systematically characterize the linkages between:

1. Brominated DBP formation, influent water characteristic, and treatment scenarios.
2. Available source water indicators of cyanobacteria, treatment regimes, and observed finished water cyanotoxin levels.

The statutory mandate for UCMR is to develop the national occurrence of unregulated contaminants in ***"drinking water supplied by public water systems..."*** (emphasis added). The drinking water community has successfully implemented unregulated contaminant monitoring rule requirements for more than 30 years to serve that purpose. We also know from that history that UCMR is ill-suited to researching and developing an understanding of the underlying factors for that occurrence. For examples, see previous AWWA comments on the challenges posed analyzing UCMR2 nitrosamine occurrence data with respect to disinfection practice.[2]

## Coordinating Data Systems

The UCMR4 Federal Register notice and "DRAFT Information Collection Request for the Unregulated Contaminant Monitoring Rule (UCMR 4)" are silent with respect to which data system water systems and laboratories will be instructed to submit data. EPA's UCMR electronic data reporting system, the Safe Drinking Water Accession and Review System (SDWARS) is the implied data system on pages 80 FR 76905 and 76907 (recognition of entry points to the distribution system and laboratory applications). However, the proposed UCMR4 has no substantial discussion of the data system. For the past several years, EPA has had an ongoing collaboration with the Association of State Drinking Water Administrators (ASDWA) to develop a new electronic data portal for compliance monitoring known as the Compliance Monitoring Data Portal (CMDP). CMDP is scheduled for beta testing in 2016 and going live in 2017, one year prior to the beginning of UCMR4. Appropriate alignment of UCMR4 and CMDP is important for several reasons:

1. Coordinating compliance and UCMR4 DBP monitoring would be much more informative than separate data collection efforts,
2. Coordinating Entry Point to the Distribution System (EPTDS) monitoring locations with routine monitoring sites would be a more effective use of resources; and
3. Potentially coordination of available water system treatment information.

[2] AWWA, Comments on Revisions to the Unregulated Contaminant Monitoring Regulation (UCMR 3) for Public Water Systems, Docket ID No. OW–2009–0090, 2011



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### Application of EPA Health Advisories and Reference Levels

In June 2015, EPA finalized 10-day health advisories for microcystins and cylindrospermopsin. These advisories are described by the Agency as non-regulatory and informational. In the final UCMR4, EPA needs to clearly state the non-regulatory aspects of these numbers. In some EPA regions, the current UCMR3 monitoring data is be used to require additional treatment and abandonment of wells based on the perfluorooctane sulfonate (PFOS) observations and the provisional EPA health advisory.[3] EPA has gone to considerable length to describe the cyanotoxin health advisories as 10-day levels, and that multiple toxin observations above the health advisory levels are necessary to support risk management steps by the public.[4] AWWA recommends that EPA be explicit in the final rule that a single data point from the UCMR4 monitoring data alone is not sufficient to trigger public notice for cyanotoxins.

Similarly, in UCMR3, EPA provided reference levels that were calculated using standard procedures for computing drinking water equivalent levels (DWELs).[5] Having such health reference levels can be informative for communication with the public, but complications ensue given the health endpoints being explored in the scientific literature and mass media for compounds like microcystins, cylindrospermopsin, nodularin, manganese, DBPs, etc. Therefore, AWWA recommends that EPA carefully consider the quality of the available information for such reference levels and to thoughtfully present such levels in the final UCMR4.

## Cyanotoxin Monitoring

AWWA has several concerns and recommendation to improve the proposed cyanotoxin monitoring methodologies. The issues raised bear on both the resulting UCMR4 data and the usefulness of that data for needed analyses. The ultimate goal of any UCMR is to appropriately inform future regulatory decision-making, and we believe that our recommendations will aid in optimizing the decision-making processes.

First, EPA's proposed microcystins sampling methodology includes taking both source and finished water samples. AWWA recommends that EPA remove source water monitoring from the final UCMR4, and restructure the finished water monitoring as detailed below. We believe this is the most prudent course of action for the following reasons:

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[3] EPA, Health Advisories for Perfluorooctanoic Acid and Perfluorooctane Sulfonate in Drinking Water, 2009, [http://www.epa.gov/dwstandardsregulations/health-advisories-perfluorooctanoic-acid-and-perfluorooctane-sulfonate]

[4] EPA, Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water, 2015, [http://www.epa.gov/nutrient-policy-data/guidelines-and-recommendations#health]

[5] EPA, October 2015 UCMR 3 Data Summary for Chemical Contaminants, EPA 815-S-15-003, [http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3].



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1. The purpose of the UCMR is to develop occurrence data for potential contaminants that may be present in ***"drinking water supplied by public water systems..."*** (emphasis added). Past UCMRs have monitored only at EPTDSs and at points within the distribution system. Source water monitoring is not appropriate under the UCMR regulatory framework, and should be undertaken in targeted research studies that collect treatment plant meta-data sufficient to support analysis.

2. In addition to the potential for existing treatment to remove cyanotoxins, treatment can also lead to the release (*e.g.*, oxidant addition) or concentration of toxins (*e.g.*, recycle streams). Using the "phased" microcystins methodology would miss both processes that increase cyanotoxins within the plant and processes that decrease cyanotoxins within the plant.

3. Because water takes time to travel through a treatment facility, sampling methodologies meant to determine treatment effectiveness must accurately account for travel time from source to the EPTDS. Taking simultaneous source and finished samples does not provide information on treatment effectiveness, but only two different sets of data that can only be analyzed independently. Because of the complexity of determining a uniform methodology to accurately measure pre- and post- treatment concentration that accounts for travel time, such data collection is appropriate as a separate research study, not as a part of UCMR.

4. EPA's proposed use of the ELISA test for microcystins on source water samples would likely create a communication challenge for water systems. Because UCMR monitoring must be reported on the system's Consumer Confidence Report (CCR), some systems will likely have readings above 0.3 µg/l in source water samples, but then non-detect in finished water samples. Consequently, these systems will report a positive source water monitoring result on their CCR. The CCR is designed to help consumers understand their drinking water quality. The inclusion of source water data, when the contaminant of concern was not actually found in the water delivered to customers, will further complicate the CCR and public understanding of their system's water quality.

5. Research on the treatment of microcystins consistently shows that very low levels of extracellular microcystins are removed with conventional water treatment, and intracellular microcystins are removed through flocculation, coagulation, and filtration processes. The phased monitoring methodology that EPA has proposed fails to account for the best available science in setting the source water screening level (0.3 µg/l). The proposed screening level is lowest readable value in the most commonly used ELISA methods, and even is typically considered "semi-quantitative". Water systems with low readings would nearly always have non-detects in finished water. The current combination of sample location and screening value contributes to implementation

burden without adding new information, as the literature has already shown that conventional treatment and disinfection remove very low levels of microcystins.

6. Removing source water monitoring would simplify the analytical method requirements. The Ohio EPA ELISA method, which is expected to share most characteristics with the EPA standard ELISA method currently in development, requires several rounds of freezing and thawing to lyse any cyanobacteria cells present in the sample and release all of their stored toxins. Conventional water treatment in most instances will remove all or nearly all of the cyanobacteria and all of the intracellular toxins contained within those cells will not be present in finished water. Unlike source water monitoring, which would require both lysed and not-lysed samples to capture both total and extracellular microcystins, finished water monitoring does not require lysing.

In summary, AWWA is concerned that the quality of occurrence data in drinking water generated by the phased methodology for microcystins would be poor. Eliminating source water monitoring and instead monitoring finished water directly, using the methodology proposed below, would generate much higher quality occurrence data that would be more useful for the purposes of determining both national occurrence and deciding whether there is or is not a meaningful opportunity for risk reduction under a future regulation.

In place of source water monitoring, EPA should restructure microcystins monitoring in finished water using the following protocol:

1. Samples to run finished water ELISA and LC/MS/MS (EPA Method 544) should be taken simultaneously.
2. ELISA results for any sample should be compared against a low-level calibration curve designed for greatest accuracy of values less than 1µg/l.
3. If the sample result is above the low-concentration calibration range, then the sample result should be compared against a higher concentration calibration curve designed for accuracy above 1µg/l.
4. The reported result should be the result using the correct calibration curve. For ELISA values above the MRL at the correct calibration curve, EPA 544 should also be run and reported.

EPA should carefully consider all of these comments to assure that useful data is on microcystins is generated without creating an overly large burden on public water systems and contributing to the other issues mentioned throughout the comments.



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## Microcystins ELISA Method Development and Lab Certification

As EPA is well aware, the ELISA calibration is logarithmic in nature.[6] Therefore, if the most accurate results are needed at relatively low levels (e.g. 0.3 µg/l), then the calibration accuracy in that range is critical. Most detected values in UCMR are expected to be at the low end of the calibration range, if detected at all. ELISA is typically calibrated over a range from 0.15 to 5 µg/l and there is seldom clear guidance regarding dilution in the test kits. AWWA recommends that in the development of the EPA version of an ELISA method, the EPA ELISA method requires that initial measurements be conducted against a calibration curve that goes no higher than 1 µg/l (e.g. 1 order of magnitude) and, if values are over-range, they should be re-calculated against either the full calibration range or that portion of the calibration range that goes from 1 to the high end. As EPA typically includes requirements for back calculation and acceptance criteria in methods, we assume this will be taken into consideration. AWWA recommends that EPA focus on evaluating calibration ranges to ensure greatest accuracy and precision, especially because values above the MRL (currently 0.3 µg/l) will trigger the more expensive LC/MS/MS method. Note also that this does not take into consideration the different responses of microcystin variants. Therefore, the more precise EPA can make their ELISA method, the lower the overall uncertainty.[7]

Use of ELISA as a screening measure under UCMR4 to measure total microcystins is only appropriate if EPA can demonstrate the method meets all applicable quality control measures expected of an EPA Standard Method. Although we commend Ohio EPA for leading initial method development, EPA should not assume that Ohio EPA has already completed all of the appropriate quality assurance/quality control (QA/QC) measures expected of an EPA standard method that is to be applied nationally. AWWA recommends that EPA independently verify all necessary procedures and performance information of the method during method development. There may be too many unknowns about interactions with degradation byproducts, interferences from other compounds, and different, but unknown, sensitivities to different congeners to pass appropriate QA/QC. EPA should be prepared to pursue alternate sampling methodologies if the ELISA method currently in development cannot pass appropriate QA/QC criteria.

Additionally, according to the UMCR4 laboratory certification manual, laboratories must be able to accurately measure down to 1/3 of the MRL to achieve certification. Given a proposed MRL of 0.3 µg/l for total microcystins, meeting the proposed certification criteria requires accurately measuring to 0.1 µg/l. It is not clear laboratories can achieve this level of performance on a consistent basis, posing a serious laboratory certification problem.

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[6] For illustratory purposes see Abraxis Microcystins/Nodularins (ADDA), ELISA Microtiter Plate Kit's User Guide, http://www.abraxiskits.com/wp-content/uploads/2014/08/Microcystin-PL-ADDA-Users-Guide-ETV-R082714.pdf (downloaded February 3, 2016).

[7] Abraxis Microcystins/Nodularins (ADDA), ELISA Microtiter Plate Kit's User Guide, http://www.abraxiskits.com/wp-content/uploads/2014/08/Microcystin-PL-ADDA-Users-Guide-ETV-R082714.pdf (downloaded February 3, 2016)



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Current ELISA methods only become semi-quantitative at 0.3 µg/l (+/- 50%) and it may not be realistic to detect down to 0.1 µg/l. EPA should carefully consider revising its performance criteria for microcystin analysis by ELISA when setting this threshold value and while testing its standard method under development. The Abraxis ADDA test has a manufacturer-supplied MRL of 0.15 µg/l. This manufacturer MRL would require EPA to either have 0.45 µg/l or higher UCMR MRL, or to change the laboratory certification processes and requirements. Any change to those requirements needs to be based upon good science.

Alternatively, EPA could fast track the development of its upcoming MMPB method, which is expected to be both more reliable and deliver more granular information for potential regulatory decision making. EPA could then add the MMPB method to UCMR as soon as it is available.[8] For this reason, and for other reasons described below, AWWA recommends that EPA raise the MRL for the ELISA method to at least 0.45 µg/l if the current Abraxis ADDA test is used, or higher if analysis of EPA's standard method currently in development indicates a higher MRL is appropriate.

Additionally, EPA Method 544 is currently used rarely and only by a handful of laboratories. Many laboratories have developed "direct injection" methods that are more straightforward, potentially less expensive, and still have a strong sensitivity (50-100 ng/l). EPA should discuss this issue with laboratories and consider the possibility of developing an EPA standard method to reduce the overall burden compared to running EPA Method 544.

## Need for Specific Cyanotoxins Analysis Plan

AWWA is concerned about how data analysis will be performed on the cyanotoxins data collected in UCMR4 as proposed. It is well known that ELISA does not measure every microcystin congener equally. That is to say a known amount of Microcystin-LR does not yield the same result on an ELISA test as the same known amount Microcystin-LA or another congener. In some cases, the same concentration of one congener can yield a result several times greater on ELISA than another congener. For example, when a total microcystins ELISA test is calibrated using Microcystin-LR (as it most commonly is), there is the possibly that any unknown congener could either:

1. Produce 10% of the response of Microcystin-LR, yet be much more toxic and present a greater health risk, under-reporting the actual concern, or

[8] MMPB analytical method is a liquid chromatography tandem mass spectroscopy (LC/MS/MS) analysis on the 3-methoxy-2-methyl-4-phenylbutyric acid molecule (MMPB) and calibrated using a certified reference standard, currently (microcystin-LR) and 4-phenylbutyric acid.



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2. Produce 10 times the response of Microcystin-LR, yet be much less toxic and therefore over-report the actual health concern.

Therefore, making comparisons between ELISA and LC/MS/MS measurements is difficult, and in some cases, such as if unknown congeners are present, can be nearly impossible without more information. Total Microcystins as measured by ELISA is *not* equal to the congeners measured by LC/MS/MS plus unknown congeners. The translation from ELISA to LC/MS/MS is not known for every compound and circumstance. Additionally, the sensitivity of ELISA known for many congeners is unknown. Finally, it is thought that ELISA picks up some cyanotoxin oxidation degradates, falsely implying greater concern than warranted by the substance that is actually present. Therefore, we recommend that EPA create a clear, transparent plan for the analysis of UCMR data to address these complexities prior to the collection of the data.

## Additional Cyanotoxins Concerns

AWWA requests that EPA explain the benefit of monitoring for nodularin based upon a total microcystins trigger. Many do not consider nodularin to be a microcystin, although it does share some structural similarities with microcystins. We cannot foresee any scenarios where this proposed methodology yields any conclusions on national occurrence for nodularin, and it appears to be included only because it is part of the EPA 544 analytical method. Simply being part of the EPA 544 method is not appropriate for the inclusion of another compound in the final UCMR4 that does not appear to inform any future regulatory decision-making.

In the supporting cost analysis, EPA has used the presumption that 20% of surface water raw / intake ELISA samples will read as 0.3 µg/l or greater. AWWA does not agree that this frequency is supported by the available evidence. There are good reasons to expect the frequency could be substantially higher. Given the potential for interference by other compounds, the tendency for ELISA to generate false positive results, and the intentional biasing towards finding greater occurrence (by concentrating the sampling in warmer months) it is more likely that the cost assumptions are incorrect. Again, AWWA recommends that EPA eliminate source water monitoring from the sampling methodology for microcystins. With this elimination, EPA will be able to more accurately estimate the projected cost of conducting sampling directly on finished water.

## Monitoring to Inform DBP Risk Management

AWWA supports the collection of occurrence data in UCMR4 in order to inform evaluating risk management decisions regarding DBPs. The development of the current DBP standards reflect an extensive body of research and substantive, fact-based, stakeholder dialogue. To make changes in the existing DBP – microbial disinfection framework will require a careful consideration of off-setting and overlapping risk management challenges.



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Given the potential for unintended, undesirable impacts, AWWA urges EPA to set objectives for UCMR4 that effectively utilize this national occurrence survey's strengths and minimizes its weaknesses. UCMR4's objectives should fit within a cohesive research and information collection strategy that includes:

1. A clearly articulated vision of data and information needs to support future risk-management decisions,
2. A cohesive research plan that reflects what information is to be developed through EPA intra- and extramural research,
3. Occurrence gaps that UCMR4 will fill, and
4. A process for engaging the drinking water sector to leverage EPA's work.

Such a strategy would need to extend beyond occurrence and treatment to health effects. While EPA has posited a premise for focusing on brominated DBPs in future decision-making, a substantive debate is ongoing on whether the drinking water community presently has sufficient evidence to warrant changing treatment practice.[9, 10] The balance of AWWA's comments on UCMR4 assume that brominated DBPs will be a substantial component of future risk management and the question at hand is what information from UCMR4 monitoring would most appropriately inform those decisions.

The proposed UCMR4 appears to incorporate the following elements to support DBP risk management evaluation:

1. The collection of HAA5, HAA6Br, and HAA9 samples from current distribution system compliance monitoring locations for the purpose of estimating the national occurrence of unregulated brominated HAAs while staying within the UCMR monitoring cap of 30 contaminants.
2. The collection of total organic carbon (TOC) and bromide at LT2ESWTR (or similar) source water monitoring locations to inform modeling the linkage between influent water quality and observed DBP formation.
3. Temperature and pH at LT2ESWTR (or similar) source water monitoring locations to inform modeling the linkage between influent water quality and observed DBP formation.

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[9] Regli, S., J. Chen, M. Messner, M.S. Elovitz, F. J. Letkiewicz, R.A. Pegram, T.J. Pepping, S.D. Richardson, and J. M. Wright, "Estimating Potential Increased Bladder Cancer Risk Due to Increased Bromide Concentrations in Sources of Disinfected Drinking Waters, 2015, Environ. Sci. Technol., 2015, 49 (22), pp 13094–13102. http://dx.doi.org/10.1021/acs.est.5b03547

[10] Hrudey S.E., Backer L.C., Humpage A.R., Krasner S.W., Michaud D.S., Moore L.E., Singer P.C., Stanford B.D., Evaluating Evidence for Association of Human Bladder Cancer with Drinking-Water Chlorination Disinfection By-Products, ,J Toxicol Environ Health B Crit Rev. 2015;18(5):213-41. doi: 10.1080/10937404.2015.1067661.

4. Data element, including primary and secondary disinfection practice and treatment information for each sample, in order to distinguish differences in DBP occurrence as a function of disinfection and treatment practice.

AWWA supports each of the above data collection objectives but does not agree that the data collected as proposed will be informative or that UCMR is the appropriate mechanism to develop data to inform the analyses envisioned.

### Applicability of HAA Monitoring

As currently proposed, HAAs are a part of Assessment Monitoring and as such must be monitored by all systems serving more than 10,000 population served. Additional regulation of HAAs would be through a potential revision of existing DBP regulations. The current DBP regulations only apply to systems that employ a chemical disinfectant. For purposes of UCMR4, EPA could substantially reduce the complexity of the data collection effort and reduce the burden of the rule on undisinfected water systems by only collecting HAA data from systems subject to the existing DBP regulations. Such an approach does inadvertently bias exposure toward systems with the potential for higher levels of HAAs but is adequate to inform the potential revision of existing DBP regulations.

### Analysis Supported by Proposed Data Collection Is Superfluous

AWWA agrees with EPA that the Agency should have actual occurrence distributions of contaminants in finished water for evaluating future regulatory decisions. This is what the SDWA requires, and is particularly true of DBPs where additional regulatory action will require modelling to estimate the impact of potential risk management strategies. The proposed collection of HAA5, HAA6Br, and HAA9 will involve significant time and expense to collect data that is not a great deal more useful than analyses that can be conducted with data already available to EPA. Attachment A illustrates how well-recognized relationships, like bromide incorporation factor (BIF), can be used to achieve the same level and quality of information that will be accrued through the proposed data collection.

### Suggestions to Streamline and Enhance HAA Data Collection

EPA should explicitly list the individual brominated HAA species not captured by current monitoring for HAA5. Those species are:

1. bromochloroacetic acid,
2. bromodichloroacetic acid,
3. chlorodibromoacetic acid, and
4. tribromoacetic acid.



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This data should be obtained by analyzing Stage 2 DBPR compliance samples for HAA9 rather than HAA5. The four currently regulated THM species data should be reported for the same samples as well.

Samples processed for compliance with UCMR4 will be of sufficient quality to allow submitting the sum of dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, and trichloroacetic acid for compliance with Stage 2 DBPR. Such dual use of UCMR monitoring results has occurred previously and, if appropriately framed, will both improve the data available to EPA for analysis and help water systems manage the burden presented by compliance with the final UCMR4.

Stage 2 DBPR compliance monitoring is currently filed with state primacy agencies through either unique state data systems or SDWIS State, while UCMR1, 2 and 3 results have been submitted through SDWARS. These two systems are separate but not incompatible. EPA is presently developing CMDP, and it is scheduled to be operational a year prior to the beginning of UCMR4 monitoring. Utilizing a single data portal for submitting both compliance and UCMR data is appealing for multiple reasons, provided that the data portal is stable, easy to use, and thoroughly beta tested with users prior to implementation. Benefits could include:

1. A single HAA data submittal that would fulfill both compliance and UCMR4 requirements.
2. Collection of both individual TTHM and HAA species concentrations along with regulatory required TTHM and HAA5 sums.

### Utility of Source Water Bromide and TOC Data Collection

AWWA agrees with EPA that both bromide and TOC data should be collected to inform future technical analyses to support any potential DBP risk management decisions. AWWA does not concur with the premise that collecting bromide and TOC with the other data collected in UCMR4 are sufficient to develop an informative model of brominated DBP occurrence. As has been illustrated by previous dialogues around DBP/microbial risk management, understanding the underlying mechanisms of DBP formation and the complex relationships between treatment and DBP formation and degradation is important to regulatory option analysis. Consequently, AWWA suggests that targeted research studies investigating treatment alternatives, bromide and TOC control, other treatment options, and DBP formation considerations be developed.

Use of CMDP would again be helpful as a data collection alternative in lieu of UCMR. TOC removal is already a requirement for all surface water treatment plants in the US. Consequently, a substantial body of data is already being collected on influent and effluent TOC at existing water treatment plants. This data would inform both understanding DBP occurrence and our understanding of how much additional TOC reduction is potentially



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available to any potential future risk management activities. Collecting TOC data from existing state data systems is challenging, but CMDP is anticipated to facilitate compiling data from existing regulatory monitoring and reporting requirements.

A better understanding of bromide occurrence will be necessary to support Agency activity. Again, this need extends beyond the capacity of UCMR monitoring. In this instance, an updated national distribution of bromide occurrence is needed, as well as an understanding of the temporal trends and regional trends in both surface and ground water supplies. Data of this type is probably best developed through a collaborative effort with USGS and dedicated research projects that evaluate not only conventional sources of water supply that currently dominate water supply portfolios but also investigate implications of using more challenging waters as water supply alternatives.

### Temperature and pH

It is not clear from the UCMR4 Federal Register notice whether EPA intends to use the collected temperature and pH data to inform evaluation of the DBP occurrence data. AWWA would strongly discourage the Agency from attempting such an approach. The collection described in the notice is for temperature and pH to be monitored in source water at the time of cyanotoxin sampling. Such samples are:

1. Not clearly connected in time with the HAA samples, and
2. Reflect source water conditions, not conditions during treatment and finished water that are pertinent to DBP formation.

AWWA recommends that disinfectant residual, temperature and pH be collected and reported at the same time as the sampling for the four THMs and HAA9 at compliance monitoring sample locations.

### Primary and Secondary Disinfection Practice and Treatment Information

As previously stated, a cohesive research plan is needed to collect data that is useful for the questions most pertinent to future risk management steps. For example, while the proposed UCMR4 collects information on TOC and bromide, it does not collect the equally, if not more, important information on oxidant addition, oxidant order of application, oxidant dose, and oxidant contact time. It should be noted that AWWA is not recommending that these be included in the final UCMR4, as these are more appropriate for targeted research studies. Consequently, the proposed UCMR4 does not, and is unlikely to, collect sufficient information to support such efforts as modeling of DBP occurrence as a function of water quality parameters and treatment.

However, AWWA recommends that the final UCMR4 collect the primary and secondary disinfectant practice in place at the time of DBP sampling. This data is critical to even



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simple evaluations of the UCMR occurrence data and is fundamental to better targeting future research.

AWWA agrees that the UCMR4 data is more informative when there is information describing the associated treatment. However, collecting this data has been problematic in previous UCMRs. If UCMR4 data were collected through CMDP as AWWA recommends, connecting the UCMR4 data to the treatment plant description maintained as a part of routine system reporting to the state is possible. Unfortunately, in the near term, at least two issues are barriers to such an approach:

1. Previous EPA analyses have found that, historically, the State data for nonparametric data elements is less complete and more likely to be inaccurate than compliance data. So, in the near-term, UCMR4 may not be able to rely exclusively on data from the state data systems and some type of hybrid data collection approach may be needed.
2. The effort to implement CMDP will not include collection of nonparametric data so the data system renewal at the federal level that would result in a refresh and updated tool for this data will not be available until PRIME is developed and implemented. PRIME's development timeline is undeterminable at this point.

## Removal of Alcohols and Germanium from UCMR4

AWWA recommends that EPA remove the Alcohols (1-butanol, 2-methoxyethanol, and 2-propen-1-ol) and germanium from UCMR4. These compounds are of low toxicity and it appears unlikely to have widespread national occurrence at levels of concern. Therefore, there is not likely to be any significant opportunity for risk reduction as required by the contaminant selection process. Therefore, we request that EPA remove these compounds to make room for higher priority data collection actions recommended elsewhere in AWWA's comments.

## Requests for Comment

*"EPA invites comment on the proposed UCMR 4 contaminants and their associated analytical methods identified in Exhibit 3, as well as any other priority contaminants commenters wish to recommend."*

In commenting on the draft CCL4, AWWA specifically recommended listing individual microcystins (i.e., MC-LR, –LA, -LW, -RR, and –YR) as well as cylindrospermopsin and anatoxin A. In keeping with AWWA's earlier recommendation, we concur that if appropriate methods and sampling methodologies are used, that occurrence data for these cyanotoxins is important and a high priority for inclusion in UCMR monitoring.



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## Selected Analytical Methods for Proposed Contaminants

AWWA reviewed the analytical methods proposed by EPA in the proposal, summarized in Exhibit 1.

Exhibit 1. Overview of Proposed UCMR4 Analytical Methods and Associated Issues

| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 1 | Total microcystins | * | * | ELISA Standard Operating Procedure (SOP) (Ohio EPA, 2015). | 0.3 |
| 2 | Microcystin-LA | * | 0.3 | EPA Method 544 | 0.008 |
| 3 | Microcystin-LF | * | 0.3 | | 0.006 |
| 4 | Microcystin-LR | 0.021 | 0.3 | | 0.02 |
| 5 | Microcystin-LY | * | 0.3 | | 0.009 |
| 6 | Microcystin-RR | * | 0.3 | | 0.006 |
| 7 | Microcystin-YR | * | 0.3 | | 0.02 |
| 8 | Nodularin | ? | NA | | 0.005 |
| 9 | Anatoxin-a | ? | NA | EPA Method 545 | 0.03 |
| 10 | Cylindrospermopsin | 1.6 | 0.7 | | 0.09 |
| 11 | Germanium | 0.744 | 7.44 | EPA Method 200.8 | 0.3 |
| 12 | Manganese | 300 | 300 | SM 3125<br>SM 3125–09<br>ASTM D5673–10 | 0.4 |



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| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 13 | alpha-Hexachlorocyclohexane | 0.006 | 0.006 | EPA Method | 0.01 |
| 14 | Chlorpyrifos | 2 | | 525.3 | 0.03 |
| 15 | Dimethipin | 153 | 153 | | 0.2 |
| 16 | Ethoprop | 0.7 | 1.25 | | 0.03 |
| 17 | Oxyfluorfen | 0.478 | 210 | | 0.05 |
| 18 | Profenofos | 0.35 | 0.35 | | 0.3 |
| 19 | Tebuconazole | 210 | 210 | | 0.2 |
| | total permethrin | 3.65 | 3.65 | | 0.04 |
| | *i.e.* | | | | |
| 20 - 23 24 25 | *The combined concentration of 4 distinct stereoisomers of (3-Phenoxyphenyl)methyl ester 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylic acid* | 3.65 | | | 0.07 |
| | Tribufos | | 7 | | |
| | HAA5 | | | EPA Method | -- |
| | HAA6Br | | | 552.3 | -- |
| | HAA9 | | | | -- |
| | *i.e.* | | | | |
| 26 | *Bromochloroacetic acid* | -- | | | *0.3* |
| 27 | *Bromodichloroacetic acid* | -- | | | *0.5* |
| 28 | *Chlorodibromoacetic acid* | -- | | | *0.3* |
| 29 | *Tribromoacetic acid* | -- | | | *2.0* |
| 30 | *Monobromoacetic acid* | -- | | | *0.3* |
| 31 | *Dibromoacetic acid* | -- | | | *0.3* |
| 32 | *Dichloroacetic acid* | 0.7 | 0 | | *0.2* |
| 33 | *Monochloroacetic acid* | 70 | 70 | | *2.0* |
| 34 | *Trichloroacetic acid* | 20 | 20 | | *0.5* |
| 35 | 1-butanol | 700 | 700 | EPA Method | 2.0 |
| 36 | 2-methoxyethanol | 21 | 21 | 541 | 0.4 |
| 37 | 2-propen-1-ol | 35 | 35 | | 0.5 |
| 38 | butylated hydroxyanisole | 0.581 | 0.581 | EPA Method | 0.03 |
| 39 | o-toluidine | 0.194 | 0.194 | 530 | 0.007 |
| 40 | quinolone | 0.01 | 0.01 | | 0.02 |
| 41 | bromide | | | | |
| 42 | pH | | | | |
| 43 | Temperature | | | | |



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| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 44 | Total Organic Carbon | | | | |

Sources: HRLs included are from EPA HAs, Proposed CCL4 Notice Support Documents, CCL3 Support Documents, Stage 2 Disinfectant and Disinfection Byproduct Rule, and 2012 Drinking Water Standards and Health Advisories [11,12,13,14,15]

To allow for a robust analysis of HAA occurrence, AWWA suggests focusing on augmenting data collection through CDMP. While collecting secondary disinfectant residual values at the time of compliance DBP monitoring is not a typical practice, such information will be important to understanding observed HAA levels. Consequently, in addition to monitoring for HAA9 through augmenting routine compliance monitoring data collection, systems should collect pH, temperature, and either free or total chlorine concentrations as appropriate to the secondary disinfectant in use at the time and location of DBP sample collection. Field DPD observations using handheld colorimeters will be appropriate for collecting this data. Since field technicians are water system staff and not approved by EPA for UCMR monitoring, EPA will need to revise its current regulatory language on processing of UCMR samples at UCMR approved laboratories. For purposes of UCMR4 monitoring the existing analytical method performance should be sufficient for this data collection activity.[16]

*"EPA will consider raising MRLs if the Agency becomes aware of evidence that a proposed MRL is unattainable or impractical."*

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[11] EPA, 2015, 2015 Drinking Water Health Advisories for Two Cyanobacterial Toxins, 820F15003, http://www.epa.gov/nutrient-policy-data/drinking-water-health-advisory-documents (Accessed 1/3/2016)

[12] EPA, 2015, Contaminant Information Sheets (CISs) for the Draft Fourth Preliminary Contaminant Candidate List (PCCL 4) Nominated Contaminants, EPA 815-R-15-003, http://www.epa.gov/sites/production/files/2015-01/documents/815r15003.pdf (Accessed 1/3/2016)

[13] EPA, 2009, Contaminant Information Sheets for Final CCL3 Chemicals, EPA 815-R-09-012, http://nepis.epa.gov/Exe/ZyNET.exe/P100576U.TXT?ZyActionD=ZyDocument&Client=EPA&index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000011%5CP100576U.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL (Accessed 1/3/2016)

[14] EPA, 2006, 71 FR 388

[15] EPA, 2012, Drinking Water Standards and Health Advisories, EPA 822-S-12-001, http://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf (Accessed 1/3/2016)

[16] 40 CFR 23 and 40 CFR 131



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In the proposed UCMR4, EPA describes its rationale for use of methods with minimum reporting levels that are lower than the health reference levels for the target analytes in UCMR4. The notice does not describe the HRLs for the majority of the UCMR4 contaminants. A retrospective review of available EPA documents found a number of analytes measured in the proposed UCMR4 for which the Agency has not previously identified an HRL.[17] In other instances, the Agency has found that there was insufficient information to compute an HRL (*e.g.*, anatoxin a, nodularin, and individual microcystins other than microcystin LR). Recognizing the limited nature of available health effects information for a number of the target contaminants, AWWA encourages the Agency to place greater value on the robustness of the reliability of the analytical methods employed in UCMR.

If EPA moves forward with the proposed analytes, the Agency should clearly and transparently communicate its rationale for each proposed analyte so that water systems that have positive observations have a sound basis for communication with the public about perceived risk.

*"[Inclusion of] the following contaminants that were considered by the workgroup, but not included in the proposed list because they were deemed a lower UCMR 4 priority than the contaminants identified in Exhibit 3: Legionella pneumophila and Mycobacterium avium (both are part of the draft CCL 4); ammonia (considered as an indicator of distribution system nitrification potential); and the pesticides vinclozolin, hexazinone and disulfoton (additional analytes in EPA Method 525.3)."*

AWWA supports the inclusion of manganese in the final UCMR4. In its comments on the Draft CCL4, AWWA recommended that manganese be included in the group for a future UCMR, and the timing is such that inclusion in the final UCMR4 is appropriate.

AWWA has noted the importance of *Legionella pneumophila* and *Mycobacterium avium* for several iterations of the SDWA CCL process.[18] While AWWA views these organisms as significant, we agree with EPA's rationale for not including these contaminants on the proposed UCMR4 and agree that they should not be included on the final UCMR4. AWWA's comments on CCL4 observed the need for a cohesive, risk-management oriented research

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[17] The HRLs referenced in EPA's January 2016 webcast generally mirror those available from previously available documents, see "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems" Public Webinar, January 13, 2016.

[18] AWWA Comments on Proposed CCL3 (May 2008, Docket: EPA-HQ-OW-2007-1189) [http://www.awwa.org/Portals/0/files/legreg/documents/AWWACCL3Comments.pdf] and AWWA Comments on Proposed CCL4 (April, 2015, Docket: EPA-HQ-OW-2012-0217) [http://www.awwa.org/Portals/0/files/legreg/documents/AWWACommentsDraftCCL4.pdf]



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program for biofilm organisms including *L. pneumophila* and *M. avium*. Such a program is outside the scope of UCMR and should be conducted through separate research studies.

With respect to monitoring ammonia, AWWA does not recommend monitoring ammonia in UMCR4. The collection of ammonia in the absence of a host of other data elements would be very challenging to interpret and use constructively. A substantial body of literature exists on nitrification, including a number of papers by EPA researchers that illustrate that forecasting and controlling nitrification is not possible using a single indicator like ammonia.[19, 20] The presence of ammonia (or in the instance of nitrification, the loss of ammonia) is not a "contaminant", nor is the presence of nitrification inherently a health concern. Consequently, utility monitoring of ammonia in finished water in the final UCMR4 is not appropriate under either SDWA Section 1445(a)(2) or Section 1445(a)(1)(A).

While AWWA appreciates the Agency looking for opportunities to consolidate around groups of chemicals that can be analyzed using a single analytical method (e.g., EPA Method 525.3), it is not appropriate to include contaminants that represent little opportunity for risk reduction, because it is possible to measure them. In comments on the CCL4 proposal, AWWA indicated that there was already sufficient information for EPA to make a negative regulatory determination for disulfoton. Neither EPA or AWWA has identified hexazinone as a priority drinking water contaminant for evaluation.[21, 22] Vinclozolin is a registered pesticide; consequently, it is regulated under the Federal Insecticide, Fungicide, and Rodenticide Act and the Food Quality Protection Act. As part of re-registration EPA prepared an analysis of the risks posed by Vinclozolin and explicitly considered models of high-risk exposure scenarios via drinking water. The Agency concluded:

> "Model estimates of potential drinking water exposure from ground and surface water sources **are not of concern for vinclozolin**." [emphasis added][23]

Consequently, while Vinclosolin is proposed for inclusion on CCL4, it is not a relevant analyte for UCMR monitoring.

*"Exhibit 3 that you think represent a lower priority than your new recommendation(s) or that should otherwise be removed from the list; the recommended analytical method(s) for any new*

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[19] Odell, L.H., G.J. Kirmeyer, A. Wilczak, J.G. Jacangelo, J.P. Marcinko, R.L. Wolfe, Controlling Nitrification in Chloraminated Systems, 1996, Journal AWWA, page 86 – 98.
[20] AWWA, Nitrification Prevention and Control in Drinking Water, AWWA Manual M56, Second Edition, 2013.
[21] EPA CCL4 Docket: EPA–HQ–OW–2012–0217
[22] AWWA, AWWA Recommendations for Contaminant Candidate List 4 (CCL4), 2015, [http://www.awwa.org/Portals/0/files/legreg/documents/2015CCLAWWAReport.pdf]
[23] EPA, RED Facts, Vinclozolin, EPA-738-F-00-021, 2000, [http://iaspub.epa.gov/apex/pesticides/f?p=CHEMICALSEARCH:31:::NO:1,3,31,7,12,25:P3_XCHEMICAL_ID:4400]

*contaminant(s) that you propose; and other relevant details (e.g., reporting level, sampling location and sampling frequency)."*

AWWA's CCL3 comments identified a number of contaminants with higher priority for collection of occurrence information, specifically: 1,4-dioxane, molybdenum, and 1,1-dichloroethane. These three contaminants are being monitored in UCMR3 and despite 0, 34, and 1 water systems to-date, respectively, observing these high priority contaminants at levels above the health reference level.[24]

EPA's proposed UCMR4 already includes many of the contaminants AWWA identified in its CCL4 analysis: anatoxin-a, cylindrospermopsin, microcystin-LA, microcystin-LR, microcystin-RR, and microcystin-YR, Chlorpyrifos, and manganese. AWWA also recommended monitoring the following in UCMR4:

1. microcystin-LW,
2. 3-Hydroxycarbofuran,
3. Azinphos-methyl,
4. Saxitoxin, and
5. Saxitoxin-related paralytic shellfish toxins.[25]

There is sufficient information to consider microcystin-LW, 3-Hydroxycarbonfuran, and Azinophos-methyl for inclusion in UCMR4. Exhibit 2 summarizes the relevant details for monitoring under UCMR4.

Exhibit 2. Recommended Additions to UCMR4 Monitoring

| Analyte | Available Methods | Reporting Level (µg/L) | Relevant Systems | Sampling Locations | Sampling Frequency |
|---|---|---|---|---|---|
| microcystin-LW | EPA 544 | * | Surface Water | Same as other cyanotoxins | Same as other cyanotoxins |
| 3-Hydroxycarbofuran | EPA 531,2 | 0.029 | All systems | Entry Point to Distribution System | Same as other pesticides |

[24] EPA, October 2015 UCMR 3 Data Summary for Chemical Contaminants, EPA 815-S-15-003, [http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3]. It should be noted that there are 325 systems identified with 1,4-dioxane levels observed above the 1 in 1,000,000 risk level but none above the 1 in 10,000 risk level.

[25] AWWA, AWWA Recommendations for Contaminant Candidate List 4 (CCL4), 2015, [http://www.awwa.org/Portals/0/files/legreg/documents/2015CCLAWWAReport.pdf]



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| Analyte | Available Methods | Reporting Level (µg/L) | Relevant Systems | Sampling Locations | Sampling Frequency |
|---|---|---|---|---|---|
| Azinphos-methyl | EPA 525 | ** | All systems | Entry Point to Distribution System | Same as other pesticides |

Notes:
* Reporting level should be comparable to other six microcystins which EPA proposes to monitor using Method 544. Inclusion in UCMR4 would necessitate locating a suitable standard for development of a final MRL, calibration, and QA/QC.

** Reporting level would need to be established through an inter-laboratory method performance study.

There is an opportunity to remove contaminants from the proposed UCMR4 list in order to both make room within the analyte cap set in SDWA for UCMR4 and better align the UCMR4 rulemaking with public health priorities.

## Burden and Logistics

### UCMR4 Monitoring by Groundwater Systems

AWWA recommends that UCMR4 contaminants monitoring other than DBP monitoring, be reduced to a single sample per point of entry for groundwater systems. Other comments speak to an alternative monitoring strategy for UCMR4 DBPs. Moving to a single sample per EPTDS will result in a sufficiently robust dataset for the purposes UCMR monitoring is intended to serve. This suggestion is meant to compliment not replace representative monitoring.

A detailed analysis of UCMR3 data, based primarily on the June 2015 National Contaminant Occurrence Database, but also supported by some analysis of the October 2015 NCOD release demonstrate that there is little statistical basis for UCMR4 to include 2 samples for water systems that rely on ground water supplies. Rather, a single sample would provide data of equal robustness. This general statement is true across the families of compounds analyzed in UCMR3. There were specific instances where the nature of the contaminant or analytical method does warrant consideration before reducing monitoring to a single sample per point of entry. Instances warranting more careful evaluation include:

1. Where the performance of the method leads to high variability (*e.g.*, total chromium), and
2. When the expected variations in water treatment plant operations are likely to change the concentration of the target analyte in finished water (*e.g.*, disinfection practice and chlorate).



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See Attachment 2 for a preliminary summary of this analysis.

### Basing UCMR Applicability on Retail Population

In developing UCMR3, EPA chose to base the rule's applicability on retail population. As a consequence there are unintended complications in the implementation of UCMR4 monitoring, including:

1. Where wholesalers routinely assist their consecutive systems meet monitoring requirements, the current approach penalizes a collaborative and efficient sampling strategy.
2. If UCMR only collects consecutive system data then there is not a mechanism to collect the treatment and source water data currently envisioned.
3. Is inequitable without providing higher quality data. A wholesale distribution system network will collect many more samples and incur the higher associated sampling expense than a single water system of a similar size.

AWWA recommends that where wholesale and consecutive systems offer to provide a combined monitoring framework, that UCMR4 allow such submittals. The required number of samples should be no more than required of a single city of the same service population. Since monitoring under UCMR is a mandatory responsibility, systems participating in such a combined monitoring framework would be beholden to each other with respect to rule compliance. Where consecutive systems monitor as a standalone entity, they should not be responsible under this rulemaking for source water data and treatment information. The source and treatment information targeted by this data collection effort is the responsibility of the wholesale supplier and if the submitted dataset characterized only the consecutive system, the data would be misleading during subsequent analysis.

### Transparency in Rulemaking Process

Significant UCMR4 details should have been more clearly highlighted in the proposed rule notice. Federal Register notices often require a detailed understanding of the topic at hand and it can be challenging for the Agency to highlight all significant changes from past practice and their import. But, it is not reasonable for substantial expansions of the rule's scope to be relegated to footnotes. The following are examples where the current notice, and by extension the associated Information Collection Request (ICR) do not clearly articulate the proposed data collection and the associated burden:



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1. "TOC and bromide must be collected at the same time as HAA samples. These indicator samples must be collected at a single source water intake"[26]
2. "Temperature and pH must be measured at the same time as cyanotoxin samples at the source water intake ..."[27]
3. "Systems must assign a sample event code for each contaminant listed in Exhibit 1. Sample event codes must be assigned by the PWS for each sample event.[28]

### Use of Dedicated Data Portal

The proposed UCMR4 specifies that "Information that must be submitted using EPA's electronic data reporting system must be submitted through: *http://www2.epa.gov/dwucmr*." EPA is simultaneously developing the CMDP. CMDP is scheduled to be operational in 2017. The proposed UCMR data collection substantially overlaps with data currently submitted by water systems for compliance and will be submitted through CMDP. EPA's data collection should leverage existing compliance data submittals rather than require separate testing, analysis, and reporting to a parallel data system. Use of CMDP does not test the statutory objectives of the SDWA's unregulated contaminant monitoring provision, as is the case with the proposed rule construct. Compliance data would also be more robust in that data for TOC, pH, and individual HAAs would be much denser and reflect each system's current compliance status.

### Data Elements

AWWA has commented previously that understanding UCMR contaminant occurrence necessitates collection of appropriate ancillary data elements.[29] The current proposal includes a very lengthy list of data elements and element definitions that as a practical matter will lead to data entry errors and fail in many instances to meaningfully inform subsequent data analysis. This latter point is important to bear in mind as UCMR collects a snapshot of contaminant occurrence. This snapshot is not a sufficient to intuit the effects of treatment on occurrence beyond gross categorical binning. Consequently, AWWA recommends that EPA simplify the data elements and data definitions substantially.

AWWA's earlier comments also stipulated inclusion of ancillary data elements should occur after a dialogue with stakeholders on how to effectively collect that information.[30] The proposed data definitions for treatment and UCMR4 data collection scheme are unlikely to lead to improved UCMR analysis. At a minimum EPA should:

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[26] 80 FR 76921
[27] 80 FR 76921
[28] 80 FR 76921
[29] AWWA, Comment Letter on Proposed UCMR3 (Docket ID No. OW–2009–0090), May 2, 2011.
[30] AWWA, Comment Letter on Proposed UCMR3 (Docket ID No. OW–2009–0090), May 2, 2011.



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1. Simplify the data definitions for disinfection and treatment, reducing the number of oxidant options and focusing specifically on primary and secondary disinfection.
2. Limit treatment characterization to (no treatment, primary disinfection only, conventional treatment, softening, carbon contactors, and nanofiltration/reverse osmosis).
3. Eliminate secondary disinfectant definition "CAC", where "CAC" is chlorine and chloramines being mixed.
4. Eliminate excessive QA/QC tracking, such as data elements for extraction batch identification code, extraction date, analysis date, sample analysis type, additional value, and sample event code.

As previously noted, the submittal of additional laboratory QA/QC is not a wise use of limited resources. EPA is implementing UCMR4 with limited resources and is unlikely to have the necessary support system for qualifying laboratory information management system (LIMS) data uploads prior to UCMR laboratory approval. Absent such software, the limited value provided by this additional QA/QC data is not worth the transactional burden on laboratories or the potential for water system non-compliance due to failure of EPA QA/QC review to occur in a timely manner. EPA's experience to-date with this type of QA/QC data has been limited to contractual obligations with UCMR laboratories processing small system samples – this experience is substantially different from setting a regulatory requirement to which all water systems conducting monitoring at their own expense through multiple commercial laboratories must adhere. This provision is also an impediment to AWWA's recommendation that EPA use CMDP to achieve some of the data collection objectives described in the UCMR4 proposal.

The use of the Sample Event Code data element is another opportunity for an extraneous data element to lead to inadvertent non-compliance or, a transactional cost for participating water systems and EPA. Compliance with UCMR is based on meeting the monitoring requirements. This proposed data element does not contribute toward that task but it does create the opportunity for data entry errors.

### Statistical Basis for the Small System Sample

The UCMR4 proposal preamble introduces the concept of State Implementation Plans and the statistical premise for the UCMR4 small system sample.[31] The statistical premise cited for the small system sample is an analysis prepared in 1999.[32] The referenced analysis does not address the current UCMR4's proposed changes including:

[31] 80 FR 76901

[32] EPA, Statistical Design and Sample Selection for the Unregulated Contaminant Monitoring Regulation (1999).



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1. Utilizing a stratified sampling construct for cyanotoxin monitoring,
2. Eliminating monitoring in December, January, and February, and
3. Collecting data representative of untreated source water.

While the 1999 analysis spoke directly to the size of the representative sample, it was premised solely on the objective of describing contaminant occurrence in finished water.

## Summary

AWWA supports a robust UCMR monitoring program so that EPA is able to meet its statutory requirements when determining whether or not a national regulation is needed and what an appropriate drinking water standard might be. Sound national occurrence information is critical to the regulatory determinations EPA must make in assessing whether a national regulation will provide a meaningful opportunity for risk reduction. The proposed UCMR4 is a step in the right direction for the development of sound national occurrence data, but several critical revisions are needed in the final UCMR4 for cyanotoxins, DBPs, and other issues.



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# Attachment A: Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) Extension: Brominated Disinfection Byproducts Analysis

The following report is an interim work product. The research team is preparing a paper for submission to a peer-reviewed journal. A copy of the accepted paper will be forwarded to the Agency once it is published.

CORONA | ENVIRONMENTAL CONSULTING  University of Colorado Boulder

# WITAF #266
# Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) Extension: Brominated Disinfection Byproducts Analysis

**Draft Report**

**February 2, 2016**

**Submitted to American Water Works Association**

**Prepared by Corona Environmental Consulting, LLC**

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# 1 Introduction

## 1.1 Background

Reducing exposure to disinfection byproducts (DBPs) remains a concern for the national drinking water utility community. The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) (USEPA, 2006) is the most recent regulatory change the drinking water community has addressed to reduce DBP exposure, with its April 1, 2012 compliance monitoring deadline for Community Water Systems (CWSs) and Non-Transient Non-Community Water Systems (NTNCWSs) serving at least 100,000 people. The WITAF #266 Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) study (Seidel et al., 2015), funded and directed by the American Water Works Association, was implemented to assess DBP occurrence since the implementation of the Stage 2 DBPR. The study collected DBP data from state regulatory agencies for all but five states, provided quality assurance for data from >95% of very large CWSs, and housed the data in a well-documented database. The study developed a preliminary assessment of the impacts of the Stage 2 DBPR using the compiled data, which is sufficiently representative of national DBP data to allow characterization of current DBP exposures and evaluation of trends.

Brominated DBPs are understood to pose a greater health risk than their fully chlorinated counterparts for both regulated classes of DBPs, trihalomethanes (THMs) and haloacetic acids (HAAs) (Richards et al., 2007). An important concern regarding the implementation of the Stage 2 DBPR is how the occurrence of the three brominated THM species (THM3) and six brominated HAA species (HAA6-Br) have changed overall and in comparison to changes in total trihalomethane sum (TTHM), the sum of the five regulated haloacetic acids (HAA5), and the sum of all nine haloacetic acids (HAA9), as a result of treatment changes to meet the regulation. The preliminary analysis conducted through the WITAF #266 study suggests that a decrease in chloroform concentrations, and not in the brominated THM species, may have occurred on a national scale since the implementation of the Stage 2 DBPR. This study aims to further investigate the extent of brominated DBP formation through analyzing brominated DBPs, specifically HAA9 and HAA6-Br, and bromine incorporation factor trends. Bromine incorporation factors, also known as bromine fractions, are calculated based on the relative number of bromine substitutions in the species in a given DBP class to the total number of halogen substitutions (Obolensky & Singer, 2005).

While the WITAF #266 database contains a rich temporal and geographic span of TTHM, THM species, HAA5 and HAA5 species data, data for the four unregulated haloacetic acids (HAA4) are limited. Modeling techniques for estimating concentrations of the HAA4 species allow for estimating HAA9 and HAA6-Br concentrations in instances where THM species and HAA5 species concentrations are known. The resulting modeled HAA9 and HAA6-BR occurrence data developed using the WITAF #266 database can provide insights into the impact of the Stage 2 DBPR on the occurrence of brominated DBPs on a national scale. An analysis of the brominated DBPs, specifically modeled HAA9 and HAA6-Br, will allow important questions to be answered, such as

- How have HAA9 and HAA6-Br concentrations changed over time, given the implementation of the Stage 1 and 2 DBP Rules?
- How have bromine incorporation factors changed over time, given the implementation of the Stage 1 and Stage 2 DBP Rules?



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## 1.2 Project Goals

The objectives of this project were

- Modeling brominated disinfection byproduct concentrations, specifically haloacetic acid 9 (HAA9) that is a focus of the Fourth Unregulated Contaminant Monitoring Rule, using existing data from the WITAF 266 database including total trihalomethane (TTHM) and TTHM species, haloacetic acid 5 (HAA5), and HAA5 species.
- Comparing and validating calculated bromine incorporation factor values and modeled HAA9 concentrations with observed data where available.
- Analyzing the modeled HAA9 data pre- and post-State 2 Disinfection Byproduct Rule implementation and over time and geographically.

The analysis of brominated DBPs occurrence conducted in this study provides an important understanding, particularly for future regulations that may include separate consideration of brominated THM and HAA species in addition to the currently regulated sums.

# 2 Methods and "Representativity"

## 2.1 Modeling Approach for HAA4 Species and HAA9

While the WITAF #266 database contains a wealth of data for TTHM, THM species, HAA5 and HAA5 species, there is very limited data for HAA4 species available. Modeling the HAA4 species provides an opportunity to model HAA9, as well as HAA6-Br. Modeled HAA9 and HAA6-Br concentrations can be compared with HAA5 concentrations to analyze relative changes in brominated DBPs before and after the implementation of the Stage 2 DBPR. For samples in which THM species concentrations and HAA5 species concentrations are known, HAA4 species can be estimated using the following equations:

$$[BrCl_2AA] = [Cl_3AA] \times [CHBrCl_2]/[CHCl_3] \quad (1)$$

$$[Br_2ClAA] = [Cl_3AA] \times [CHBr_2Cl]/[CHCl_3] \quad (2)$$

$$[Br_3AA] = [Cl_3AA] \times [CHBr_3]/[CHCl_3] \quad (3)$$

$$[BrClAA] = 0.5\ [\langle CHBrCl_2 + CHBr_2Cl\rangle\ Cl_2AA]/CHCl_3 \quad (4)$$

in which BrClAA, $BrCl_2AA$, $Br_2ClAA$, $Br_3AA$, $Cl_2AA$, and $Cl_3AA$ refer to the molar concentrations of bromochloro-, bromodichloro-, dibromochloro-, tribromo-, dichloro-, and trichloro-acetic acids, respectively, and $CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, and $CHBr_3$ refer to the molar concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, respectively. Eq 1-3 were developed and validated by Roberts et al. (2001) using data from the Information Collection Rule, based on equal bromine incorporation among corresponding trihalomethane species and trihaloacetic acid species relative to the fully-chlorinated species. Eq 4 was developed by Shoaf & Singer (2007) using the assumption the degree of bromine incorporation is an average of the extent of bromine incorporation in bromodichloromethane and dibromochloromethane relative to chloroform.

To validate this modeling approach, THM species and HAA9 species concentration data for a given sample event were merged together using sample information, where available, provided in the WITAF #266 database, including Sample ID, Collection Date, Sample Type, Sample Point Type, Sample Point Description, Facility Name, and Facility ID. Data records from water utilities in fourteen states included



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sufficient sample information to develop unique sample identifiers for a given sample event for merging THM species concentration data, and in thirteen states for merging HAA5 species concentration data. Sample data for merging all THM and HAA9 species in a given sample event were available for five water utilities for modeling validation. Molar concentrations were calculated for each DBP species' mass concentrations, and the HAA4 species were modeled using Eq 1-4. The corresponding mass concentrations were calculated for the modeled HAA4 molar concentrations. The observed HAA4 species concentrations were then added to the observed HAA5 species concentrations to determine the observed HAA9 concentrations, and similarly, the modeled HAA4 species concentrations were added to the observed HAA5 species concentrations to calculate the modeled HAA9 concentrations. Figure 1 shows the modeled HAA9 concentrations versus the observed HAA9 concentrations; the corresponding $R^2$ value is 0.9 demonstrating a good fit for the modeling approach based upon the limited observed HAA9 values available in the WITAF #266 database.

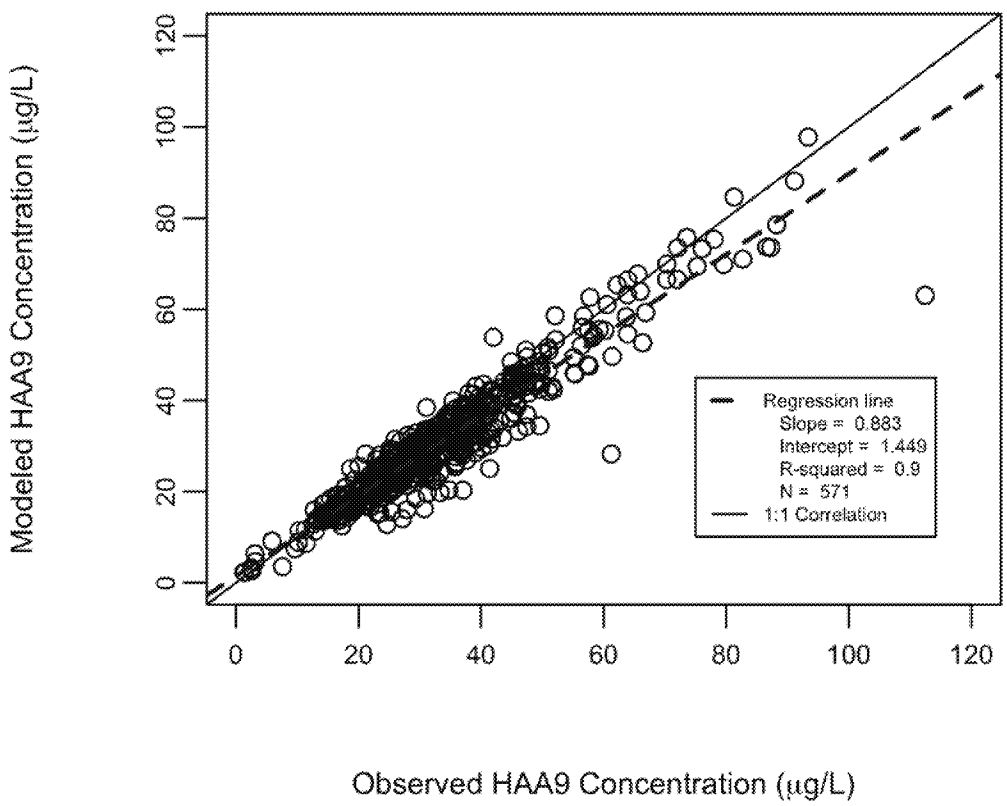


*Figure 1 Modeled HAA9 Concentration versus Observed HAA9 Concentration*

While this modeling approach illustrated in Figure 1 produced good results, HAA4 species could only be modeled for sample data from 55 systems in 13 states, due to limited sample information for merging species data. In the preliminary analysis of the WITAF #266 study, running annual averages of the 95$^{th}$ percentile concentration by PWS were validated and used as a representative non-locational statistical



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surrogate to represent locational running annual averages (LRAAs). In a similar manner, this study developed a second modeling approach by calculating quarterly 95th percentile concentrations by PWS for each THM and HAA9 species, and merging the resulting quarterly 95th percentile concentrations by PWS for modeling HAA4 species and HAA9. Using this approach, HAA4 species and HAA9 can be modeled for 243 water utilities in 23 states, which would allow for a far greater national representation in the analysis of brominated DBP occurrence.

For the quarterly 95th percentile by PWS approach, molar concentrations were calculated for each mass concentration, the HAA4 species were modeled using Eq 1-4, and corresponding mass concentrations were calculated. As with the first modeling approach where species concentrations were merged by sample information, modeled quarterly 95th percentile HAA9 concentrations by PWS were calculated by adding the modeled quarterly 95th percentile HAA4 concentrations to the observed quarterly 95th percentile HAA5 concentrations. Figure 2 shows the modeled versus observed values for the quarterly 95th percentile HAA9 concentrations. The $R^2$ value is 0.902, showing a very similar fit to the first modeling approach.

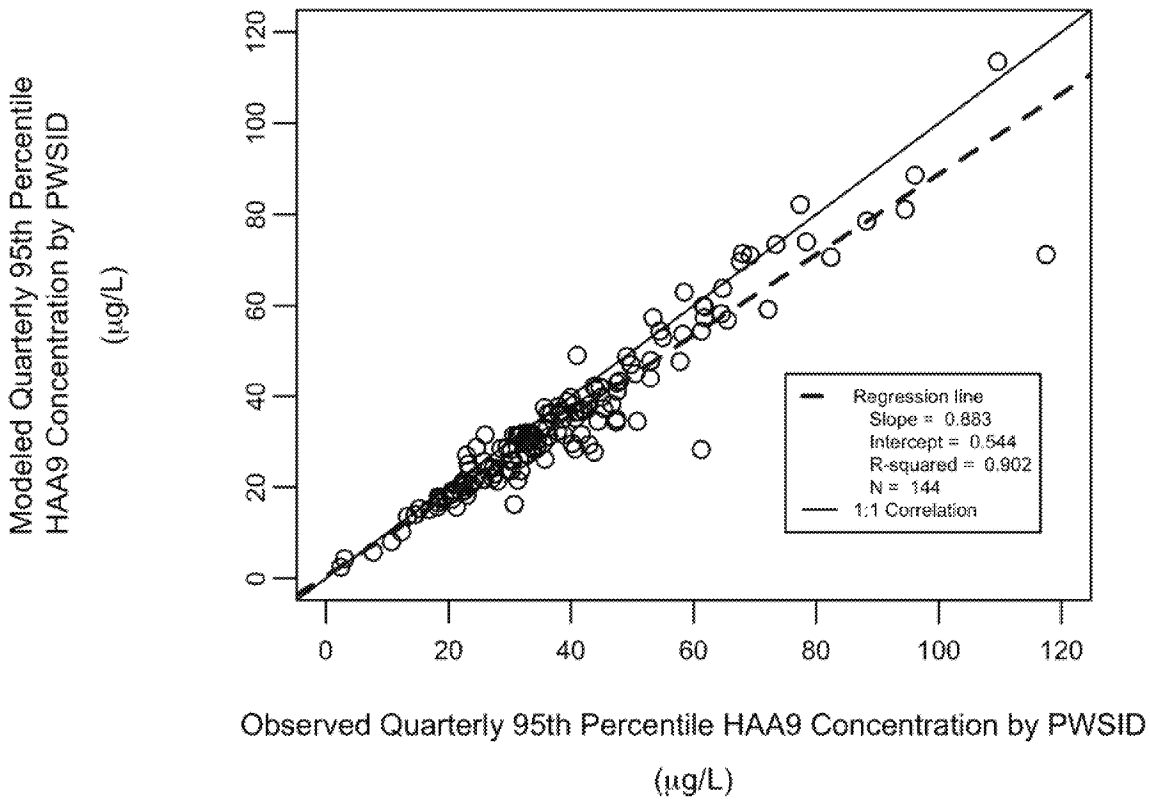


*Figure 2 Modeled Quarterly PWS 95th Percentile HAA9 Concentrations versus Observed Quarterly PWS 95th Percentile HAA9 Concentration*



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## 2.2 Approach for Calculating Bromine Incorporation Factors

The quarterly 95th percentile concentration by PWS modeling approach for HAA4 species and HAA9 can be further validated through the calculation of bromine incorporation factors (BIFs). BIFs quantify the formation of brominated DBP species within a class of DBPs relative to the total DBP formation. BIFs for THMs, dihaloacetic acids (2XAAs), and trihaloacetic acids (3XAAs) can be calculated using the following equations (Obolensky & Singer, 2005):

$$\text{THM BIF} = \frac{([CHBrCl_2] + 2\ x\ [CHBr_2Cl] + 3\ x\ [CHBr_3])}{3\ x\ ([CHCl_3] + [CHBrCl_2] + [CHBr_2Cl] + [CHBr_3])} \quad (5)$$

$$\text{2XAA BIF} = \frac{([BrClAA] + 2\ x\ [Br_2AA])}{2\ x\ ([Cl_2AA] + [BrClAA] + [Br_2AA])} \quad (6)$$

$$\text{3XAA BIF} = \frac{([BrCl_2AA] + 2\ x\ [Br_2ClAA] + 3\ x\ [Br_3AA])}{3\ x\ ([Cl_3AA] + [BrCl_2AA] + [Br_2ClAA] + [Br_3AA])} \quad (7)$$

in which BrClAA, $Br_2AA$, $Cl_2AA$, $BrCl_2AA$, $Br_2ClAA$, $Br_3AA$, and $Cl_3AA$ refer to the molar concentrations of bromochloro-, dibromo-, dichloro-, bromodichloro-, dibromochloro-, tribromo-, and trichloro-acetic acids, respectively, and $CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, and $CHBr_3$ refer to the molar concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, respectively.

BIFs were calculated for THMs, 2XAAs, and 3XAAs using Eq 5-7 using the two approaches described above for modeling HAA9. In the first approach, species concentrations data for a given sample event were merged based on sample information, and in the second approach, quarterly 95th percentile species concentrations by PWS were merged together. Once the BIFs were calculated, the distribution of BIFs for both approaches, during the two years before the Stage 2 DBPR implementation (April 1, 2010 – March 31, 2012) and for the two years after the Stage 2 DBPR implementation (April 1, 2012 – March 31, 2014) were compared to determine if they were statistically different. To do this, the 95th percentile values by PWS for the two years before the Stage 2 DBPR and the two years after the Stage 2 DBPR for BIFs from both approaches were calculated. Systems that did not have a 95th percentile value in both the two years before and the two years after were removed from the analysis. Figure 3 shows the cumulative probability distribution of the 95th percentile THM BIF values by PWS for both approaches; this analysis includes data for 52 systems in 12 states. Figure 4 and Figure 5 show the same cumulative probability distributions for the 2XAA BIF and for the 3XAA BIF, respectively. The analysis shown in both Figure 4 and Figure 5 included data for 36 systems from 9 states.



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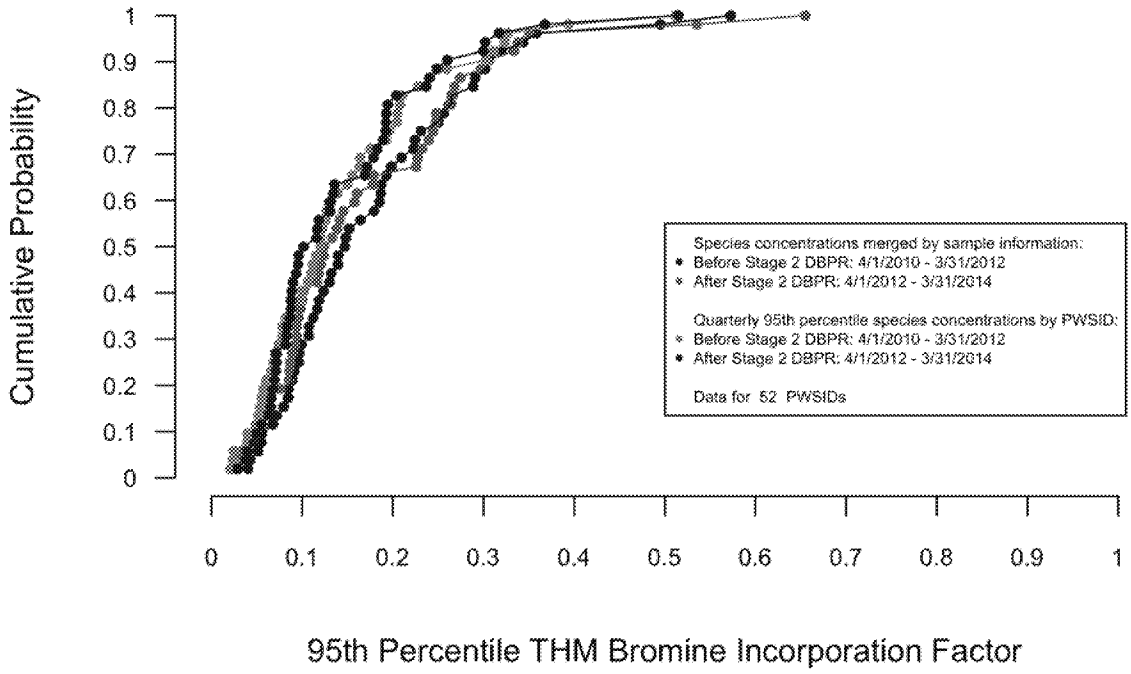


*Figure 3 Comparison of THM BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*

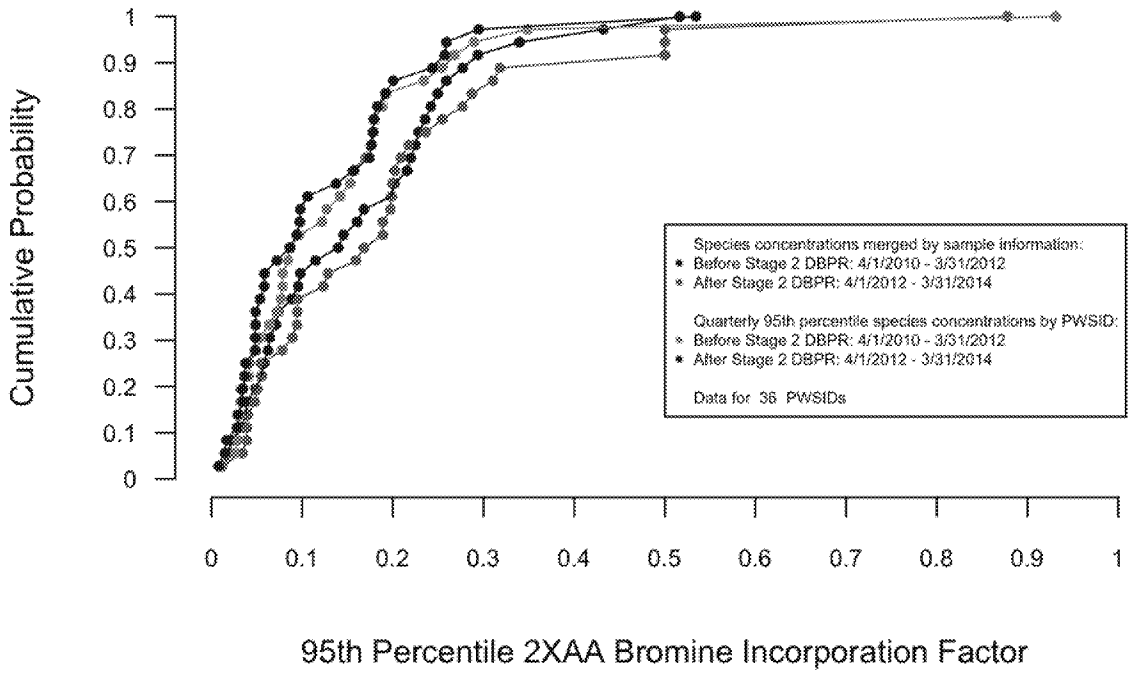


*Figure 4 Comparison of 2XAA BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*



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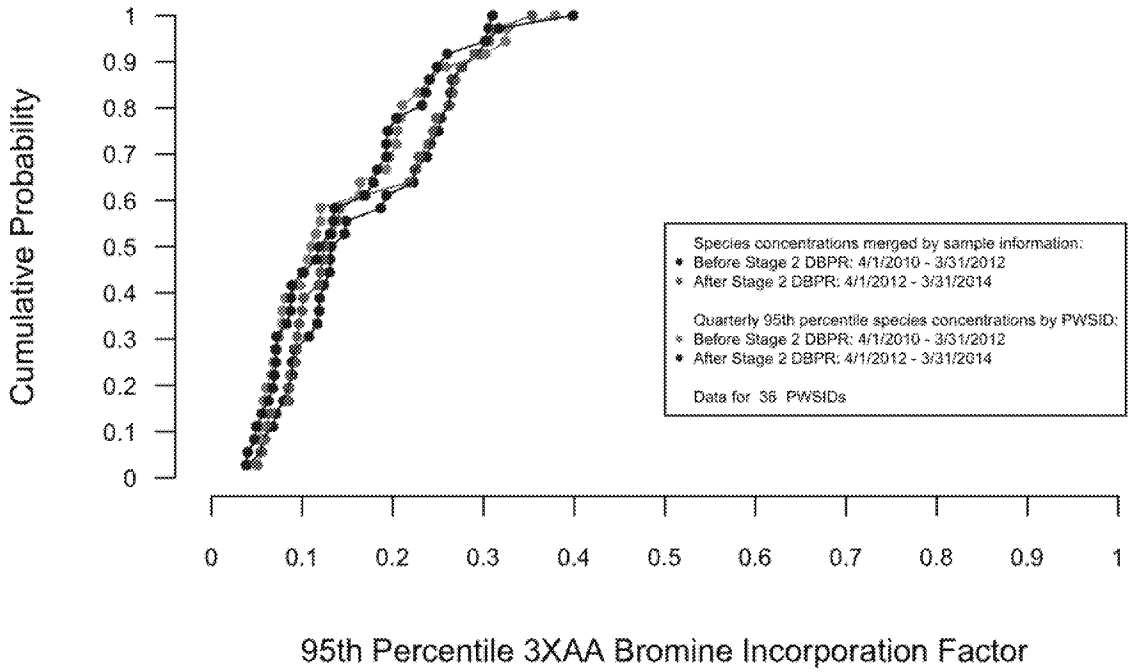


*Figure 5 Comparison of 3XAA BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*

The Kolmogorov–Smirnov (KS) two-sample test (Young, 1977) and the two *k*-sample versions of the Anderson-Darling (AD) test (Scholz & Stephens, 1987) were employed to determine if the distributions of corresponding BIFs during the same two-year time period, either the two years before or the two years after the Stage 2 DBPR, calculated through the two different approaches were statistically different. The resulting p-values for each of the tests are shown in Table 1. In all cases with a 95% confidence level, the distributions of corresponding BIFs calculated using the two different approaches are not statistically different. These findings provide justification that the approach for calculating BIFs by using quarterly 95$^{th}$ percentile species concentrations by PWS is representative of the "true" BIFs, calculated from species concentrations for a given sample event.

*Table 1 Results of Statistical Tests Comparing Distributions of PWS 95$^{th}$ Percentile BIFs Calculated Using Species Concentrations Merged by Sample Information with Corresponding PWS 95$^{th}$ Percentile Bromine Incorporation Factors Using Quarterly 95$^{th}$*

| Item | THM BIF | | 2XAA BIF | | 3XAA BIF | |
|---|---|---|---|---|---|---|
| | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* |
| *KS test p-value* | 0.07754 | 0.4206 | 0.2106 | 0.06939 | 0.3364 | 0.2123 |
| *AD test version 1 p-value* | 0.063878 | 0.40534 | 0.15616 | 0.072521 | 0.20546 | 0.24453 |
| *AD test version 2 p-value* | 0.063704 | 0.40379 | 0.15795 | 0.070525 | 0.20332 | 0.24491 |



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The results from comparing the two modeling approaches for HAA4 species and HAA9 and the two approaches for calculating the BIFs indicate the two approaches in both cases provide results that do have statistically significant difference. The sections that follow provide analysis solely based on modeling HAA4 species, HAA9, and HAA6-Br, and calculating BIFs based on quarterly 95th percentile concentrations by PWS, which is representative of results that would be seen based on using species concentrations from specific sample events.

## 2.3 National "Representativity"

The WITAF #266 database provides sufficient data for modeling HAA4 species and HAA9 concentrations, and calculating 2XAA and 3XAA BIFs using modeled species, based on quarterly 95th percentiles by PWS for 243 water utilities in 23 states. The database contains data for TTHM and HAA5 concentrations in 394 systems and 386 systems, respectively, in 44 states. An important consideration is how well the distribution of the TTHM and HAA5 concentration data in systems with sufficient data for modeling HAA9 compares to the distribution of TTHM and HAA5 concentration data in all systems where this data is available. To address this question, a similar approach as to that taken in Section 2.2 was employed. For all systems where TTHM concentrations data were available and for systems with sufficient data to model HAA9, the 95th percentile value by PWS, in the two years before the Stage 2 DBPR and in the two years after the Stage 2 DBPR, was calculated for the quarterly 95th percentile TTHM concentrations by PWS. The same analysis was conducted for HAA5 concentrations. Figure 6 shows the results for the cumulative probability distributions of 95th percentile values for TTHM data, and Figure 7 shows the corresponding results for HAA5 data.

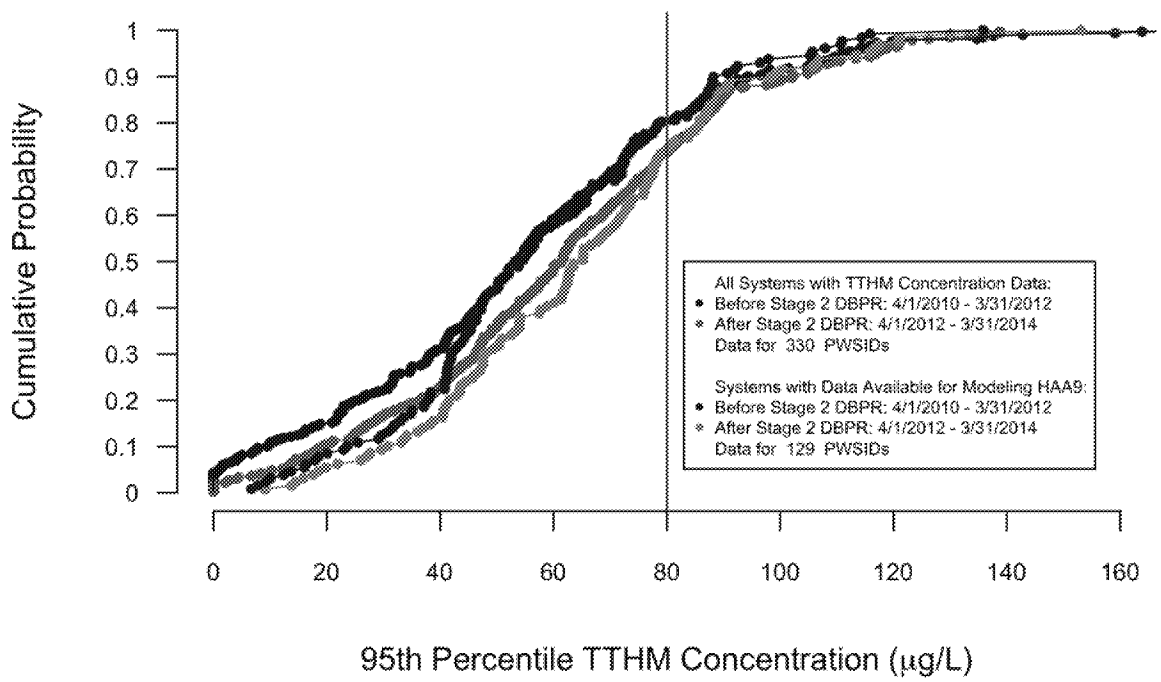


*Figure 6 Cumulative Distributions of PWS 95th Percentile Value of Quarterly PWS 95th Percentile TTHM Concentration for All Systems with TTHM Data and for Systems with THM and HAA5 Species Data for Modeling HAA9 before and after Implementation of the Stage 2 DBPR*



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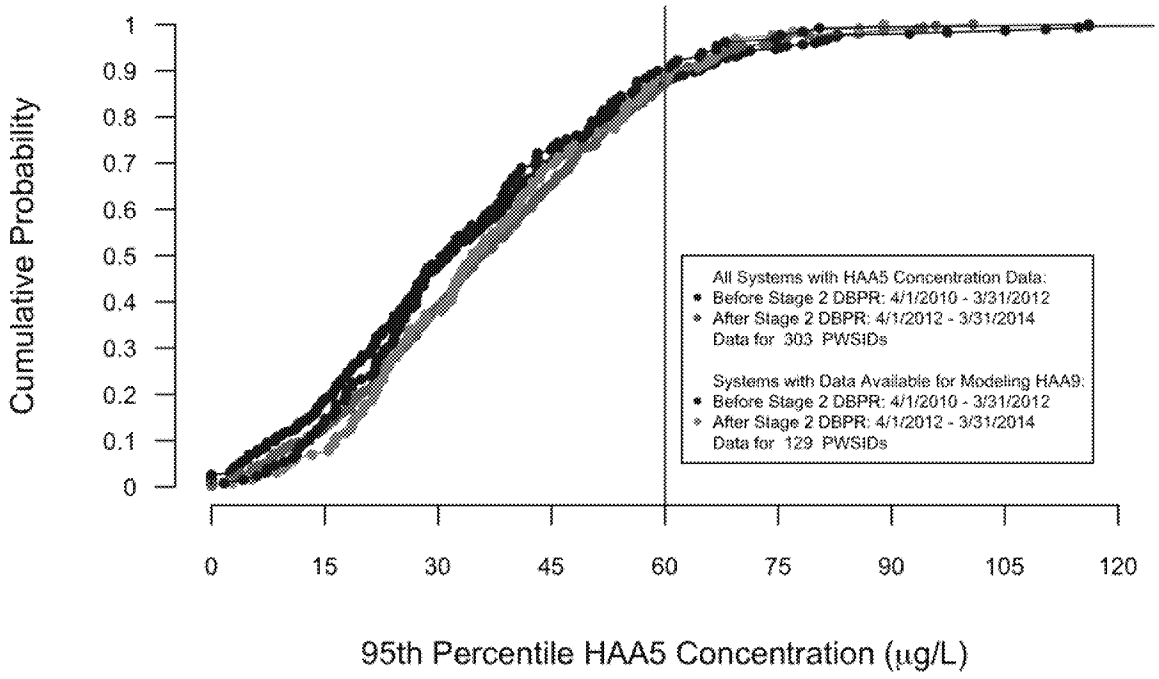


*Figure 7 Cumulative Distributions of PWS 95th Percentile Value of Quarterly PWS 95th Percentile HAA5 Concentration for All Systems with HAA5 Data and for Systems with THM and HAA5 Species Data for Modeling HAA9 before and after Implementation of the Stage 2 DBPR*

The KS two-sample test and the two *k*-sample versions of the AD test were applied to determine if there were statistically differences in the two distributions of TTHM data in each time period, and in the two distributions of HAA5 data in each time period. The resulting p-values are provided in Table 2; with a 95% confidence level, none of the distributions compared were statistically different. This result provides confidence that the distribution of modeled HAA4 species, HAA9, HAA6-Br, and the calculated 2XAA and 3XAA BIFs with modeled HAA4 species represent the "true" national distribution of HAA4 species, HAA9, HAA6-Br, and 2XAA and 3XAA BIFs.

*Table 2 Results of Statistical Tests Comparing Distributions of PWS 95th Percentile Values for Quarterly PWS 95th Percentile TTHM/HAA5 Concentrations for All Systems with TTHM/HAA5 Data with Systems with Sufficient Data for Modeling HAA9*

| Item | TTHM | | HAA5 | |
|---|---|---|---|---|
| | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* |
| *KS test p-value* | 0.1952 | 0.4972 | 0.7821 | 0.8746 |
| *AD test version 1 p-value* | 0.090358 | 0.21953 | 0.35914 | 0.69765 |
| *AD test version 2 p-value* | 0.087815 | 0.21215 | 0.35428 | 0.69304 |



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# 3 Analysis of Brominated DBP Occurrence

## 3.1 HAA9 and HAA6-Br

Analysis of HAA9 and HAA6-Br occurrence focused on modeled quarterly 95th percentile HAA9 and HAA6-Br concentrations by PWS as a representation of national HAA9 and HAA6-Br occurrence. Figure 8, Figure 9, and Figure 10 show yearly boxplots of HAA9, HAA6-Br and HAA5 quarterly 95th percentile concentrations by PWS, respectively. In each of these figures, the horizontal lines inside the boxes represent the median values, lower and upper ends of the boxes represent the 25th and 75th percentile values, the ends of the "whiskers" at the bottom and top of the boxes represent the 5th and 95th percentile values, and the circles below and above the whiskers represent values less than the 5th percentile and greater than the 95th percentile. The red horizontal line in each figure represents the maximum contaminant level (MCL) for the regulated HAA5 sum and is included as a reference point. The dataset used in this analysis is filtered so that each boxplot in Figure 8, Figure 9, and Figure 10 is based on data for the exact same 84 systems from 15 states.

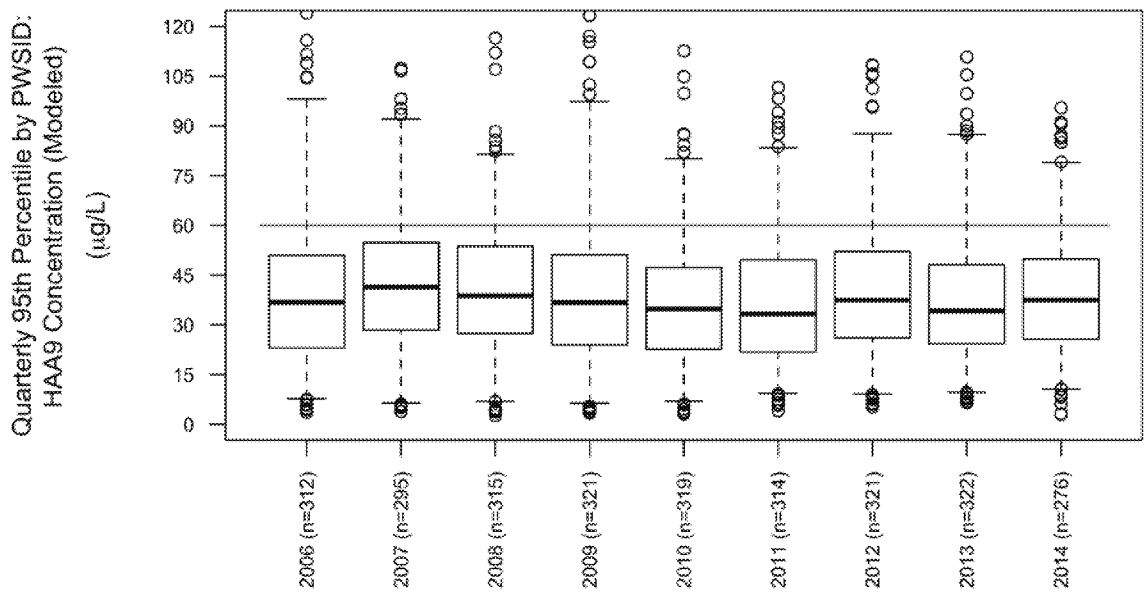


*Figure 8 Yearly Boxplots of Quarterly PWS 95th Percentile HAA9 Concentrations (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*



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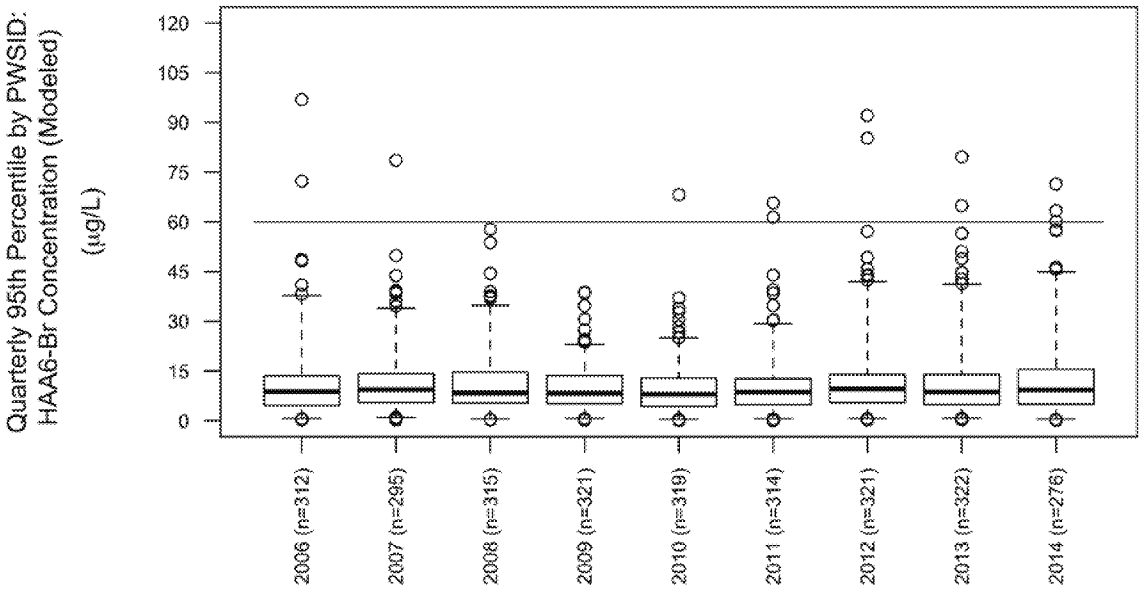


*Figure 9 Yearly Boxplots of Quarterly PWS 95th Percentile HAA6-Br Concentrations (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*

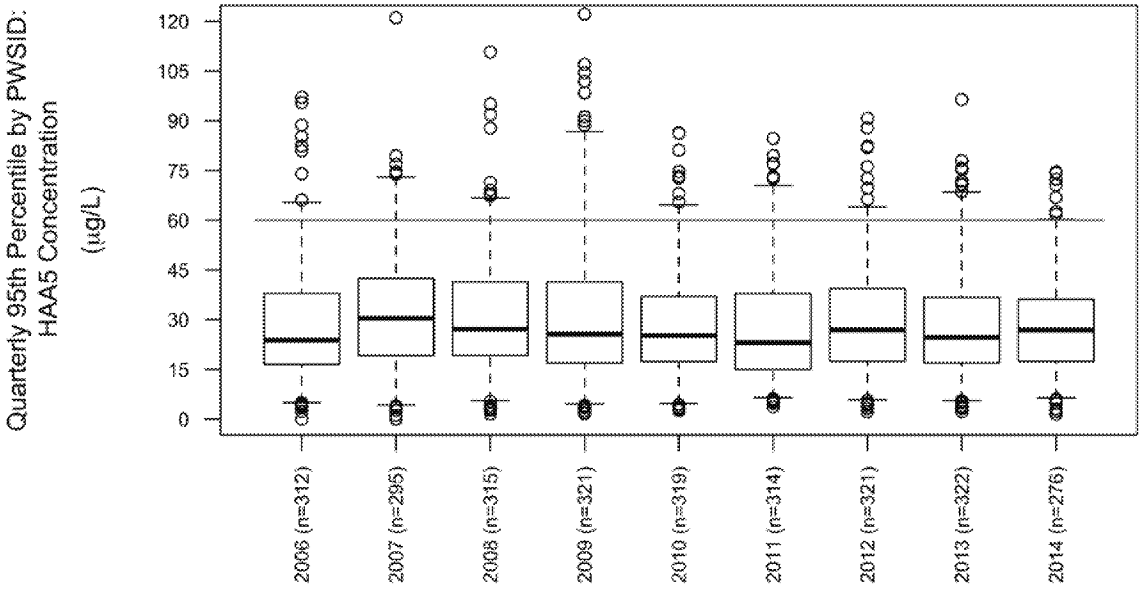




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*Figure 10 Yearly Boxplots of Quarterly PWS 95th Percentile HAA5 Concentrations for 84 Water Utilities in 15 States from 2006 – 2014*

There is some variability present in the yearly boxplots for HAA9 shown in Figure 8, although there is no clear trend over the years included in the analysis, particularly for the median, 25$^{th}$ and 75$^{th}$ percentile values. There does appear to be some decrease in 95$^{th}$ percentile and greater values over time. No significant changes are apparent in HAA9 concentrations after the Stage 2 DBPR implementation as compared with the years prior. In the yearly boxplots for HAA6-Br shown in Figure 9, there is very little variability in median and 75$^{th}$ percentile concentrations over the years of this analysis, although these values are just slightly higher in the boxplots representing years after the Stage 2 DBPR implementation (2012 – 2014) than the boxplots representing the three years prior (2009 – 2011). The 95$^{th}$ percentile and greater HAA6-Br concentrations do appear to have increased in the years after the Stage 2 DBPR implementation. Figure 10 is included in this analysis to compare changes in HAA9 and HAA6-Br over time to changes in HAA5. Once again, there is no clear trend apparent in the yearly boxplots for HAA5, although 75$^{th}$ and 95$^{th}$ percentile values appear to be relatively low in the years after the Stage DBPR implementation. Overall, this analysis suggests that there may have been less reduction in the brominated HAA species relative to the reduction in regulated HAA5 species in the few years following the Stage 2 DBPR implementation.

To further analyze any changes in HAA9 and HAA6-Br concentration before and after the implementation of the Stage 2 DBPR, the cumulative distribution of the 95$^{th}$ percentile value by PWS of modeled quarterly 95$^{th}$ percentile HAA9 and HAA6-Br concentrations by PWS in the two years before the Stage 2 DBPR implementation (April 1, 2010 – March 31, 1012) were compared with the corresponding cumulative distribution in the two years after the Stage 2 DBPR implementation (April 1, 2012 – March 31, 2014). The before and after Stage 2 DBPR cumulative distributions for HAA9 are shown in Figure 11, and the cumulative distributions for HAA6-Br are shown in Figure 12. In both cases, the cumulative distributions in the "after" time period are shifted slightly to the right, indicating overall increases in HAA9 and HAA6-Br occurrence. The greatest spread between the cumulative distributions for HAA9 occurs close to the 50$^{th}$ percentile water utility, while the greatest increases in HAA6-Br concentration appear to have occurred in water utilities with the highest HAA6-Br concentrations.



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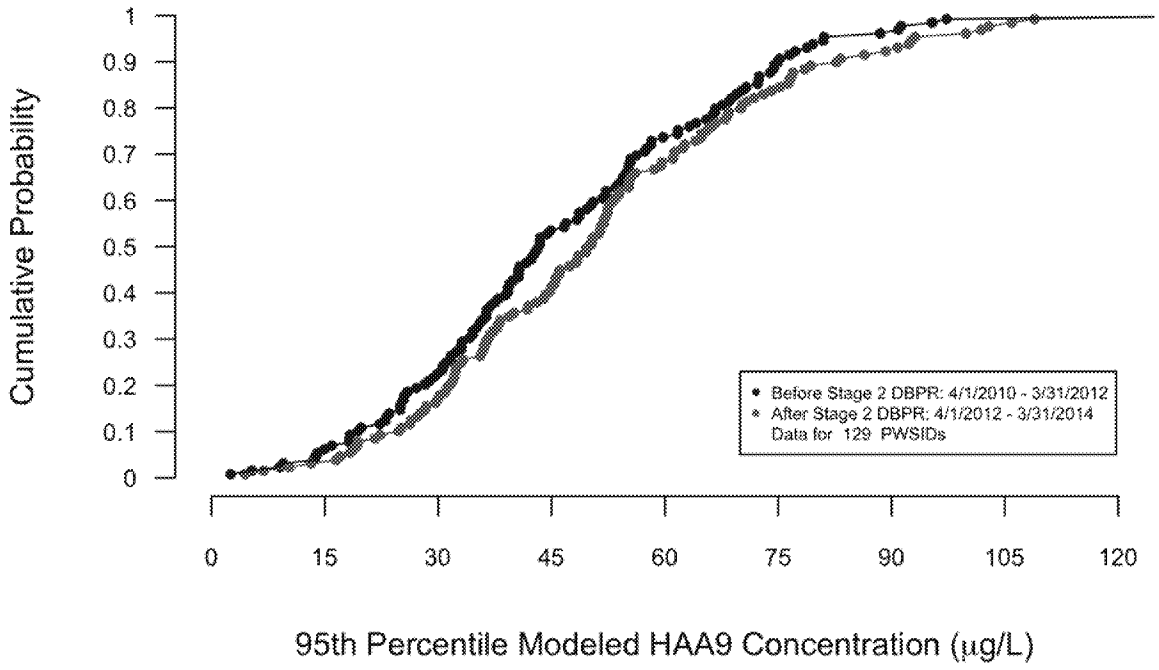


*Figure 11 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA9 Concentration before and after Implementation of the Stage 2 DBPR*

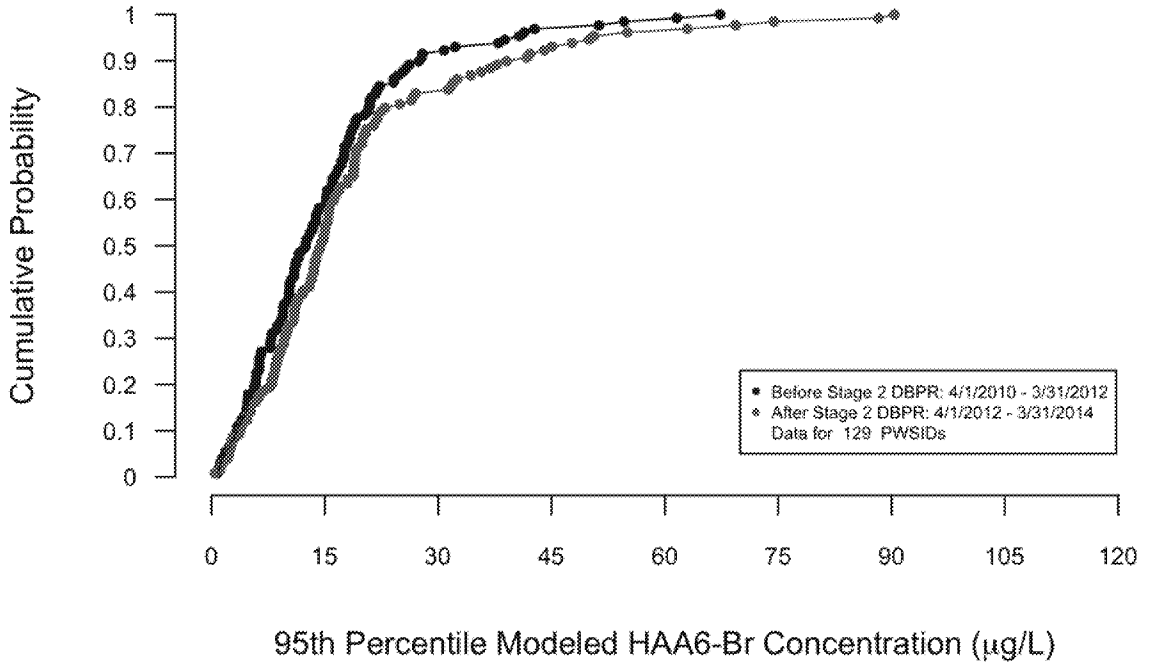


*Figure 12 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA6-Br Concentration before and after Implementation of the Stage 2 DBPR*



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To further assess impacts of the Stage 2 DBPR on HAA9 and HAA6-Br concentration, the cumulative distribution plots were modified to show the change in 95$^{th}$ percentile HAA9 and HAA6-Br concentration for individual PWSs. Figure 13 shows the same cumulative distribution for the "before" time period for HAA9 as Figure 11, and horizontal black lines extend from each 95$^{th}$ percentile HAA9 concentration before Stage 2 DBPR to the corresponding 95$^{th}$ percentile HAA9 concentration after Stage 2 DBPR, effectively showing the change in 95$^{th}$ percentile HAA9 concentration for each PWS. Figure 14 presents the same information for 95$^{th}$ percentile HAA6-Br concentration. More systems experienced increases in both HAA9 and HAA6-Br concentrations than decreases, and systems that did have decreases in HAA9 or HAA6-Br concentrations were generally systems with relatively high concentrations before Stage 2 DBPR. Very few systems show significant decrease in HAA6-Br concentrations.



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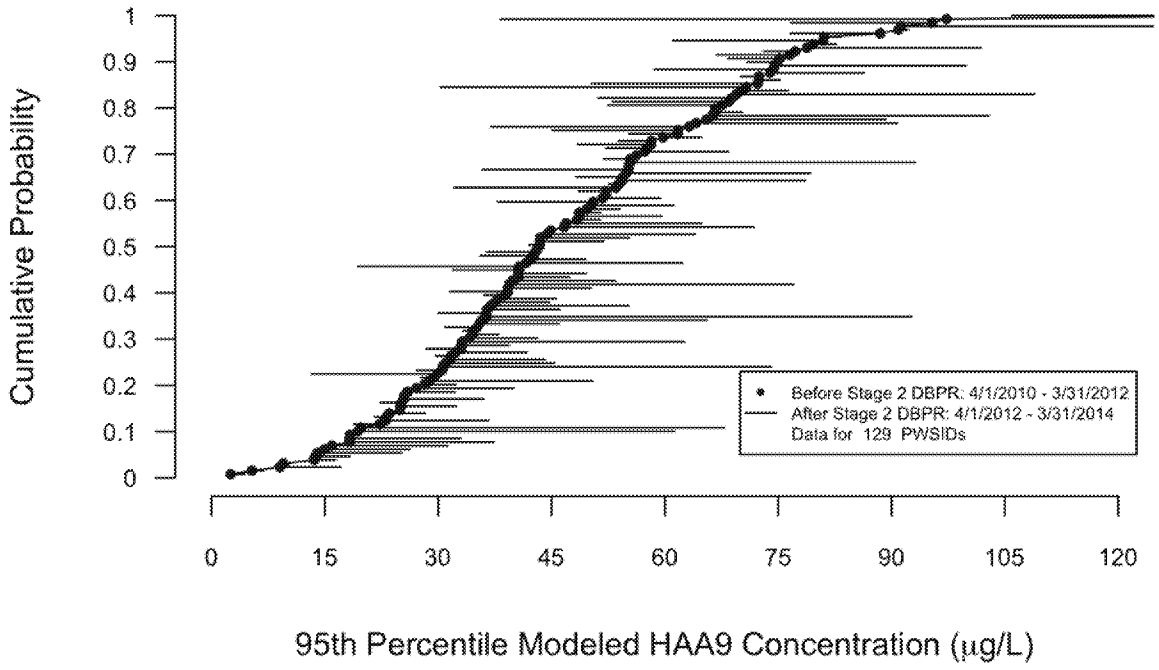


*Figure 13 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA9 Concentration Showing Impacts to Individual PWSs*

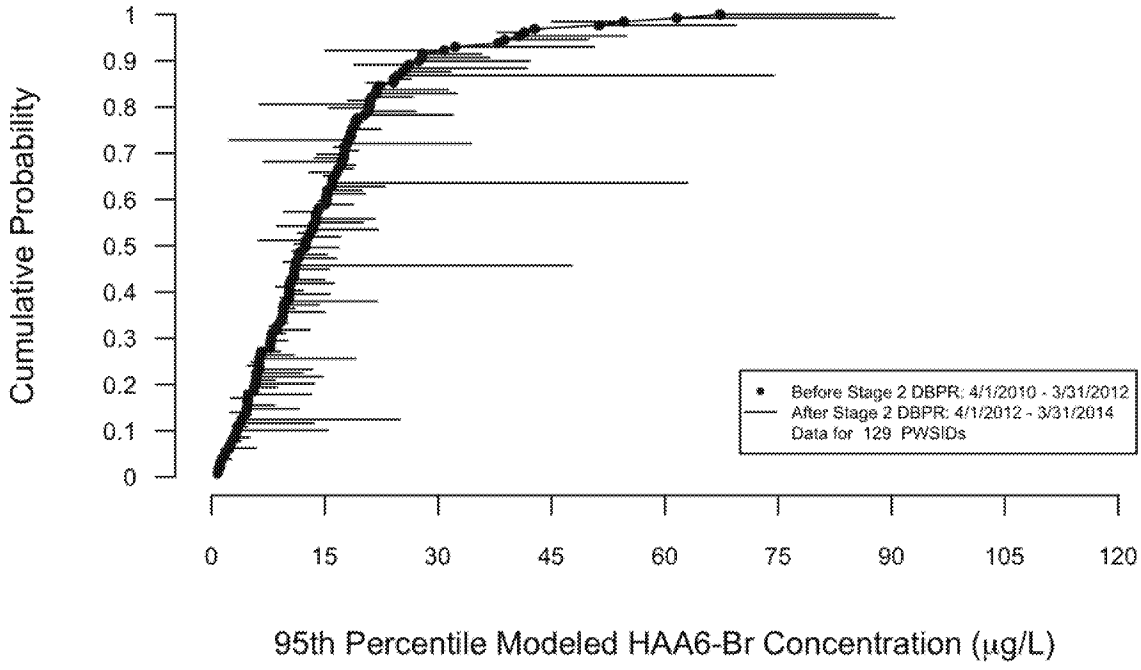


*Figure 14 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA6-Br Concentration Showing Impacts to Individual PWSs*



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## 3.2 Bromine Incorporation Factors

Further assessment of relative changes in brominated DBPs can be approached using the bromine incorporation factors for THMs, dihaloacetic acids (2XAA), and trihaloacetic acids (3XAA). Figure 15 shows yearly boxplots for quarterly 95th percentile THM BIFs by PWS from 2006 to 2014 for 130 PWSs in 18 states. Each boxplot is based on data for the same 130 systems. Overall, there is relatively little variability of the years, but a slight increase in median and 75th percentile BIF values occurred in 2011 – 2014. Figure 16 and Figure 17 show yearly boxplots for quarterly 95th percentile 2XAA and 3XAA BIF, respectively, by PWS, from 2006 to 2014 for 84 PWS in 15 states. Similar to the THM BIF boxplots, the yearly boxplots for 2XAA and 3XAA BIFs show relatively little variability, besides an increase in the 75th percentile values in 2013 and 2014 and a slightly increasing trend for the 95th percentile values.

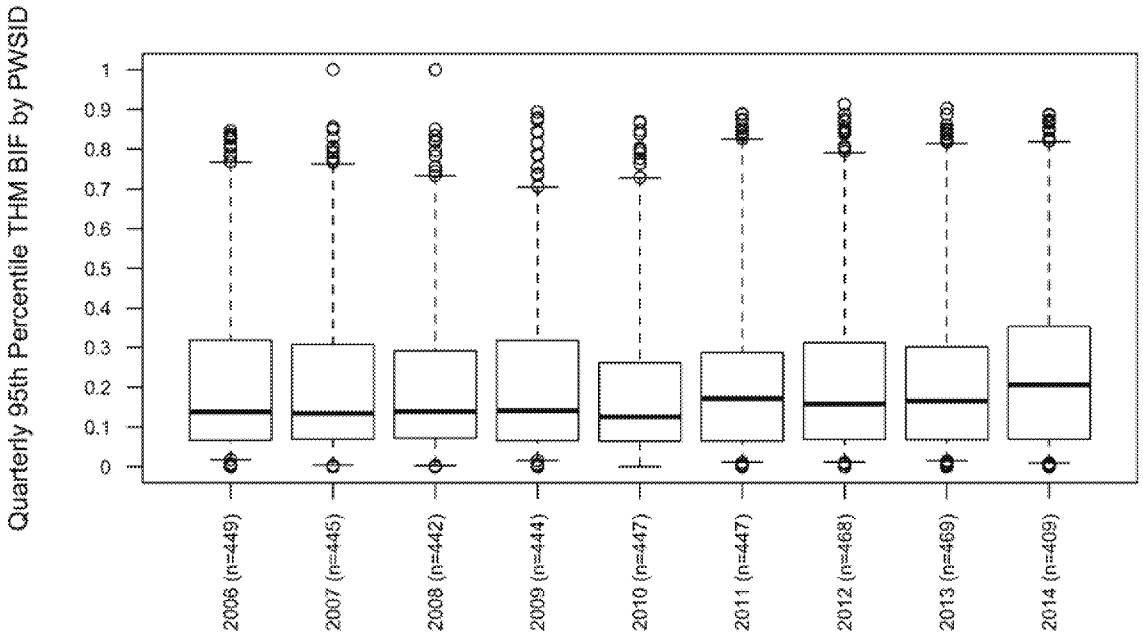


*Figure 15 Yearly Boxplots of Quarterly PWS 95th Percentile THM BIFs (Modeled) for 130 Water Utilities in 18 States from 2006 – 2014*



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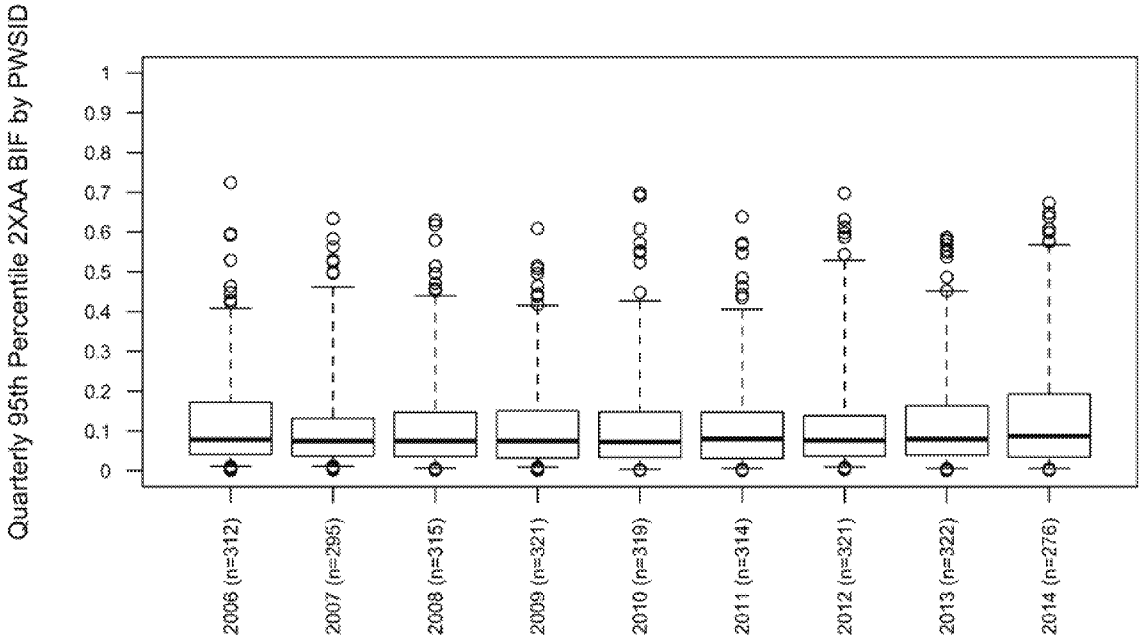


*Figure 16 Yearly Boxplots of Quarterly PWS 95th Percentile 2XAA BIFs (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*



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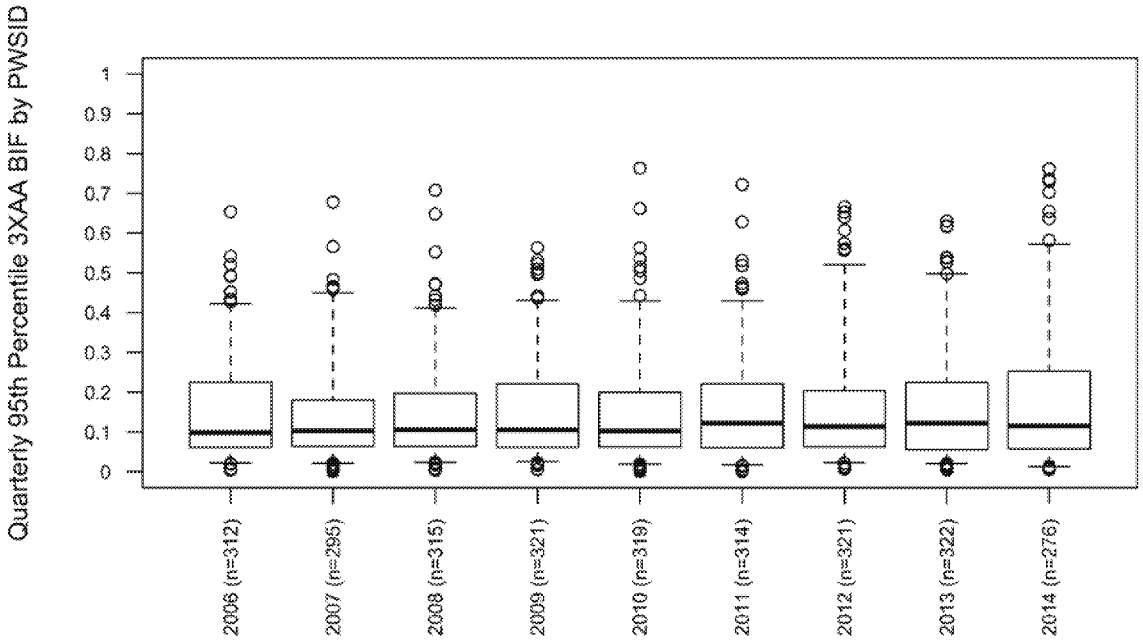


*Figure 17 Yearly Boxplots of Quarterly PWS 95th Percentile 3XAA BIFs (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*

The impact of the Stage 2 DBPR on bromine incorporation factors is further investigated by comparing cumulative distributions of the 95$^{th}$ percentile values by PWS of quarterly 95$^{th}$ percentile BIFs by PWS before and after Stage 2 DBPR. Figure 18, Figure 19 and Figure 20 show this analysis for THM, 2XAA, and 3XAA BIFs, respectively. In all three cases, the before and after cumulative distributions of BIFs are very close, but exhibit increases in BIF values for utilities in approximately the 50$^{th}$ – 85$^{th}$ percentile for the THM and 2XAA BIFs and in approximately the 60$^{th}$ – 90$^{th}$ percentile for the 3XAA BIF.



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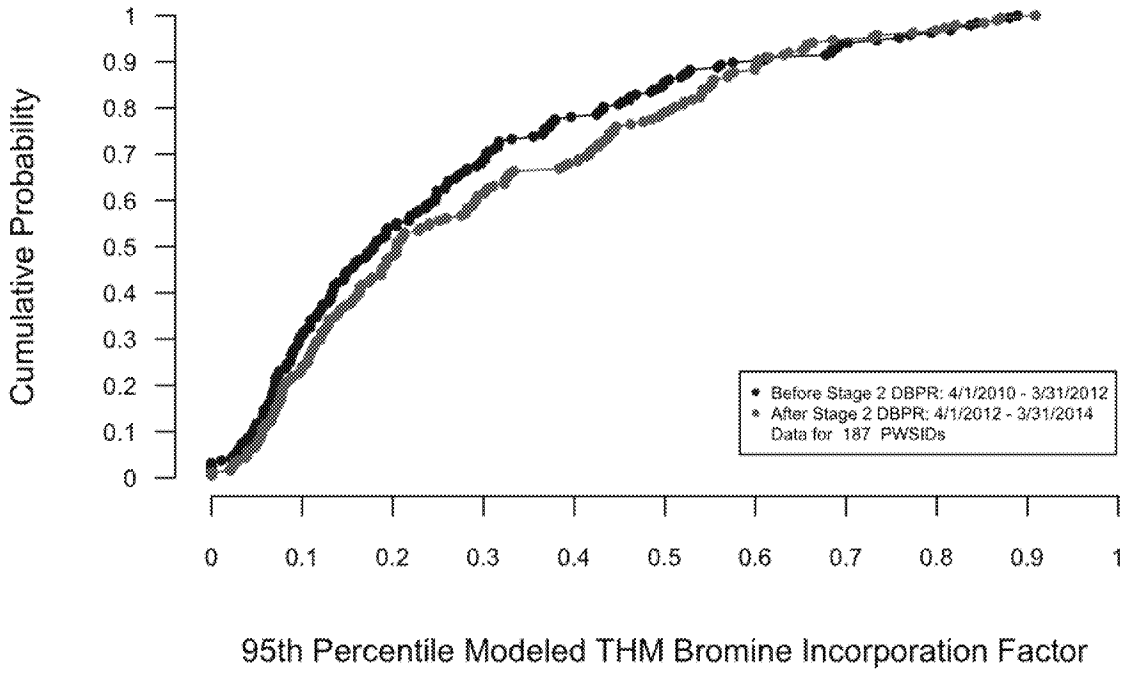


*Figure 18 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile THM BIF before and after Implementation of the Stage 2 DBPR*

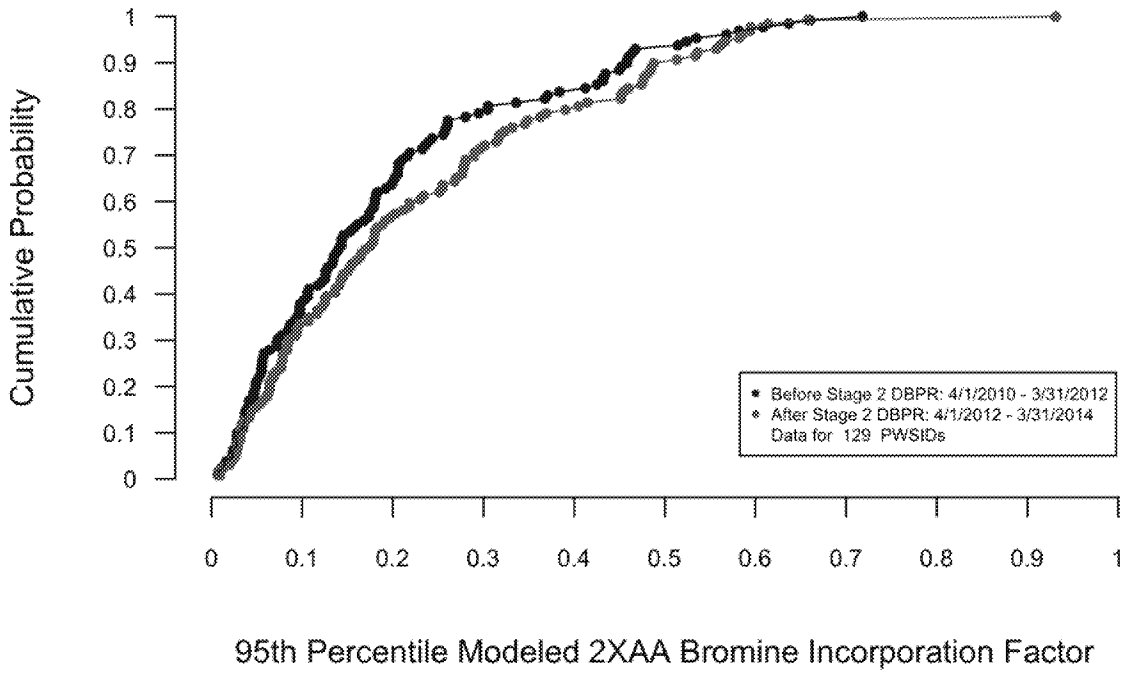


*Figure 19 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 2XAA BIF before and after Implementation of the Stage 2 DBPR*



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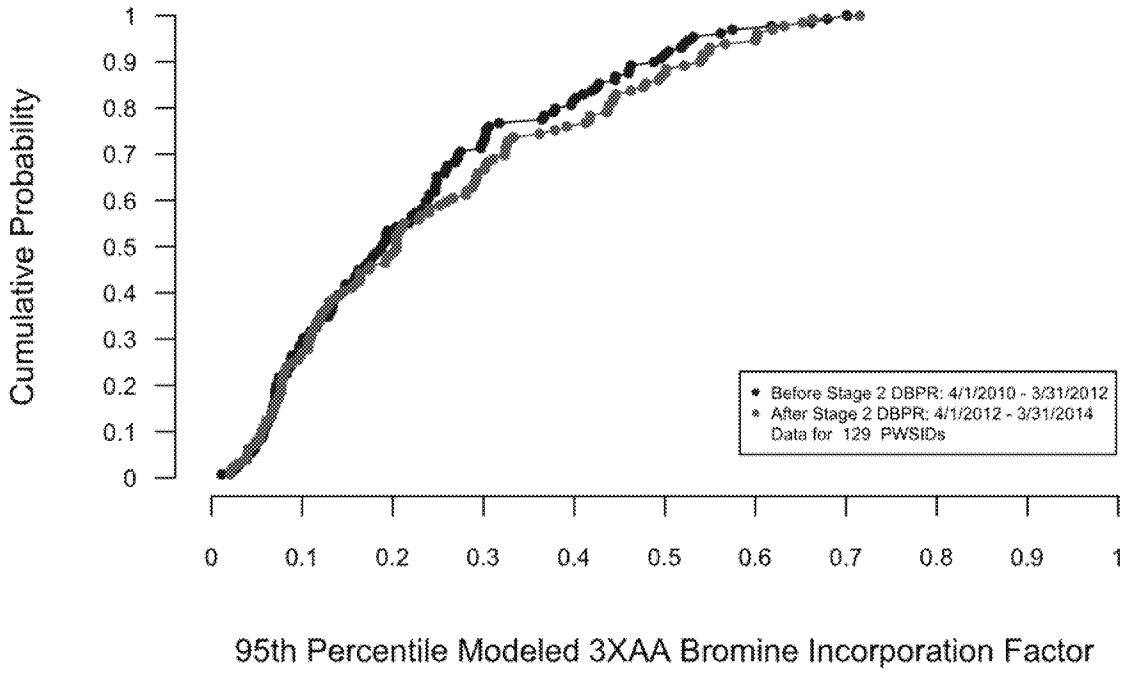


*Figure 20 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 3XAA BIF before and after Implementation of the Stage 2 DBPR*

As done previously for the HAA9 and HAA6-Br occurrence analysis, the cumulative distribution plots for the 95$^{th}$ percentile BIF values in Figure 18, Figure 19, and Figure 20 were modified to show impacts for individual PWSs. Figure 21, Figure 22, and Figure 23 show the same before cumulative distributions as in Figure 18, Figure 19, and Figure 20, and to illustrate the change in BIF values for each PWS, a horizontal black is drawn from each system's 95$^{th}$ percentile BIF value before Stage 2 DBPR to its 95$^{th}$ percentile BIF value after Stage 2 DBPR. While both increases and decreases occurred for the THM, 2XAA, and 3XAA 95$^{th}$ percentile BIF values, the changes with the greatest magnitudes tend to be increases from before Stage 2 DBPR to after.



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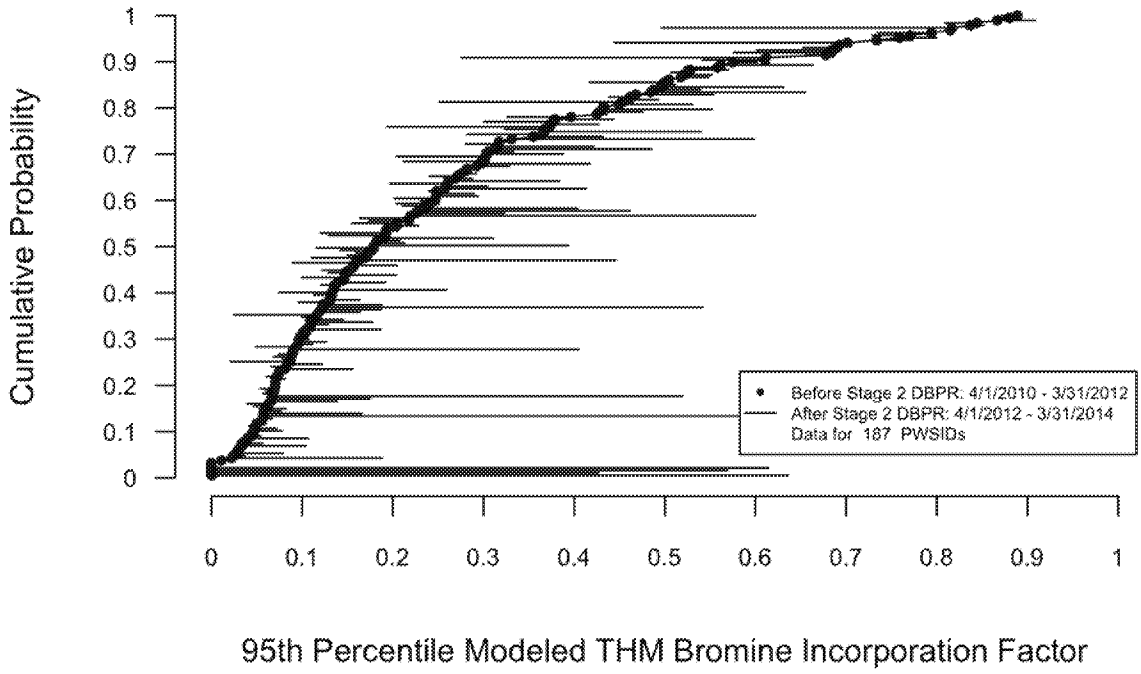


*Figure 21 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile THM BIF Showing Impacts to Individual PWSs*

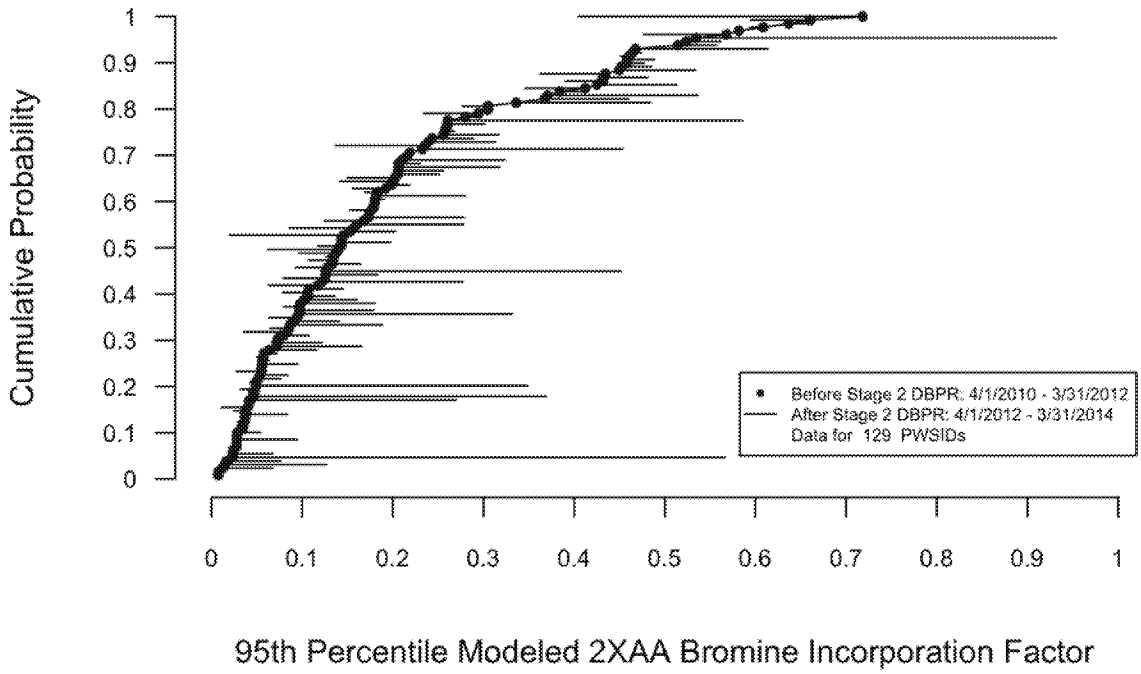


*Figure 22 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 2XAA BIF Showing Impacts to Individual PWSs*



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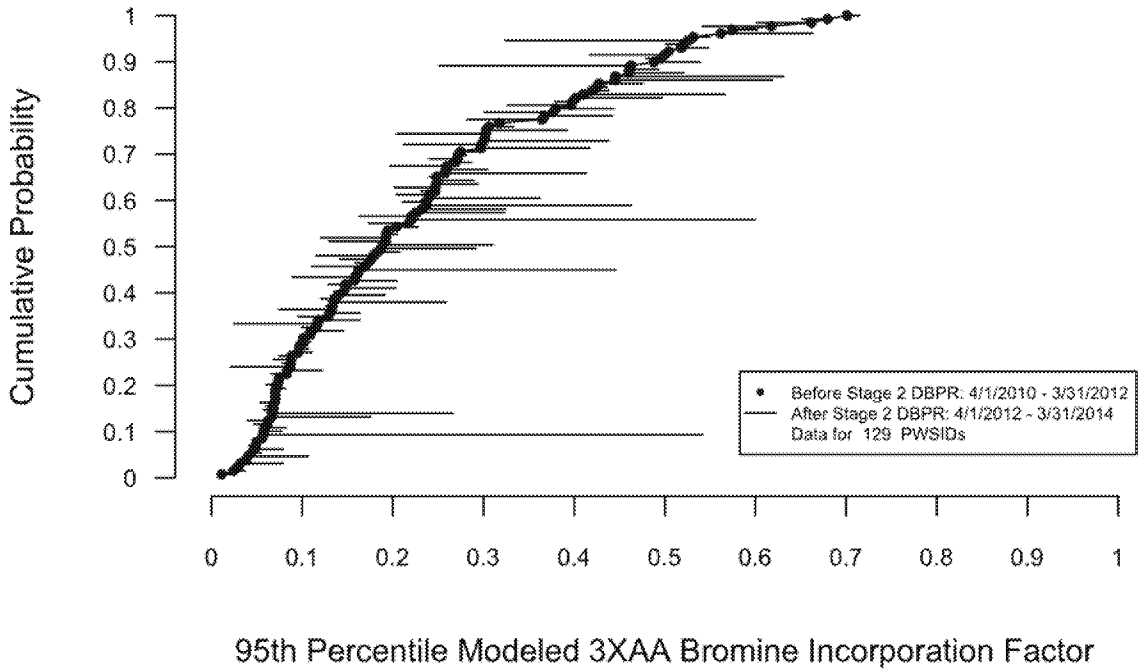


*Figure 23 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 3XAA BIF Showing Impacts to Individual PWSs*

# 4 Summary

The WITAF #266 database was used to assess the occurrence of brominated DBPs through modeling HAA4 species and HAA9 sums, validating the modeled HAA9 sums using observed HAA9 concentration data, and calculating bromine incorporation factors for THMs, dihaloacetic acids (2XAA), and trihaloacetic acids (3XAA). The "representativity" of the modeled HAA4 species, HAA9 and HAA6-Br concentrations was validated by analyzing distributions of TTHM and HAA5 data for two cases: for all systems with TTHM or HAA5 data, and for systems with THM and HAA5 species for modeling HAA9. An alternative approach to modeling HAA4 species, HAA9 and HAA6-Br, and calculating BIFs was developed due to a lack of necessary sample information to merge species concentrations for a given sampling event. The alternative approach used quarterly PWS 95$^{th}$ percentile species concentrations, which were then merged based on the PWS and quarter, as a surrogate for species concentration data. Analyses to validate this approach were presented.

This study demonstrates that the WITAF #266 database provides sufficient DBP data to analyze the occurrence of brominated DBPs, particularly before and after the implementation of the Stage 2 DBPR. This analysis is important in understanding how concentrations of unregulated HAAs, HAA9, and HAA6-Br concentrations have changed over time, and can be used to inform future regulatory decisions regarding the consideration of regulations based on brominated THM and HAA species in addition to the currently regulated sums.



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# 5 References

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Seidel, C.J., Samson, C., Bartrand, T., Ergul, A., Summers, R.S., 2015. WITAF #266 Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served). Final Report.

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# Attachment B: Preliminary Analysis of UCMR3 Data and Potential Impact on UCMR4

The following report is an interim work product. The research team is preparing a paper for submission to a peer-reviewed journal. A copy of the accepted paper will be forwarded to the Agency once it is published.

**Analysis of UCMR 3 Data and Potential Impact on UCMR 4 (manuscript in preparation)**

## Introduction

As part of the analysis of UCMR 3 data to determine whether it makes sense to recommend changes in sampling strategy to EPA for the UCMR 4 sampling framework, we did a detailed analysis of UCMR 3 data, initially based on the June 2015 National Contaminant Occurrence Database, but followed up by also doing some additional analyses of the October 2015 NCOD release.

We focused on several things.

- Any differences in frequency of occurrence based on PWS population. We obtained population data from EPA and then plotted frequency of occurrence for each contaminant by population band (<10K, 10-25K, 25-50K, 50K-100K, and >100K).
- Covariance plots of SE1 vs SE2 for groundwaters for each contaminant
- Probability distributions for groundwater systems for each contaminant for SE1 vs SE2
- Probability distributions for surface water systems for each contaminant for SE1 vs SE2 vs SE3 vs SE4
- Covariance plots of SE1 vs SE2 and Covariance plots of SE3 vs SE4 for surface water systems.

Corona Environmental (Tim Bartrand and Saul Rosen) performed statistical analyses of the paired samples and the probability plots using R.

Based on EPA's proposal to only have UCMR 4 sampling take place between March and November, Corona also did a statistical analysis of the same data based on only March-November samples to determine whether that would change any conclusions regarding differences between sampling periods.

## Background

In the UCMR 4 proposal information collection document (EPA 815-B-15-003), EPA has indicated that the analysis of the UCMR data are based on the following criteria (note highlighted sections). EPA does indicate that they may look at measures for each EPTDS for each PWS, but there is no indication that they have ever done that, and in the NCOD and the periodic data releases, they focus strictly on frequency of detection by count and PWS and % exceeding an HRL. The UCMR sampling strategy is not fundamentally focused around evaluating variability at any single utility or sampling point, but rather on national occurrence trends.

*The first stage of analysis, Stage 1, provides a straightforward evaluation of occurrence for simple and conservative assessments of contaminant occurrence. The Stage 1 analysis of the UCMR data consists of non-parametric, unweighted counts and simple descriptive statistics of analytical results for each of the contaminants. These occurrence analyses are conducted at the sample level, PWS level and population-served level. For each contaminant, occurrence measures include the number and percent of samples with analytical detections and the minimum, median, maximum, and 99th percentile values of those detections. PWS-level occurrence measures include the number and percent of PWSs with one or more*



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*analytical detections and the number and percent of PWSs with two or more analytical detections of a given contaminant. Population-served occurrence measures include: the number and percent of population served by PWSs with one or more analytical detections, and the number and percent of population served by PWSs with two or more analytical detections of a given contaminant. Similar measures may also be conducted for each EPTDS for each PWS. Since these contaminant and PWS- level occurrence measures are based on raw occurrence data (that have not been adjusted for population-weighting and sampling), they are less accurate representations of national occurrence than occurrence measures based on adjusted occurrence data.*

**Data Analysis –Groundwater systems**

In our view, a "table" tells a thousand words. The tables below and statistical analyses for the data are for groundwater samples courtesy of Corona Environmental. The statistical evaluation compares the probability plots for the two sample events. We have also included covariant plots and a separate analysis of paired SE1 and SE2 samples using the Wilcoxon Rank Sum test. For purposes of statistical analysis any result which was non detect in the UCMR 3 database was assigned a value of 0.



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**Table 1. Summary of Statistical Tests Comparing Sample Events for GW systems.**

| | all data | | | | | | Exclude Dec-Feb | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Contaminant** | **K-S *p*** | **Mann-Whitney *p*** | ***N* both above DL** | ***N* one below DL** | ***N* both below DL** | ***% detects*** | **K-S *p*** | **Mann-Whitney *p*** | ***N* both above DL** | ***N* one below DL** | ***N* both below DL** | ***% detects*** |
| 1,1-Dichloroethane | 1 | 0.379 | 238 | 172 | 8590 | 3.6% | | 0.927 | 126 | 94 | 4517 | 3.7% |
| 1,2,3-Trichloropropane | 1 | 0.473 | 78 | 40 | 8883 | 1.1% | | 0.643 | 47 | 23 | 4667 | 1.2% |
| 1,3-Butadiene | ID | ID | 0 | 1 | 9000 | 0.0% | | ID | 0 | 1 | 4736 | 0.0% |
| 1,4-Dioxane | 1 | 0.568 | 916 | 421 | 7589 | 12.6% | | 0.558 | 471 | 226 | 3968 | 12.5% |
| 17α-Ethynylestradiol | ID | ID | 0 | 1 | 2857 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| 17β-Estradiol | ID | ID | 0 | 3 | 2855 | 0.1% | ID | ID | 0 | 0 | 1492 | 0.0% |
| 4-Androstene-3,17-dione | ID | ID | 0 | 7 | 2851 | 0.1% | ID | ID | 0 | 2 | 1490 | 0.1% |
| Bromomethane | 1 | 0.833 | 29 | 32 | 8939 | 0.5% | 1 | 0.86 | 8 | 17 | 4712 | 0.3% |
| Chlorate | 0.00464 | 0.00717 | 6381 | 1418 | 5967 | 51.5% | 0.00282 | 0.0383 | 3309 | 714 | 3150 | 51.1% |
| Chloromethane | 1 | 0.612 | 62 | 71 | 8868 | 1.1% | 1 | 0.17 | 26 | 39 | 4672 | 1.0% |
| Chromium | $2.23\times10^{-5}$ | 0.00222 | 6402 | 2025 | 5412 | 53.6% | $2.06\times10^{-4}$ | 0.00512 | 3256 | 1124 | 2757 | 53.5% |
| Chromium-6 | 0.942 | 0.811 | 8862 | 1289 | 3686 | 68.7% | 0.82 | 0.667 | 4605 | 743 | 1887 | 68.8% |
| Cobalt | 1 | 0.489 | 224 | 194 | 13478 | 2.3% | 1 | 0.773 | 103 | 105 | 6994 | 2.2% |
| Equilin | ID | ID | 0 | 0 | 2858 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Estriol | ID | ID | 0 | 1 | 2587 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Estrone | ID | ID | 0 | 0 | 2858 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Germanium | 1 | 0.734 | 16 | 4 | 1015 | 1.7% | 1 | 0.629 | 8 | 2 | 450 | 2.0% |
| Halon 1011 | 1 | 0.049 | 30 | 129 | 8842 | 1.0% | 1 | 0.802 | 20 | 71 | 4646 | 1.2% |
| HCFC-22 | 1 | 0.967 | 221 | 143 | 8637 | 3.2% | 1 | 0.855 | 107 | 73 | 4557 | 3.0% |
| Manganese | 0.983 | 0.922 | 589 | 148 | 298 | 64.1% | 0.944 | 0.894 | 267 | 64 | 129 | 65.0% |
| Molybdenum | 0.913 | 0.913 | 5657 | 822 | 7433 | 43.6% | 0.964 | 0.728 | 2890 | 441 | 3876 | 43.2% |
| *n*-Propylbenzene | ID | ID | 1 | 6 | 585 | 0.7% | ID | ID | 1 | 2 | 248 | 0.8% |
| PFBS | ID | ID | 1 | 2 | 9164 | 0.0% | ID | ID | 0 | 0 | 4817 | 0.0% |
| PFHpA | 1 | 0.512 | 45 | 29 | 9093 | 0.6% | 1 | 0.676 | 20 | 13 | 4784 | 0.6% |
| PFHxS | 1 | 0.686 | 68 | 21 | 9078 | 0.9% | 1 | 0.994 | 30 | 14 | 4773 | 0.8% |
| PFNA | 1 | 0.317 | 5 | 6 | 9156 | 0.1% | ID | ID | 1 | 4 | 4812 | 0.1% |
| PFOA | 1 | 0.736 | 82 | 51 | 9034 | 1.2% | 1 | 0.923 | 34 | 33 | 4750 | 1.0% |
| PFOS | 1 | 0.76 | 71 | 38 | 9058 | 1.0% | 1 | 0.44 | 31 | 21 | 4765 | 0.9% |
| *sec*-Butylbenzene | ID | ID | 0 | 0 | 592 | 0.0% | ID | ID | 0 | 0 | 251 | 0.0% |
| Strontium | 0.677 | 0.373 | 13774 | 91 | 8 | 99.6% | 0.655 | 0.359 | 7127 | 61 | 5 | 99.5% |
| Tellurium | ID | ID | 0 | 0 | 1035 | 0.0% | ID | ID | 0 | 0 | 460 | 0.0% |
| Testosterone | ID | ID | 0 | 13 | 2844 | 0.2% | ID | ID | 0 | 6 | 1486 | 0.2% |
| Vanadium | 0.689 | 0.505 | 7531 | 974 | 5398 | 57.7% | 0.964 | 0.708 | 3877 | 538 | 2784 | 57.6% |



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In all cases except for total chromium and chlorate, there is no statistical difference in the probability plots for sample event 1 and sample event 2. This is true even when there are a large number of non-detects. For UCMR 4, EPA has proposed only sampling between March and November. Thus the same analysis was done excluding the Dec-Feb samples. In that case there is also no significant difference between events and the overall frequency of detection is similar, suggesting that excluding the winter months would, at least for the UCMR 3 contaminants not make any difference in the data, while significantly complicating the monitoring process. If one thinks about ground water systems which are not under the direct influence of surface water and may even have travel times that are decades long, there is no reason to expect that sampling in any given month would be reflective of surface conditions at that time. Thus, even for analytes that might be seasonal in application (e.g. pesticides) ground water systems would almost certainly not reflect that seasonality.

The probability plots here (figure 1) are for chlorate, total chromium, and hexavalent chromium. Just from a visual inspection it is apparent that even though individual events may have different results for a given sample site, the overall distribution of occurrence is essentially the same, as is true of hexavalent chromium also. In the case of chlorate there are differences in the extreme values.

For chlorate it makes perfect sense that there could be significant differences between events, because utilities change their disinfection practices over time, which will in turn have an impact on chlorate, which is disinfection byproduct. Thus chlorate patterns would not be a cause for considering 1 vs 2 sampling events for groundwater systems, but should rather be treated like any other disinfection byproduct in terms of sampling strategy (e.g. sample only at a point in the distribution system and sample frequently enough to have a meaningful understanding of variability. It is worth noting that a visual assessment of the probability plots for chlorate (figure 1) suggests that they are not different, but likely show as statistically significant only because of differences in the extreme values.

For total chromium, the statistically significantly different results are also puzzling both because a covariance plot between the two events shows good correlation, and because when one looks at probability plots between the two sample events there is nearly perfect overlap. We suspect that the apparent statistically significant difference may relate to issues with the total chromium method accuracy and precision near the 0.2 ug/L reporting limit, coupled with the assumption of 0 for all non detect samples. Hexavalent chromium, with a much lower reporting limit, showed no significant difference between sample events. Additionally, when all non-detect samples for total chromium are excluded the correlation coefficient between sample event 1 and sample event 2 for groundwater goes from an $r^2$ of 0.705 to 0.83 and there is no statistical difference between probability plots. Thus we consider the apparent significant difference between events to be an artifact of the analytical method and not a true statistically significant difference that would justify multiple sampling rounds.



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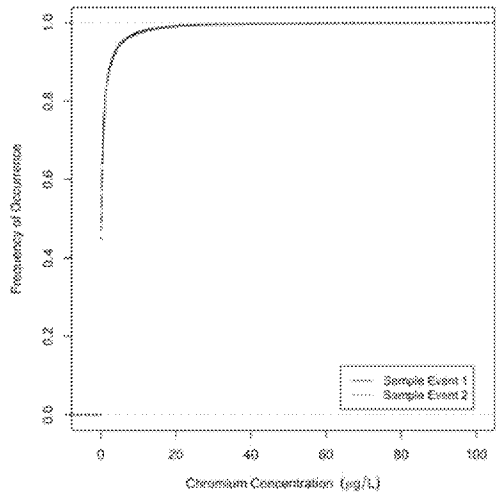
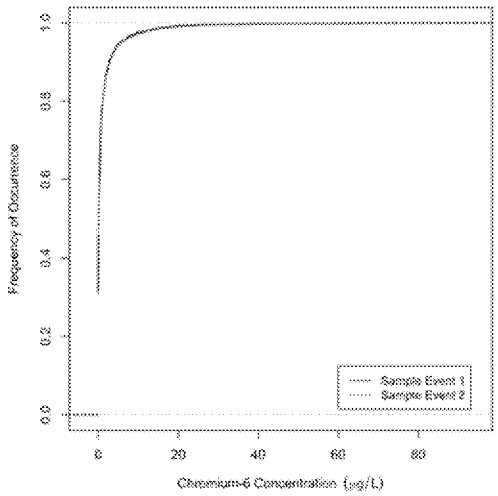
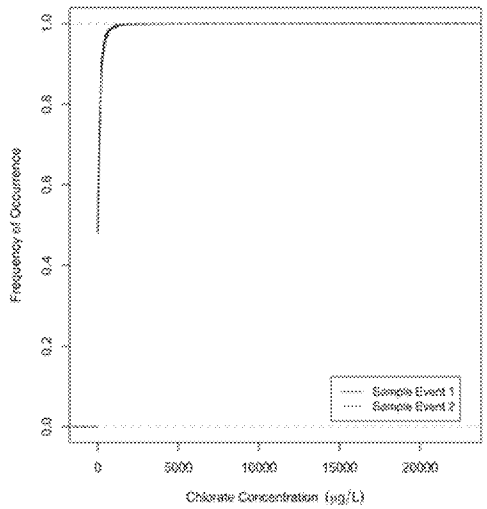
Figure 1: Probability plots for groundwater systems for SE1 and SE2 for chromium, hexavalent chromium, and chlorate.




Although not shown here, there is no difference in the nature of the plots if one excludes the December-February data. Thus no information is gained by restricting sampling periods. Table 1 also demonstrates that there is no difference in overall frequency of occurrence for any contaminant when one excludes the winter months.

The following plots (figures 2-5) are covariance plots of sample event 1 vs sample event 2 for each contaminant with even as little as 1% overall occurrence. Without referring to the statistical analysis it is clear that in most cases there is a high degree of covariance between events, even if the overall correlation coefficient is in some cases low, mainly because of limited occurrence.

The covariance, coupled with the probability plots and statistical evaluation of those plots all suggest that there is no information which is gained by having multiple sample events for groundwater systems.



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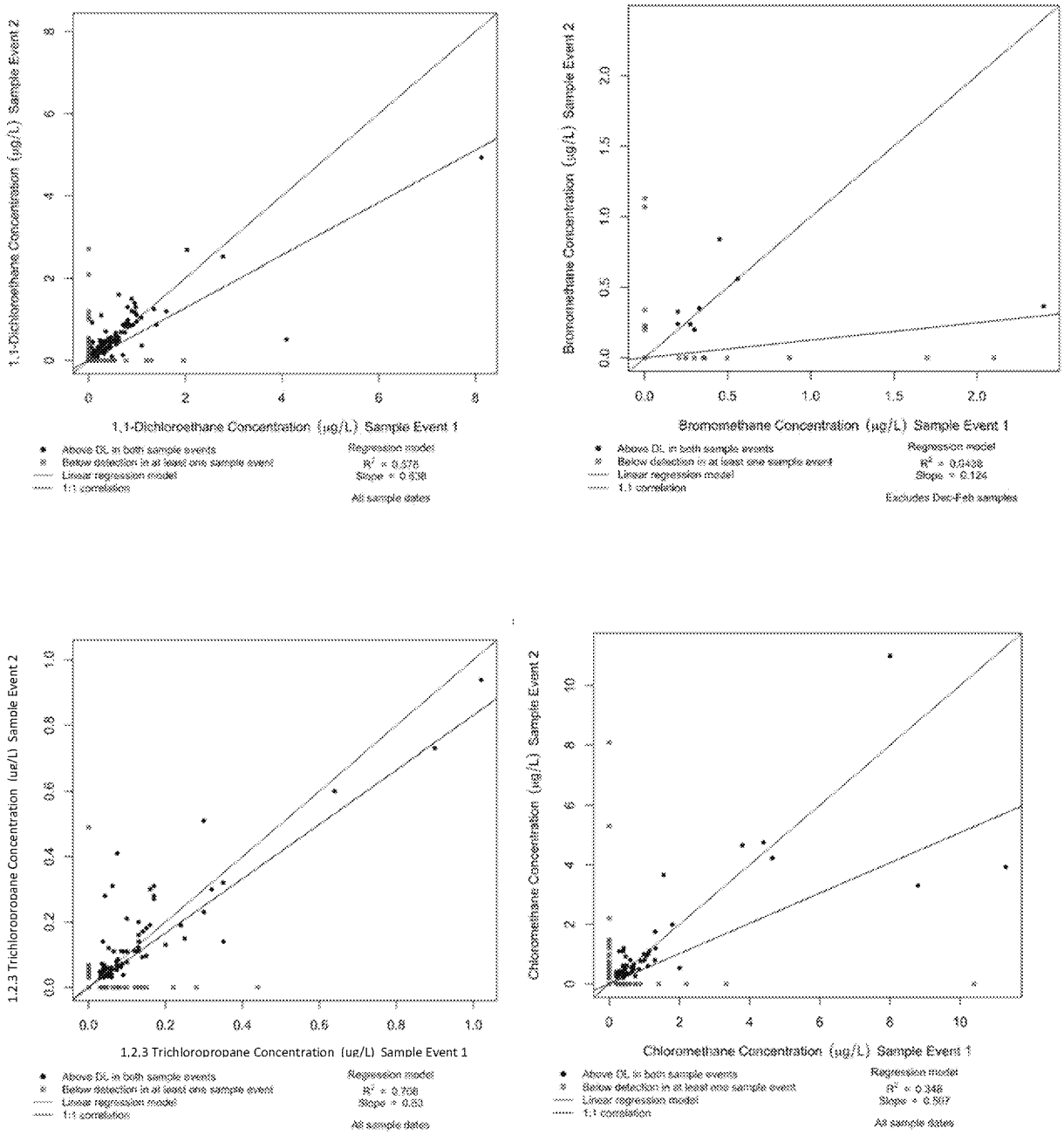
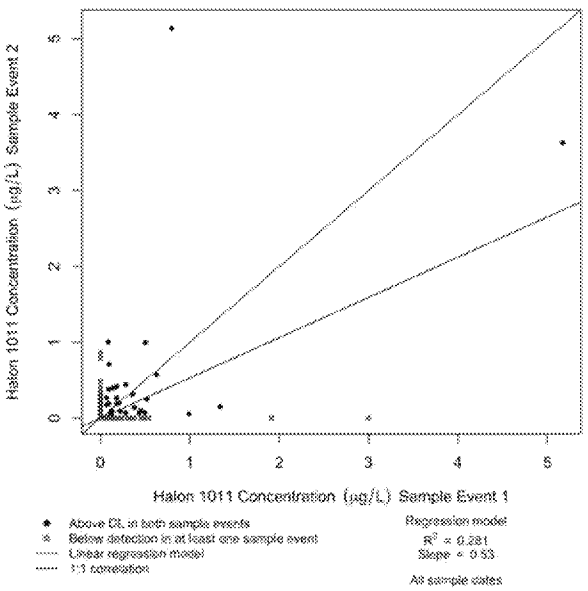
Figure 2a: Covariance plots for groundwater systems for VOC contaminants with sufficient data for statistical analysis. Plots below are based on using all samples (not excluding the winter months).




Halon 1011 Concentration (µg/L) Sample Event 2
Halon 1011 Concentration (µg/L) Sample Event 1
0
1
2
3
4
5
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.281
Slope = 0.53
All sample dates

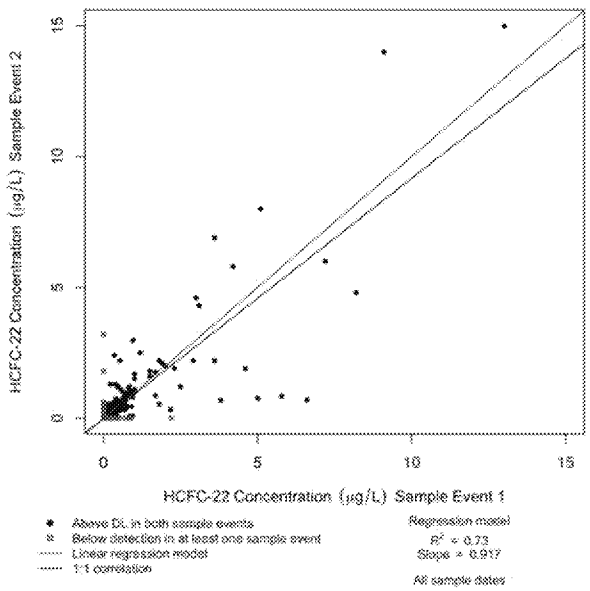
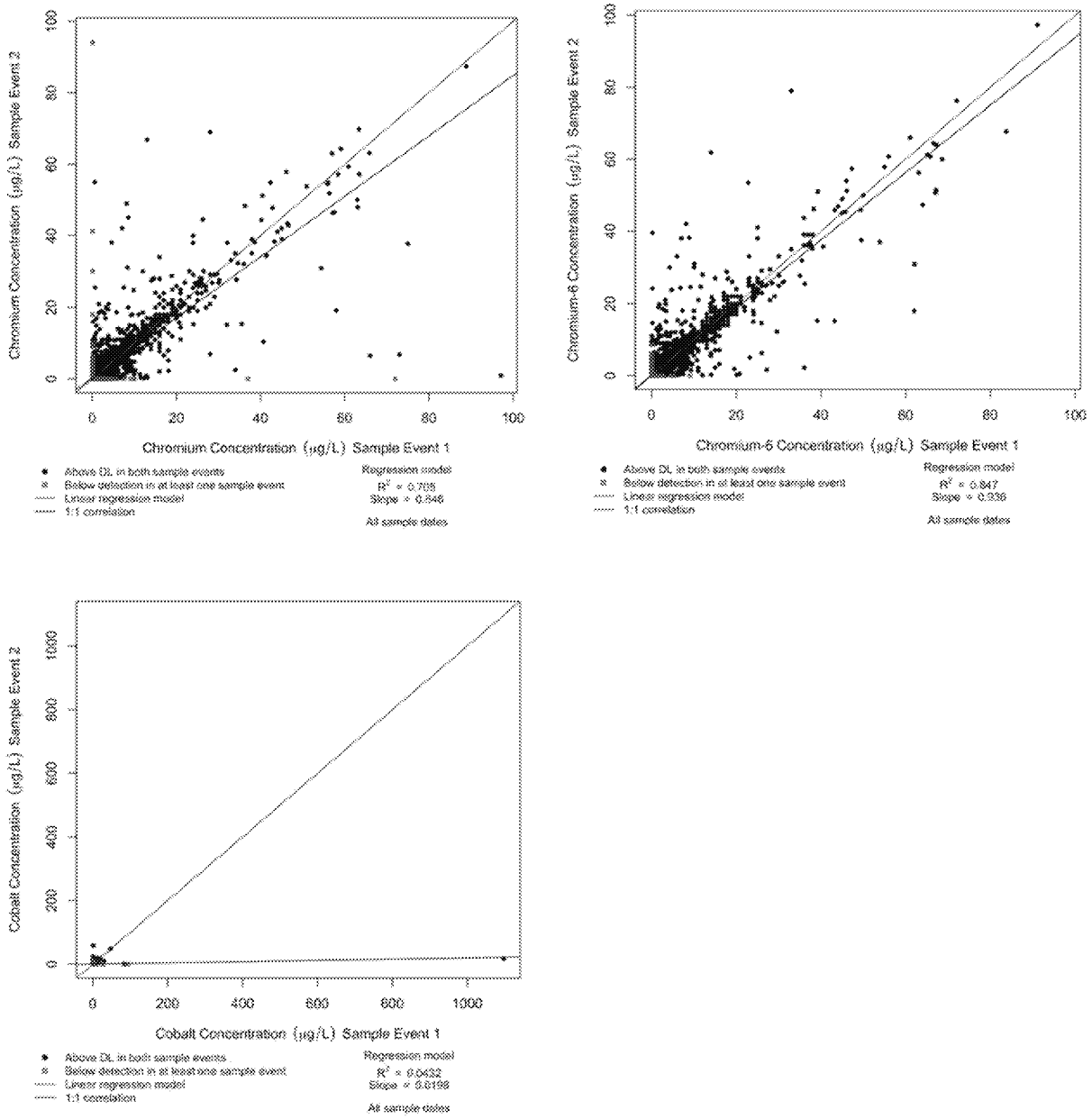
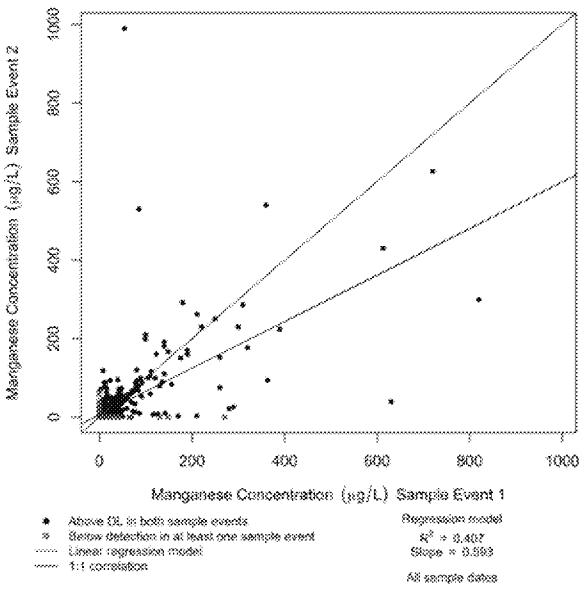
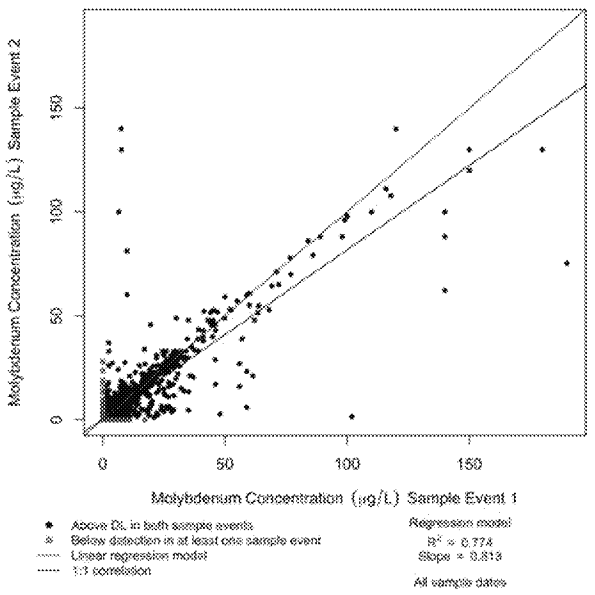
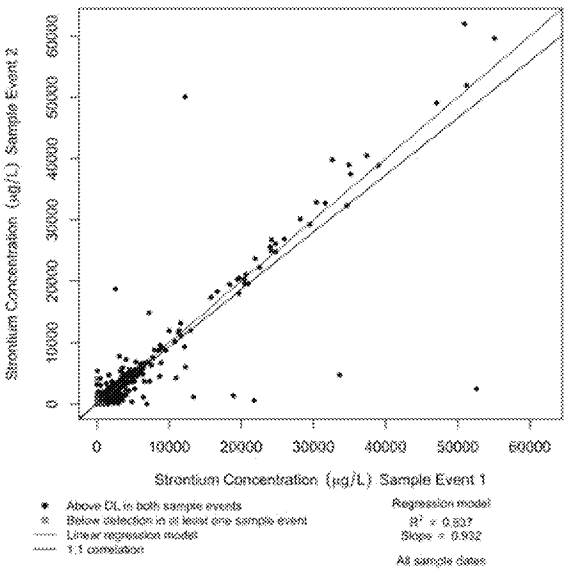

HCFC-22 Concentration (µg/L) Sample Event 2
HCFC-22 Concentration (µg/L) Sample Event 1
0
5
10
15
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.73
Slope = 0.917
All sample dates

Figure 3: Covariance plots for groundwater systems for metals. Plots below are based on using all samples (not excluding the winter months). Figure includes data for manganese and germanium (small systems data only, but planned for inclusion in UCMR 4.




Manganese Concentration (µg/L) Sample Event 2
Manganese Concentration (µg/L) Sample Event 1
0
200
400
600
800
1000
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.407
Slope = 0.593
All sample dates


Molybdenum Concentration (µg/L) Sample Event 2
Molybdenum Concentration (µg/L) Sample Event 1
0
50
100
150
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.774
Slope = 0.813
All sample dates


Strontium Concentration (µg/L) Sample Event 2
Strontium Concentration (µg/L) Sample Event 1
0
10000
20000
30000
40000
50000
60000
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.937
Slope = 0.932
All sample dates

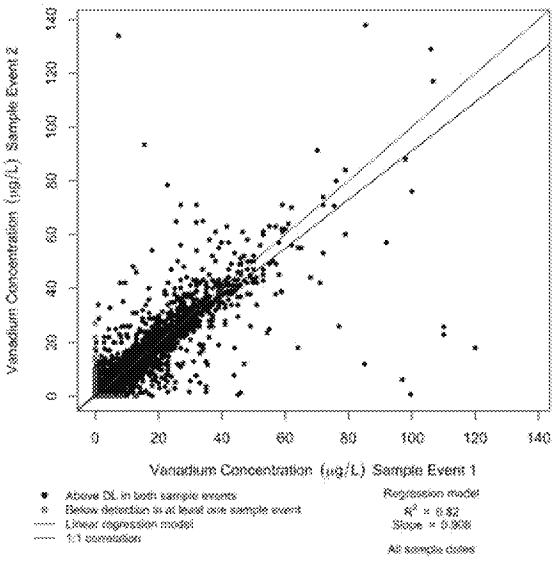
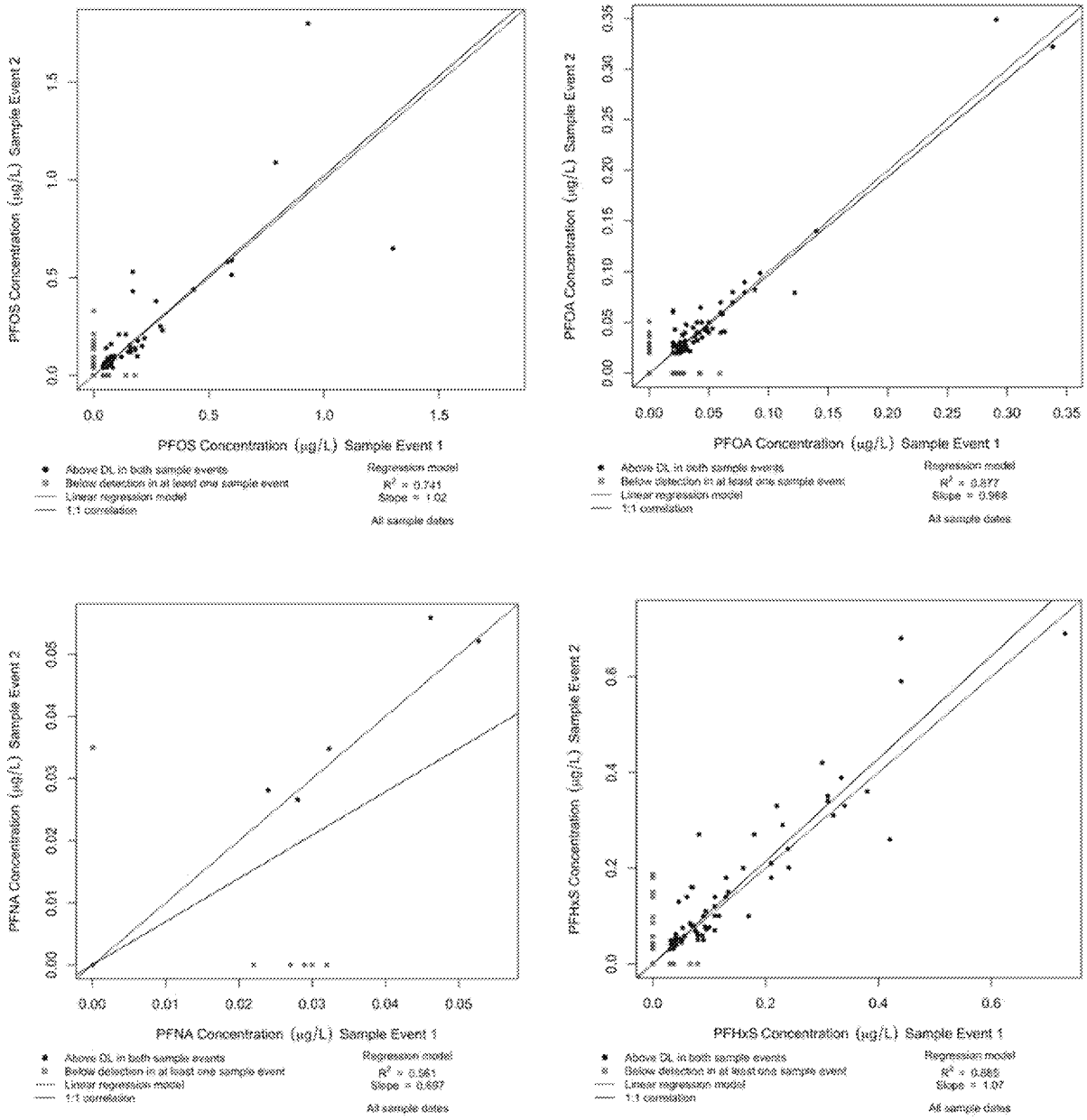

Vanadium Concentration (µg/L) Sample Event 2
Vanadium Concentration (µg/L) Sample Event 1
0
20
40
60
80
100
120
140
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.92
Slope = 0.868
All sample dates

Figure 4: Covariance plots for groundwater systems for PFC contaminants with sufficient data for statistical analysis. Plots below are based on using all samples (not excluding the winter months).



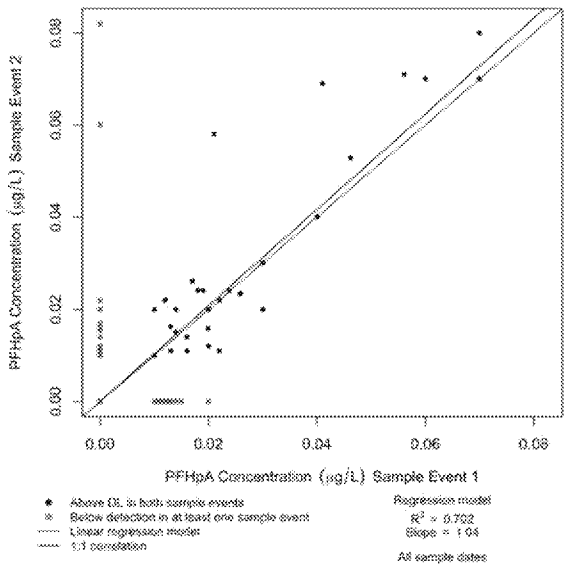
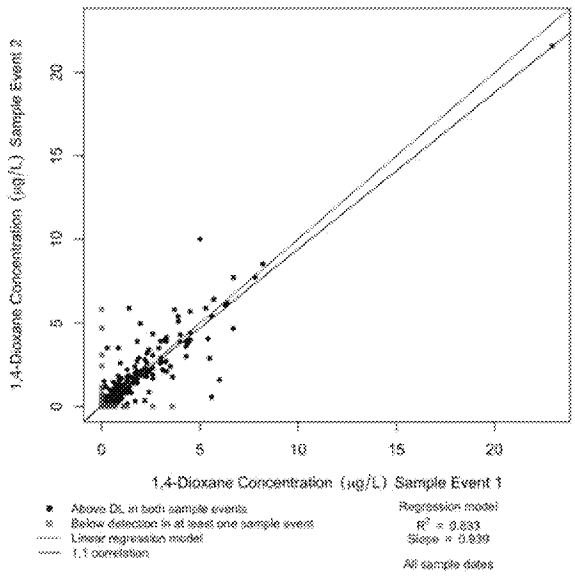
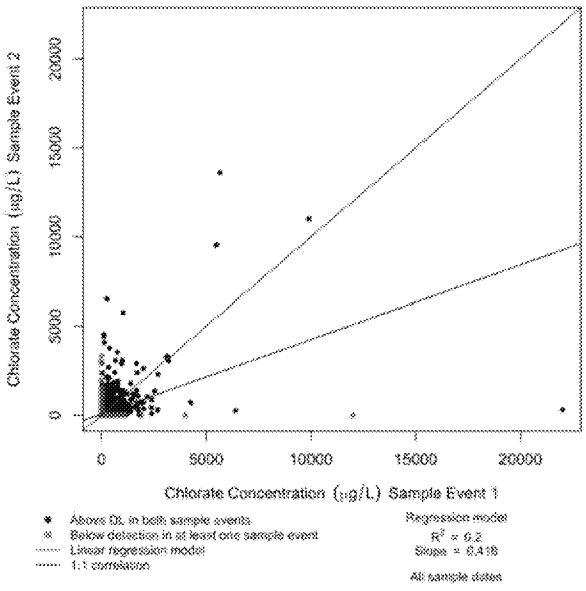



Figure 5: Covariance plot for groundwater systems for 1,4-dioxane and chlorate. Plots below are based on using all samples (not excluding the winter months).



**System size impact on results.**

The current UCMR construct calls for using a statistical sampling of small systems (< 10K population) and sampling all larger systems. Because one factor in interpreting UCMR data is the population impacted by contaminants it is important to determine the extent of variation in contaminant occurrence as a function of population size. The June, 2015 data from the NCOD was merged with population information from EPA and frequency of occurrence plotted for each contaminant as a function of system size. This analysis does not take into account the range of concentrations or the frequency with which contaminants may exceed the current health reference level (HRL), but rather focuses solely on the detection frequency as this is one factor EPA had indicated is a consideration in regulatory decision making. It is clear from the plots below (figure 6-10) that there **are differences** in frequency of occurrence for most contaminants as a function of population size, with greater frequency occurring in systems serving > 100K population, as would be expected in general for anthropogenic contaminants, where urban areas are more subject to potential contamination. In some cases the frequency of occurrence in the >100K systems may be more than double that of smaller systems, which may provide some justification for regulation, even though overall occurrence is low. This same pattern is true even for contaminants that are predominantly naturally occurring (e.g. the metals). EPA should perform a similar analysis of the data focusing not just on detection frequency but also on relative concentration levels. This analysis suggests that if EPA were to consider a statistical subset of systems serving >10K population for future UCMRs, including potentially UCMR 4, as a way of reducing the overall burden on utilities, it would be especially important that it be a robust analysis. We don't think there is sufficient time between now and the beginning of UCMR 4 to consider that approach for this round.

Figure 6: Frequency of occurrence for chlorate and 1,4-dioxane by population served.

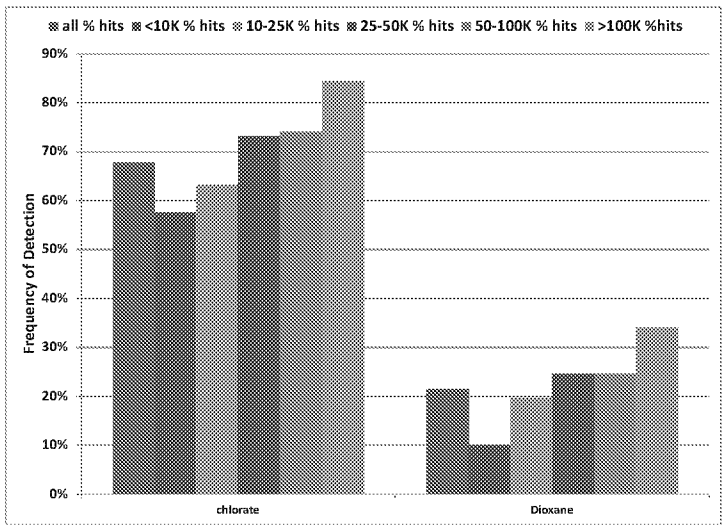
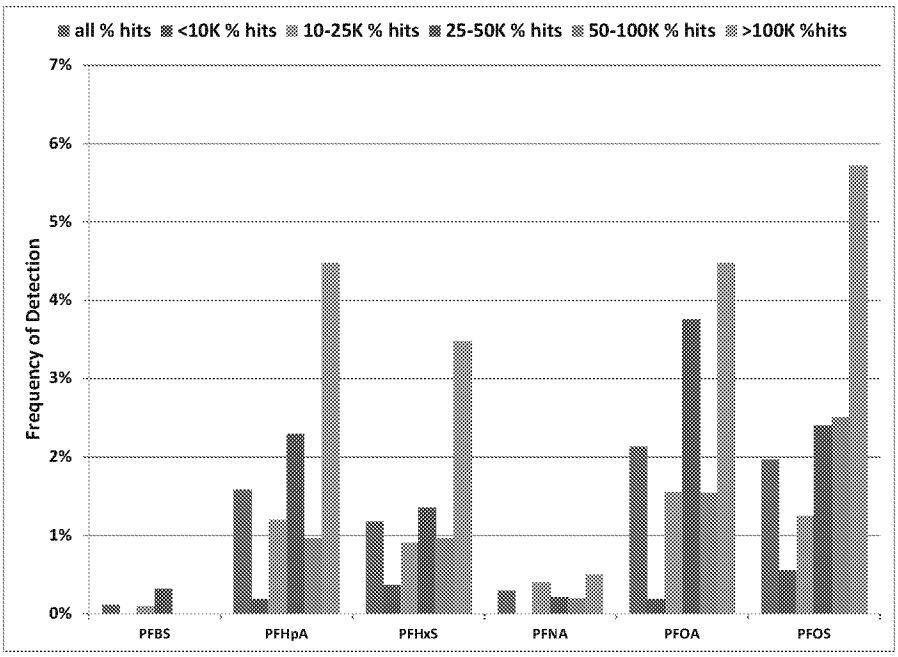
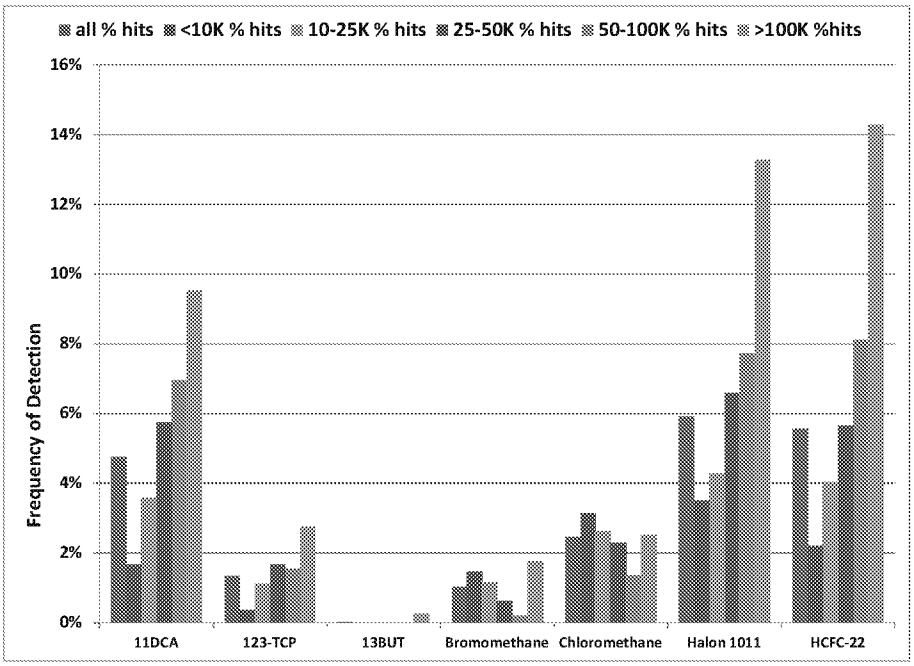


Figure 7: Frequency of occurrence for PFCs by population served.




For the PFCs, very large systems (>100K) in general have a much greater likelihood of detection than smaller systems. This may be a cause for considering potential regulation.

Figure 8: Frequency of occurrence for VOCs by population served.




VOCs show the same pattern as PFCs, a much greater likelihood of detection in 100K+ systems.



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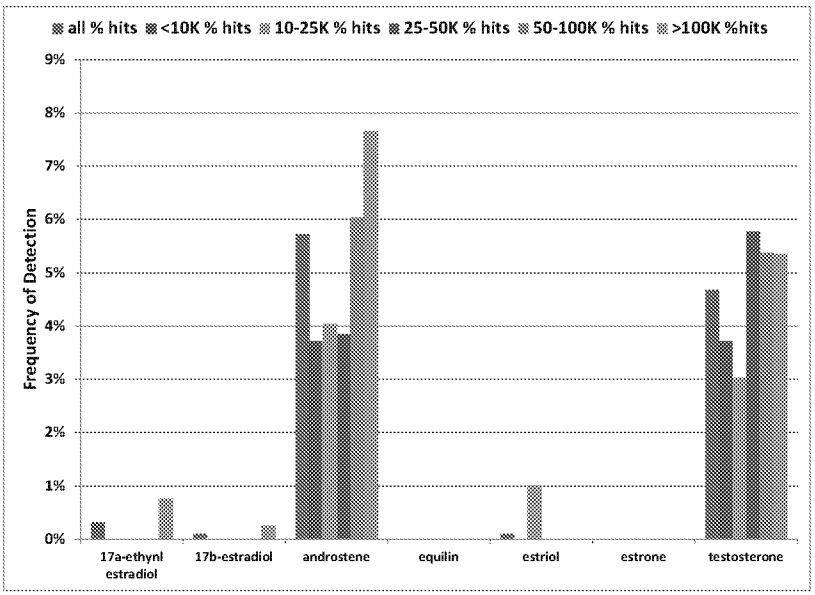
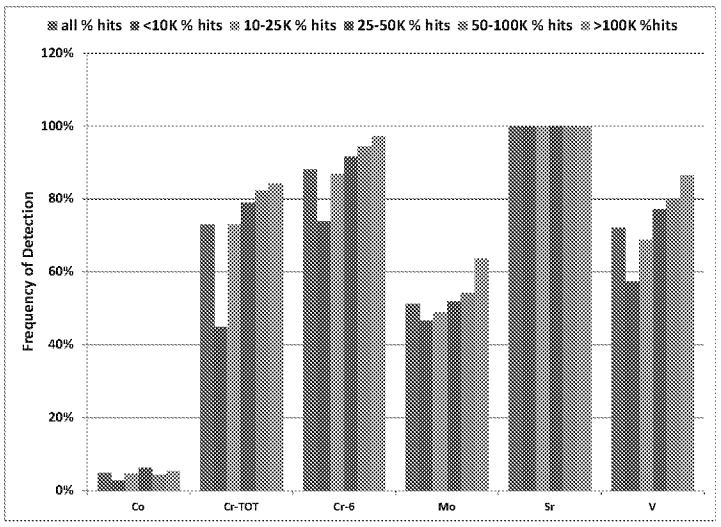
Figure 9: Frequency of occurrence for hormones by population served.




Even though the frequency of occurrence is relatively high (~5% of systems with detects for testosterone and androstenedione), there is no clear trend with population size. This is most likely due to the fact that detection levels overall are very close to the minimum reporting levels, as one would expect the hormones to show a major anthropogenic impact (e.g. more population = more hormone detections). When detected, hormones are almost always a single detection and not repeated on additional sampling events, making it more likely that at least some of the detects may be artifacts of some sort.

Figure 10: Frequency of occurrence for metals by population served




For the metals the difference across system size is less marked than for some of the anthropogenic contaminants, but there are still trends suggesting greater occurrence in larger systems, and thus also larger population impacts.



ED_002479_00000002-00076

American Water Works Association

*Dedicated to the World's Most Important Resource*™

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February 9, 2016

Water Docket
U.S. Environmental Protection Agency
Mail Code 2821T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Comments on "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting", Docket ID No. EPA–HQ–OW–2015–0218

Dear Sir or Madam,

The American Water Works Association (AWWA) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA's) proposal for the Fourth Unregulated Contaminant Monitoring Rule (UCMR4) (80 Federal Register 76897). UCMRs have always been a critical component of the Safe Drinking Water Act (SDWA) regulatory decision-making process. AWWA supports a robust UCMR monitoring program to assist EPA in meeting its statutory requirements when determining whether or not a national regulation is needed and what an appropriate drinking water standard might be. Sound national occurrence information is critical to the regulatory determinations EPA must make in assessing whether a national regulation will provide a meaningful opportunity for risk reduction.

AWWA has previously recommended EPA include cyanotoxins and disinfection by-products (DBPs) on the Fourth Contaminant Candidate List (CCL4) in order to facilitate data collection and evaluation for potential additional risk management. AWWA agrees with the inclusion of both cyanotoxins and the nine haloacetic acids (HAAs) in the proposed UCMR4; however, revisions in the final UCMR4 for both of these groups are necessary to ensure that the monitoring data will appropriately inform future regulatory decisions.

For cyanotoxins, source water monitoring should not be included in the final UCMR4. Instead, UCMR4 monitoring for cyanotoxins should be at the Entry Point to the Distribution System (EPTDS). SDWA Section 1445(a)(2)(A) clearly states that "The

regulations shall require monitoring of ***"drinking water supplied by public water systems..."*** (emphasis added), therefore, AWWA recommends that all UCMR4 monitoring be taken at the EPTDS or at sampling locations in the distribution system. This recommendation also applies to future UCMRs.

AWWA continues to have serious concerns about the accuracy and the reliability of the enzyme-linked immunosorbent assay (ELISA) analytical method. Moreover, the Agency should not directly correlate or compare the ELISA and the LC/MS/MS data. For example, the ELISA test has not been adequately tested for matrix interferences, nor for the relative sensitivity of the vast majority of congeners and disinfection degradates. Inter-laboratory comparisons cited to-date only test for precision or reproducibility, and not for the accuracy of the method itself. Much is still unknown about how disinfection interfaces with ELISA tests, making interpretation of the information difficult. The toxicity of disinfection degradates is unknown relative to known microcystins (such as MC-LR), which is further complicated by the variability in the toxicity of the known microcystins. AWWA recommends that EPA proceed cautiously in developing its ELISA standard method. Recognizing the limitations of the ELISA methods, AWWA recommends its use for screening in the finished water with an EPTDS sample at 0.3 µg/l or at a level demonstrated as sound through EPA's ongoing method development efforts as a trigger for analysis using the LC/MS/MS method.

AWWA agrees that management of DBPs is an important regulatory issue that warrants additional research and resources, but the approach in the proposed UCMR4 is inappropriate. UCMR's mandated, national monitoring framework is not the most appropriate method to obtain reliable and robust monitoring data and meta-data for regulatory decision-making on the complex issues surrounding the formation and degradation of DBPs, assuring microbial protection, and maintaining disinfectant residuals. The meta-data that is proposed to be collected will confuse and confound future data analyses. AWWA recommends a simpler classification of treatment "bins" for UCMR4 meta-data, and EPA should better articulate the future intended use of any meta-data collected in the final UCMR4.

The monitoring frequency in the proposed UCMR4 is inappropriate. UCMR4 monitoring should be conducted quarterly as has been done in past UCMRs. Monitoring should not be "skipped" in December, January, or February. The time frame as proposed (March-November) unnecessarily constrains the monitoring with no benefit for future regulatory decisions. All nine species of HAAs and four species of THMs need to be collected from compliance samples at the same time (four quarters in one year) and at all of the Stage 2 DBPR compliance sampling locations,

and all 13 analyte results need to be reported. Additionally, disinfectant residual for these samples should be collected and analyzed at the same time.

Finally, AWWA and other stakeholders have observed the need to effectively integrate regulatory activity so that in setting new regulatory requirements, simultaneous compliance issues are not ignored and that the Agency does not inadvertently create new hazards. The management of disinfection and DBPs are a clear example where there is a long history of existing and interwoven regulatory requirements. Any monitoring and associated research on DBPs should both be robust and reliable, and be conducted in a manner that appropriately informs any potential future regulatory actions.

Attached are detailed comments that elaborate on the above, and also address other important UCMR4 issues. The ultimate goal of AWWA's recommendations is a well thought out, comprehensive and optimized UCMR4 data collection effort. Both the Agency and the water sector should move forward with reasonable expectations for UCMR4, and the monitoring effort should be complimentary with EPA's drinking water research program. Robust national occurrence data is not as meaningful for regulatory decision-making without additional research into the other considerations that must be taken into account in regulatory decision-making, especially health effects research.

Please feel free to contact AWWA if you have any questions regarding the attached or would like to discuss mechanisms to more actively engage stakeholders in crafting a cohesive strategy to collect the complete suite of data needed to support drinking water regulation development.

Best regards,

G. Tracy Mehan, III
Executive Director of Government Affairs
AWWA

cc: Eric Burneson
Brenda Paris
Melissa Simic
Zeno Bain

***What is the American Water Works Association?***

*The American Water Works Association is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes over 3,900 utilities that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our nearly 50,000 total memberships represent the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.*

Comments of the American Water Works Association
on
"Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting"

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Comments of the American Water Works Association
On
"Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting"

The following are the American Water Works Association's (AWWA's) comments on the Environmental Protection Agency's (EPA's) proposed "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting", Docket ID No. EPA–HQ–OW–2015–0218 (80 Federal Register 76897, December 11, 2015). AWWA's comments are organized into general overarching comments, specific comments with respect to cyanotoxin monitoring, specific comments on haloacetic acid monitoring, responses to EPA's requests for comment, feedback on EPA's presentation of the burden and logistics of UCMR implementation, and a brief summary.

## Overarching Comments

AWWA supports the Proposed Fourth Unregulated Contaminant Monitoring Rule (UCMR4) as part of the suite of activities to inform regulatory decision-making; however, several important revisions need to be made in the final UCMR4.

1. Disinfection byproducts (DBPs) are an important regulatory issue that warrant additional research and resources, but the approach in the proposed UCMR4 is not an appropriate mechanism to accomplish this goal. The drinking water community needs robust and reliable UCMR monitoring data and meta-data to be collected in order to appropriately inform regulatory decision-making on the complex issues surrounding the formation and degradation of DBPs and maintaining microbial protection, disinfectant residual, and optimized corrosion control.

2. The proposed UCMR4 would collect meta-data in such a way as to confuse and confound effective analysis in the future. A simpler classification of treatment "bins" for UCMR4 meta-data would be more effective. EPA should clearly articulate the future intended use of any meta-data collected in the final UCMR4.

3. Source water monitoring for cyanotoxins should not be included in the final UCMR4. Instead, enzyme-linked immunosorbent assays (ELISAs) of finished water should first be run against a low-level calibration curve (designed specifically for values below 1µg/l), (2) re-calculated for a higher level calibration curve for values that fall above 1µg/l on the low-level calibration curve. The value reported should be the value calculated using the correct calibration curve. If the sample continues to demonstrate occurrence greater than the MRL using the correct calibration curve, then the additional analysis using EPA Method 544 should also be conducted. See



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the section "Microcystins ELISA development..." for more details on calibration curves.

4. Reconsider the proposed contaminants and revise the sampling framework for UCMR4 samples. AWWA recommends:

    a. Retaining year-round monitoring,

    b. Monitoring for the nine haloacetic acids (HAA9) in conjunction with compliance monitoring and data submittal,

    c. Reducing ground water monitoring to a single event for each EPTDS, based on our analysis of UCMR3 data that shows similar concentrations between the two sampling events, and

    d. Eliminating monitoring of the proposed alcohols and germanium to keep the total number of UCMR4 contaminants under 30 with the inclusion of the 13 species of DBPs (four trihalomethanes (THMs) and HAA9).

### Integrating SDWA Policy Development

A very positive development in the UCMR4 proposal is the forethought EPA utilized to integrate data needs across both Section 1412(b)(1)(B) (regulation of unregulated contaminants) and Section 1412(b)(9) (six-year review). The cost incurred by water systems and EPA to implement unregulated contaminant monitoring is substantial and unequitable for some systems. Consequently, the contaminants included should be carefully selected so as to make the best use of limited available resources. Equally importantly, the logistics of a national data collection effort require time yet is critical to national regulatory decisions, which cannot be made without a sound understanding contaminant occurrence. Therefore, the time spent on UCMR should not be wasted monitoring for contaminants that are unlikely to be observed, and if they are observed, unlikely to pose a significant national health consequence or to provide a "meaningful opportunity for risk reduction" through a national drinking water regulation. Thousands of non-detects in past UCMRs that have not been used to make negative regulatory determinations have not been an effective use of the drinking water community's fiscal resources.

### EPA Research Agenda Should Support SDWA Contaminant Evaluation

EPA's "Safe and Sustainable Water Resources Strategic Research Action Plan 2016 – 2019" is the latest in a series of EPA research plans that do not support the Agency's mission and mandatory duties under SDWA.[1] The lack of a cohesive and robust research plan to support regulatory actions being considered under SDWA sections 1412(b)(1)(B) and

[1] EPA, Safe and Sustainable Water Resources Strategic Research Action Plan 2016 – 2019, 2015 [http://www.epa.gov/sites/production/files/2015-10/documents/strap_2016_sswr_508.pdf]



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1412(b)(9) have resulted in the UCMR4 proposal including "make do" solutions for data collection that will pose serious challenges to data interpretation. Effectively targeted research projects could much more systematically characterize the linkages between:

1. Brominated DBP formation, influent water characteristic, and treatment scenarios.
2. Available source water indicators of cyanobacteria, treatment regimes, and observed finished water cyanotoxin levels.

The statutory mandate for UCMR is to develop the national occurrence of unregulated contaminants in ***"drinking water supplied by public water systems..."*** (emphasis added). The drinking water community has successfully implemented unregulated contaminant monitoring rule requirements for more than 30 years to serve that purpose. We also know from that history that UCMR is ill-suited to researching and developing an understanding of the underlying factors for that occurrence. For examples, see previous AWWA comments on the challenges posed analyzing UCMR2 nitrosamine occurrence data with respect to disinfection practice.[2]

## Coordinating Data Systems

The UCMR4 Federal Register notice and "DRAFT Information Collection Request for the Unregulated Contaminant Monitoring Rule (UCMR 4)" are silent with respect to which data system water systems and laboratories will be instructed to submit data. EPA's UCMR electronic data reporting system, the Safe Drinking Water Accession and Review System (SDWARS) is the implied data system on pages 80 FR 76905 and 76907 (recognition of entry points to the distribution system and laboratory applications). However, the proposed UCMR4 has no substantial discussion of the data system. For the past several years, EPA has had an ongoing collaboration with the Association of State Drinking Water Administrators (ASDWA) to develop a new electronic data portal for compliance monitoring known as the Compliance Monitoring Data Portal (CMDP). CMDP is scheduled for beta testing in 2016 and going live in 2017, one year prior to the beginning of UCMR4. Appropriate alignment of UCMR4 and CMDP is important for several reasons:

1. Coordinating compliance and UCMR4 DBP monitoring would be much more informative than separate data collection efforts,
2. Coordinating Entry Point to the Distribution System (EPTDS) monitoring locations with routine monitoring sites would be a more effective use of resources; and
3. Potentially coordination of available water system treatment information.

[2] AWWA, Comments on Revisions to the Unregulated Contaminant Monitoring Regulation (UCMR 3) for Public Water Systems, Docket ID No. OW–2009–0090, 2011



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### Application of EPA Health Advisories and Reference Levels

In June 2015, EPA finalized 10-day health advisories for microcystins and cylindrospermopsin. These advisories are described by the Agency as non-regulatory and informational. In the final UCMR4, EPA needs to clearly state the non-regulatory aspects of these numbers. In some EPA regions, the current UCMR3 monitoring data is be used to require additional treatment and abandonment of wells based on the perfluorooctane sulfonate (PFOS) observations and the provisional EPA health advisory.[3] EPA has gone to considerable length to describe the cyanotoxin health advisories as 10-day levels, and that multiple toxin observations above the health advisory levels are necessary to support risk management steps by the public.[4] AWWA recommends that EPA be explicit in the final rule that a single data point from the UCMR4 monitoring data alone is not sufficient to trigger public notice for cyanotoxins.

Similarly, in UCMR3, EPA provided reference levels that were calculated using standard procedures for computing drinking water equivalent levels (DWELs).[5] Having such health reference levels can be informative for communication with the public, but complications ensue given the health endpoints being explored in the scientific literature and mass media for compounds like microcystins, cylindrospermopsin, nodularin, manganese, DBPs, etc. Therefore, AWWA recommends that EPA carefully consider the quality of the available information for such reference levels and to thoughtfully present such levels in the final UCMR4.

## Cyanotoxin Monitoring

AWWA has several concerns and recommendation to improve the proposed cyanotoxin monitoring methodologies. The issues raised bear on both the resulting UCMR4 data and the usefulness of that data for needed analyses. The ultimate goal of any UCMR is to appropriately inform future regulatory decision-making, and we believe that our recommendations will aid in optimizing the decision-making processes.

First, EPA's proposed microcystins sampling methodology includes taking both source and finished water samples. AWWA recommends that EPA remove source water monitoring from the final UCMR4, and restructure the finished water monitoring as detailed below. We believe this is the most prudent course of action for the following reasons:

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[3] EPA, Health Advisories for Perfluorooctanoic Acid and Perfluorooctane Sulfonate in Drinking Water, 2009, [http://www.epa.gov/dwstandardsregulations/health-advisories-perfluorooctanoic-acid-and-perfluorooctane-sulfonate]

[4] EPA, Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water, 2015, [http://www.epa.gov/nutrient-policy-data/guidelines-and-recommendations#health]

[5] EPA, October 2015 UCMR 3 Data Summary for Chemical Contaminants, EPA 815-S-15-003, [http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3].



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1. The purpose of the UCMR is to develop occurrence data for potential contaminants that may be present in ***"drinking water supplied by public water systems..."*** (emphasis added). Past UCMRs have monitored only at EPTDSs and at points within the distribution system. Source water monitoring is not appropriate under the UCMR regulatory framework, and should be undertaken in targeted research studies that collect treatment plant meta-data sufficient to support analysis.

2. In addition to the potential for existing treatment to remove cyanotoxins, treatment can also lead to the release (*e.g.*, oxidant addition) or concentration of toxins (*e.g.*, recycle streams). Using the "phased" microcystins methodology would miss both processes that increase cyanotoxins within the plant and processes that decrease cyanotoxins within the plant.

3. Because water takes time to travel through a treatment facility, sampling methodologies meant to determine treatment effectiveness must accurately account for travel time from source to the EPTDS. Taking simultaneous source and finished samples does not provide information on treatment effectiveness, but only two different sets of data that can only be analyzed independently. Because of the complexity of determining a uniform methodology to accurately measure pre- and post- treatment concentration that accounts for travel time, such data collection is appropriate as a separate research study, not as a part of UCMR.

4. EPA's proposed use of the ELISA test for microcystins on source water samples would likely create a communication challenge for water systems. Because UCMR monitoring must be reported on the system's Consumer Confidence Report (CCR), some systems will likely have readings above 0.3 µg/l in source water samples, but then non-detect in finished water samples. Consequently, these systems will report a positive source water monitoring result on their CCR. The CCR is designed to help consumers understand their drinking water quality. The inclusion of source water data, when the contaminant of concern was not actually found in the water delivered to customers, will further complicate the CCR and public understanding of their system's water quality.

5. Research on the treatment of microcystins consistently shows that very low levels of extracellular microcystins are removed with conventional water treatment, and intracellular microcystins are removed through flocculation, coagulation, and filtration processes. The phased monitoring methodology that EPA has proposed fails to account for the best available science in setting the source water screening level (0.3 µg/l). The proposed screening level is lowest readable value in the most commonly used ELISA methods, and even is typically considered "semi-quantitative". Water systems with low readings would nearly always have non-detects in finished water. The current combination of sample location and screening value contributes to implementation

burden without adding new information, as the literature has already shown that conventional treatment and disinfection remove very low levels of microcystins.

6. Removing source water monitoring would simplify the analytical method requirements. The Ohio EPA ELISA method, which is expected to share most characteristics with the EPA standard ELISA method currently in development, requires several rounds of freezing and thawing to lyse any cyanobacteria cells present in the sample and release all of their stored toxins. Conventional water treatment in most instances will remove all or nearly all of the cyanobacteria and all of the intracellular toxins contained within those cells will not be present in finished water. Unlike source water monitoring, which would require both lysed and not-lysed samples to capture both total and extracellular microcystins, finished water monitoring does not require lysing.

In summary, AWWA is concerned that the quality of occurrence data in drinking water generated by the phased methodology for microcystins would be poor. Eliminating source water monitoring and instead monitoring finished water directly, using the methodology proposed below, would generate much higher quality occurrence data that would be more useful for the purposes of determining both national occurrence and deciding whether there is or is not a meaningful opportunity for risk reduction under a future regulation.

In place of source water monitoring, EPA should restructure microcystins monitoring in finished water using the following protocol:

1. Samples to run finished water ELISA and LC/MS/MS (EPA Method 544) should be taken simultaneously.
2. ELISA results for any sample should be compared against a low-level calibration curve designed for greatest accuracy of values less than 1µg/l.
3. If the sample result is above the low-concentration calibration range, then the sample result should be compared against a higher concentration calibration curve designed for accuracy above 1µg/l.
4. The reported result should be the result using the correct calibration curve. For ELISA values above the MRL at the correct calibration curve, EPA 544 should also be run and reported.

EPA should carefully consider all of these comments to assure that useful data is on microcystins is generated without creating an overly large burden on public water systems and contributing to the other issues mentioned throughout the comments.



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## Microcystins ELISA Method Development and Lab Certification

As EPA is well aware, the ELISA calibration is logarithmic in nature.[6] Therefore, if the most accurate results are needed at relatively low levels (e.g. 0.3 µg/l), then the calibration accuracy in that range is critical. Most detected values in UCMR are expected to be at the low end of the calibration range, if detected at all. ELISA is typically calibrated over a range from 0.15 to 5 µg/l and there is seldom clear guidance regarding dilution in the test kits. AWWA recommends that in the development of the EPA version of an ELISA method, the EPA ELISA method requires that initial measurements be conducted against a calibration curve that goes no higher than 1 µg/l (e.g. 1 order of magnitude) and, if values are over-range, they should be re-calculated against either the full calibration range or that portion of the calibration range that goes from 1 to the high end. As EPA typically includes requirements for back calculation and acceptance criteria in methods, we assume this will be taken into consideration. AWWA recommends that EPA focus on evaluating calibration ranges to ensure greatest accuracy and precision, especially because values above the MRL (currently 0.3 µg/l) will trigger the more expensive LC/MS/MS method. Note also that this does not take into consideration the different responses of microcystin variants. Therefore, the more precise EPA can make their ELISA method, the lower the overall uncertainty.[7]

Use of ELISA as a screening measure under UCMR4 to measure total microcystins is only appropriate if EPA can demonstrate the method meets all applicable quality control measures expected of an EPA Standard Method. Although we commend Ohio EPA for leading initial method development, EPA should not assume that Ohio EPA has already completed all of the appropriate quality assurance/quality control (QA/QC) measures expected of an EPA standard method that is to be applied nationally. AWWA recommends that EPA independently verify all necessary procedures and performance information of the method during method development. There may be too many unknowns about interactions with degradation byproducts, interferences from other compounds, and different, but unknown, sensitivities to different congeners to pass appropriate QA/QC. EPA should be prepared to pursue alternate sampling methodologies if the ELISA method currently in development cannot pass appropriate QA/QC criteria.

Additionally, according to the UMCR4 laboratory certification manual, laboratories must be able to accurately measure down to 1/3 of the MRL to achieve certification. Given a proposed MRL of 0.3 µg/l for total microcystins, meeting the proposed certification criteria requires accurately measuring to 0.1 µg/l. It is not clear laboratories can achieve this level of performance on a consistent basis, posing a serious laboratory certification problem.

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[6] For illustratory purposes see Abraxis Microcystins/Nodularins (ADDA), ELISA Microtiter Plate Kit's User Guide, http://www.abraxiskits.com/wp-content/uploads/2014/08/Microcystin-PL-ADDA-Users-Guide-ETV-R082714.pdf (downloaded February 3, 2016).

[7] Abraxis Microcystins/Nodularins (ADDA), ELISA Microtiter Plate Kit's User Guide, http://www.abraxiskits.com/wp-content/uploads/2014/08/Microcystin-PL-ADDA-Users-Guide-ETV-R082714.pdf (downloaded February 3, 2016)



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Current ELISA methods only become semi-quantitative at 0.3 µg/l (+/- 50%) and it may not be realistic to detect down to 0.1 µg/l. EPA should carefully consider revising its performance criteria for microcystin analysis by ELISA when setting this threshold value and while testing its standard method under development. The Abraxis ADDA test has a manufacturer-supplied MRL of 0.15 µg/l. This manufacturer MRL would require EPA to either have 0.45 µg/l or higher UCMR MRL, or to change the laboratory certification processes and requirements. Any change to those requirements needs to be based upon good science.

Alternatively, EPA could fast track the development of its upcoming MMPB method, which is expected to be both more reliable and deliver more granular information for potential regulatory decision making. EPA could then add the MMPB method to UCMR as soon as it is available.[8] For this reason, and for other reasons described below, AWWA recommends that EPA raise the MRL for the ELISA method to at least 0.45 µg/l if the current Abraxis ADDA test is used, or higher if analysis of EPA's standard method currently in development indicates a higher MRL is appropriate.

Additionally, EPA Method 544 is currently used rarely and only by a handful of laboratories. Many laboratories have developed "direct injection" methods that are more straightforward, potentially less expensive, and still have a strong sensitivity (50-100 ng/l). EPA should discuss this issue with laboratories and consider the possibility of developing an EPA standard method to reduce the overall burden compared to running EPA Method 544.

## Need for Specific Cyanotoxins Analysis Plan

AWWA is concerned about how data analysis will be performed on the cyanotoxins data collected in UCMR4 as proposed. It is well known that ELISA does not measure every microcystin congener equally. That is to say a known amount of Microcystin-LR does not yield the same result on an ELISA test as the same known amount Microcystin-LA or another congener. In some cases, the same concentration of one congener can yield a result several times greater on ELISA than another congener. For example, when a total microcystins ELISA test is calibrated using Microcystin-LR (as it most commonly is), there is the possibly that any unknown congener could either:

1. Produce 10% of the response of Microcystin-LR, yet be much more toxic and present a greater health risk, under-reporting the actual concern, or

[8] MMPB analytical method is a liquid chromatography tandem mass spectroscopy (LC/MS/MS) analysis on the 3-methoxy-2-methyl-4-phenylbutyric acid molecule (MMPB) and calibrated using a certified reference standard, currently (microcystin-LR) and 4-phenylbutyric acid.



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2. Produce 10 times the response of Microcystin-LR, yet be much less toxic and therefore over-report the actual health concern.

Therefore, making comparisons between ELISA and LC/MS/MS measurements is difficult, and in some cases, such as if unknown congeners are present, can be nearly impossible without more information. Total Microcystins as measured by ELISA is *not* equal to the congeners measured by LC/MS/MS plus unknown congeners. The translation from ELISA to LC/MS/MS is not known for every compound and circumstance. Additionally, the sensitivity of ELISA known for many congeners is unknown. Finally, it is thought that ELISA picks up some cyanotoxin oxidation degradates, falsely implying greater concern than warranted by the substance that is actually present. Therefore, we recommend that EPA create a clear, transparent plan for the analysis of UCMR data to address these complexities prior to the collection of the data.

## Additional Cyanotoxins Concerns

AWWA requests that EPA explain the benefit of monitoring for nodularin based upon a total microcystins trigger. Many do not consider nodularin to be a microcystin, although it does share some structural similarities with microcystins. We cannot foresee any scenarios where this proposed methodology yields any conclusions on national occurrence for nodularin, and it appears to be included only because it is part of the EPA 544 analytical method. Simply being part of the EPA 544 method is not appropriate for the inclusion of another compound in the final UCMR4 that does not appear to inform any future regulatory decision-making.

In the supporting cost analysis, EPA has used the presumption that 20% of surface water raw / intake ELISA samples will read as 0.3 µg/l or greater. AWWA does not agree that this frequency is supported by the available evidence. There are good reasons to expect the frequency could be substantially higher. Given the potential for interference by other compounds, the tendency for ELISA to generate false positive results, and the intentional biasing towards finding greater occurrence (by concentrating the sampling in warmer months) it is more likely that the cost assumptions are incorrect. Again, AWWA recommends that EPA eliminate source water monitoring from the sampling methodology for microcystins. With this elimination, EPA will be able to more accurately estimate the projected cost of conducting sampling directly on finished water.

## Monitoring to Inform DBP Risk Management

AWWA supports the collection of occurrence data in UCMR4 in order to inform evaluating risk management decisions regarding DBPs. The development of the current DBP standards reflect an extensive body of research and substantive, fact-based, stakeholder dialogue. To make changes in the existing DBP – microbial disinfection framework will require a careful consideration of off-setting and overlapping risk management challenges.



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Given the potential for unintended, undesirable impacts, AWWA urges EPA to set objectives for UCMR4 that effectively utilize this national occurrence survey's strengths and minimizes its weaknesses. UCMR4's objectives should fit within a cohesive research and information collection strategy that includes:

1. A clearly articulated vision of data and information needs to support future risk-management decisions,
2. A cohesive research plan that reflects what information is to be developed through EPA intra- and extramural research,
3. Occurrence gaps that UCMR4 will fill, and
4. A process for engaging the drinking water sector to leverage EPA's work.

Such a strategy would need to extend beyond occurrence and treatment to health effects. While EPA has posited a premise for focusing on brominated DBPs in future decision-making, a substantive debate is ongoing on whether the drinking water community presently has sufficient evidence to warrant changing treatment practice.[9, 10] The balance of AWWA's comments on UCMR4 assume that brominated DBPs will be a substantial component of future risk management and the question at hand is what information from UCMR4 monitoring would most appropriately inform those decisions.

The proposed UCMR4 appears to incorporate the following elements to support DBP risk management evaluation:

1. The collection of HAA5, HAA6Br, and HAA9 samples from current distribution system compliance monitoring locations for the purpose of estimating the national occurrence of unregulated brominated HAAs while staying within the UCMR monitoring cap of 30 contaminants.
2. The collection of total organic carbon (TOC) and bromide at LT2ESWTR (or similar) source water monitoring locations to inform modeling the linkage between influent water quality and observed DBP formation.
3. Temperature and pH at LT2ESWTR (or similar) source water monitoring locations to inform modeling the linkage between influent water quality and observed DBP formation.

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[9] Regli, S., J. Chen, M. Messner, M.S. Elovitz, F. J. Letkiewicz, R.A. Pegram, T.J. Pepping, S.D. Richardson, and J. M. Wright, "Estimating Potential Increased Bladder Cancer Risk Due to Increased Bromide Concentrations in Sources of Disinfected Drinking Waters, 2015, Environ. Sci. Technol., 2015, 49 (22), pp 13094–13102. http://dx.doi.org/10.1021/acs.est.5b03547

[10] Hrudey S.E., Backer L.C., Humpage A.R., Krasner S.W., Michaud D.S., Moore L.E., Singer P.C., Stanford B.D., Evaluating Evidence for Association of Human Bladder Cancer with Drinking-Water Chlorination Disinfection By-Products, ,J Toxicol Environ Health B Crit Rev. 2015;18(5):213-41. doi: 10.1080/10937404.2015.1067661.

4. Data element, including primary and secondary disinfection practice and treatment information for each sample, in order to distinguish differences in DBP occurrence as a function of disinfection and treatment practice.

AWWA supports each of the above data collection objectives but does not agree that the data collected as proposed will be informative or that UCMR is the appropriate mechanism to develop data to inform the analyses envisioned.

### Applicability of HAA Monitoring

As currently proposed, HAAs are a part of Assessment Monitoring and as such must be monitored by all systems serving more than 10,000 population served. Additional regulation of HAAs would be through a potential revision of existing DBP regulations. The current DBP regulations only apply to systems that employ a chemical disinfectant. For purposes of UCMR4, EPA could substantially reduce the complexity of the data collection effort and reduce the burden of the rule on undisinfected water systems by only collecting HAA data from systems subject to the existing DBP regulations. Such an approach does inadvertently bias exposure toward systems with the potential for higher levels of HAAs but is adequate to inform the potential revision of existing DBP regulations.

### Analysis Supported by Proposed Data Collection Is Superfluous

AWWA agrees with EPA that the Agency should have actual occurrence distributions of contaminants in finished water for evaluating future regulatory decisions. This is what the SDWA requires, and is particularly true of DBPs where additional regulatory action will require modelling to estimate the impact of potential risk management strategies. The proposed collection of HAA5, HAA6Br, and HAA9 will involve significant time and expense to collect data that is not a great deal more useful than analyses that can be conducted with data already available to EPA. Attachment A illustrates how well-recognized relationships, like bromide incorporation factor (BIF), can be used to achieve the same level and quality of information that will be accrued through the proposed data collection.

### Suggestions to Streamline and Enhance HAA Data Collection

EPA should explicitly list the individual brominated HAA species not captured by current monitoring for HAA5. Those species are:

1. bromochloroacetic acid,
2. bromodichloroacetic acid,
3. chlorodibromoacetic acid, and
4. tribromoacetic acid.



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This data should be obtained by analyzing Stage 2 DBPR compliance samples for HAA9 rather than HAA5. The four currently regulated THM species data should be reported for the same samples as well.

Samples processed for compliance with UCMR4 will be of sufficient quality to allow submitting the sum of dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, and trichloroacetic acid for compliance with Stage 2 DBPR. Such dual use of UCMR monitoring results has occurred previously and, if appropriately framed, will both improve the data available to EPA for analysis and help water systems manage the burden presented by compliance with the final UCMR4.

Stage 2 DBPR compliance monitoring is currently filed with state primacy agencies through either unique state data systems or SDWIS State, while UCMR1, 2 and 3 results have been submitted through SDWARS. These two systems are separate but not incompatible. EPA is presently developing CMDP, and it is scheduled to be operational a year prior to the beginning of UCMR4 monitoring. Utilizing a single data portal for submitting both compliance and UCMR data is appealing for multiple reasons, provided that the data portal is stable, easy to use, and thoroughly beta tested with users prior to implementation. Benefits could include:

1. A single HAA data submittal that would fulfill both compliance and UCMR4 requirements.
2. Collection of both individual TTHM and HAA species concentrations along with regulatory required TTHM and HAA5 sums.

### Utility of Source Water Bromide and TOC Data Collection

AWWA agrees with EPA that both bromide and TOC data should be collected to inform future technical analyses to support any potential DBP risk management decisions. AWWA does not concur with the premise that collecting bromide and TOC with the other data collected in UCMR4 are sufficient to develop an informative model of brominated DBP occurrence. As has been illustrated by previous dialogues around DBP/microbial risk management, understanding the underlying mechanisms of DBP formation and the complex relationships between treatment and DBP formation and degradation is important to regulatory option analysis. Consequently, AWWA suggests that targeted research studies investigating treatment alternatives, bromide and TOC control, other treatment options, and DBP formation considerations be developed.

Use of CMDP would again be helpful as a data collection alternative in lieu of UCMR. TOC removal is already a requirement for all surface water treatment plants in the US. Consequently, a substantial body of data is already being collected on influent and effluent TOC at existing water treatment plants. This data would inform both understanding DBP occurrence and our understanding of how much additional TOC reduction is potentially

available to any potential future risk management activities. Collecting TOC data from existing state data systems is challenging, but CMDP is anticipated to facilitate compiling data from existing regulatory monitoring and reporting requirements.

A better understanding of bromide occurrence will be necessary to support Agency activity. Again, this need extends beyond the capacity of UCMR monitoring. In this instance, an updated national distribution of bromide occurrence is needed, as well as an understanding of the temporal trends and regional trends in both surface and ground water supplies. Data of this type is probably best developed through a collaborative effort with USGS and dedicated research projects that evaluate not only conventional sources of water supply that currently dominate water supply portfolios but also investigate implications of using more challenging waters as water supply alternatives.

### Temperature and pH

It is not clear from the UCMR4 Federal Register notice whether EPA intends to use the collected temperature and pH data to inform evaluation of the DBP occurrence data. AWWA would strongly discourage the Agency from attempting such an approach. The collection described in the notice is for temperature and pH to be monitored in source water at the time of cyanotoxin sampling. Such samples are:

1. Not clearly connected in time with the HAA samples, and
2. Reflect source water conditions, not conditions during treatment and finished water that are pertinent to DBP formation.

AWWA recommends that disinfectant residual, temperature and pH be collected and reported at the same time as the sampling for the four THMs and HAA9 at compliance monitoring sample locations.

### Primary and Secondary Disinfection Practice and Treatment Information

As previously stated, a cohesive research plan is needed to collect data that is useful for the questions most pertinent to future risk management steps. For example, while the proposed UCMR4 collects information on TOC and bromide, it does not collect the equally, if not more, important information on oxidant addition, oxidant order of application, oxidant dose, and oxidant contact time. It should be noted that AWWA is not recommending that these be included in the final UCMR4, as these are more appropriate for targeted research studies. Consequently, the proposed UCMR4 does not, and is unlikely to, collect sufficient information to support such efforts as modeling of DBP occurrence as a function of water quality parameters and treatment.

However, AWWA recommends that the final UCMR4 collect the primary and secondary disinfectant practice in place at the time of DBP sampling. This data is critical to even



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simple evaluations of the UCMR occurrence data and is fundamental to better targeting future research.

AWWA agrees that the UCMR4 data is more informative when there is information describing the associated treatment. However, collecting this data has been problematic in previous UCMRs. If UCMR4 data were collected through CMDP as AWWA recommends, connecting the UCMR4 data to the treatment plant description maintained as a part of routine system reporting to the state is possible. Unfortunately, in the near term, at least two issues are barriers to such an approach:

1. Previous EPA analyses have found that, historically, the State data for nonparametric data elements is less complete and more likely to be inaccurate than compliance data. So, in the near-term, UCMR4 may not be able to rely exclusively on data from the state data systems and some type of hybrid data collection approach may be needed.
2. The effort to implement CMDP will not include collection of nonparametric data so the data system renewal at the federal level that would result in a refresh and updated tool for this data will not be available until PRIME is developed and implemented. PRIME's development timeline is undeterminable at this point.

## Removal of Alcohols and Germanium from UCMR4

AWWA recommends that EPA remove the Alcohols (1-butanol, 2-methoxyethanol, and 2-propen-1-ol) and germanium from UCMR4. These compounds are of low toxicity and it appears unlikely to have widespread national occurrence at levels of concern. Therefore, there is not likely to be any significant opportunity for risk reduction as required by the contaminant selection process. Therefore, we request that EPA remove these compounds to make room for higher priority data collection actions recommended elsewhere in AWWA's comments.

## Requests for Comment

*"EPA invites comment on the proposed UCMR 4 contaminants and their associated analytical methods identified in Exhibit 3, as well as any other priority contaminants commenters wish to recommend."*

In commenting on the draft CCL4, AWWA specifically recommended listing individual microcystins (i.e., MC-LR, –LA, -LW, -RR, and –YR) as well as cylindrospermopsin and anatoxin A. In keeping with AWWA's earlier recommendation, we concur that if appropriate methods and sampling methodologies are used, that occurrence data for these cyanotoxins is important and a high priority for inclusion in UCMR monitoring.



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## Selected Analytical Methods for Proposed Contaminants

AWWA reviewed the analytical methods proposed by EPA in the proposal, summarized in Exhibit 1.

Exhibit 1. Overview of Proposed UCMR4 Analytical Methods and Associated Issues

| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 1 | Total microcystins | * | * | ELISA Standard Operating Procedure (SOP) (Ohio EPA, 2015). | 0.3 |
| 2 | Microcystin-LA | * | 0.3 | EPA Method 544 | 0.008 |
| 3 | Microcystin-LF | * | 0.3 | | 0.006 |
| 4 | Microcystin-LR | 0.021 | 0.3 | | 0.02 |
| 5 | Microcystin-LY | * | 0.3 | | 0.009 |
| 6 | Microcystin-RR | * | 0.3 | | 0.006 |
| 7 | Microcystin-YR | * | 0.3 | | 0.02 |
| 8 | Nodularin | ? | NA | | 0.005 |
| 9 | Anatoxin-a | ? | NA | EPA Method 545 | 0.03 |
| 10 | Cylindrospermopsin | 1.6 | 0.7 | | 0.09 |
| 11 | Germanium | 0.744 | 7.44 | EPA Method 200.8 | 0.3 |
| 12 | Manganese | 300 | 300 | SM 3125<br>SM 3125–09<br>ASTM D5673–10 | 0.4 |



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| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 13 | alpha-Hexachlorocyclohexane | 0.006 | 0.006 | EPA Method | 0.01 |
| 14 | Chlorpyrifos | 2 | | 525.3 | 0.03 |
| 15 | Dimethipin | 153 | 153 | | 0.2 |
| 16 | Ethoprop | 0.7 | 1.25 | | 0.03 |
| 17 | Oxyfluorfen | 0.478 | 210 | | 0.05 |
| 18 | Profenofos | 0.35 | 0.35 | | 0.3 |
| 19 | Tebuconazole | 210 | 210 | | 0.2 |
| | total permethrin | 3.65 | 3.65 | | 0.04 |
| | *i.e.* | | | | |
| 20 - 23 24 25 | *The combined concentration of 4 distinct stereoisomers of (3-Phenoxyphenyl)methyl ester 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylic acid* | 3.65 | | | 0.07 |
| | Tribufos | | 7 | | |
| | HAA5 | | | EPA Method | -- |
| | HAA6Br | | | 552.3 | -- |
| | HAA9 | | | | -- |
| | *i.e.* | | | | |
| 26 | *Bromochloroacetic acid* | -- | | | *0.3* |
| 27 | *Bromodichloroacetic acid* | -- | | | *0.5* |
| 28 | *Chlorodibromoacetic acid* | -- | | | *0.3* |
| 29 | *Tribromoacetic acid* | -- | | | *2.0* |
| 30 | *Monobromoacetic acid* | -- | | | *0.3* |
| 31 | *Dibromoacetic acid* | -- | | | *0.3* |
| 32 | *Dichloroacetic acid* | 0.7 | 0 | | *0.2* |
| 33 | *Monochloroacetic acid* | 70 | 70 | | *2.0* |
| 34 | *Trichloroacetic acid* | 20 | 20 | | *0.5* |
| 35 | 1-butanol | 700 | 700 | EPA Method | 2.0 |
| 36 | 2-methoxyethanol | 21 | 21 | 541 | 0.4 |
| 37 | 2-propen-1-ol | 35 | 35 | | 0.5 |
| 38 | butylated hydroxyanisole | 0.581 | 0.581 | EPA Method | 0.03 |
| 39 | o-toluidine | 0.194 | 0.194 | 530 | 0.007 |
| 40 | quinolone | 0.01 | 0.01 | | 0.02 |
| 41 | bromide | | | | |
| 42 | pH | | | | |
| 43 | Temperature | | | | |



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| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 44 | Total Organic Carbon | | | | |

Sources: HRLs included are from EPA HAs, Proposed CCL4 Notice Support Documents, CCL3 Support Documents, Stage 2 Disinfectant and Disinfection Byproduct Rule, and 2012 Drinking Water Standards and Health Advisories [11,12,13,14,15]

To allow for a robust analysis of HAA occurrence, AWWA suggests focusing on augmenting data collection through CDMP. While collecting secondary disinfectant residual values at the time of compliance DBP monitoring is not a typical practice, such information will be important to understanding observed HAA levels. Consequently, in addition to monitoring for HAA9 through augmenting routine compliance monitoring data collection, systems should collect pH, temperature, and either free or total chlorine concentrations as appropriate to the secondary disinfectant in use at the time and location of DBP sample collection. Field DPD observations using handheld colorimeters will be appropriate for collecting this data. Since field technicians are water system staff and not approved by EPA for UCMR monitoring, EPA will need to revise its current regulatory language on processing of UCMR samples at UCMR approved laboratories. For purposes of UCMR4 monitoring the existing analytical method performance should be sufficient for this data collection activity.[16]

*"EPA will consider raising MRLs if the Agency becomes aware of evidence that a proposed MRL is unattainable or impractical."*

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[11] EPA, 2015, 2015 Drinking Water Health Advisories for Two Cyanobacterial Toxins, 820F15003, http://www.epa.gov/nutrient-policy-data/drinking-water-health-advisory-documents (Accessed 1/3/2016)

[12] EPA, 2015, Contaminant Information Sheets (CISs) for the Draft Fourth Preliminary Contaminant Candidate List (PCCL 4) Nominated Contaminants, EPA 815-R-15-003, http://www.epa.gov/sites/production/files/2015-01/documents/815r15003.pdf (Accessed 1/3/2016)

[13] EPA, 2009, Contaminant Information Sheets for Final CCL3 Chemicals, EPA 815-R-09-012, http://nepis.epa.gov/Exe/ZyNET.exe/P100576U.TXT?ZyActionD=ZyDocument&Client=EPA&index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000011%5CP100576U.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL (Accessed 1/3/2016)

[14] EPA, 2006, 71 FR 388

[15] EPA, 2012, Drinking Water Standards and Health Advisories, EPA 822-S-12-001, http://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf (Accessed 1/3/2016)

[16] 40 CFR 23 and 40 CFR 131



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In the proposed UCMR4, EPA describes its rationale for use of methods with minimum reporting levels that are lower than the health reference levels for the target analytes in UCMR4. The notice does not describe the HRLs for the majority of the UCMR4 contaminants. A retrospective review of available EPA documents found a number of analytes measured in the proposed UCMR4 for which the Agency has not previously identified an HRL.[17] In other instances, the Agency has found that there was insufficient information to compute an HRL (*e.g.*, anatoxin a, nodularin, and individual microcystins other than microcystin LR). Recognizing the limited nature of available health effects information for a number of the target contaminants, AWWA encourages the Agency to place greater value on the robustness of the reliability of the analytical methods employed in UCMR.

If EPA moves forward with the proposed analytes, the Agency should clearly and transparently communicate its rationale for each proposed analyte so that water systems that have positive observations have a sound basis for communication with the public about perceived risk.

*"[Inclusion of] the following contaminants that were considered by the workgroup, but not included in the proposed list because they were deemed a lower UCMR 4 priority than the contaminants identified in Exhibit 3: Legionella pneumophila and Mycobacterium avium (both are part of the draft CCL 4); ammonia (considered as an indicator of distribution system nitrification potential); and the pesticides vinclozolin, hexazinone and disulfoton (additional analytes in EPA Method 525.3)."*

AWWA supports the inclusion of manganese in the final UCMR4. In its comments on the Draft CCL4, AWWA recommended that manganese be included in the group for a future UCMR, and the timing is such that inclusion in the final UCMR4 is appropriate.

AWWA has noted the importance of *Legionella pneumophila* and *Mycobacterium avium* for several iterations of the SDWA CCL process.[18] While AWWA views these organisms as significant, we agree with EPA's rationale for not including these contaminants on the proposed UCMR4 and agree that they should not be included on the final UCMR4. AWWA's comments on CCL4 observed the need for a cohesive, risk-management oriented research

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[17] The HRLs referenced in EPA's January 2016 webcast generally mirror those available from previously available documents, see "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems" Public Webinar, January 13, 2016.

[18] AWWA Comments on Proposed CCL3 (May 2008, Docket: EPA-HQ-OW-2007-1189) [http://www.awwa.org/Portals/0/files/legreg/documents/AWWACCL3Comments.pdf] and AWWA Comments on Proposed CCL4 (April, 2015, Docket: EPA-HQ-OW-2012-0217) [http://www.awwa.org/Portals/0/files/legreg/documents/AWWACommentsDraftCCL4.pdf]



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program for biofilm organisms including *L. pneumophila* and *M. avium*. Such a program is outside the scope of UCMR and should be conducted through separate research studies.

With respect to monitoring ammonia, AWWA does not recommend monitoring ammonia in UMCR4. The collection of ammonia in the absence of a host of other data elements would be very challenging to interpret and use constructively. A substantial body of literature exists on nitrification, including a number of papers by EPA researchers that illustrate that forecasting and controlling nitrification is not possible using a single indicator like ammonia.[19, 20] The presence of ammonia (or in the instance of nitrification, the loss of ammonia) is not a "contaminant", nor is the presence of nitrification inherently a health concern. Consequently, utility monitoring of ammonia in finished water in the final UCMR4 is not appropriate under either SDWA Section 1445(a)(2) or Section 1445(a)(1)(A).

While AWWA appreciates the Agency looking for opportunities to consolidate around groups of chemicals that can be analyzed using a single analytical method (e.g., EPA Method 525.3), it is not appropriate to include contaminants that represent little opportunity for risk reduction, because it is possible to measure them. In comments on the CCL4 proposal, AWWA indicated that there was already sufficient information for EPA to make a negative regulatory determination for disulfoton. Neither EPA or AWWA has identified hexazinone as a priority drinking water contaminant for evaluation.[21, 22] Vinclozolin is a registered pesticide; consequently, it is regulated under the Federal Insecticide, Fungicide, and Rodenticide Act and the Food Quality Protection Act. As part of re-registration EPA prepared an analysis of the risks posed by Vinclozolin and explicitly considered models of high-risk exposure scenarios via drinking water. The Agency concluded:

> "Model estimates of potential drinking water exposure from ground and surface water sources **are not of concern for vinclozolin**." [emphasis added][23]

Consequently, while Vinclosolin is proposed for inclusion on CCL4, it is not a relevant analyte for UCMR monitoring.

*"Exhibit 3 that you think represent a lower priority than your new recommendation(s) or that should otherwise be removed from the list; the recommended analytical method(s) for any new*

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[19] Odell, L.H., G.J. Kirmeyer, A. Wilczak, J.G. Jacangelo, J.P. Marcinko, R.L. Wolfe, Controlling Nitrification in Chloraminated Systems, 1996, Journal AWWA, page 86 – 98.
[20] AWWA, Nitrification Prevention and Control in Drinking Water, AWWA Manual M56, Second Edition, 2013.
[21] EPA CCL4 Docket: EPA–HQ–OW–2012–0217
[22] AWWA, AWWA Recommendations for Contaminant Candidate List 4 (CCL4), 2015, [http://www.awwa.org/Portals/0/files/legreg/documents/2015CCLAWWAReport.pdf]
[23] EPA, RED Facts, Vinclozolin, EPA-738-F-00-021, 2000, [http://iaspub.epa.gov/apex/pesticides/f?p=CHEMICALSEARCH:31:::NO:1,3,31,7,12,25:P3_XCHEMICAL_ID:4400]



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*contaminant(s) that you propose; and other relevant details (e.g., reporting level, sampling location and sampling frequency)."*

AWWA's CCL3 comments identified a number of contaminants with higher priority for collection of occurrence information, specifically: 1,4-dioxane, molybdenum, and 1,1-dichloroethane. These three contaminants are being monitored in UCMR3 and despite 0, 34, and 1 water systems to-date, respectively, observing these high priority contaminants at levels above the health reference level.[24]

EPA's proposed UCMR4 already includes many of the contaminants AWWA identified in its CCL4 analysis: anatoxin-a, cylindrospermopsin, microcystin-LA, microcystin-LR, microcystin-RR, and microcystin-YR, Chlorpyrifos, and manganese. AWWA also recommended monitoring the following in UCMR4:

1. microcystin-LW,
2. 3-Hydroxycarbofuran,
3. Azinphos-methyl,
4. Saxitoxin, and
5. Saxitoxin-related paralytic shellfish toxins.[25]

There is sufficient information to consider microcystin-LW, 3-Hydroxycarbonfuran, and Azinophos-methyl for inclusion in UCMR4. Exhibit 2 summarizes the relevant details for monitoring under UCMR4.

Exhibit 2. Recommended Additions to UCMR4 Monitoring

| Analyte | Available Methods | Reporting Level (µg/L) | Relevant Systems | Sampling Locations | Sampling Frequency |
|---|---|---|---|---|---|
| microcystin-LW | EPA 544 | * | Surface Water | Same as other cyanotoxins | Same as other cyanotoxins |
| 3-Hydroxycarbofuran | EPA 531,2 | 0.029 | All systems | Entry Point to Distribution System | Same as other pesticides |

[24] EPA, October 2015 UCMR 3 Data Summary for Chemical Contaminants, EPA 815-S-15-003, [http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3]. It should be noted that there are 325 systems identified with 1,4-dioxane levels observed above the 1 in 1,000,000 risk level but none above the 1 in 10,000 risk level.

[25] AWWA, AWWA Recommendations for Contaminant Candidate List 4 (CCL4), 2015, [http://www.awwa.org/Portals/0/files/legreg/documents/2015CCLAWWAReport.pdf]



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| Analyte | Available Methods | Reporting Level (µg/L) | Relevant Systems | Sampling Locations | Sampling Frequency |
|---|---|---|---|---|---|
| Azinphos-methyl | EPA 525 | ** | All systems | Entry Point to Distribution System | Same as other pesticides |

Notes:
* Reporting level should be comparable to other six microcystins which EPA proposes to monitor using Method 544. Inclusion in UCMR4 would necessitate locating a suitable standard for development of a final MRL, calibration, and QA/QC.

** Reporting level would need to be established through an inter-laboratory method performance study.

There is an opportunity to remove contaminants from the proposed UCMR4 list in order to both make room within the analyte cap set in SDWA for UCMR4 and better align the UCMR4 rulemaking with public health priorities.

## Burden and Logistics

### UCMR4 Monitoring by Groundwater Systems

AWWA recommends that UCMR4 contaminants monitoring other than DBP monitoring, be reduced to a single sample per point of entry for groundwater systems. Other comments speak to an alternative monitoring strategy for UCMR4 DBPs. Moving to a single sample per EPTDS will result in a sufficiently robust dataset for the purposes UCMR monitoring is intended to serve. This suggestion is meant to compliment not replace representative monitoring.

A detailed analysis of UCMR3 data, based primarily on the June 2015 National Contaminant Occurrence Database, but also supported by some analysis of the October 2015 NCOD release demonstrate that there is little statistical basis for UCMR4 to include 2 samples for water systems that rely on ground water supplies. Rather, a single sample would provide data of equal robustness. This general statement is true across the families of compounds analyzed in UCMR3. There were specific instances where the nature of the contaminant or analytical method does warrant consideration before reducing monitoring to a single sample per point of entry. Instances warranting more careful evaluation include:

1. Where the performance of the method leads to high variability (*e.g.*, total chromium), and
2. When the expected variations in water treatment plant operations are likely to change the concentration of the target analyte in finished water (*e.g.*, disinfection practice and chlorate).



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See Attachment 2 for a preliminary summary of this analysis.

### Basing UCMR Applicability on Retail Population

In developing UCMR3, EPA chose to base the rule's applicability on retail population. As a consequence there are unintended complications in the implementation of UCMR4 monitoring, including:

1. Where wholesalers routinely assist their consecutive systems meet monitoring requirements, the current approach penalizes a collaborative and efficient sampling strategy.
2. If UCMR only collects consecutive system data then there is not a mechanism to collect the treatment and source water data currently envisioned.
3. Is inequitable without providing higher quality data. A wholesale distribution system network will collect many more samples and incur the higher associated sampling expense than a single water system of a similar size.

AWWA recommends that where wholesale and consecutive systems offer to provide a combined monitoring framework, that UCMR4 allow such submittals. The required number of samples should be no more than required of a single city of the same service population. Since monitoring under UCMR is a mandatory responsibility, systems participating in such a combined monitoring framework would be beholden to each other with respect to rule compliance. Where consecutive systems monitor as a standalone entity, they should not be responsible under this rulemaking for source water data and treatment information. The source and treatment information targeted by this data collection effort is the responsibility of the wholesale supplier and if the submitted dataset characterized only the consecutive system, the data would be misleading during subsequent analysis.

### Transparency in Rulemaking Process

Significant UCMR4 details should have been more clearly highlighted in the proposed rule notice. Federal Register notices often require a detailed understanding of the topic at hand and it can be challenging for the Agency to highlight all significant changes from past practice and their import. But, it is not reasonable for substantial expansions of the rule's scope to be relegated to footnotes. The following are examples where the current notice, and by extension the associated Information Collection Request (ICR) do not clearly articulate the proposed data collection and the associated burden:



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1. "TOC and bromide must be collected at the same time as HAA samples. These indicator samples must be collected at a single source water intake"[26]
2. "Temperature and pH must be measured at the same time as cyanotoxin samples at the source water intake ..."[27]
3. "Systems must assign a sample event code for each contaminant listed in Exhibit 1. Sample event codes must be assigned by the PWS for each sample event.[28]

### Use of Dedicated Data Portal

The proposed UCMR4 specifies that "Information that must be submitted using EPA's electronic data reporting system must be submitted through: *http://www2.epa.gov/dwucmr*." EPA is simultaneously developing the CMDP. CMDP is scheduled to be operational in 2017. The proposed UCMR data collection substantially overlaps with data currently submitted by water systems for compliance and will be submitted through CMDP. EPA's data collection should leverage existing compliance data submittals rather than require separate testing, analysis, and reporting to a parallel data system. Use of CMDP does not test the statutory objectives of the SDWA's unregulated contaminant monitoring provision, as is the case with the proposed rule construct. Compliance data would also be more robust in that data for TOC, pH, and individual HAAs would be much denser and reflect each system's current compliance status.

### Data Elements

AWWA has commented previously that understanding UCMR contaminant occurrence necessitates collection of appropriate ancillary data elements.[29] The current proposal includes a very lengthy list of data elements and element definitions that as a practical matter will lead to data entry errors and fail in many instances to meaningfully inform subsequent data analysis. This latter point is important to bear in mind as UCMR collects a snapshot of contaminant occurrence. This snapshot is not a sufficient to intuit the effects of treatment on occurrence beyond gross categorical binning. Consequently, AWWA recommends that EPA simplify the data elements and data definitions substantially.

AWWA's earlier comments also stipulated inclusion of ancillary data elements should occur after a dialogue with stakeholders on how to effectively collect that information.[30] The proposed data definitions for treatment and UCMR4 data collection scheme are unlikely to lead to improved UCMR analysis. At a minimum EPA should:

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[26] 80 FR 76921
[27] 80 FR 76921
[28] 80 FR 76921
[29] AWWA, Comment Letter on Proposed UCMR3 (Docket ID No. OW–2009–0090), May 2, 2011.
[30] AWWA, Comment Letter on Proposed UCMR3 (Docket ID No. OW–2009–0090), May 2, 2011.



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1. Simplify the data definitions for disinfection and treatment, reducing the number of oxidant options and focusing specifically on primary and secondary disinfection.
2. Limit treatment characterization to (no treatment, primary disinfection only, conventional treatment, softening, carbon contactors, and nanofiltration/reverse osmosis).
3. Eliminate secondary disinfectant definition "CAC", where "CAC" is chlorine and chloramines being mixed.
4. Eliminate excessive QA/QC tracking, such as data elements for extraction batch identification code, extraction date, analysis date, sample analysis type, additional value, and sample event code.

As previously noted, the submittal of additional laboratory QA/QC is not a wise use of limited resources. EPA is implementing UCMR4 with limited resources and is unlikely to have the necessary support system for qualifying laboratory information management system (LIMS) data uploads prior to UCMR laboratory approval. Absent such software, the limited value provided by this additional QA/QC data is not worth the transactional burden on laboratories or the potential for water system non-compliance due to failure of EPA QA/QC review to occur in a timely manner. EPA's experience to-date with this type of QA/QC data has been limited to contractual obligations with UCMR laboratories processing small system samples – this experience is substantially different from setting a regulatory requirement to which all water systems conducting monitoring at their own expense through multiple commercial laboratories must adhere. This provision is also an impediment to AWWA's recommendation that EPA use CMDP to achieve some of the data collection objectives described in the UCMR4 proposal.

The use of the Sample Event Code data element is another opportunity for an extraneous data element to lead to inadvertent non-compliance or, a transactional cost for participating water systems and EPA. Compliance with UCMR is based on meeting the monitoring requirements. This proposed data element does not contribute toward that task but it does create the opportunity for data entry errors.

### Statistical Basis for the Small System Sample

The UCMR4 proposal preamble introduces the concept of State Implementation Plans and the statistical premise for the UCMR4 small system sample.[31] The statistical premise cited for the small system sample is an analysis prepared in 1999.[32] The referenced analysis does not address the current UCMR4's proposed changes including:

[31] 80 FR 76901

[32] EPA, Statistical Design and Sample Selection for the Unregulated Contaminant Monitoring Regulation (1999).



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1. Utilizing a stratified sampling construct for cyanotoxin monitoring,
2. Eliminating monitoring in December, January, and February, and
3. Collecting data representative of untreated source water.

While the 1999 analysis spoke directly to the size of the representative sample, it was premised solely on the objective of describing contaminant occurrence in finished water.

## Summary

AWWA supports a robust UCMR monitoring program so that EPA is able to meet its statutory requirements when determining whether or not a national regulation is needed and what an appropriate drinking water standard might be. Sound national occurrence information is critical to the regulatory determinations EPA must make in assessing whether a national regulation will provide a meaningful opportunity for risk reduction. The proposed UCMR4 is a step in the right direction for the development of sound national occurrence data, but several critical revisions are needed in the final UCMR4 for cyanotoxins, DBPs, and other issues.



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# Attachment A: Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) Extension: Brominated Disinfection Byproducts Analysis

The following report is an interim work product. The research team is preparing a paper for submission to a peer-reviewed journal. A copy of the accepted paper will be forwarded to the Agency once it is published.

CORONA | ENVIRONMENTAL CONSULTING  University of Colorado Boulder

# WITAF #266
# Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) Extension: Brominated Disinfection Byproducts Analysis

**Draft Report**

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**Prepared by Corona Environmental Consulting, LLC**

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# 1 Introduction

## 1.1 Background

Reducing exposure to disinfection byproducts (DBPs) remains a concern for the national drinking water utility community. The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) (USEPA, 2006) is the most recent regulatory change the drinking water community has addressed to reduce DBP exposure, with its April 1, 2012 compliance monitoring deadline for Community Water Systems (CWSs) and Non-Transient Non-Community Water Systems (NTNCWSs) serving at least 100,000 people. The WITAF #266 Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) study (Seidel et al., 2015), funded and directed by the American Water Works Association, was implemented to assess DBP occurrence since the implementation of the Stage 2 DBPR. The study collected DBP data from state regulatory agencies for all but five states, provided quality assurance for data from >95% of very large CWSs, and housed the data in a well-documented database. The study developed a preliminary assessment of the impacts of the Stage 2 DBPR using the compiled data, which is sufficiently representative of national DBP data to allow characterization of current DBP exposures and evaluation of trends.

Brominated DBPs are understood to pose a greater health risk than their fully chlorinated counterparts for both regulated classes of DBPs, trihalomethanes (THMs) and haloacetic acids (HAAs) (Richards et al., 2007). An important concern regarding the implementation of the Stage 2 DBPR is how the occurrence of the three brominated THM species (THM3) and six brominated HAA species (HAA6-Br) have changed overall and in comparison to changes in total trihalomethane sum (TTHM), the sum of the five regulated haloacetic acids (HAA5), and the sum of all nine haloacetic acids (HAA9), as a result of treatment changes to meet the regulation. The preliminary analysis conducted through the WITAF #266 study suggests that a decrease in chloroform concentrations, and not in the brominated THM species, may have occurred on a national scale since the implementation of the Stage 2 DBPR. This study aims to further investigate the extent of brominated DBP formation through analyzing brominated DBPs, specifically HAA9 and HAA6-Br, and bromine incorporation factor trends. Bromine incorporation factors, also known as bromine fractions, are calculated based on the relative number of bromine substitutions in the species in a given DBP class to the total number of halogen substitutions (Obolensky & Singer, 2005).

While the WITAF #266 database contains a rich temporal and geographic span of TTHM, THM species, HAA5 and HAA5 species data, data for the four unregulated haloacetic acids (HAA4) are limited. Modeling techniques for estimating concentrations of the HAA4 species allow for estimating HAA9 and HAA6-Br concentrations in instances where THM species and HAA5 species concentrations are known. The resulting modeled HAA9 and HAA6-BR occurrence data developed using the WITAF #266 database can provide insights into the impact of the Stage 2 DBPR on the occurrence of brominated DBPs on a national scale. An analysis of the brominated DBPs, specifically modeled HAA9 and HAA6-Br, will allow important questions to be answered, such as

- How have HAA9 and HAA6-Br concentrations changed over time, given the implementation of the Stage 1 and 2 DBP Rules?
- How have bromine incorporation factors changed over time, given the implementation of the Stage 1 and Stage 2 DBP Rules?



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## 1.2 Project Goals

The objectives of this project were

- Modeling brominated disinfection byproduct concentrations, specifically haloacetic acid 9 (HAA9) that is a focus of the Fourth Unregulated Contaminant Monitoring Rule, using existing data from the WITAF 266 database including total trihalomethane (TTHM) and TTHM species, haloacetic acid 5 (HAA5), and HAA5 species.
- Comparing and validating calculated bromine incorporation factor values and modeled HAA9 concentrations with observed data where available.
- Analyzing the modeled HAA9 data pre- and post-State 2 Disinfection Byproduct Rule implementation and over time and geographically.

The analysis of brominated DBPs occurrence conducted in this study provides an important understanding, particularly for future regulations that may include separate consideration of brominated THM and HAA species in addition to the currently regulated sums.

# 2 Methods and "Representativity"

## 2.1 Modeling Approach for HAA4 Species and HAA9

While the WITAF #266 database contains a wealth of data for TTHM, THM species, HAA5 and HAA5 species, there is very limited data for HAA4 species available. Modeling the HAA4 species provides an opportunity to model HAA9, as well as HAA6-Br. Modeled HAA9 and HAA6-Br concentrations can be compared with HAA5 concentrations to analyze relative changes in brominated DBPs before and after the implementation of the Stage 2 DBPR. For samples in which THM species concentrations and HAA5 species concentrations are known, HAA4 species can be estimated using the following equations:

$$[BrCl_2AA] = [Cl_3AA] \times [CHBrCl_2]/[CHCl_3] \quad (1)$$

$$[Br_2ClAA] = [Cl_3AA] \times [CHBr_2Cl]/[CHCl_3] \quad (2)$$

$$[Br_3AA] = [Cl_3AA] \times [CHBr_3]/[CHCl_3] \quad (3)$$

$$[BrClAA] = 0.5\ [\langle CHBrCl_2 + CHBr_2Cl\rangle\ Cl_2AA]/CHCl_3 \quad (4)$$

in which BrClAA, $BrCl_2AA$, $Br_2ClAA$, $Br_3AA$, $Cl_2AA$, and $Cl_3AA$ refer to the molar concentrations of bromochloro-, bromodichloro-, dibromochloro-, tribromo-, dichloro-, and trichloro-acetic acids, respectively, and $CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, and $CHBr_3$ refer to the molar concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, respectively. Eq 1-3 were developed and validated by Roberts et al. (2001) using data from the Information Collection Rule, based on equal bromine incorporation among corresponding trihalomethane species and trihaloacetic acid species relative to the fully-chlorinated species. Eq 4 was developed by Shoaf & Singer (2007) using the assumption the degree of bromine incorporation is an average of the extent of bromine incorporation in bromodichloromethane and dibromochloromethane relative to chloroform.

To validate this modeling approach, THM species and HAA9 species concentration data for a given sample event were merged together using sample information, where available, provided in the WITAF #266 database, including Sample ID, Collection Date, Sample Type, Sample Point Type, Sample Point Description, Facility Name, and Facility ID. Data records from water utilities in fourteen states included



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sufficient sample information to develop unique sample identifiers for a given sample event for merging THM species concentration data, and in thirteen states for merging HAA5 species concentration data. Sample data for merging all THM and HAA9 species in a given sample event were available for five water utilities for modeling validation. Molar concentrations were calculated for each DBP species' mass concentrations, and the HAA4 species were modeled using Eq 1-4. The corresponding mass concentrations were calculated for the modeled HAA4 molar concentrations. The observed HAA4 species concentrations were then added to the observed HAA5 species concentrations to determine the observed HAA9 concentrations, and similarly, the modeled HAA4 species concentrations were added to the observed HAA5 species concentrations to calculate the modeled HAA9 concentrations. Figure 1 shows the modeled HAA9 concentrations versus the observed HAA9 concentrations; the corresponding $R^2$ value is 0.9 demonstrating a good fit for the modeling approach based upon the limited observed HAA9 values available in the WITAF #266 database.

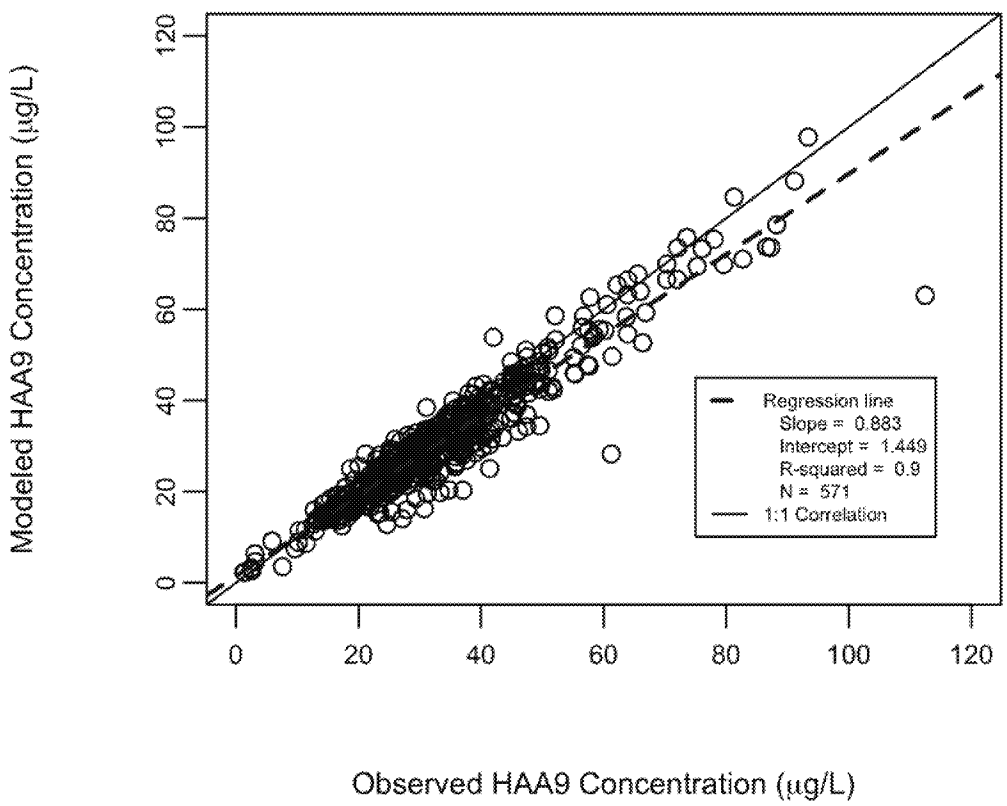


*Figure 1 Modeled HAA9 Concentration versus Observed HAA9 Concentration*

While this modeling approach illustrated in Figure 1 produced good results, HAA4 species could only be modeled for sample data from 55 systems in 13 states, due to limited sample information for merging species data. In the preliminary analysis of the WITAF #266 study, running annual averages of the 95$^{th}$ percentile concentration by PWS were validated and used as a representative non-locational statistical



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surrogate to represent locational running annual averages (LRAAs). In a similar manner, this study developed a second modeling approach by calculating quarterly 95th percentile concentrations by PWS for each THM and HAA9 species, and merging the resulting quarterly 95th percentile concentrations by PWS for modeling HAA4 species and HAA9. Using this approach, HAA4 species and HAA9 can be modeled for 243 water utilities in 23 states, which would allow for a far greater national representation in the analysis of brominated DBP occurrence.

For the quarterly 95th percentile by PWS approach, molar concentrations were calculated for each mass concentration, the HAA4 species were modeled using Eq 1-4, and corresponding mass concentrations were calculated. As with the first modeling approach where species concentrations were merged by sample information, modeled quarterly 95th percentile HAA9 concentrations by PWS were calculated by adding the modeled quarterly 95th percentile HAA4 concentrations to the observed quarterly 95th percentile HAA5 concentrations. Figure 2 shows the modeled versus observed values for the quarterly 95th percentile HAA9 concentrations. The $R^2$ value is 0.902, showing a very similar fit to the first modeling approach.

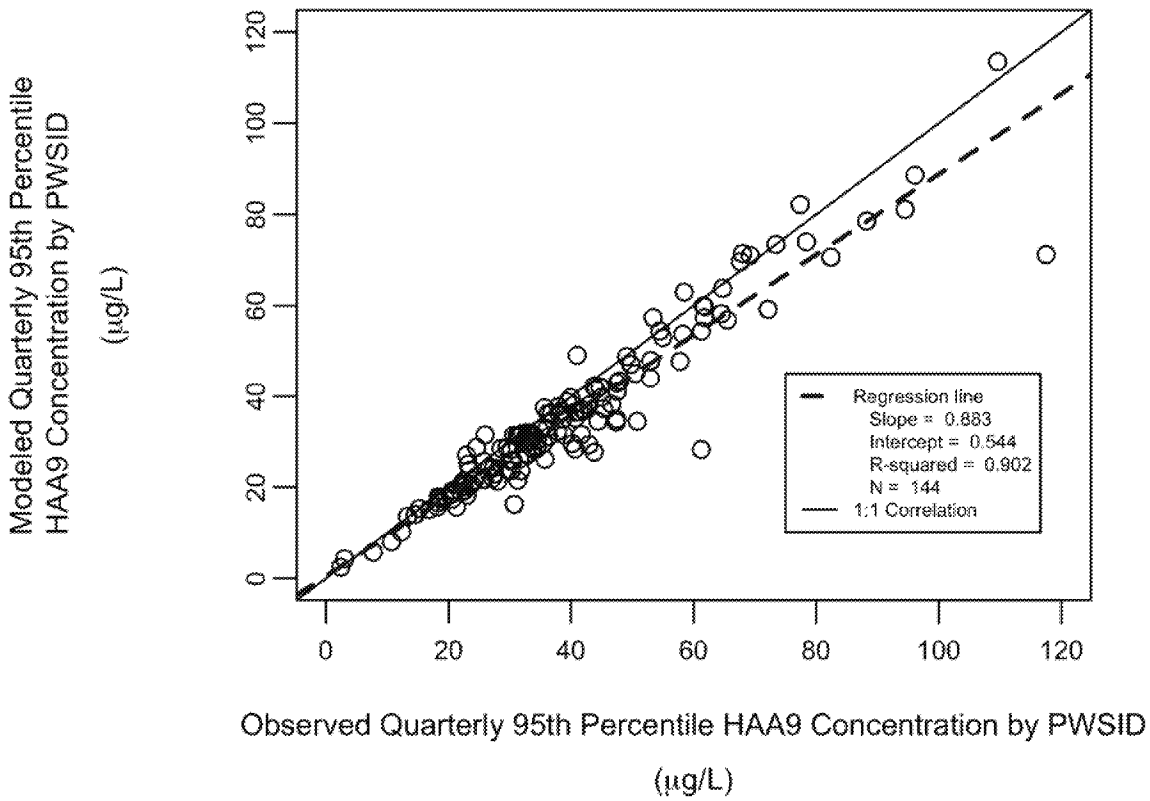


*Figure 2 Modeled Quarterly PWS 95th Percentile HAA9 Concentrations versus Observed Quarterly PWS 95th Percentile HAA9 Concentration*



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## 2.2 Approach for Calculating Bromine Incorporation Factors

The quarterly 95th percentile concentration by PWS modeling approach for HAA4 species and HAA9 can be further validated through the calculation of bromine incorporation factors (BIFs). BIFs quantify the formation of brominated DBP species within a class of DBPs relative to the total DBP formation. BIFs for THMs, dihaloacetic acids (2XAAs), and trihaloacetic acids (3XAAs) can be calculated using the following equations (Obolensky & Singer, 2005):

$$\text{THM BIF} = \frac{([CHBrCl_2] + 2\ x\ [CHBr_2Cl] + 3\ x\ [CHBr_3])}{3\ x\ ([CHCl_3] + [CHBrCl_2] + [CHBr_2Cl] + [CHBr_3])} \quad (5)$$

$$\text{2XAA BIF} = \frac{([BrClAA] + 2\ x\ [Br_2AA])}{2\ x\ ([Cl_2AA] + [BrClAA] + [Br_2AA])} \quad (6)$$

$$\text{3XAA BIF} = \frac{([BrCl_2AA] + 2\ x\ [Br_2ClAA] + 3\ x\ [Br_3AA])}{3\ x\ ([Cl_3AA] + [BrCl_2AA] + [Br_2ClAA] + [Br_3AA])} \quad (7)$$

in which BrClAA, $Br_2AA$, $Cl_2AA$, $BrCl_2AA$, $Br_2ClAA$, $Br_3AA$, and $Cl_3AA$ refer to the molar concentrations of bromochloro-, dibromo-, dichloro-, bromodichloro-, dibromochloro-, tribromo-, and trichloro-acetic acids, respectively, and $CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, and $CHBr_3$ refer to the molar concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, respectively.

BIFs were calculated for THMs, 2XAAs, and 3XAAs using Eq 5-7 using the two approaches described above for modeling HAA9. In the first approach, species concentrations data for a given sample event were merged based on sample information, and in the second approach, quarterly 95th percentile species concentrations by PWS were merged together. Once the BIFs were calculated, the distribution of BIFs for both approaches, during the two years before the Stage 2 DBPR implementation (April 1, 2010 – March 31, 2012) and for the two years after the Stage 2 DBPR implementation (April 1, 2012 – March 31, 2014) were compared to determine if they were statistically different. To do this, the 95th percentile values by PWS for the two years before the Stage 2 DBPR and the two years after the Stage 2 DBPR for BIFs from both approaches were calculated. Systems that did not have a 95th percentile value in both the two years before and the two years after were removed from the analysis. Figure 3 shows the cumulative probability distribution of the 95th percentile THM BIF values by PWS for both approaches; this analysis includes data for 52 systems in 12 states. Figure 4 and Figure 5 show the same cumulative probability distributions for the 2XAA BIF and for the 3XAA BIF, respectively. The analysis shown in both Figure 4 and Figure 5 included data for 36 systems from 9 states.



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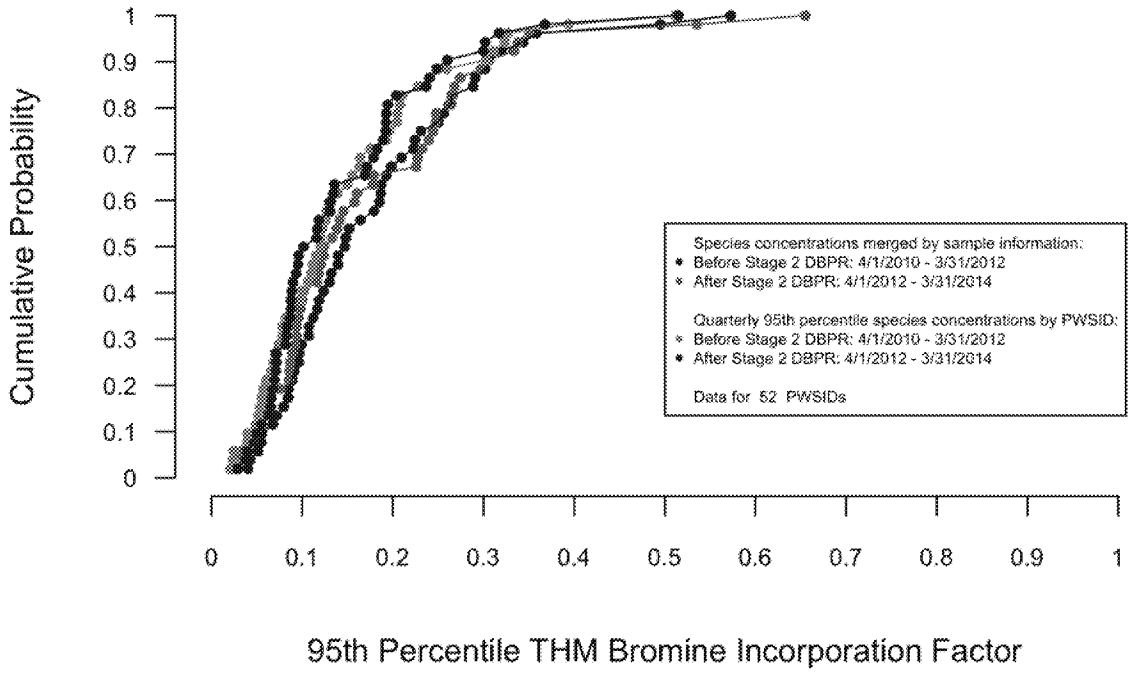


*Figure 3 Comparison of THM BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*

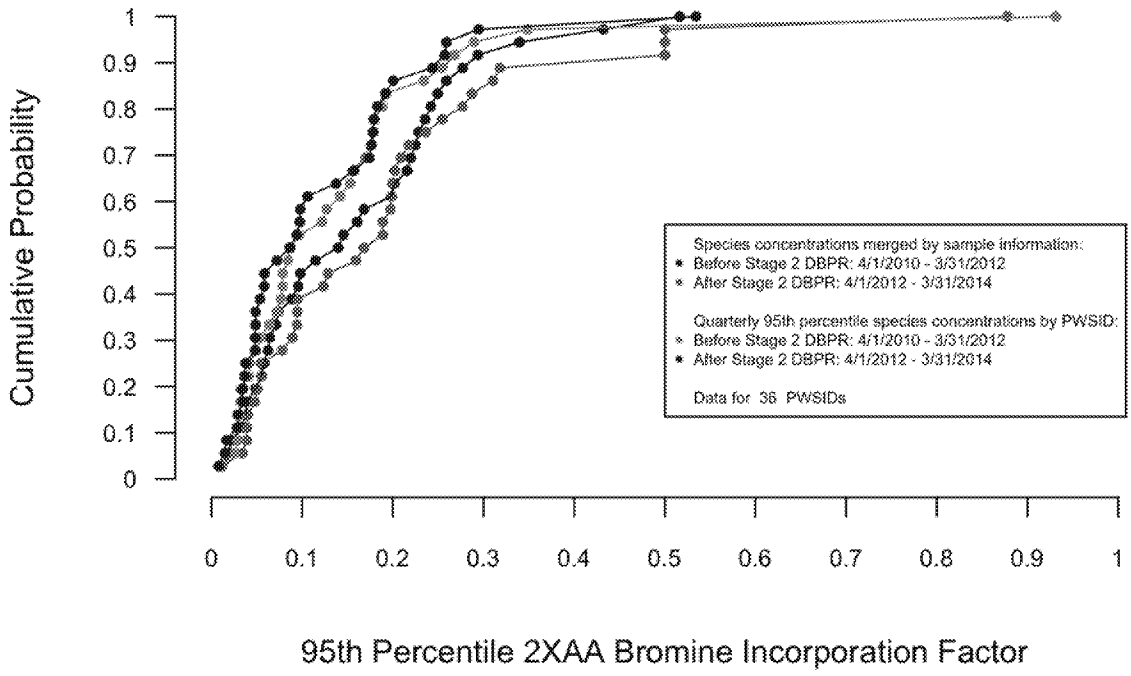


*Figure 4 Comparison of 2XAA BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*



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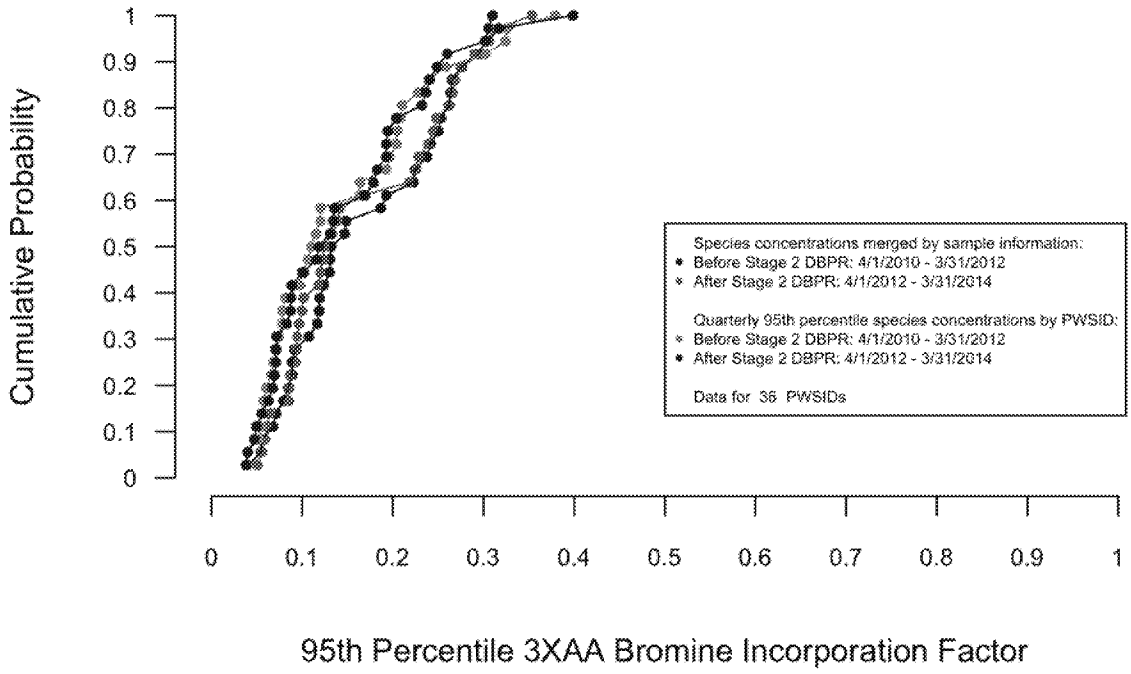


*Figure 5 Comparison of 3XAA BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*

The Kolmogorov–Smirnov (KS) two-sample test (Young, 1977) and the two *k*-sample versions of the Anderson-Darling (AD) test (Scholz & Stephens, 1987) were employed to determine if the distributions of corresponding BIFs during the same two-year time period, either the two years before or the two years after the Stage 2 DBPR, calculated through the two different approaches were statistically different. The resulting p-values for each of the tests are shown in Table 1. In all cases with a 95% confidence level, the distributions of corresponding BIFs calculated using the two different approaches are not statistically different. These findings provide justification that the approach for calculating BIFs by using quarterly 95$^{th}$ percentile species concentrations by PWS is representative of the "true" BIFs, calculated from species concentrations for a given sample event.

*Table 1 Results of Statistical Tests Comparing Distributions of PWS 95$^{th}$ Percentile BIFs Calculated Using Species Concentrations Merged by Sample Information with Corresponding PWS 95$^{th}$ Percentile Bromine Incorporation Factors Using Quarterly 95$^{th}$*

| Item | THM BIF | | 2XAA BIF | | 3XAA BIF | |
|---|---|---|---|---|---|---|
| | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* |
| *KS test p-value* | 0.07754 | 0.4206 | 0.2106 | 0.06939 | 0.3364 | 0.2123 |
| *AD test version 1 p-value* | 0.063878 | 0.40534 | 0.15616 | 0.072521 | 0.20546 | 0.24453 |
| *AD test version 2 p-value* | 0.063704 | 0.40379 | 0.15795 | 0.070525 | 0.20332 | 0.24491 |



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The results from comparing the two modeling approaches for HAA4 species and HAA9 and the two approaches for calculating the BIFs indicate the two approaches in both cases provide results that do have statistically significant difference. The sections that follow provide analysis solely based on modeling HAA4 species, HAA9, and HAA6-Br, and calculating BIFs based on quarterly 95th percentile concentrations by PWS, which is representative of results that would be seen based on using species concentrations from specific sample events.

## 2.3 National "Representativity"

The WITAF #266 database provides sufficient data for modeling HAA4 species and HAA9 concentrations, and calculating 2XAA and 3XAA BIFs using modeled species, based on quarterly 95th percentiles by PWS for 243 water utilities in 23 states. The database contains data for TTHM and HAA5 concentrations in 394 systems and 386 systems, respectively, in 44 states. An important consideration is how well the distribution of the TTHM and HAA5 concentration data in systems with sufficient data for modeling HAA9 compares to the distribution of TTHM and HAA5 concentration data in all systems where this data is available. To address this question, a similar approach as to that taken in Section 2.2 was employed. For all systems where TTHM concentrations data were available and for systems with sufficient data to model HAA9, the 95th percentile value by PWS, in the two years before the Stage 2 DBPR and in the two years after the Stage 2 DBPR, was calculated for the quarterly 95th percentile TTHM concentrations by PWS. The same analysis was conducted for HAA5 concentrations. Figure 6 shows the results for the cumulative probability distributions of 95th percentile values for TTHM data, and Figure 7 shows the corresponding results for HAA5 data.

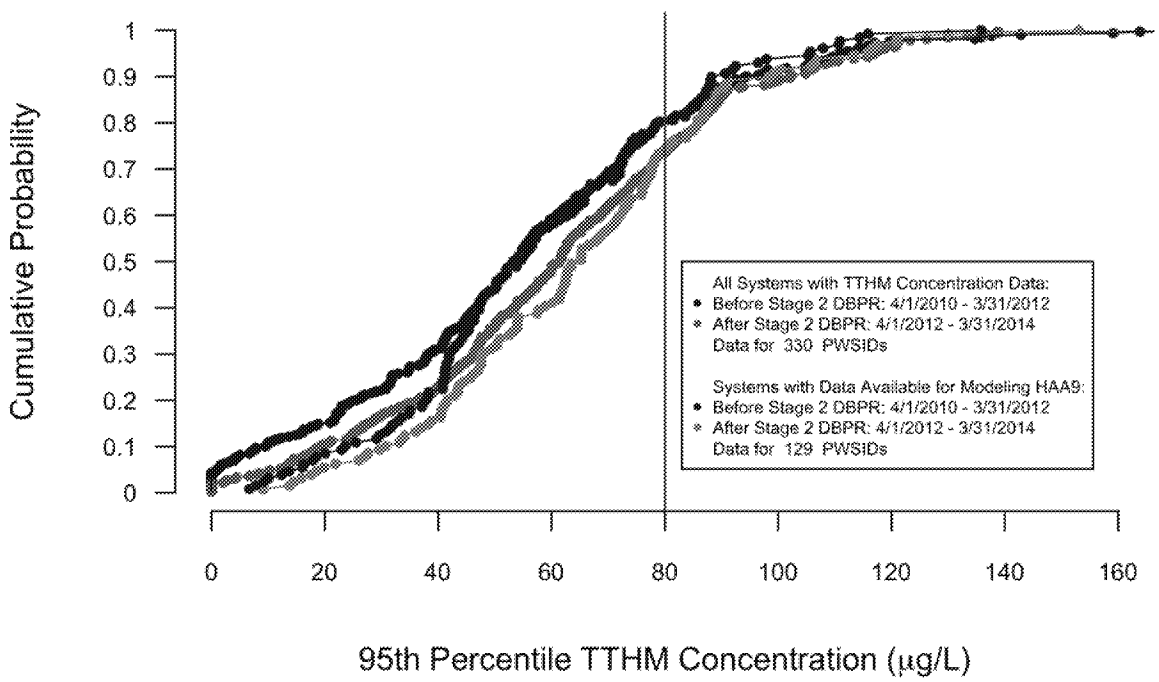


*Figure 6 Cumulative Distributions of PWS 95th Percentile Value of Quarterly PWS 95th Percentile TTHM Concentration for All Systems with TTHM Data and for Systems with THM and HAA5 Species Data for Modeling HAA9 before and after Implementation of the Stage 2 DBPR*



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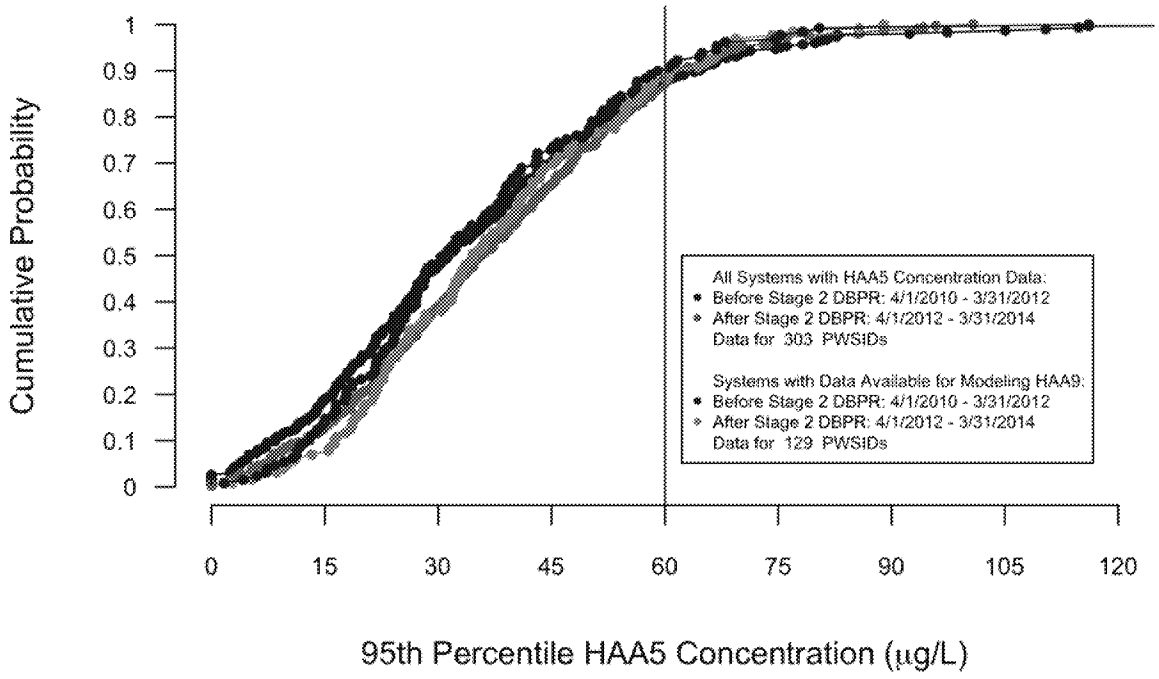


*Figure 7 Cumulative Distributions of PWS 95th Percentile Value of Quarterly PWS 95th Percentile HAA5 Concentration for All Systems with HAA5 Data and for Systems with THM and HAA5 Species Data for Modeling HAA9 before and after Implementation of the Stage 2 DBPR*

The KS two-sample test and the two *k*-sample versions of the AD test were applied to determine if there were statistically differences in the two distributions of TTHM data in each time period, and in the two distributions of HAA5 data in each time period. The resulting p-values are provided in Table 2; with a 95% confidence level, none of the distributions compared were statistically different. This result provides confidence that the distribution of modeled HAA4 species, HAA9, HAA6-Br, and the calculated 2XAA and 3XAA BIFs with modeled HAA4 species represent the "true" national distribution of HAA4 species, HAA9, HAA6-Br, and 2XAA and 3XAA BIFs.

*Table 2 Results of Statistical Tests Comparing Distributions of PWS 95th Percentile Values for Quarterly PWS 95th Percentile TTHM/HAA5 Concentrations for All Systems with TTHM/HAA5 Data with Systems with Sufficient Data for Modeling HAA9*

| Item | TTHM | | HAA5 | |
|---|---|---|---|---|
| | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* |
| *KS test p-value* | 0.1952 | 0.4972 | 0.7821 | 0.8746 |
| *AD test version 1 p-value* | 0.090358 | 0.21953 | 0.35914 | 0.69765 |
| *AD test version 2 p-value* | 0.087815 | 0.21215 | 0.35428 | 0.69304 |



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# 3 Analysis of Brominated DBP Occurrence

## 3.1 HAA9 and HAA6-Br

Analysis of HAA9 and HAA6-Br occurrence focused on modeled quarterly 95th percentile HAA9 and HAA6-Br concentrations by PWS as a representation of national HAA9 and HAA6-Br occurrence. Figure 8, Figure 9, and Figure 10 show yearly boxplots of HAA9, HAA6-Br and HAA5 quarterly 95th percentile concentrations by PWS, respectively. In each of these figures, the horizontal lines inside the boxes represent the median values, lower and upper ends of the boxes represent the 25th and 75th percentile values, the ends of the "whiskers" at the bottom and top of the boxes represent the 5th and 95th percentile values, and the circles below and above the whiskers represent values less than the 5th percentile and greater than the 95th percentile. The red horizontal line in each figure represents the maximum contaminant level (MCL) for the regulated HAA5 sum and is included as a reference point. The dataset used in this analysis is filtered so that each boxplot in Figure 8, Figure 9, and Figure 10 is based on data for the exact same 84 systems from 15 states.

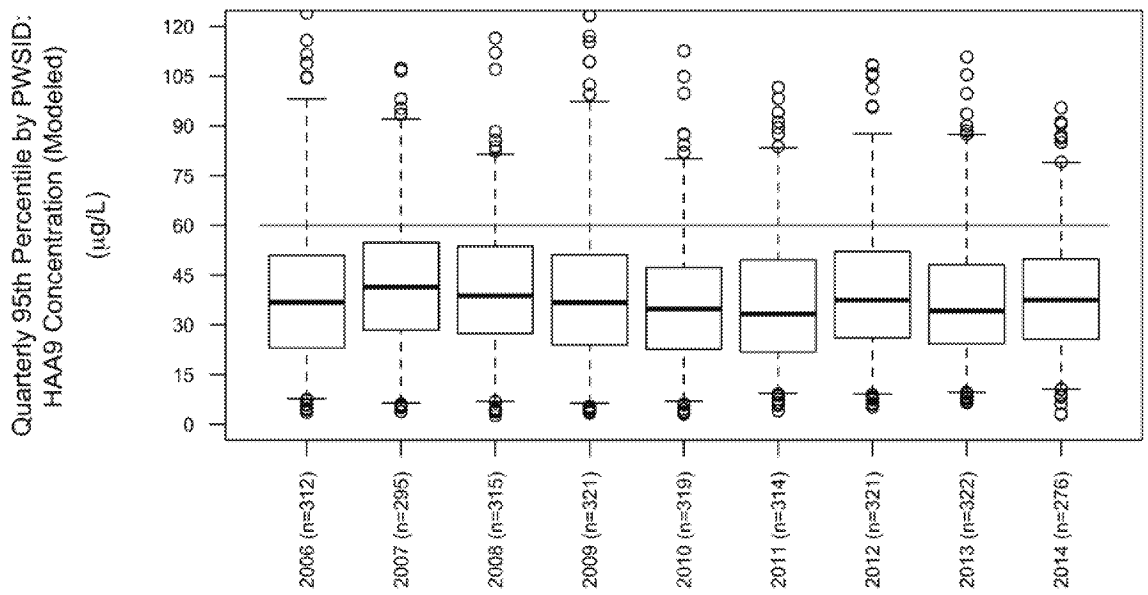


*Figure 8 Yearly Boxplots of Quarterly PWS 95th Percentile HAA9 Concentrations (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*



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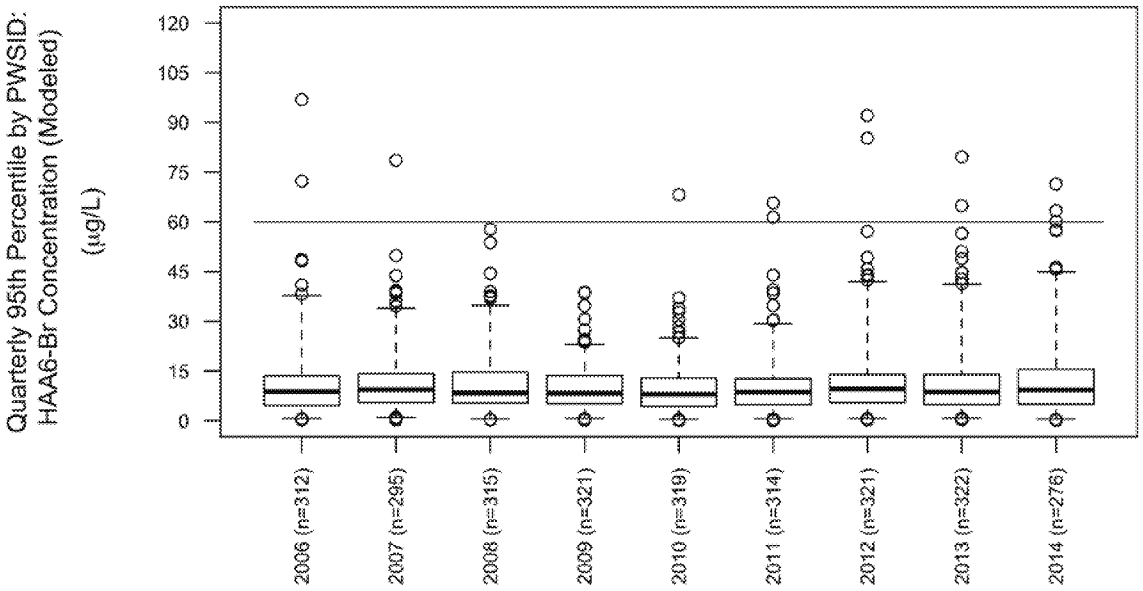


*Figure 9 Yearly Boxplots of Quarterly PWS 95th Percentile HAA6-Br Concentrations (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*

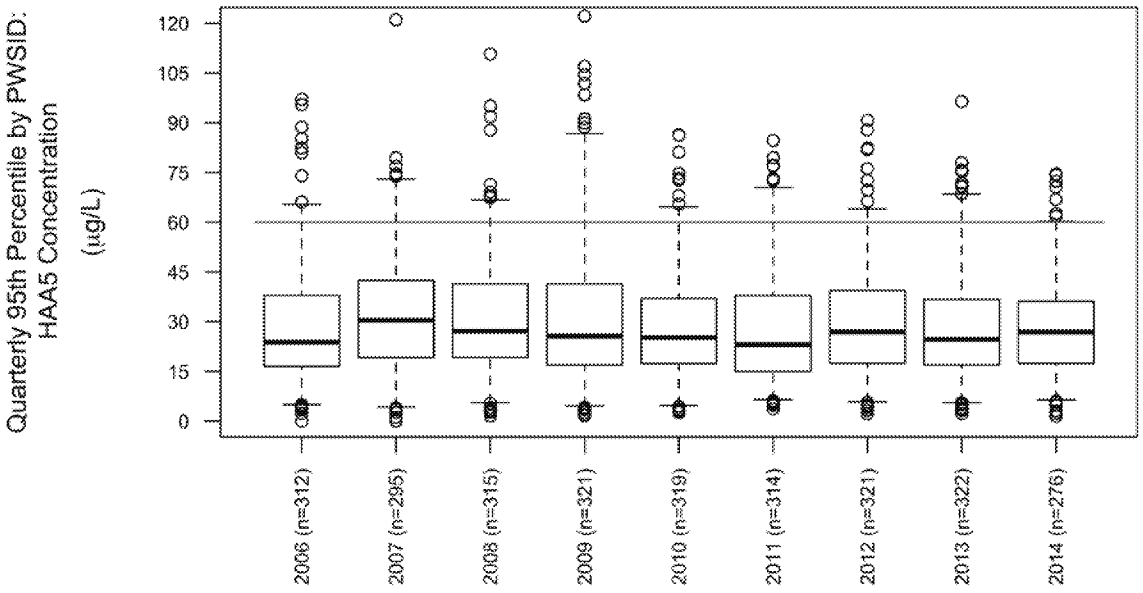




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*Figure 10 Yearly Boxplots of Quarterly PWS 95th Percentile HAA5 Concentrations for 84 Water Utilities in 15 States from 2006 – 2014*

There is some variability present in the yearly boxplots for HAA9 shown in Figure 8, although there is no clear trend over the years included in the analysis, particularly for the median, 25$^{th}$ and 75$^{th}$ percentile values. There does appear to be some decrease in 95$^{th}$ percentile and greater values over time. No significant changes are apparent in HAA9 concentrations after the Stage 2 DBPR implementation as compared with the years prior. In the yearly boxplots for HAA6-Br shown in Figure 9, there is very little variability in median and 75$^{th}$ percentile concentrations over the years of this analysis, although these values are just slightly higher in the boxplots representing years after the Stage 2 DBPR implementation (2012 – 2014) than the boxplots representing the three years prior (2009 – 2011). The 95$^{th}$ percentile and greater HAA6-Br concentrations do appear to have increased in the years after the Stage 2 DBPR implementation. Figure 10 is included in this analysis to compare changes in HAA9 and HAA6-Br over time to changes in HAA5. Once again, there is no clear trend apparent in the yearly boxplots for HAA5, although 75$^{th}$ and 95$^{th}$ percentile values appear to be relatively low in the years after the Stage DBPR implementation. Overall, this analysis suggests that there may have been less reduction in the brominated HAA species relative to the reduction in regulated HAA5 species in the few years following the Stage 2 DBPR implementation.

To further analyze any changes in HAA9 and HAA6-Br concentration before and after the implementation of the Stage 2 DBPR, the cumulative distribution of the 95$^{th}$ percentile value by PWS of modeled quarterly 95$^{th}$ percentile HAA9 and HAA6-Br concentrations by PWS in the two years before the Stage 2 DBPR implementation (April 1, 2010 – March 31, 1012) were compared with the corresponding cumulative distribution in the two years after the Stage 2 DBPR implementation (April 1, 2012 – March 31, 2014). The before and after Stage 2 DBPR cumulative distributions for HAA9 are shown in Figure 11, and the cumulative distributions for HAA6-Br are shown in Figure 12. In both cases, the cumulative distributions in the "after" time period are shifted slightly to the right, indicating overall increases in HAA9 and HAA6-Br occurrence. The greatest spread between the cumulative distributions for HAA9 occurs close to the 50$^{th}$ percentile water utility, while the greatest increases in HAA6-Br concentration appear to have occurred in water utilities with the highest HAA6-Br concentrations.



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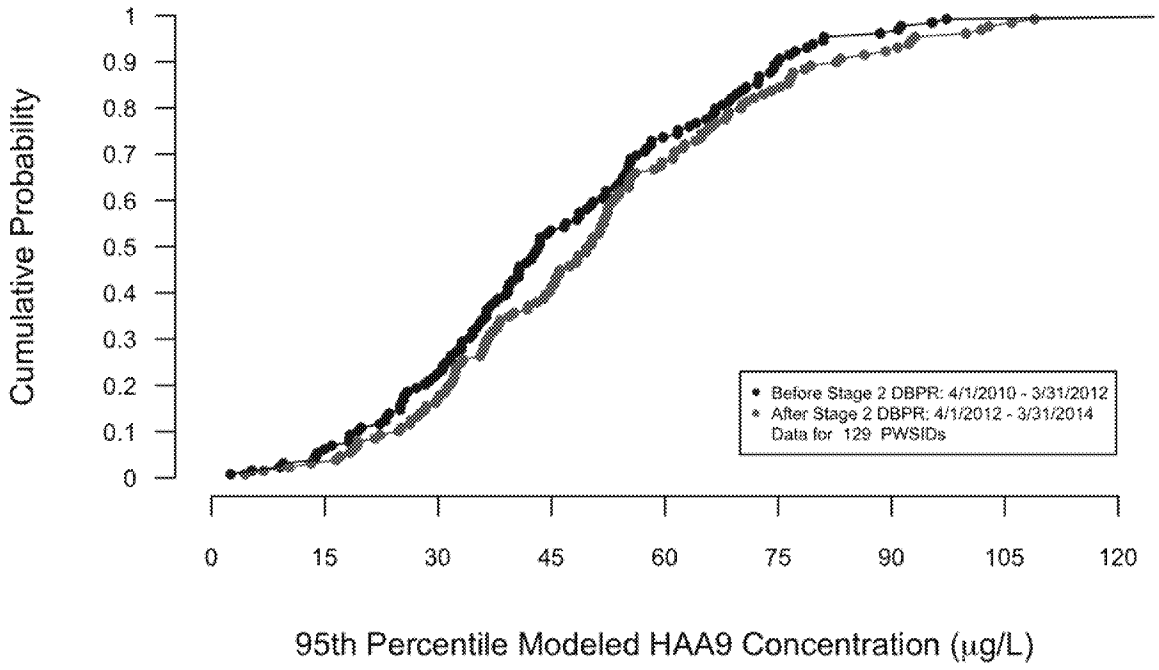


*Figure 11 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA9 Concentration before and after Implementation of the Stage 2 DBPR*

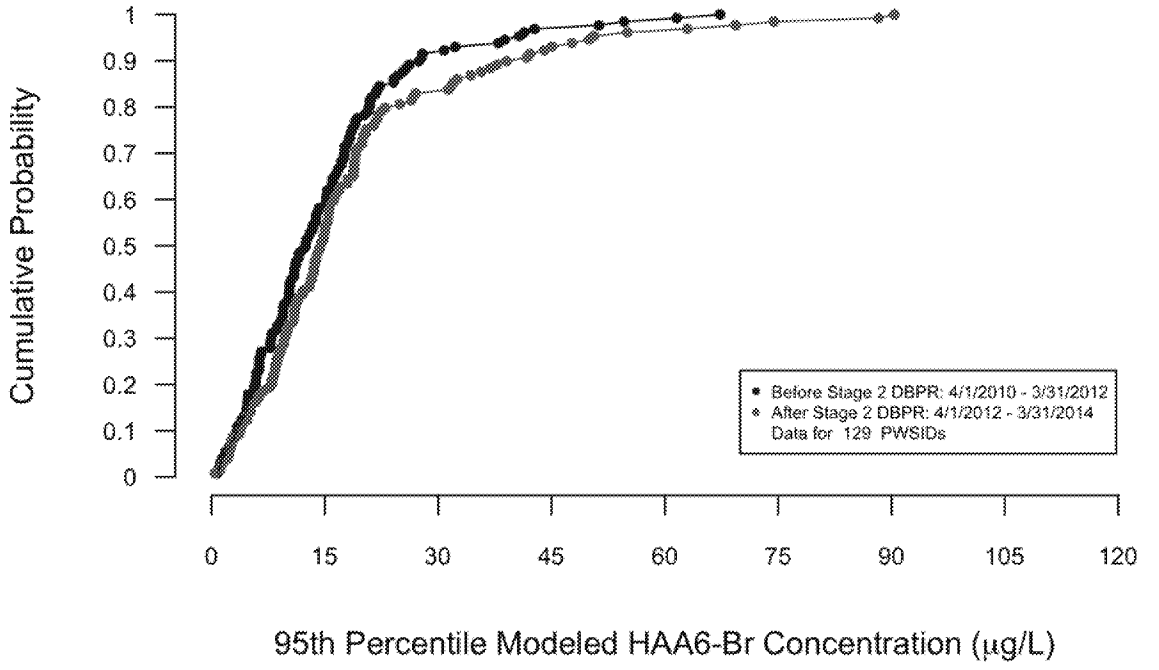


*Figure 12 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA6-Br Concentration before and after Implementation of the Stage 2 DBPR*



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To further assess impacts of the Stage 2 DBPR on HAA9 and HAA6-Br concentration, the cumulative distribution plots were modified to show the change in 95$^{th}$ percentile HAA9 and HAA6-Br concentration for individual PWSs. Figure 13 shows the same cumulative distribution for the "before" time period for HAA9 as Figure 11, and horizontal black lines extend from each 95$^{th}$ percentile HAA9 concentration before Stage 2 DBPR to the corresponding 95$^{th}$ percentile HAA9 concentration after Stage 2 DBPR, effectively showing the change in 95$^{th}$ percentile HAA9 concentration for each PWS. Figure 14 presents the same information for 95$^{th}$ percentile HAA6-Br concentration. More systems experienced increases in both HAA9 and HAA6-Br concentrations than decreases, and systems that did have decreases in HAA9 or HAA6-Br concentrations were generally systems with relatively high concentrations before Stage 2 DBPR. Very few systems show significant decrease in HAA6-Br concentrations.



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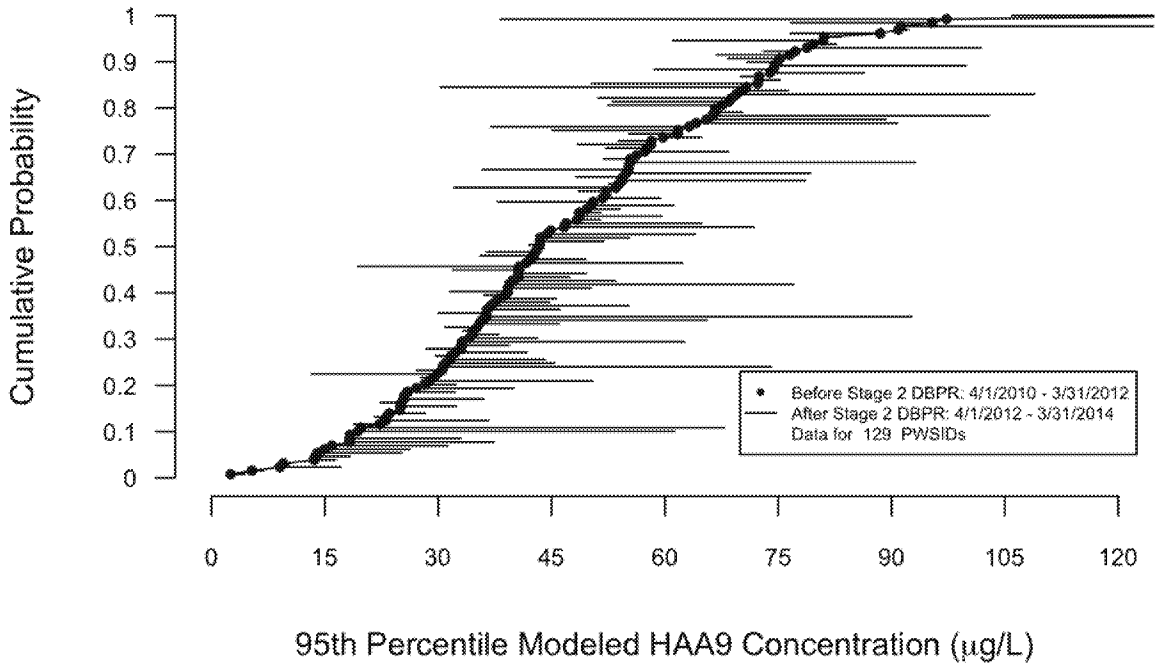


*Figure 13 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA9 Concentration Showing Impacts to Individual PWSs*

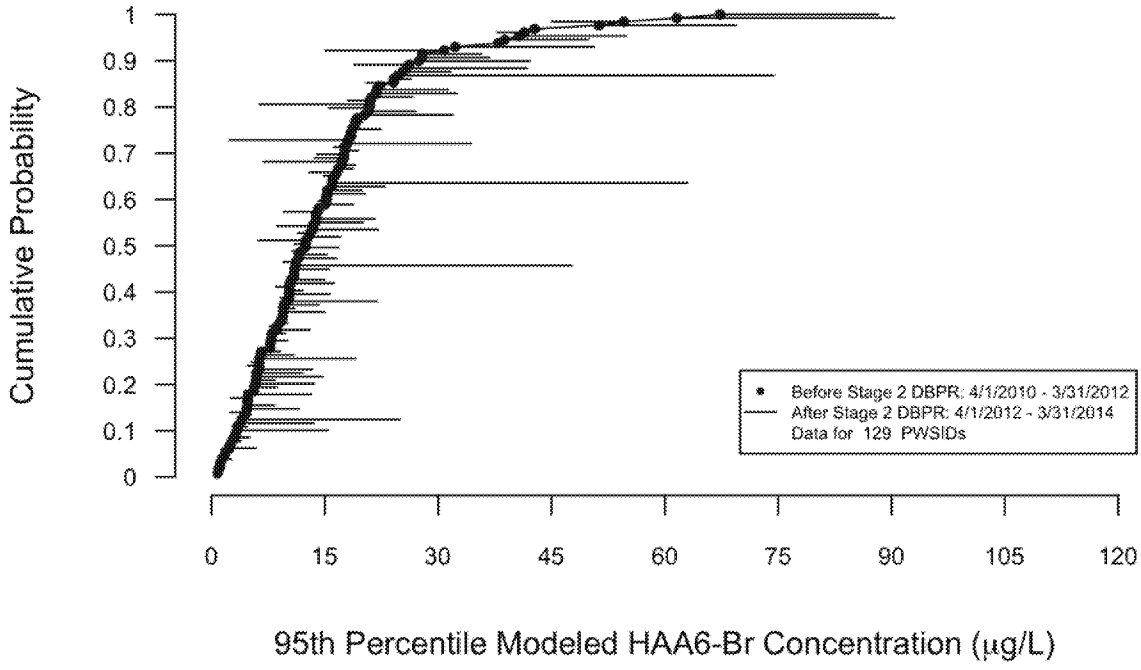


*Figure 14 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA6-Br Concentration Showing Impacts to Individual PWSs*



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## 3.2 Bromine Incorporation Factors

Further assessment of relative changes in brominated DBPs can be approached using the bromine incorporation factors for THMs, dihaloacetic acids (2XAA), and trihaloacetic acids (3XAA). Figure 15 shows yearly boxplots for quarterly 95th percentile THM BIFs by PWS from 2006 to 2014 for 130 PWSs in 18 states. Each boxplot is based on data for the same 130 systems. Overall, there is relatively little variability of the years, but a slight increase in median and 75th percentile BIF values occurred in 2011 – 2014. Figure 16 and Figure 17 show yearly boxplots for quarterly 95th percentile 2XAA and 3XAA BIF, respectively, by PWS, from 2006 to 2014 for 84 PWS in 15 states. Similar to the THM BIF boxplots, the yearly boxplots for 2XAA and 3XAA BIFs show relatively little variability, besides an increase in the 75th percentile values in 2013 and 2014 and a slightly increasing trend for the 95th percentile values.

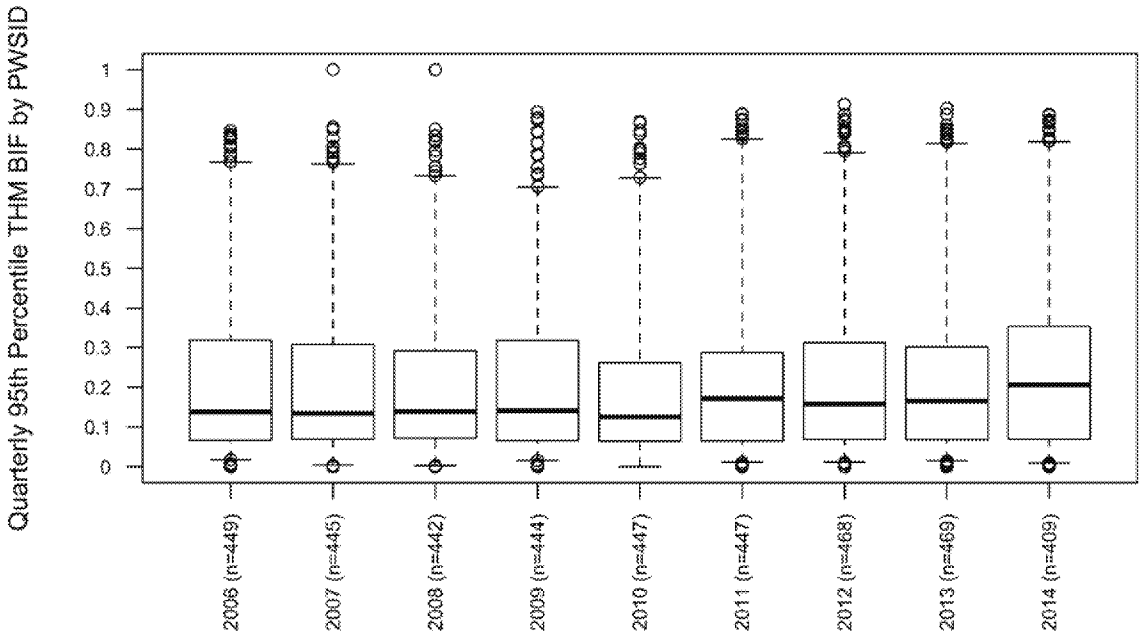


*Figure 15 Yearly Boxplots of Quarterly PWS 95th Percentile THM BIFs (Modeled) for 130 Water Utilities in 18 States from 2006 – 2014*



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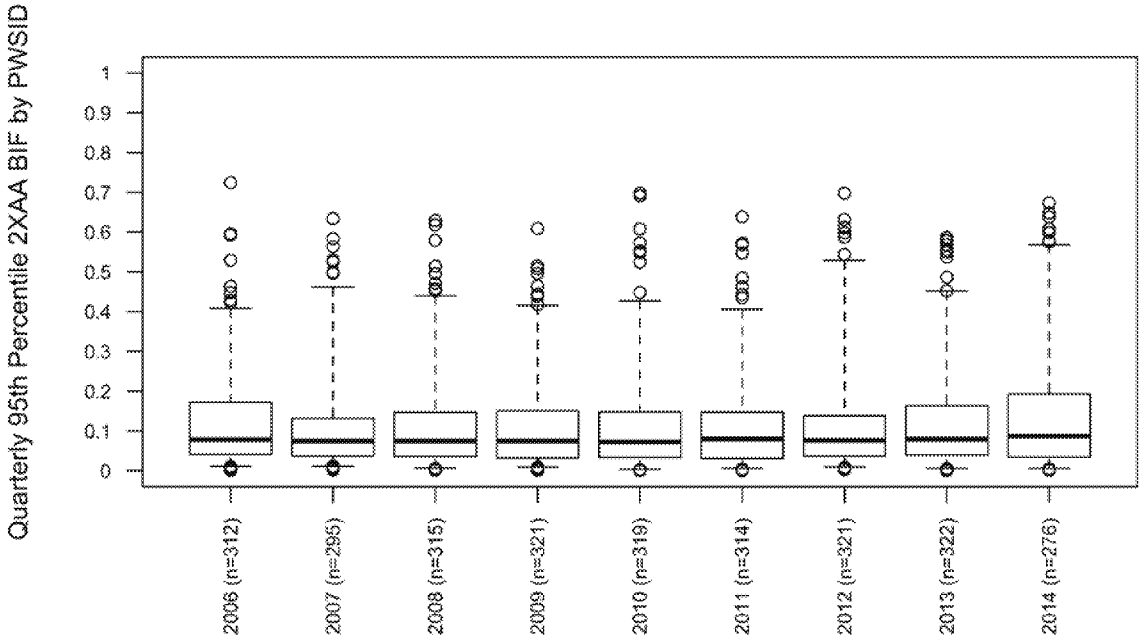


*Figure 16 Yearly Boxplots of Quarterly PWS 95th Percentile 2XAA BIFs (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*



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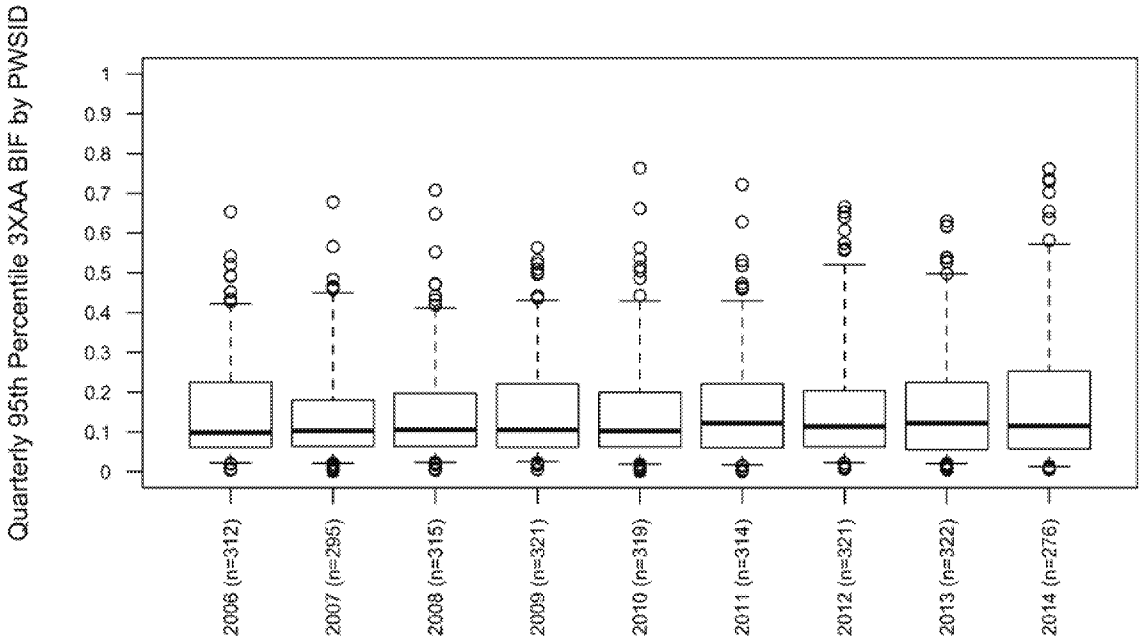


*Figure 17 Yearly Boxplots of Quarterly PWS 95th Percentile 3XAA BIFs (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*

The impact of the Stage 2 DBPR on bromine incorporation factors is further investigated by comparing cumulative distributions of the 95$^{th}$ percentile values by PWS of quarterly 95$^{th}$ percentile BIFs by PWS before and after Stage 2 DBPR. Figure 18, Figure 19 and Figure 20 show this analysis for THM, 2XAA, and 3XAA BIFs, respectively. In all three cases, the before and after cumulative distributions of BIFs are very close, but exhibit increases in BIF values for utilities in approximately the 50$^{th}$ – 85$^{th}$ percentile for the THM and 2XAA BIFs and in approximately the 60$^{th}$ – 90$^{th}$ percentile for the 3XAA BIF.



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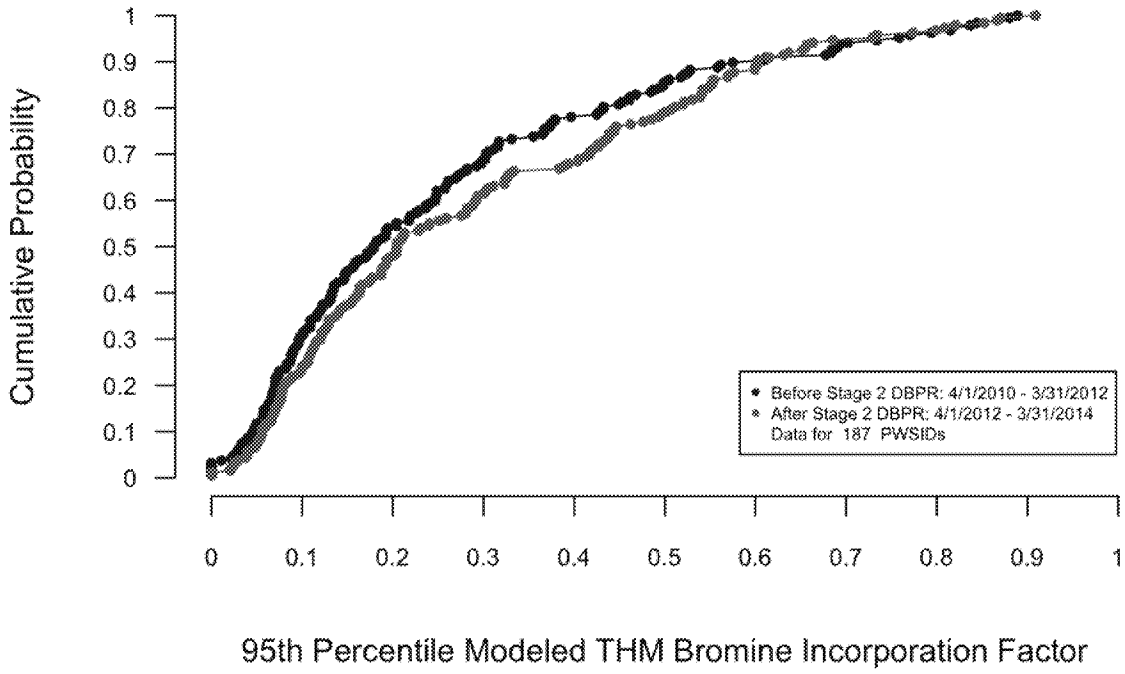


*Figure 18 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile THM BIF before and after Implementation of the Stage 2 DBPR*

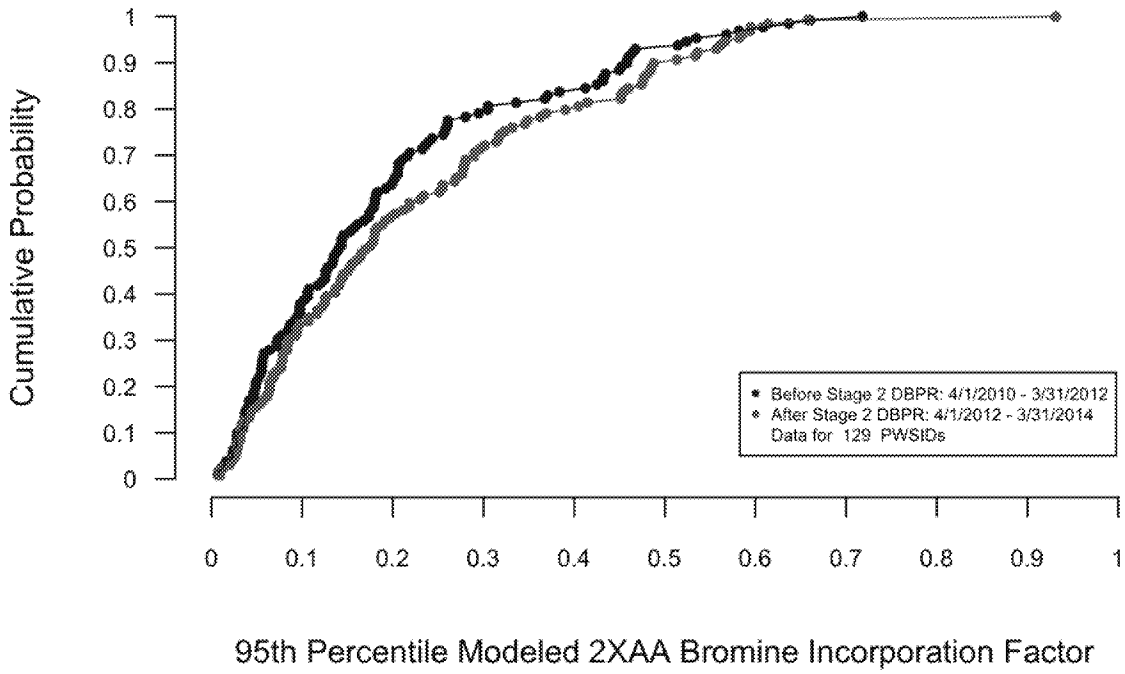


*Figure 19 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 2XAA BIF before and after Implementation of the Stage 2 DBPR*



ED_002479_00000004-00057

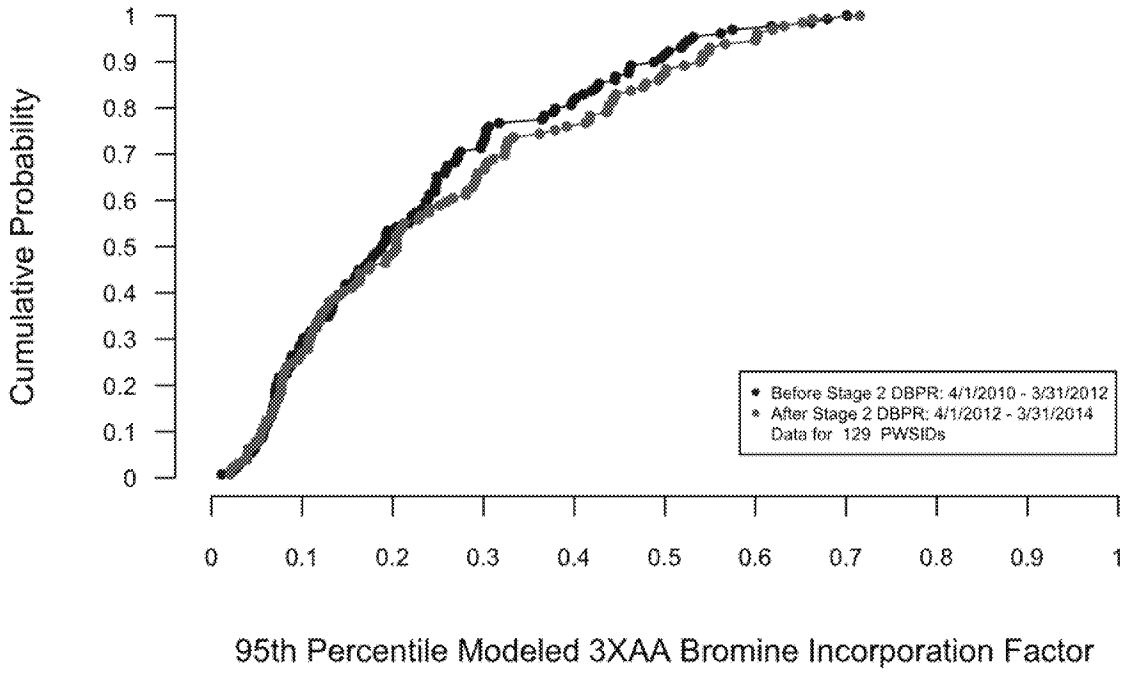


*Figure 20 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 3XAA BIF before and after Implementation of the Stage 2 DBPR*

As done previously for the HAA9 and HAA6-Br occurrence analysis, the cumulative distribution plots for the 95$^{th}$ percentile BIF values in Figure 18, Figure 19, and Figure 20 were modified to show impacts for individual PWSs. Figure 21, Figure 22, and Figure 23 show the same before cumulative distributions as in Figure 18, Figure 19, and Figure 20, and to illustrate the change in BIF values for each PWS, a horizontal black is drawn from each system's 95$^{th}$ percentile BIF value before Stage 2 DBPR to its 95$^{th}$ percentile BIF value after Stage 2 DBPR. While both increases and decreases occurred for the THM, 2XAA, and 3XAA 95$^{th}$ percentile BIF values, the changes with the greatest magnitudes tend to be increases from before Stage 2 DBPR to after.



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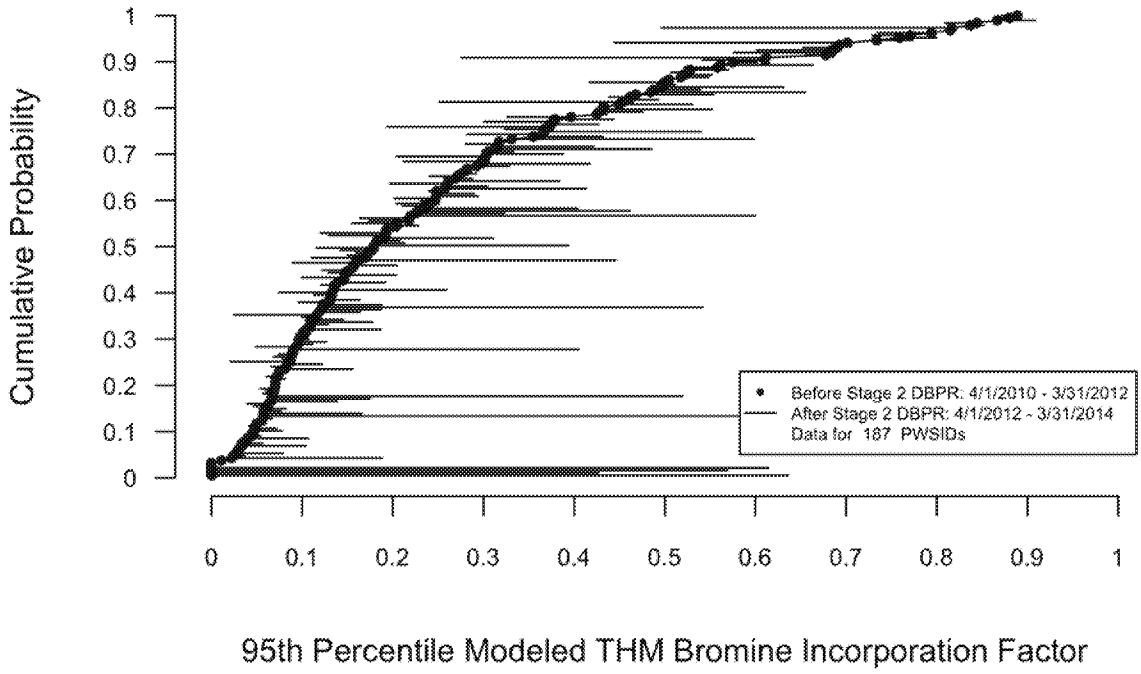


*Figure 21 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile THM BIF Showing Impacts to Individual PWSs*

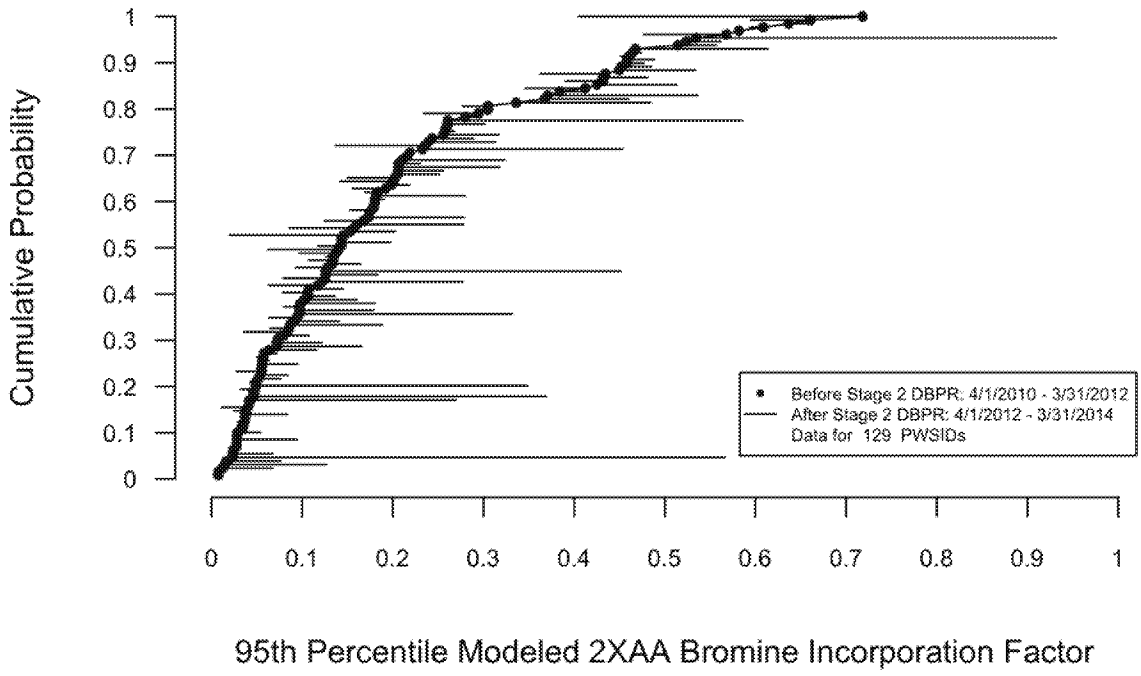


*Figure 22 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 2XAA BIF Showing Impacts to Individual PWSs*



ED_002479_00000004-00059

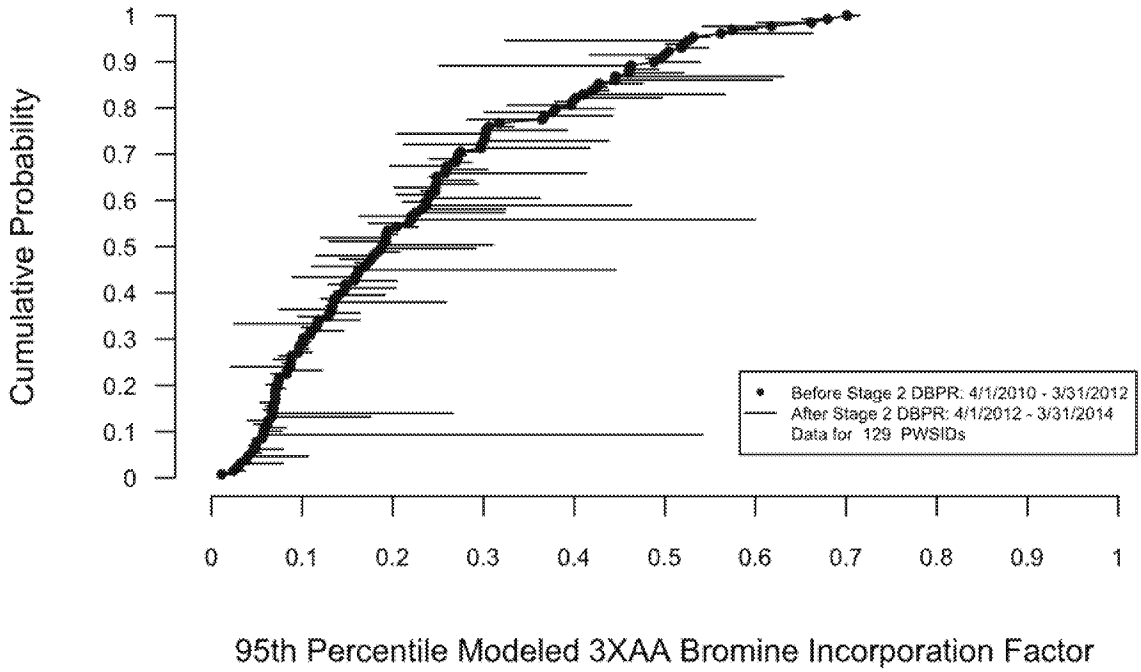


*Figure 23 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 3XAA BIF Showing Impacts to Individual PWSs*

# 4 Summary

The WITAF #266 database was used to assess the occurrence of brominated DBPs through modeling HAA4 species and HAA9 sums, validating the modeled HAA9 sums using observed HAA9 concentration data, and calculating bromine incorporation factors for THMs, dihaloacetic acids (2XAA), and trihaloacetic acids (3XAA). The "representativity" of the modeled HAA4 species, HAA9 and HAA6-Br concentrations was validated by analyzing distributions of TTHM and HAA5 data for two cases: for all systems with TTHM or HAA5 data, and for systems with THM and HAA5 species for modeling HAA9. An alternative approach to modeling HAA4 species, HAA9 and HAA6-Br, and calculating BIFs was developed due to a lack of necessary sample information to merge species concentrations for a given sampling event. The alternative approach used quarterly PWS 95$^{th}$ percentile species concentrations, which were then merged based on the PWS and quarter, as a surrogate for species concentration data. Analyses to validate this approach were presented.

This study demonstrates that the WITAF #266 database provides sufficient DBP data to analyze the occurrence of brominated DBPs, particularly before and after the implementation of the Stage 2 DBPR. This analysis is important in understanding how concentrations of unregulated HAAs, HAA9, and HAA6-Br concentrations have changed over time, and can be used to inform future regulatory decisions regarding the consideration of regulations based on brominated THM and HAA species in addition to the currently regulated sums.



ED_002479_00000004-00060

# 5 References

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Scholz, F.W., Stephens, M.A., 1987. K-Sample Anderson-Darling Tests. Journal of the American Statistical Association 82(399):918-924.

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Shoaf, D.R., Singer, P.C., 2007. An analysis of monitoring data for the Stage 1 Disinfectants/Disinfection Byproducts Rule. Journal AWWA 99(10):69-80.

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# Attachment B: Preliminary Analysis of UCMR3 Data and Potential Impact on UCMR4

The following report is an interim work product. The research team is preparing a paper for submission to a peer-reviewed journal. A copy of the accepted paper will be forwarded to the Agency once it is published.

**Analysis of UCMR 3 Data and Potential Impact on UCMR 4 (manuscript in preparation)**

## Introduction

As part of the analysis of UCMR 3 data to determine whether it makes sense to recommend changes in sampling strategy to EPA for the UCMR 4 sampling framework, we did a detailed analysis of UCMR 3 data, initially based on the June 2015 National Contaminant Occurrence Database, but followed up by also doing some additional analyses of the October 2015 NCOD release.

We focused on several things.

- Any differences in frequency of occurrence based on PWS population. We obtained population data from EPA and then plotted frequency of occurrence for each contaminant by population band (<10K, 10-25K, 25-50K, 50K-100K, and >100K).
- Covariance plots of SE1 vs SE2 for groundwaters for each contaminant
- Probability distributions for groundwater systems for each contaminant for SE1 vs SE2
- Probability distributions for surface water systems for each contaminant for SE1 vs SE2 vs SE3 vs SE4
- Covariance plots of SE1 vs SE2 and Covariance plots of SE3 vs SE4 for surface water systems.

Corona Environmental (Tim Bartrand and Saul Rosen) performed statistical analyses of the paired samples and the probability plots using R.

Based on EPA's proposal to only have UCMR 4 sampling take place between March and November, Corona also did a statistical analysis of the same data based on only March-November samples to determine whether that would change any conclusions regarding differences between sampling periods.

## Background

In the UCMR 4 proposal information collection document (EPA 815-B-15-003), EPA has indicated that the analysis of the UCMR data are based on the following criteria (note highlighted sections). EPA does indicate that they may look at measures for each EPTDS for each PWS, but there is no indication that they have ever done that, and in the NCOD and the periodic data releases, they focus strictly on frequency of detection by count and PWS and % exceeding an HRL. The UCMR sampling strategy is not fundamentally focused around evaluating variability at any single utility or sampling point, but rather on national occurrence trends.

*The first stage of analysis, Stage 1, provides a straightforward evaluation of occurrence for simple and conservative assessments of contaminant occurrence. The Stage 1 analysis of the UCMR data consists of non-parametric, unweighted counts and simple descriptive statistics of analytical results for each of the contaminants. These occurrence analyses are conducted at the sample level, PWS level and population-served level. For each contaminant, occurrence measures include the number and percent of samples with analytical detections and the minimum, median, maximum, and 99th percentile values of those detections. PWS-level occurrence measures include the number and percent of PWSs with one or more*



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*analytical detections and the number and percent of PWSs with two or more analytical detections of a given contaminant. Population-served occurrence measures include: the number and percent of population served by PWSs with one or more analytical detections, and the number and percent of population served by PWSs with two or more analytical detections of a given contaminant. Similar measures may also be conducted for each EPTDS for each PWS. Since these contaminant and PWS- level occurrence measures are based on raw occurrence data (that have not been adjusted for population-weighting and sampling), they are less accurate representations of national occurrence than occurrence measures based on adjusted occurrence data.*

**Data Analysis –Groundwater systems**

In our view, a "table" tells a thousand words. The tables below and statistical analyses for the data are for groundwater samples courtesy of Corona Environmental. The statistical evaluation compares the probability plots for the two sample events. We have also included covariant plots and a separate analysis of paired SE1 and SE2 samples using the Wilcoxon Rank Sum test. For purposes of statistical analysis any result which was non detect in the UCMR 3 database was assigned a value of 0.



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**Table 1. Summary of Statistical Tests Comparing Sample Events for GW systems.**

| | all data | | | | | | Exclude Dec-Feb | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Contaminant** | **K-S *p*** | **Mann-Whitney *p*** | ***N* both above DL** | ***N* one below DL** | ***N* both below DL** | ***% detects*** | **K-S *p*** | **Mann-Whitney *p*** | ***N* both above DL** | ***N* one below DL** | ***N* both below DL** | ***% detects*** |
| 1,1-Dichloroethane | 1 | 0.379 | 238 | 172 | 8590 | 3.6% | | 0.927 | 126 | 94 | 4517 | 3.7% |
| 1,2,3-Trichloropropane | 1 | 0.473 | 78 | 40 | 8883 | 1.1% | | 0.643 | 47 | 23 | 4667 | 1.2% |
| 1,3-Butadiene | ID | ID | 0 | 1 | 9000 | 0.0% | | ID | 0 | 1 | 4736 | 0.0% |
| 1,4-Dioxane | 1 | 0.568 | 916 | 421 | 7589 | 12.6% | | 0.558 | 471 | 226 | 3968 | 12.5% |
| 17α-Ethynylestradiol | ID | ID | 0 | 1 | 2857 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| 17β-Estradiol | ID | ID | 0 | 3 | 2855 | 0.1% | ID | ID | 0 | 0 | 1492 | 0.0% |
| 4-Androstene-3,17-dione | ID | ID | 0 | 7 | 2851 | 0.1% | ID | ID | 0 | 2 | 1490 | 0.1% |
| Bromomethane | 1 | 0.833 | 29 | 32 | 8939 | 0.5% | 1 | 0.86 | 8 | 17 | 4712 | 0.3% |
| Chlorate | 0.00464 | 0.00717 | 6381 | 1418 | 5967 | 51.5% | 0.00282 | 0.0383 | 3309 | 714 | 3150 | 51.1% |
| Chloromethane | 1 | 0.612 | 62 | 71 | 8868 | 1.1% | 1 | 0.17 | 26 | 39 | 4672 | 1.0% |
| Chromium | $2.23\times10^{-5}$ | 0.00222 | 6402 | 2025 | 5412 | 53.6% | $2.06\times10^{-4}$ | 0.00512 | 3256 | 1124 | 2757 | 53.5% |
| Chromium-6 | 0.942 | 0.811 | 8862 | 1289 | 3686 | 68.7% | 0.82 | 0.667 | 4605 | 743 | 1887 | 68.8% |
| Cobalt | 1 | 0.489 | 224 | 194 | 13478 | 2.3% | 1 | 0.773 | 103 | 105 | 6994 | 2.2% |
| Equilin | ID | ID | 0 | 0 | 2858 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Estriol | ID | ID | 0 | 1 | 2587 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Estrone | ID | ID | 0 | 0 | 2858 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Germanium | 1 | 0.734 | 16 | 4 | 1015 | 1.7% | 1 | 0.629 | 8 | 2 | 450 | 2.0% |
| Halon 1011 | 1 | 0.049 | 30 | 129 | 8842 | 1.0% | 1 | 0.802 | 20 | 71 | 4646 | 1.2% |
| HCFC-22 | 1 | 0.967 | 221 | 143 | 8637 | 3.2% | 1 | 0.855 | 107 | 73 | 4557 | 3.0% |
| Manganese | 0.983 | 0.922 | 589 | 148 | 298 | 64.1% | 0.944 | 0.894 | 267 | 64 | 129 | 65.0% |
| Molybdenum | 0.913 | 0.913 | 5657 | 822 | 7433 | 43.6% | 0.964 | 0.728 | 2890 | 441 | 3876 | 43.2% |
| *n*-Propylbenzene | ID | ID | 1 | 6 | 585 | 0.7% | ID | ID | 1 | 2 | 248 | 0.8% |
| PFBS | ID | ID | 1 | 2 | 9164 | 0.0% | ID | ID | 0 | 0 | 4817 | 0.0% |
| PFHpA | 1 | 0.512 | 45 | 29 | 9093 | 0.6% | 1 | 0.676 | 20 | 13 | 4784 | 0.6% |
| PFHxS | 1 | 0.686 | 68 | 21 | 9078 | 0.9% | 1 | 0.994 | 30 | 14 | 4773 | 0.8% |
| PFNA | 1 | 0.317 | 5 | 6 | 9156 | 0.1% | ID | ID | 1 | 4 | 4812 | 0.1% |
| PFOA | 1 | 0.736 | 82 | 51 | 9034 | 1.2% | 1 | 0.923 | 34 | 33 | 4750 | 1.0% |
| PFOS | 1 | 0.76 | 71 | 38 | 9058 | 1.0% | 1 | 0.44 | 31 | 21 | 4765 | 0.9% |
| *sec*-Butylbenzene | ID | ID | 0 | 0 | 592 | 0.0% | ID | ID | 0 | 0 | 251 | 0.0% |
| Strontium | 0.677 | 0.373 | 13774 | 91 | 8 | 99.6% | 0.655 | 0.359 | 7127 | 61 | 5 | 99.5% |
| Tellurium | ID | ID | 0 | 0 | 1035 | 0.0% | ID | ID | 0 | 0 | 460 | 0.0% |
| Testosterone | ID | ID | 0 | 13 | 2844 | 0.2% | ID | ID | 0 | 6 | 1486 | 0.2% |
| Vanadium | 0.689 | 0.505 | 7531 | 974 | 5398 | 57.7% | 0.964 | 0.708 | 3877 | 538 | 2784 | 57.6% |



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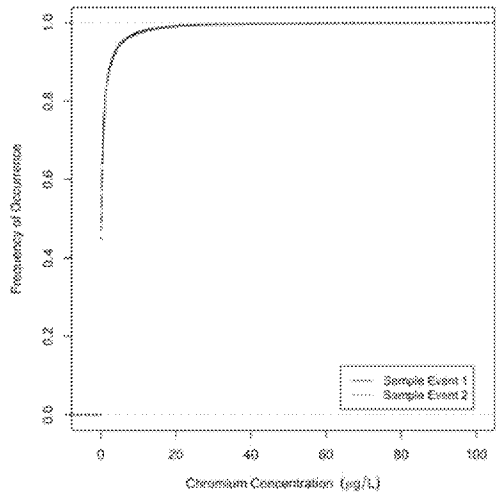
In all cases except for total chromium and chlorate, there is no statistical difference in the probability plots for sample event 1 and sample event 2. This is true even when there are a large number of non-detects. For UCMR 4, EPA has proposed only sampling between March and November. Thus the same analysis was done excluding the Dec-Feb samples. In that case there is also no significant difference between events and the overall frequency of detection is similar, suggesting that excluding the winter months would, at least for the UCMR 3 contaminants not make any difference in the data, while significantly complicating the monitoring process. If one thinks about ground water systems which are not under the direct influence of surface water and may even have travel times that are decades long, there is no reason to expect that sampling in any given month would be reflective of surface conditions at that time. Thus, even for analytes that might be seasonal in application (e.g. pesticides) ground water systems would almost certainly not reflect that seasonality.

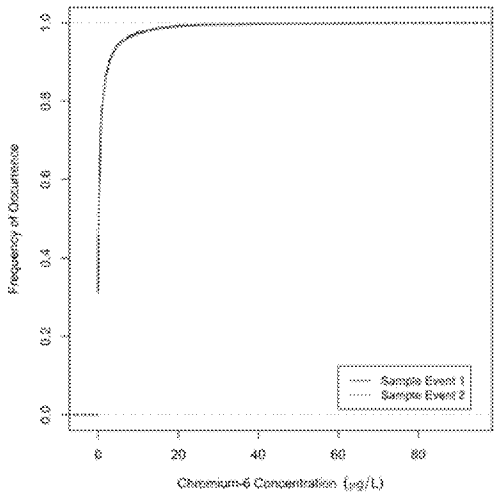
The probability plots here (figure 1) are for chlorate, total chromium, and hexavalent chromium. Just from a visual inspection it is apparent that even though individual events may have different results for a given sample site, the overall distribution of occurrence is essentially the same, as is true of hexavalent chromium also. In the case of chlorate there are differences in the extreme values.

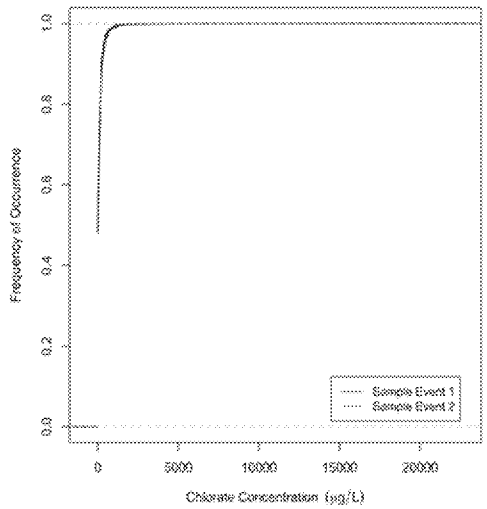
For chlorate it makes perfect sense that there could be significant differences between events, because utilities change their disinfection practices over time, which will in turn have an impact on chlorate, which is disinfection byproduct. Thus chlorate patterns would not be a cause for considering 1 vs 2 sampling events for groundwater systems, but should rather be treated like any other disinfection byproduct in terms of sampling strategy (e.g. sample only at a point in the distribution system and sample frequently enough to have a meaningful understanding of variability. It is worth noting that a visual assessment of the probability plots for chlorate (figure 1) suggests that they are not different, but likely show as statistically significant only because of differences in the extreme values.

For total chromium, the statistically significantly different results are also puzzling both because a covariance plot between the two events shows good correlation, and because when one looks at probability plots between the two sample events there is nearly perfect overlap. We suspect that the apparent statistically significant difference may relate to issues with the total chromium method accuracy and precision near the 0.2 ug/L reporting limit, coupled with the assumption of 0 for all non detect samples. Hexavalent chromium, with a much lower reporting limit, showed no significant difference between sample events. Additionally, when all non-detect samples for total chromium are excluded the correlation coefficient between sample event 1 and sample event 2 for groundwater goes from an $r^2$ of 0.705 to 0.83 and there is no statistical difference between probability plots. Thus we consider the apparent significant difference between events to be an artifact of the analytical method and not a true statistically significant difference that would justify multiple sampling rounds.

Figure 1: Probability plots for groundwater systems for SE1 and SE2 for chromium, hexavalent chromium, and chlorate.




Although not shown here, there is no difference in the nature of the plots if one excludes the December-February data. Thus no information is gained by restricting sampling periods. Table 1 also demonstrates that there is no difference in overall frequency of occurrence for any contaminant when one excludes the winter months.

The following plots (figures 2-5) are covariance plots of sample event 1 vs sample event 2 for each contaminant with even as little as 1% overall occurrence. Without referring to the statistical analysis it is clear that in most cases there is a high degree of covariance between events, even if the overall correlation coefficient is in some cases low, mainly because of limited occurrence.

The covariance, coupled with the probability plots and statistical evaluation of those plots all suggest that there is no information which is gained by having multiple sample events for groundwater systems.



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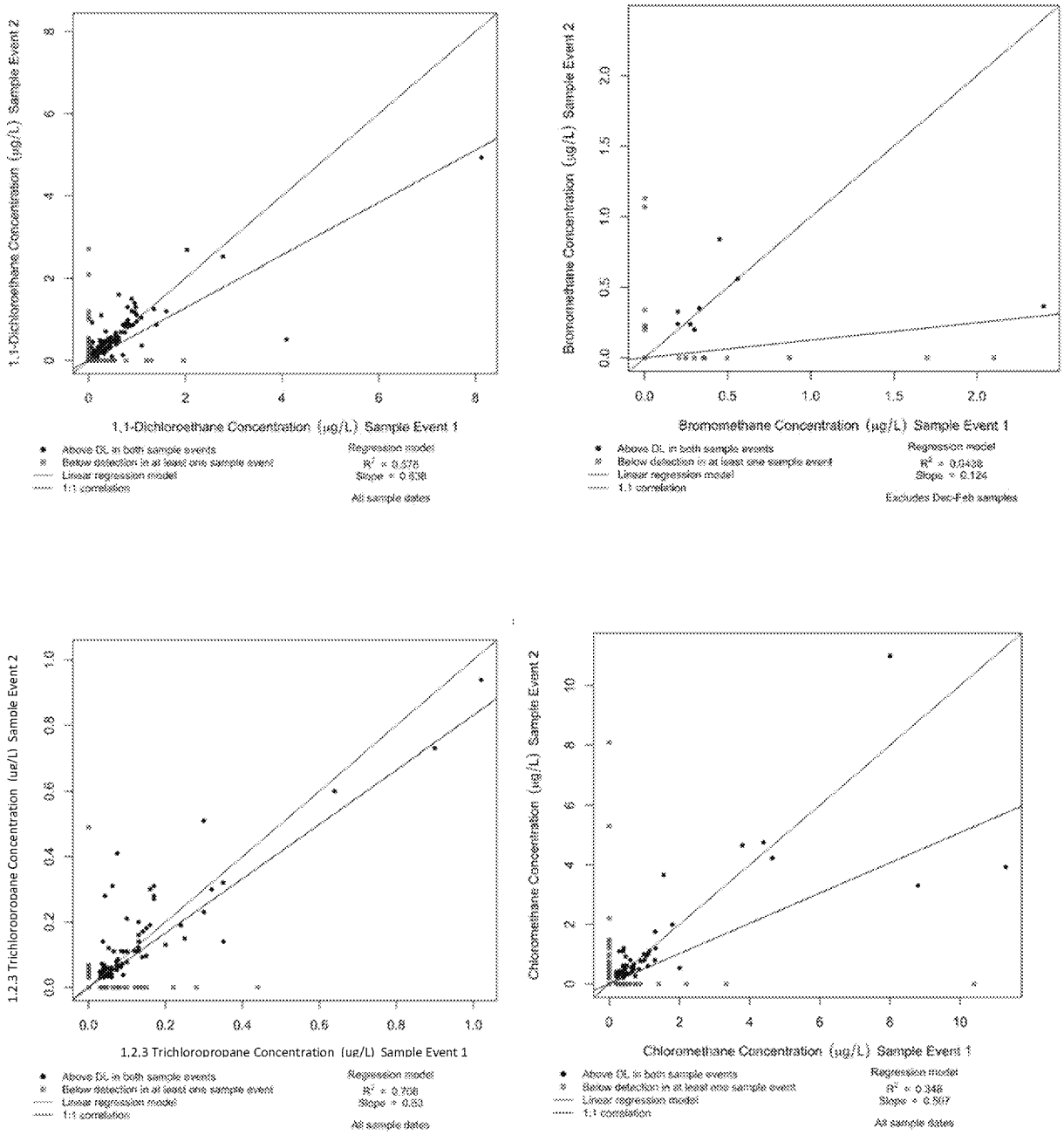
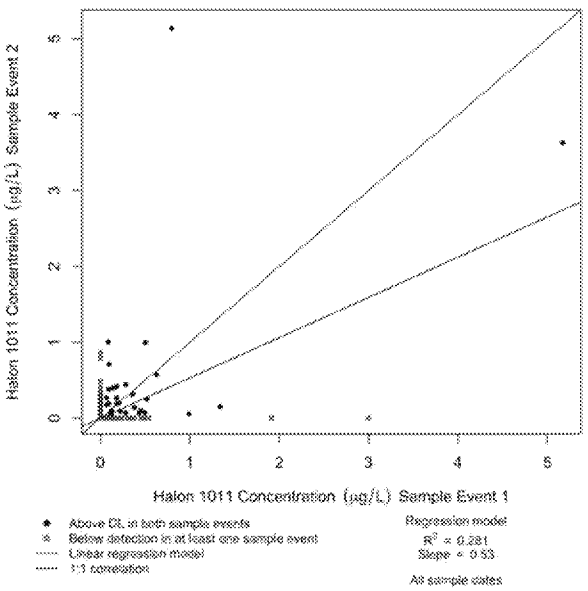
Figure 2a: Covariance plots for groundwater systems for VOC contaminants with sufficient data for statistical analysis. Plots below are based on using all samples (not excluding the winter months).




Halon 1011 Concentration (µg/L) Sample Event 2
Halon 1011 Concentration (µg/L) Sample Event 1
0
1
2
3
4
5
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.281
Slope = 0.53
All sample dates

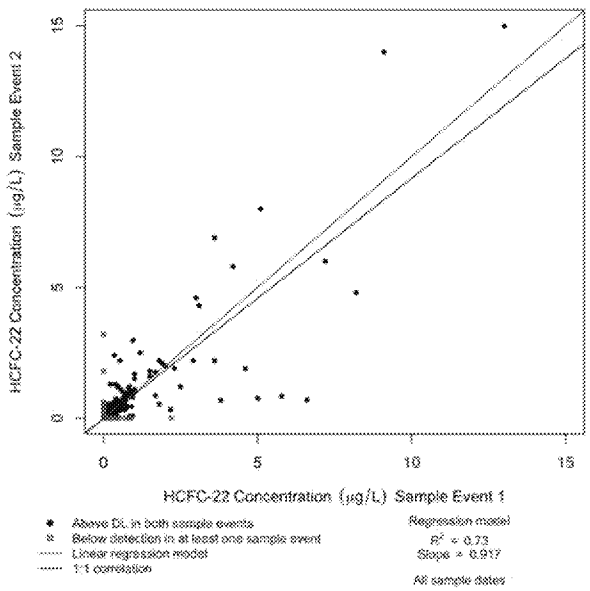
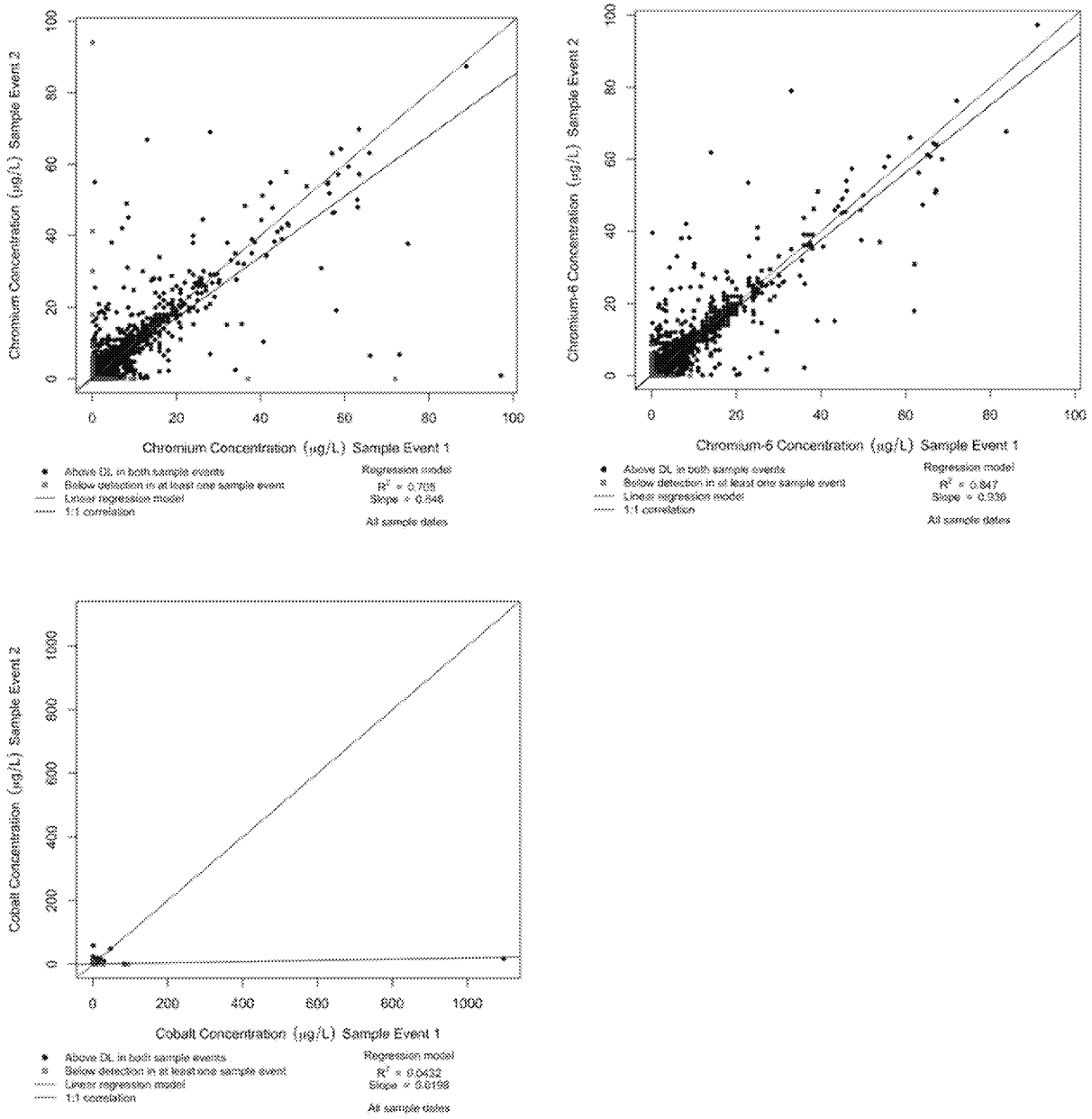
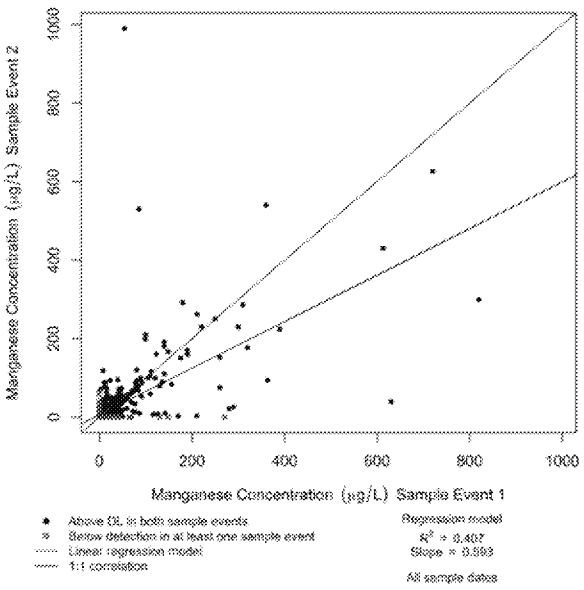
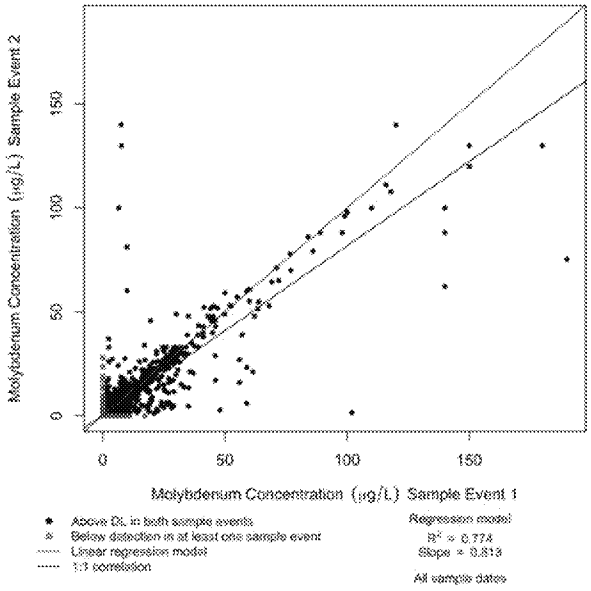
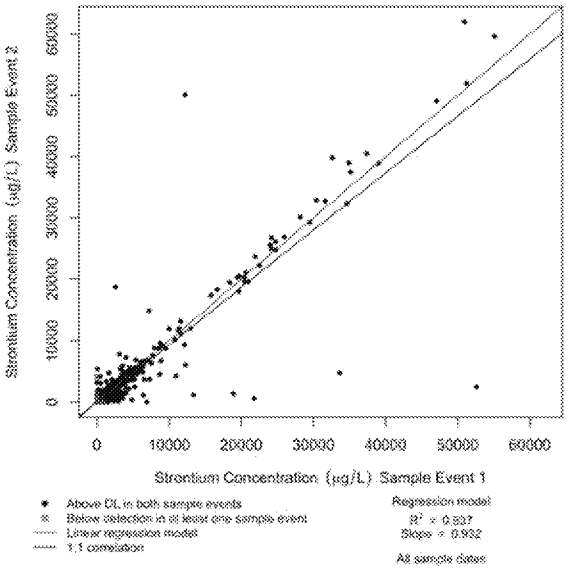

HCFC-22 Concentration (µg/L) Sample Event 2
HCFC-22 Concentration (µg/L) Sample Event 1
0
5
10
15
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.73
Slope = 0.917
All sample dates

Figure 3: Covariance plots for groundwater systems for metals. Plots below are based on using all samples (not excluding the winter months). Figure includes data for manganese and germanium (small systems data only, but planned for inclusion in UCMR 4.




Manganese Concentration (µg/L) Sample Event 2
Manganese Concentration (µg/L) Sample Event 1
0
200
400
600
800
1000
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.407
Slope = 0.593
All sample dates


Molybdenum Concentration (µg/L) Sample Event 2
Molybdenum Concentration (µg/L) Sample Event 1
0
50
100
150
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.774
Slope = 0.813
All sample dates


Strontium Concentration (µg/L) Sample Event 2
Strontium Concentration (µg/L) Sample Event 1
0
10000
20000
30000
40000
50000
60000
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.937
Slope = 0.932
All sample dates

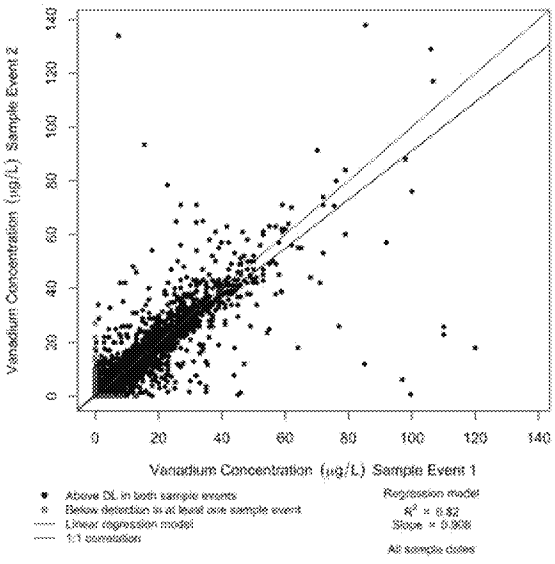
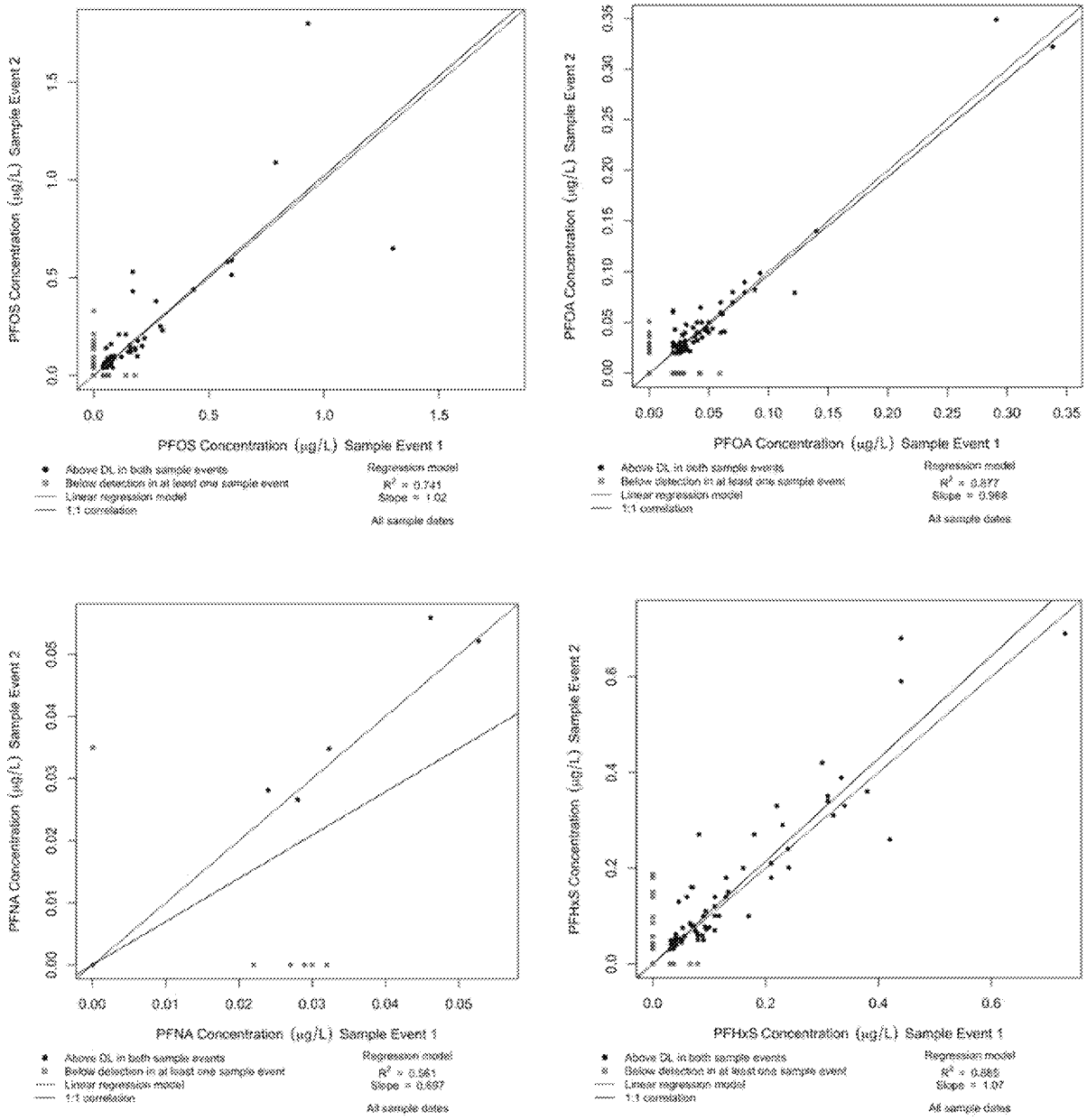

Vanadium Concentration (µg/L) Sample Event 2
Vanadium Concentration (µg/L) Sample Event 1
0
20
40
60
80
100
120
140
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.92
Slope = 0.868
All sample dates

Figure 4: Covariance plots for groundwater systems for PFC contaminants with sufficient data for statistical analysis. Plots below are based on using all samples (not excluding the winter months).



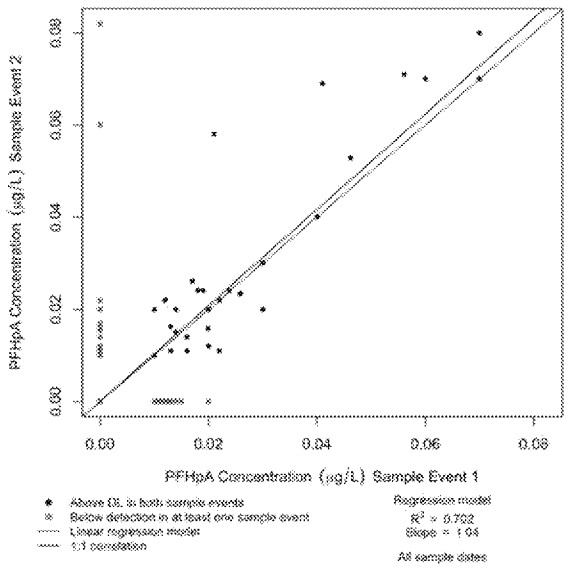
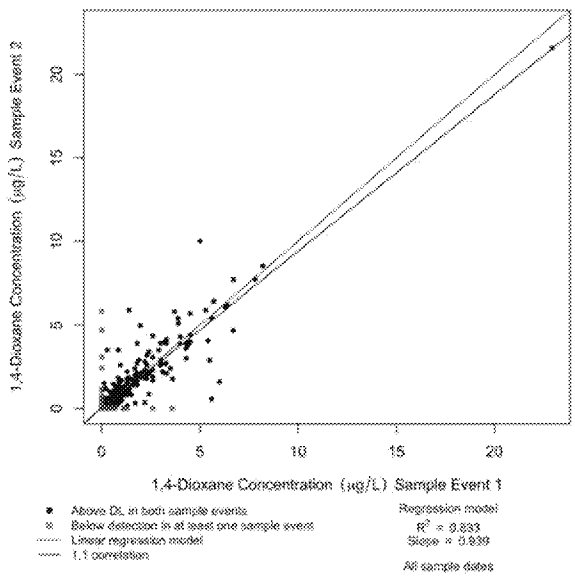
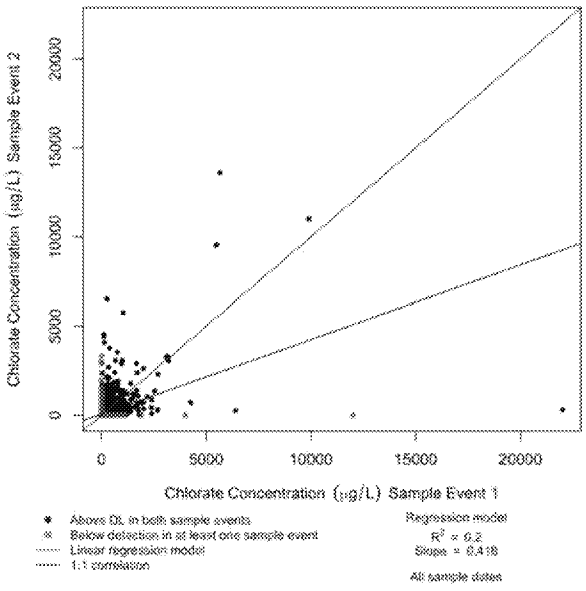



Figure 5: Covariance plot for groundwater systems for 1,4-dioxane and chlorate. Plots below are based on using all samples (not excluding the winter months).



**System size impact on results.**

The current UCMR construct calls for using a statistical sampling of small systems (< 10K population) and sampling all larger systems. Because one factor in interpreting UCMR data is the population impacted by contaminants it is important to determine the extent of variation in contaminant occurrence as a function of population size. The June, 2015 data from the NCOD was merged with population information from EPA and frequency of occurrence plotted for each contaminant as a function of system size. This analysis does not take into account the range of concentrations or the frequency with which contaminants may exceed the current health reference level (HRL), but rather focuses solely on the detection frequency as this is one factor EPA had indicated is a consideration in regulatory decision making. It is clear from the plots below (figure 6-10) that there **are differences** in frequency of occurrence for most contaminants as a function of population size, with greater frequency occurring in systems serving > 100K population, as would be expected in general for anthropogenic contaminants, where urban areas are more subject to potential contamination. In some cases the frequency of occurrence in the >100K systems may be more than double that of smaller systems, which may provide some justification for regulation, even though overall occurrence is low. This same pattern is true even for contaminants that are predominantly naturally occurring (e.g. the metals). EPA should perform a similar analysis of the data focusing not just on detection frequency but also on relative concentration levels. This analysis suggests that if EPA were to consider a statistical subset of systems serving >10K population for future UCMRs, including potentially UCMR 4, as a way of reducing the overall burden on utilities, it would be especially important that it be a robust analysis. We don't think there is sufficient time between now and the beginning of UCMR 4 to consider that approach for this round.

Figure 6: Frequency of occurrence for chlorate and 1,4-dioxane by population served.

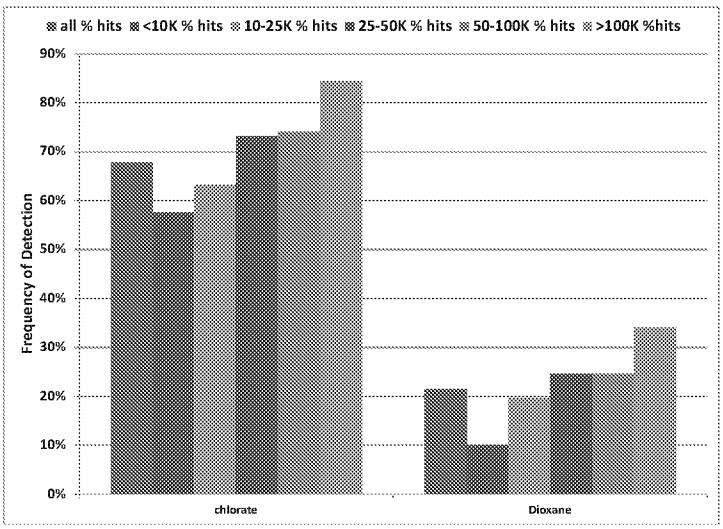
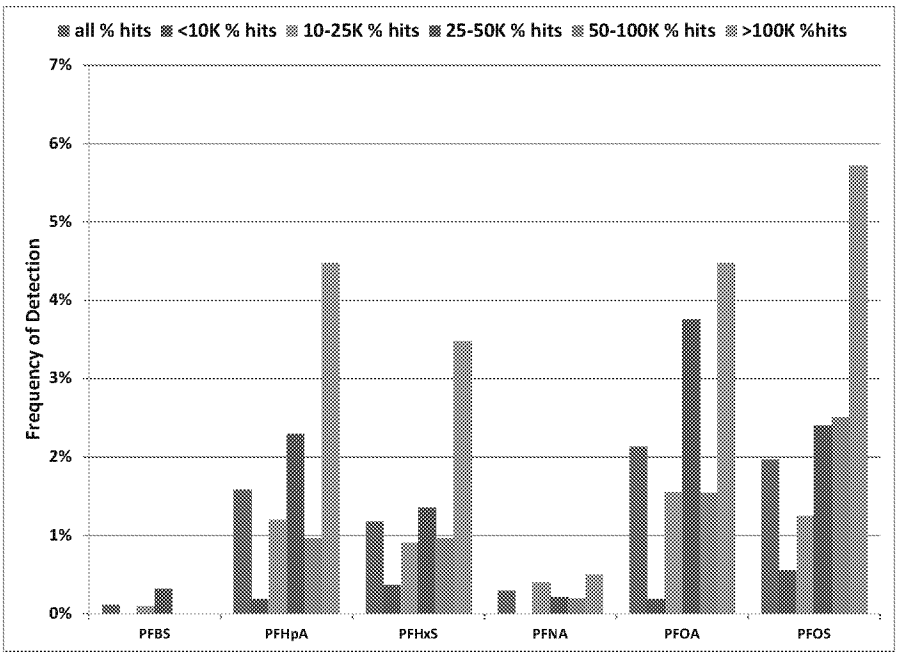
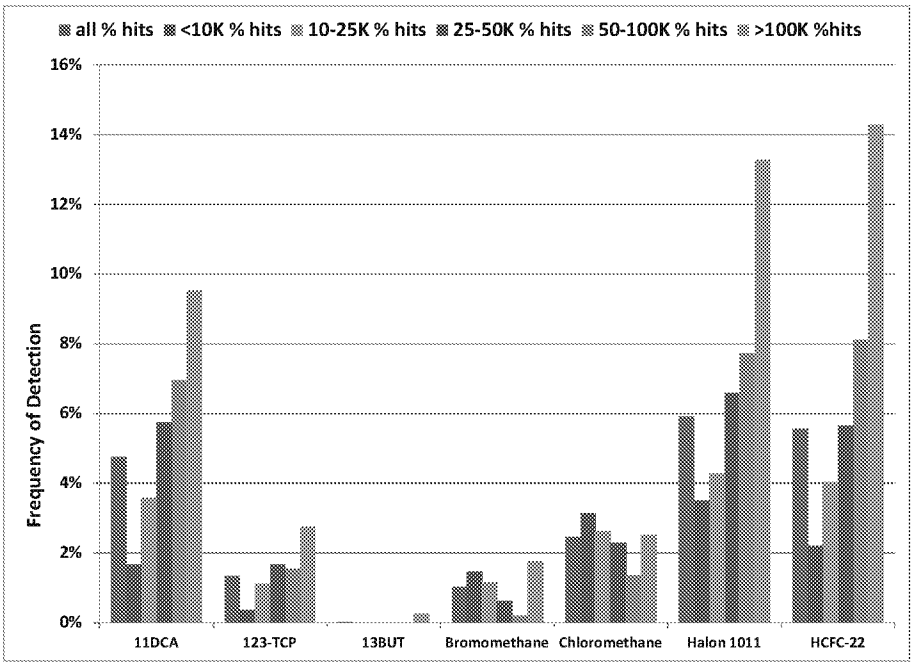


Figure 7: Frequency of occurrence for PFCs by population served.




For the PFCs, very large systems (>100K) in general have a much greater likelihood of detection than smaller systems. This may be a cause for considering potential regulation.

Figure 8: Frequency of occurrence for VOCs by population served.




VOCs show the same pattern as PFCs, a much greater likelihood of detection in 100K+ systems.



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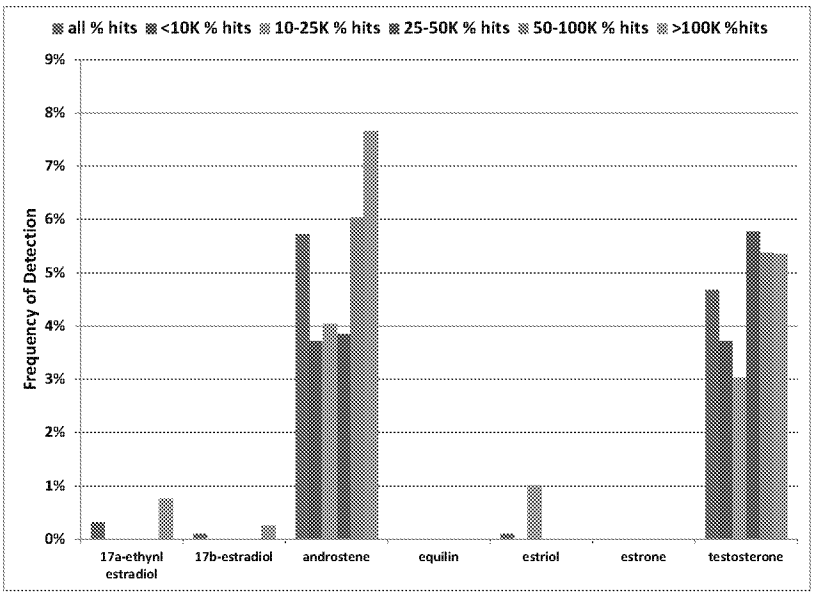
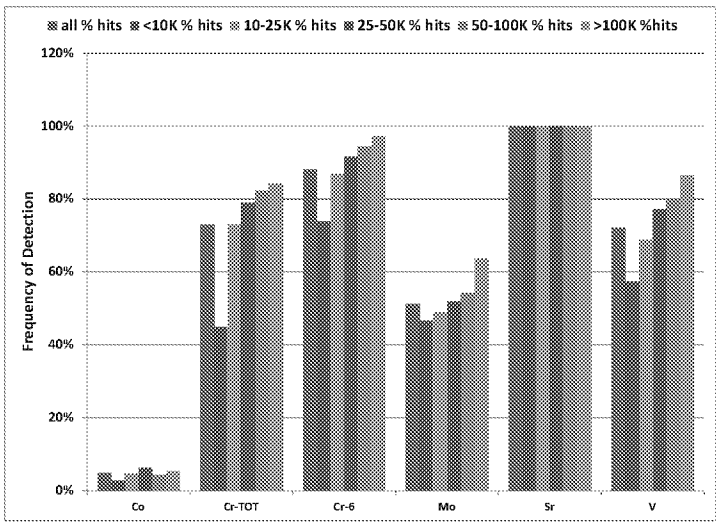
Figure 9: Frequency of occurrence for hormones by population served.




Even though the frequency of occurrence is relatively high (~5% of systems with detects for testosterone and androstenedione), there is no clear trend with population size. This is most likely due to the fact that detection levels overall are very close to the minimum reporting levels, as one would expect the hormones to show a major anthropogenic impact (e.g. more population = more hormone detections). When detected, hormones are almost always a single detection and not repeated on additional sampling events, making it more likely that at least some of the detects may be artifacts of some sort.

Figure 10: Frequency of occurrence for metals by population served




For the metals the difference across system size is less marked than for some of the anthropogenic contaminants, but there are still trends suggesting greater occurrence in larger systems, and thus also larger population impacts.



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# PUBLIC SUBMISSION

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Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

**Comment On:** EPA-HQ-OW-2015-0218-0001
Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems,

**Document:** EPA-HQ-OW-2015-0218-DRAFT-0086
Comment on EPA-HQ-OW-2015-0218-0001

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## Submitter Information

**Submitter's Representative:** Adam Carpenter
**Organization:** American Water Works Association

---

## General Comment

Please see the attached file for comments from the American Water Works Association (AWWA).

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## Attachments

20160209_UCMR4_Comments

American Water Works Association

*Dedicated to the World's Most Important Resource*™

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February 9, 2016

Water Docket
U.S. Environmental Protection Agency
Mail Code 2821T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Comments on "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting", Docket ID No. EPA–HQ–OW–2015–0218

Dear Sir or Madam,

The American Water Works Association (AWWA) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA's) proposal for the Fourth Unregulated Contaminant Monitoring Rule (UCMR4) (80 Federal Register 76897). UCMRs have always been a critical component of the Safe Drinking Water Act (SDWA) regulatory decision-making process. AWWA supports a robust UCMR monitoring program to assist EPA in meeting its statutory requirements when determining whether or not a national regulation is needed and what an appropriate drinking water standard might be. Sound national occurrence information is critical to the regulatory determinations EPA must make in assessing whether a national regulation will provide a meaningful opportunity for risk reduction.

AWWA has previously recommended EPA include cyanotoxins and disinfection by-products (DBPs) on the Fourth Contaminant Candidate List (CCL4) in order to facilitate data collection and evaluation for potential additional risk management. AWWA agrees with the inclusion of both cyanotoxins and the nine haloacetic acids (HAAs) in the proposed UCMR4; however, revisions in the final UCMR4 for both of these groups are necessary to ensure that the monitoring data will appropriately inform future regulatory decisions.

For cyanotoxins, source water monitoring should not be included in the final UCMR4. Instead, UCMR4 monitoring for cyanotoxins should be at the Entry Point to the Distribution System (EPTDS). SDWA Section 1445(a)(2)(A) clearly states that "The

regulations shall require monitoring of ***"drinking water supplied by public water systems..."*** (emphasis added), therefore, AWWA recommends that all UCMR4 monitoring be taken at the EPTDS or at sampling locations in the distribution system. This recommendation also applies to future UCMRs.

AWWA continues to have serious concerns about the accuracy and the reliability of the enzyme-linked immunosorbent assay (ELISA) analytical method. Moreover, the Agency should not directly correlate or compare the ELISA and the LC/MS/MS data. For example, the ELISA test has not been adequately tested for matrix interferences, nor for the relative sensitivity of the vast majority of congeners and disinfection degradates. Inter-laboratory comparisons cited to-date only test for precision or reproducibility, and not for the accuracy of the method itself. Much is still unknown about how disinfection interfaces with ELISA tests, making interpretation of the information difficult. The toxicity of disinfection degradates is unknown relative to known microcystins (such as MC-LR), which is further complicated by the variability in the toxicity of the known microcystins. AWWA recommends that EPA proceed cautiously in developing its ELISA standard method. Recognizing the limitations of the ELISA methods, AWWA recommends its use for screening in the finished water with an EPTDS sample at 0.3 µg/l or at a level demonstrated as sound through EPA's ongoing method development efforts as a trigger for analysis using the LC/MS/MS method.

AWWA agrees that management of DBPs is an important regulatory issue that warrants additional research and resources, but the approach in the proposed UCMR4 is inappropriate. UCMR's mandated, national monitoring framework is not the most appropriate method to obtain reliable and robust monitoring data and meta-data for regulatory decision-making on the complex issues surrounding the formation and degradation of DBPs, assuring microbial protection, and maintaining disinfectant residuals. The meta-data that is proposed to be collected will confuse and confound future data analyses. AWWA recommends a simpler classification of treatment "bins" for UCMR4 meta-data, and EPA should better articulate the future intended use of any meta-data collected in the final UCMR4.

The monitoring frequency in the proposed UCMR4 is inappropriate. UCMR4 monitoring should be conducted quarterly as has been done in past UCMRs. Monitoring should not be "skipped" in December, January, or February. The time frame as proposed (March-November) unnecessarily constrains the monitoring with no benefit for future regulatory decisions. All nine species of HAAs and four species of THMs need to be collected from compliance samples at the same time (four quarters in one year) and at all of the Stage 2 DBPR compliance sampling locations,

and all 13 analyte results need to be reported. Additionally, disinfectant residual for these samples should be collected and analyzed at the same time.

Finally, AWWA and other stakeholders have observed the need to effectively integrate regulatory activity so that in setting new regulatory requirements, simultaneous compliance issues are not ignored and that the Agency does not inadvertently create new hazards. The management of disinfection and DBPs are a clear example where there is a long history of existing and interwoven regulatory requirements. Any monitoring and associated research on DBPs should both be robust and reliable, and be conducted in a manner that appropriately informs any potential future regulatory actions.

Attached are detailed comments that elaborate on the above, and also address other important UCMR4 issues. The ultimate goal of AWWA's recommendations is a well thought out, comprehensive and optimized UCMR4 data collection effort. Both the Agency and the water sector should move forward with reasonable expectations for UCMR4, and the monitoring effort should be complimentary with EPA's drinking water research program. Robust national occurrence data is not as meaningful for regulatory decision-making without additional research into the other considerations that must be taken into account in regulatory decision-making, especially health effects research.

Please feel free to contact AWWA if you have any questions regarding the attached or would like to discuss mechanisms to more actively engage stakeholders in crafting a cohesive strategy to collect the complete suite of data needed to support drinking water regulation development.

Best regards,

G. Tracy Mehan, III
Executive Director of Government Affairs
AWWA

cc: Eric Burneson
Brenda Paris
Melissa Simic
Zeno Bain

***What is the American Water Works Association?***

*The American Water Works Association is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes over 3,900 utilities that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our nearly 50,000 total memberships represent the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.*

Comments of the American Water Works Association
on
"Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting"

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Comments of the American Water Works Association
On
"Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting"

The following are the American Water Works Association's (AWWA's) comments on the Environmental Protection Agency's (EPA's) proposed "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting", Docket ID No. EPA–HQ–OW–2015–0218 (80 Federal Register 76897, December 11, 2015). AWWA's comments are organized into general overarching comments, specific comments with respect to cyanotoxin monitoring, specific comments on haloacetic acid monitoring, responses to EPA's requests for comment, feedback on EPA's presentation of the burden and logistics of UCMR implementation, and a brief summary.

## Overarching Comments

AWWA supports the Proposed Fourth Unregulated Contaminant Monitoring Rule (UCMR4) as part of the suite of activities to inform regulatory decision-making; however, several important revisions need to be made in the final UCMR4.

1. Disinfection byproducts (DBPs) are an important regulatory issue that warrant additional research and resources, but the approach in the proposed UCMR4 is not an appropriate mechanism to accomplish this goal. The drinking water community needs robust and reliable UCMR monitoring data and meta-data to be collected in order to appropriately inform regulatory decision-making on the complex issues surrounding the formation and degradation of DBPs and maintaining microbial protection, disinfectant residual, and optimized corrosion control.

2. The proposed UCMR4 would collect meta-data in such a way as to confuse and confound effective analysis in the future. A simpler classification of treatment "bins" for UCMR4 meta-data would be more effective. EPA should clearly articulate the future intended use of any meta-data collected in the final UCMR4.

3. Source water monitoring for cyanotoxins should not be included in the final UCMR4. Instead, enzyme-linked immunosorbent assays (ELISAs) of finished water should first be run against a low-level calibration curve (designed specifically for values below 1µg/l), (2) re-calculated for a higher level calibration curve for values that fall above 1µg/l on the low-level calibration curve. The value reported should be the value calculated using the correct calibration curve. If the sample continues to demonstrate occurrence greater than the MRL using the correct calibration curve, then the additional analysis using EPA Method 544 should also be conducted. See



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the section "Microcystins ELISA development..." for more details on calibration curves.

4. Reconsider the proposed contaminants and revise the sampling framework for UCMR4 samples. AWWA recommends:

    a. Retaining year-round monitoring,

    b. Monitoring for the nine haloacetic acids (HAA9) in conjunction with compliance monitoring and data submittal,

    c. Reducing ground water monitoring to a single event for each EPTDS, based on our analysis of UCMR3 data that shows similar concentrations between the two sampling events, and

    d. Eliminating monitoring of the proposed alcohols and germanium to keep the total number of UCMR4 contaminants under 30 with the inclusion of the 13 species of DBPs (four trihalomethanes (THMs) and HAA9).

### Integrating SDWA Policy Development

A very positive development in the UCMR4 proposal is the forethought EPA utilized to integrate data needs across both Section 1412(b)(1)(B) (regulation of unregulated contaminants) and Section 1412(b)(9) (six-year review). The cost incurred by water systems and EPA to implement unregulated contaminant monitoring is substantial and unequitable for some systems. Consequently, the contaminants included should be carefully selected so as to make the best use of limited available resources. Equally importantly, the logistics of a national data collection effort require time yet is critical to national regulatory decisions, which cannot be made without a sound understanding contaminant occurrence. Therefore, the time spent on UCMR should not be wasted monitoring for contaminants that are unlikely to be observed, and if they are observed, unlikely to pose a significant national health consequence or to provide a "meaningful opportunity for risk reduction" through a national drinking water regulation. Thousands of non-detects in past UCMRs that have not been used to make negative regulatory determinations have not been an effective use of the drinking water community's fiscal resources.

### EPA Research Agenda Should Support SDWA Contaminant Evaluation

EPA's "Safe and Sustainable Water Resources Strategic Research Action Plan 2016 – 2019" is the latest in a series of EPA research plans that do not support the Agency's mission and mandatory duties under SDWA.[1] The lack of a cohesive and robust research plan to support regulatory actions being considered under SDWA sections 1412(b)(1)(B) and

[1] EPA, Safe and Sustainable Water Resources Strategic Research Action Plan 2016 – 2019, 2015 [http://www.epa.gov/sites/production/files/2015-10/documents/strap_2016_sswr_508.pdf]



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1412(b)(9) have resulted in the UCMR4 proposal including "make do" solutions for data collection that will pose serious challenges to data interpretation. Effectively targeted research projects could much more systematically characterize the linkages between:

1. Brominated DBP formation, influent water characteristic, and treatment scenarios.
2. Available source water indicators of cyanobacteria, treatment regimes, and observed finished water cyanotoxin levels.

The statutory mandate for UCMR is to develop the national occurrence of unregulated contaminants in ***"drinking water supplied by public water systems..."*** (emphasis added). The drinking water community has successfully implemented unregulated contaminant monitoring rule requirements for more than 30 years to serve that purpose. We also know from that history that UCMR is ill-suited to researching and developing an understanding of the underlying factors for that occurrence. For examples, see previous AWWA comments on the challenges posed analyzing UCMR2 nitrosamine occurrence data with respect to disinfection practice.[2]

## Coordinating Data Systems

The UCMR4 Federal Register notice and "DRAFT Information Collection Request for the Unregulated Contaminant Monitoring Rule (UCMR 4)" are silent with respect to which data system water systems and laboratories will be instructed to submit data. EPA's UCMR electronic data reporting system, the Safe Drinking Water Accession and Review System (SDWARS) is the implied data system on pages 80 FR 76905 and 76907 (recognition of entry points to the distribution system and laboratory applications). However, the proposed UCMR4 has no substantial discussion of the data system. For the past several years, EPA has had an ongoing collaboration with the Association of State Drinking Water Administrators (ASDWA) to develop a new electronic data portal for compliance monitoring known as the Compliance Monitoring Data Portal (CMDP). CMDP is scheduled for beta testing in 2016 and going live in 2017, one year prior to the beginning of UCMR4. Appropriate alignment of UCMR4 and CMDP is important for several reasons:

1. Coordinating compliance and UCMR4 DBP monitoring would be much more informative than separate data collection efforts,
2. Coordinating Entry Point to the Distribution System (EPTDS) monitoring locations with routine monitoring sites would be a more effective use of resources; and
3. Potentially coordination of available water system treatment information.

[2] AWWA, Comments on Revisions to the Unregulated Contaminant Monitoring Regulation (UCMR 3) for Public Water Systems, Docket ID No. OW–2009–0090, 2011



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### Application of EPA Health Advisories and Reference Levels

In June 2015, EPA finalized 10-day health advisories for microcystins and cylindrospermopsin. These advisories are described by the Agency as non-regulatory and informational. In the final UCMR4, EPA needs to clearly state the non-regulatory aspects of these numbers. In some EPA regions, the current UCMR3 monitoring data is be used to require additional treatment and abandonment of wells based on the perfluorooctane sulfonate (PFOS) observations and the provisional EPA health advisory.[3] EPA has gone to considerable length to describe the cyanotoxin health advisories as 10-day levels, and that multiple toxin observations above the health advisory levels are necessary to support risk management steps by the public.[4] AWWA recommends that EPA be explicit in the final rule that a single data point from the UCMR4 monitoring data alone is not sufficient to trigger public notice for cyanotoxins.

Similarly, in UCMR3, EPA provided reference levels that were calculated using standard procedures for computing drinking water equivalent levels (DWELs).[5] Having such health reference levels can be informative for communication with the public, but complications ensue given the health endpoints being explored in the scientific literature and mass media for compounds like microcystins, cylindrospermopsin, nodularin, manganese, DBPs, etc. Therefore, AWWA recommends that EPA carefully consider the quality of the available information for such reference levels and to thoughtfully present such levels in the final UCMR4.

## Cyanotoxin Monitoring

AWWA has several concerns and recommendation to improve the proposed cyanotoxin monitoring methodologies. The issues raised bear on both the resulting UCMR4 data and the usefulness of that data for needed analyses. The ultimate goal of any UCMR is to appropriately inform future regulatory decision-making, and we believe that our recommendations will aid in optimizing the decision-making processes.

First, EPA's proposed microcystins sampling methodology includes taking both source and finished water samples. AWWA recommends that EPA remove source water monitoring from the final UCMR4, and restructure the finished water monitoring as detailed below. We believe this is the most prudent course of action for the following reasons:

---

[3] EPA, Health Advisories for Perfluorooctanoic Acid and Perfluorooctane Sulfonate in Drinking Water, 2009, [http://www.epa.gov/dwstandardsregulations/health-advisories-perfluorooctanoic-acid-and-perfluorooctane-sulfonate]

[4] EPA, Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water, 2015, [http://www.epa.gov/nutrient-policy-data/guidelines-and-recommendations#health]

[5] EPA, October 2015 UCMR 3 Data Summary for Chemical Contaminants, EPA 815-S-15-003, [http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3].



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1. The purpose of the UCMR is to develop occurrence data for potential contaminants that may be present in ***"drinking water supplied by public water systems..."*** (emphasis added). Past UCMRs have monitored only at EPTDSs and at points within the distribution system. Source water monitoring is not appropriate under the UCMR regulatory framework, and should be undertaken in targeted research studies that collect treatment plant meta-data sufficient to support analysis.

2. In addition to the potential for existing treatment to remove cyanotoxins, treatment can also lead to the release (*e.g.*, oxidant addition) or concentration of toxins (*e.g.*, recycle streams). Using the "phased" microcystins methodology would miss both processes that increase cyanotoxins within the plant and processes that decrease cyanotoxins within the plant.

3. Because water takes time to travel through a treatment facility, sampling methodologies meant to determine treatment effectiveness must accurately account for travel time from source to the EPTDS. Taking simultaneous source and finished samples does not provide information on treatment effectiveness, but only two different sets of data that can only be analyzed independently. Because of the complexity of determining a uniform methodology to accurately measure pre- and post- treatment concentration that accounts for travel time, such data collection is appropriate as a separate research study, not as a part of UCMR.

4. EPA's proposed use of the ELISA test for microcystins on source water samples would likely create a communication challenge for water systems. Because UCMR monitoring must be reported on the system's Consumer Confidence Report (CCR), some systems will likely have readings above 0.3 µg/l in source water samples, but then non-detect in finished water samples. Consequently, these systems will report a positive source water monitoring result on their CCR. The CCR is designed to help consumers understand their drinking water quality. The inclusion of source water data, when the contaminant of concern was not actually found in the water delivered to customers, will further complicate the CCR and public understanding of their system's water quality.

5. Research on the treatment of microcystins consistently shows that very low levels of extracellular microcystins are removed with conventional water treatment, and intracellular microcystins are removed through flocculation, coagulation, and filtration processes. The phased monitoring methodology that EPA has proposed fails to account for the best available science in setting the source water screening level (0.3 µg/l). The proposed screening level is lowest readable value in the most commonly used ELISA methods, and even is typically considered "semi-quantitative". Water systems with low readings would nearly always have non-detects in finished water. The current combination of sample location and screening value contributes to implementation

burden without adding new information, as the literature has already shown that conventional treatment and disinfection remove very low levels of microcystins.

6. Removing source water monitoring would simplify the analytical method requirements. The Ohio EPA ELISA method, which is expected to share most characteristics with the EPA standard ELISA method currently in development, requires several rounds of freezing and thawing to lyse any cyanobacteria cells present in the sample and release all of their stored toxins. Conventional water treatment in most instances will remove all or nearly all of the cyanobacteria and all of the intracellular toxins contained within those cells will not be present in finished water. Unlike source water monitoring, which would require both lysed and not-lysed samples to capture both total and extracellular microcystins, finished water monitoring does not require lysing.

In summary, AWWA is concerned that the quality of occurrence data in drinking water generated by the phased methodology for microcystins would be poor. Eliminating source water monitoring and instead monitoring finished water directly, using the methodology proposed below, would generate much higher quality occurrence data that would be more useful for the purposes of determining both national occurrence and deciding whether there is or is not a meaningful opportunity for risk reduction under a future regulation.

In place of source water monitoring, EPA should restructure microcystins monitoring in finished water using the following protocol:

1. Samples to run finished water ELISA and LC/MS/MS (EPA Method 544) should be taken simultaneously.
2. ELISA results for any sample should be compared against a low-level calibration curve designed for greatest accuracy of values less than 1µg/l.
3. If the sample result is above the low-concentration calibration range, then the sample result should be compared against a higher concentration calibration curve designed for accuracy above 1µg/l.
4. The reported result should be the result using the correct calibration curve. For ELISA values above the MRL at the correct calibration curve, EPA 544 should also be run and reported.

EPA should carefully consider all of these comments to assure that useful data is on microcystins is generated without creating an overly large burden on public water systems and contributing to the other issues mentioned throughout the comments.



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## Microcystins ELISA Method Development and Lab Certification

As EPA is well aware, the ELISA calibration is logarithmic in nature.[6] Therefore, if the most accurate results are needed at relatively low levels (e.g. 0.3 µg/l), then the calibration accuracy in that range is critical. Most detected values in UCMR are expected to be at the low end of the calibration range, if detected at all. ELISA is typically calibrated over a range from 0.15 to 5 µg/l and there is seldom clear guidance regarding dilution in the test kits. AWWA recommends that in the development of the EPA version of an ELISA method, the EPA ELISA method requires that initial measurements be conducted against a calibration curve that goes no higher than 1 µg/l (e.g. 1 order of magnitude) and, if values are over-range, they should be re-calculated against either the full calibration range or that portion of the calibration range that goes from 1 to the high end. As EPA typically includes requirements for back calculation and acceptance criteria in methods, we assume this will be taken into consideration. AWWA recommends that EPA focus on evaluating calibration ranges to ensure greatest accuracy and precision, especially because values above the MRL (currently 0.3 µg/l) will trigger the more expensive LC/MS/MS method. Note also that this does not take into consideration the different responses of microcystin variants. Therefore, the more precise EPA can make their ELISA method, the lower the overall uncertainty.[7]

Use of ELISA as a screening measure under UCMR4 to measure total microcystins is only appropriate if EPA can demonstrate the method meets all applicable quality control measures expected of an EPA Standard Method. Although we commend Ohio EPA for leading initial method development, EPA should not assume that Ohio EPA has already completed all of the appropriate quality assurance/quality control (QA/QC) measures expected of an EPA standard method that is to be applied nationally. AWWA recommends that EPA independently verify all necessary procedures and performance information of the method during method development. There may be too many unknowns about interactions with degradation byproducts, interferences from other compounds, and different, but unknown, sensitivities to different congeners to pass appropriate QA/QC. EPA should be prepared to pursue alternate sampling methodologies if the ELISA method currently in development cannot pass appropriate QA/QC criteria.

Additionally, according to the UMCR4 laboratory certification manual, laboratories must be able to accurately measure down to 1/3 of the MRL to achieve certification. Given a proposed MRL of 0.3 µg/l for total microcystins, meeting the proposed certification criteria requires accurately measuring to 0.1 µg/l. It is not clear laboratories can achieve this level of performance on a consistent basis, posing a serious laboratory certification problem.

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[6] For illustratory purposes see Abraxis Microcystins/Nodularins (ADDA), ELISA Microtiter Plate Kit's User Guide, http://www.abraxiskits.com/wp-content/uploads/2014/08/Microcystin-PL-ADDA-Users-Guide-ETV-R082714.pdf (downloaded February 3, 2016).

[7] Abraxis Microcystins/Nodularins (ADDA), ELISA Microtiter Plate Kit's User Guide, http://www.abraxiskits.com/wp-content/uploads/2014/08/Microcystin-PL-ADDA-Users-Guide-ETV-R082714.pdf (downloaded February 3, 2016)



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Current ELISA methods only become semi-quantitative at 0.3 µg/l (+/- 50%) and it may not be realistic to detect down to 0.1 µg/l. EPA should carefully consider revising its performance criteria for microcystin analysis by ELISA when setting this threshold value and while testing its standard method under development. The Abraxis ADDA test has a manufacturer-supplied MRL of 0.15 µg/l. This manufacturer MRL would require EPA to either have 0.45 µg/l or higher UCMR MRL, or to change the laboratory certification processes and requirements. Any change to those requirements needs to be based upon good science.

Alternatively, EPA could fast track the development of its upcoming MMPB method, which is expected to be both more reliable and deliver more granular information for potential regulatory decision making. EPA could then add the MMPB method to UCMR as soon as it is available.[8] For this reason, and for other reasons described below, AWWA recommends that EPA raise the MRL for the ELISA method to at least 0.45 µg/l if the current Abraxis ADDA test is used, or higher if analysis of EPA's standard method currently in development indicates a higher MRL is appropriate.

Additionally, EPA Method 544 is currently used rarely and only by a handful of laboratories. Many laboratories have developed "direct injection" methods that are more straightforward, potentially less expensive, and still have a strong sensitivity (50-100 ng/l). EPA should discuss this issue with laboratories and consider the possibility of developing an EPA standard method to reduce the overall burden compared to running EPA Method 544.

## Need for Specific Cyanotoxins Analysis Plan

AWWA is concerned about how data analysis will be performed on the cyanotoxins data collected in UCMR4 as proposed. It is well known that ELISA does not measure every microcystin congener equally. That is to say a known amount of Microcystin-LR does not yield the same result on an ELISA test as the same known amount Microcystin-LA or another congener. In some cases, the same concentration of one congener can yield a result several times greater on ELISA than another congener. For example, when a total microcystins ELISA test is calibrated using Microcystin-LR (as it most commonly is), there is the possibly that any unknown congener could either:

1. Produce 10% of the response of Microcystin-LR, yet be much more toxic and present a greater health risk, under-reporting the actual concern, or

[8] MMPB analytical method is a liquid chromatography tandem mass spectroscopy (LC/MS/MS) analysis on the 3-methoxy-2-methyl-4-phenylbutyric acid molecule (MMPB) and calibrated using a certified reference standard, currently (microcystin-LR) and 4-phenylbutyric acid.



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2. Produce 10 times the response of Microcystin-LR, yet be much less toxic and therefore over-report the actual health concern.

Therefore, making comparisons between ELISA and LC/MS/MS measurements is difficult, and in some cases, such as if unknown congeners are present, can be nearly impossible without more information. Total Microcystins as measured by ELISA is *not* equal to the congeners measured by LC/MS/MS plus unknown congeners. The translation from ELISA to LC/MS/MS is not known for every compound and circumstance. Additionally, the sensitivity of ELISA known for many congeners is unknown. Finally, it is thought that ELISA picks up some cyanotoxin oxidation degradates, falsely implying greater concern than warranted by the substance that is actually present. Therefore, we recommend that EPA create a clear, transparent plan for the analysis of UCMR data to address these complexities prior to the collection of the data.

## Additional Cyanotoxins Concerns

AWWA requests that EPA explain the benefit of monitoring for nodularin based upon a total microcystins trigger. Many do not consider nodularin to be a microcystin, although it does share some structural similarities with microcystins. We cannot foresee any scenarios where this proposed methodology yields any conclusions on national occurrence for nodularin, and it appears to be included only because it is part of the EPA 544 analytical method. Simply being part of the EPA 544 method is not appropriate for the inclusion of another compound in the final UCMR4 that does not appear to inform any future regulatory decision-making.

In the supporting cost analysis, EPA has used the presumption that 20% of surface water raw / intake ELISA samples will read as 0.3 µg/l or greater. AWWA does not agree that this frequency is supported by the available evidence. There are good reasons to expect the frequency could be substantially higher. Given the potential for interference by other compounds, the tendency for ELISA to generate false positive results, and the intentional biasing towards finding greater occurrence (by concentrating the sampling in warmer months) it is more likely that the cost assumptions are incorrect. Again, AWWA recommends that EPA eliminate source water monitoring from the sampling methodology for microcystins. With this elimination, EPA will be able to more accurately estimate the projected cost of conducting sampling directly on finished water.

## Monitoring to Inform DBP Risk Management

AWWA supports the collection of occurrence data in UCMR4 in order to inform evaluating risk management decisions regarding DBPs. The development of the current DBP standards reflect an extensive body of research and substantive, fact-based, stakeholder dialogue. To make changes in the existing DBP – microbial disinfection framework will require a careful consideration of off-setting and overlapping risk management challenges.



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Given the potential for unintended, undesirable impacts, AWWA urges EPA to set objectives for UCMR4 that effectively utilize this national occurrence survey's strengths and minimizes its weaknesses. UCMR4's objectives should fit within a cohesive research and information collection strategy that includes:

1. A clearly articulated vision of data and information needs to support future risk-management decisions,
2. A cohesive research plan that reflects what information is to be developed through EPA intra- and extramural research,
3. Occurrence gaps that UCMR4 will fill, and
4. A process for engaging the drinking water sector to leverage EPA's work.

Such a strategy would need to extend beyond occurrence and treatment to health effects. While EPA has posited a premise for focusing on brominated DBPs in future decision-making, a substantive debate is ongoing on whether the drinking water community presently has sufficient evidence to warrant changing treatment practice.[9, 10] The balance of AWWA's comments on UCMR4 assume that brominated DBPs will be a substantial component of future risk management and the question at hand is what information from UCMR4 monitoring would most appropriately inform those decisions.

The proposed UCMR4 appears to incorporate the following elements to support DBP risk management evaluation:

1. The collection of HAA5, HAA6Br, and HAA9 samples from current distribution system compliance monitoring locations for the purpose of estimating the national occurrence of unregulated brominated HAAs while staying within the UCMR monitoring cap of 30 contaminants.
2. The collection of total organic carbon (TOC) and bromide at LT2ESWTR (or similar) source water monitoring locations to inform modeling the linkage between influent water quality and observed DBP formation.
3. Temperature and pH at LT2ESWTR (or similar) source water monitoring locations to inform modeling the linkage between influent water quality and observed DBP formation.

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[9] Regli, S., J. Chen, M. Messner, M.S. Elovitz, F. J. Letkiewicz, R.A. Pegram, T.J. Pepping, S.D. Richardson, and J. M. Wright, "Estimating Potential Increased Bladder Cancer Risk Due to Increased Bromide Concentrations in Sources of Disinfected Drinking Waters, 2015, Environ. Sci. Technol., 2015, 49 (22), pp 13094–13102. http://dx.doi.org/10.1021/acs.est.5b03547

[10] Hrudey S.E., Backer L.C., Humpage A.R., Krasner S.W., Michaud D.S., Moore L.E., Singer P.C., Stanford B.D., Evaluating Evidence for Association of Human Bladder Cancer with Drinking-Water Chlorination Disinfection By-Products, ,J Toxicol Environ Health B Crit Rev. 2015;18(5):213-41. doi: 10.1080/10937404.2015.1067661.

4. Data element, including primary and secondary disinfection practice and treatment information for each sample, in order to distinguish differences in DBP occurrence as a function of disinfection and treatment practice.

AWWA supports each of the above data collection objectives but does not agree that the data collected as proposed will be informative or that UCMR is the appropriate mechanism to develop data to inform the analyses envisioned.

### Applicability of HAA Monitoring

As currently proposed, HAAs are a part of Assessment Monitoring and as such must be monitored by all systems serving more than 10,000 population served. Additional regulation of HAAs would be through a potential revision of existing DBP regulations. The current DBP regulations only apply to systems that employ a chemical disinfectant. For purposes of UCMR4, EPA could substantially reduce the complexity of the data collection effort and reduce the burden of the rule on undisinfected water systems by only collecting HAA data from systems subject to the existing DBP regulations. Such an approach does inadvertently bias exposure toward systems with the potential for higher levels of HAAs but is adequate to inform the potential revision of existing DBP regulations.

### Analysis Supported by Proposed Data Collection Is Superfluous

AWWA agrees with EPA that the Agency should have actual occurrence distributions of contaminants in finished water for evaluating future regulatory decisions. This is what the SDWA requires, and is particularly true of DBPs where additional regulatory action will require modelling to estimate the impact of potential risk management strategies. The proposed collection of HAA5, HAA6Br, and HAA9 will involve significant time and expense to collect data that is not a great deal more useful than analyses that can be conducted with data already available to EPA. Attachment A illustrates how well-recognized relationships, like bromide incorporation factor (BIF), can be used to achieve the same level and quality of information that will be accrued through the proposed data collection.

### Suggestions to Streamline and Enhance HAA Data Collection

EPA should explicitly list the individual brominated HAA species not captured by current monitoring for HAA5. Those species are:

1. bromochloroacetic acid,
2. bromodichloroacetic acid,
3. chlorodibromoacetic acid, and
4. tribromoacetic acid.



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This data should be obtained by analyzing Stage 2 DBPR compliance samples for HAA9 rather than HAA5. The four currently regulated THM species data should be reported for the same samples as well.

Samples processed for compliance with UCMR4 will be of sufficient quality to allow submitting the sum of dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, and trichloroacetic acid for compliance with Stage 2 DBPR. Such dual use of UCMR monitoring results has occurred previously and, if appropriately framed, will both improve the data available to EPA for analysis and help water systems manage the burden presented by compliance with the final UCMR4.

Stage 2 DBPR compliance monitoring is currently filed with state primacy agencies through either unique state data systems or SDWIS State, while UCMR1, 2 and 3 results have been submitted through SDWARS. These two systems are separate but not incompatible. EPA is presently developing CMDP, and it is scheduled to be operational a year prior to the beginning of UCMR4 monitoring. Utilizing a single data portal for submitting both compliance and UCMR data is appealing for multiple reasons, provided that the data portal is stable, easy to use, and thoroughly beta tested with users prior to implementation. Benefits could include:

1. A single HAA data submittal that would fulfill both compliance and UCMR4 requirements.
2. Collection of both individual TTHM and HAA species concentrations along with regulatory required TTHM and HAA5 sums.

### Utility of Source Water Bromide and TOC Data Collection

AWWA agrees with EPA that both bromide and TOC data should be collected to inform future technical analyses to support any potential DBP risk management decisions. AWWA does not concur with the premise that collecting bromide and TOC with the other data collected in UCMR4 are sufficient to develop an informative model of brominated DBP occurrence. As has been illustrated by previous dialogues around DBP/microbial risk management, understanding the underlying mechanisms of DBP formation and the complex relationships between treatment and DBP formation and degradation is important to regulatory option analysis. Consequently, AWWA suggests that targeted research studies investigating treatment alternatives, bromide and TOC control, other treatment options, and DBP formation considerations be developed.

Use of CMDP would again be helpful as a data collection alternative in lieu of UCMR. TOC removal is already a requirement for all surface water treatment plants in the US. Consequently, a substantial body of data is already being collected on influent and effluent TOC at existing water treatment plants. This data would inform both understanding DBP occurrence and our understanding of how much additional TOC reduction is potentially

available to any potential future risk management activities. Collecting TOC data from existing state data systems is challenging, but CMDP is anticipated to facilitate compiling data from existing regulatory monitoring and reporting requirements.

A better understanding of bromide occurrence will be necessary to support Agency activity. Again, this need extends beyond the capacity of UCMR monitoring. In this instance, an updated national distribution of bromide occurrence is needed, as well as an understanding of the temporal trends and regional trends in both surface and ground water supplies. Data of this type is probably best developed through a collaborative effort with USGS and dedicated research projects that evaluate not only conventional sources of water supply that currently dominate water supply portfolios but also investigate implications of using more challenging waters as water supply alternatives.

### Temperature and pH

It is not clear from the UCMR4 Federal Register notice whether EPA intends to use the collected temperature and pH data to inform evaluation of the DBP occurrence data. AWWA would strongly discourage the Agency from attempting such an approach. The collection described in the notice is for temperature and pH to be monitored in source water at the time of cyanotoxin sampling. Such samples are:

1. Not clearly connected in time with the HAA samples, and
2. Reflect source water conditions, not conditions during treatment and finished water that are pertinent to DBP formation.

AWWA recommends that disinfectant residual, temperature and pH be collected and reported at the same time as the sampling for the four THMs and HAA9 at compliance monitoring sample locations.

### Primary and Secondary Disinfection Practice and Treatment Information

As previously stated, a cohesive research plan is needed to collect data that is useful for the questions most pertinent to future risk management steps. For example, while the proposed UCMR4 collects information on TOC and bromide, it does not collect the equally, if not more, important information on oxidant addition, oxidant order of application, oxidant dose, and oxidant contact time. It should be noted that AWWA is not recommending that these be included in the final UCMR4, as these are more appropriate for targeted research studies. Consequently, the proposed UCMR4 does not, and is unlikely to, collect sufficient information to support such efforts as modeling of DBP occurrence as a function of water quality parameters and treatment.

However, AWWA recommends that the final UCMR4 collect the primary and secondary disinfectant practice in place at the time of DBP sampling. This data is critical to even



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simple evaluations of the UCMR occurrence data and is fundamental to better targeting future research.

AWWA agrees that the UCMR4 data is more informative when there is information describing the associated treatment. However, collecting this data has been problematic in previous UCMRs. If UCMR4 data were collected through CMDP as AWWA recommends, connecting the UCMR4 data to the treatment plant description maintained as a part of routine system reporting to the state is possible. Unfortunately, in the near term, at least two issues are barriers to such an approach:

1. Previous EPA analyses have found that, historically, the State data for nonparametric data elements is less complete and more likely to be inaccurate than compliance data. So, in the near-term, UCMR4 may not be able to rely exclusively on data from the state data systems and some type of hybrid data collection approach may be needed.
2. The effort to implement CMDP will not include collection of nonparametric data so the data system renewal at the federal level that would result in a refresh and updated tool for this data will not be available until PRIME is developed and implemented. PRIME's development timeline is undeterminable at this point.

## Removal of Alcohols and Germanium from UCMR4

AWWA recommends that EPA remove the Alcohols (1-butanol, 2-methoxyethanol, and 2-propen-1-ol) and germanium from UCMR4. These compounds are of low toxicity and it appears unlikely to have widespread national occurrence at levels of concern. Therefore, there is not likely to be any significant opportunity for risk reduction as required by the contaminant selection process. Therefore, we request that EPA remove these compounds to make room for higher priority data collection actions recommended elsewhere in AWWA's comments.

## Requests for Comment

*"EPA invites comment on the proposed UCMR 4 contaminants and their associated analytical methods identified in Exhibit 3, as well as any other priority contaminants commenters wish to recommend."*

In commenting on the draft CCL4, AWWA specifically recommended listing individual microcystins (i.e., MC-LR, –LA, -LW, -RR, and –YR) as well as cylindrospermopsin and anatoxin A. In keeping with AWWA's earlier recommendation, we concur that if appropriate methods and sampling methodologies are used, that occurrence data for these cyanotoxins is important and a high priority for inclusion in UCMR monitoring.



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## Selected Analytical Methods for Proposed Contaminants

AWWA reviewed the analytical methods proposed by EPA in the proposal, summarized in Exhibit 1.

Exhibit 1. Overview of Proposed UCMR4 Analytical Methods and Associated Issues

| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 1 | Total microcystins | * | * | ELISA Standard Operating Procedure (SOP) (Ohio EPA, 2015). | 0.3 |
| 2 | Microcystin-LA | * | 0.3 | EPA Method 544 | 0.008 |
| 3 | Microcystin-LF | * | 0.3 | | 0.006 |
| 4 | Microcystin-LR | 0.021 | 0.3 | | 0.02 |
| 5 | Microcystin-LY | * | 0.3 | | 0.009 |
| 6 | Microcystin-RR | * | 0.3 | | 0.006 |
| 7 | Microcystin-YR | * | 0.3 | | 0.02 |
| 8 | Nodularin | ? | NA | | 0.005 |
| 9 | Anatoxin-a | ? | NA | EPA Method 545 | 0.03 |
| 10 | Cylindrospermopsin | 1.6 | 0.7 | | 0.09 |
| 11 | Germanium | 0.744 | 7.44 | EPA Method 200.8 | 0.3 |
| 12 | Manganese | 300 | 300 | SM 3125<br>SM 3125–09<br>ASTM D5673–10 | 0.4 |



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| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 13 | alpha-Hexachlorocyclohexane | 0.006 | 0.006 | EPA Method | 0.01 |
| 14 | Chlorpyrifos | 2 | | 525.3 | 0.03 |
| 15 | Dimethipin | 153 | 153 | | 0.2 |
| 16 | Ethoprop | 0.7 | 1.25 | | 0.03 |
| 17 | Oxyfluorfen | 0.478 | 210 | | 0.05 |
| 18 | Profenofos | 0.35 | 0.35 | | 0.3 |
| 19 | Tebuconazole | 210 | 210 | | 0.2 |
| | total permethrin | 3.65 | 3.65 | | 0.04 |
| | *i.e.* | | | | |
| 20 - 23 24 25 | *The combined concentration of 4 distinct stereoisomers of (3-Phenoxyphenyl)methyl ester 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylic acid* | 3.65 | | | 0.07 |
| | Tribufos | | 7 | | |
| | HAA5 | | | EPA Method | -- |
| | HAA6Br | | | 552.3 | -- |
| | HAA9 | | | | -- |
| | *i.e.* | | | | |
| 26 | *Bromochloroacetic acid* | -- | | | *0.3* |
| 27 | *Bromodichloroacetic acid* | -- | | | *0.5* |
| 28 | *Chlorodibromoacetic acid* | -- | | | *0.3* |
| 29 | *Tribromoacetic acid* | -- | | | *2.0* |
| 30 | *Monobromoacetic acid* | -- | | | *0.3* |
| 31 | *Dibromoacetic acid* | -- | | | *0.3* |
| 32 | *Dichloroacetic acid* | 0.7 | 0 | | *0.2* |
| 33 | *Monochloroacetic acid* | 70 | 70 | | *2.0* |
| 34 | *Trichloroacetic acid* | 20 | 20 | | *0.5* |
| 35 | 1-butanol | 700 | 700 | EPA Method | 2.0 |
| 36 | 2-methoxyethanol | 21 | 21 | 541 | 0.4 |
| 37 | 2-propen-1-ol | 35 | 35 | | 0.5 |
| 38 | butylated hydroxyanisole | 0.581 | 0.581 | EPA Method | 0.03 |
| 39 | o-toluidine | 0.194 | 0.194 | 530 | 0.007 |
| 40 | quinolone | 0.01 | 0.01 | | 0.02 |
| 41 | bromide | | | | |
| 42 | pH | | | | |
| 43 | Temperature | | | | |



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| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 44 | Total Organic Carbon | | | | |

Sources: HRLs included are from EPA HAs, Proposed CCL4 Notice Support Documents, CCL3 Support Documents, Stage 2 Disinfectant and Disinfection Byproduct Rule, and 2012 Drinking Water Standards and Health Advisories [11,12,13,14,15]

To allow for a robust analysis of HAA occurrence, AWWA suggests focusing on augmenting data collection through CDMP. While collecting secondary disinfectant residual values at the time of compliance DBP monitoring is not a typical practice, such information will be important to understanding observed HAA levels. Consequently, in addition to monitoring for HAA9 through augmenting routine compliance monitoring data collection, systems should collect pH, temperature, and either free or total chlorine concentrations as appropriate to the secondary disinfectant in use at the time and location of DBP sample collection. Field DPD observations using handheld colorimeters will be appropriate for collecting this data. Since field technicians are water system staff and not approved by EPA for UCMR monitoring, EPA will need to revise its current regulatory language on processing of UCMR samples at UCMR approved laboratories. For purposes of UCMR4 monitoring the existing analytical method performance should be sufficient for this data collection activity.[16]

*"EPA will consider raising MRLs if the Agency becomes aware of evidence that a proposed MRL is unattainable or impractical."*

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[11] EPA, 2015, 2015 Drinking Water Health Advisories for Two Cyanobacterial Toxins, 820F15003, http://www.epa.gov/nutrient-policy-data/drinking-water-health-advisory-documents (Accessed 1/3/2016)

[12] EPA, 2015, Contaminant Information Sheets (CISs) for the Draft Fourth Preliminary Contaminant Candidate List (PCCL 4) Nominated Contaminants, EPA 815-R-15-003, http://www.epa.gov/sites/production/files/2015-01/documents/815r15003.pdf (Accessed 1/3/2016)

[13] EPA, 2009, Contaminant Information Sheets for Final CCL3 Chemicals, EPA 815-R-09-012, http://nepis.epa.gov/Exe/ZyNET.exe/P100576U.TXT?ZyActionD=ZyDocument&Client=EPA&index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000011%5CP100576U.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL (Accessed 1/3/2016)

[14] EPA, 2006, 71 FR 388

[15] EPA, 2012, Drinking Water Standards and Health Advisories, EPA 822-S-12-001, http://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf (Accessed 1/3/2016)

[16] 40 CFR 23 and 40 CFR 131



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In the proposed UCMR4, EPA describes its rationale for use of methods with minimum reporting levels that are lower than the health reference levels for the target analytes in UCMR4. The notice does not describe the HRLs for the majority of the UCMR4 contaminants. A retrospective review of available EPA documents found a number of analytes measured in the proposed UCMR4 for which the Agency has not previously identified an HRL.[17] In other instances, the Agency has found that there was insufficient information to compute an HRL (*e.g.*, anatoxin a, nodularin, and individual microcystins other than microcystin LR). Recognizing the limited nature of available health effects information for a number of the target contaminants, AWWA encourages the Agency to place greater value on the robustness of the reliability of the analytical methods employed in UCMR.

If EPA moves forward with the proposed analytes, the Agency should clearly and transparently communicate its rationale for each proposed analyte so that water systems that have positive observations have a sound basis for communication with the public about perceived risk.

*"[Inclusion of] the following contaminants that were considered by the workgroup, but not included in the proposed list because they were deemed a lower UCMR 4 priority than the contaminants identified in Exhibit 3: Legionella pneumophila and Mycobacterium avium (both are part of the draft CCL 4); ammonia (considered as an indicator of distribution system nitrification potential); and the pesticides vinclozolin, hexazinone and disulfoton (additional analytes in EPA Method 525.3)."*

AWWA supports the inclusion of manganese in the final UCMR4. In its comments on the Draft CCL4, AWWA recommended that manganese be included in the group for a future UCMR, and the timing is such that inclusion in the final UCMR4 is appropriate.

AWWA has noted the importance of *Legionella pneumophila* and *Mycobacterium avium* for several iterations of the SDWA CCL process.[18] While AWWA views these organisms as significant, we agree with EPA's rationale for not including these contaminants on the proposed UCMR4 and agree that they should not be included on the final UCMR4. AWWA's comments on CCL4 observed the need for a cohesive, risk-management oriented research

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[17] The HRLs referenced in EPA's January 2016 webcast generally mirror those available from previously available documents, see "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems" Public Webinar, January 13, 2016.

[18] AWWA Comments on Proposed CCL3 (May 2008, Docket: EPA-HQ-OW-2007-1189) [http://www.awwa.org/Portals/0/files/legreg/documents/AWWACCL3Comments.pdf] and AWWA Comments on Proposed CCL4 (April, 2015, Docket: EPA-HQ-OW-2012-0217) [http://www.awwa.org/Portals/0/files/legreg/documents/AWWACommentsDraftCCL4.pdf]



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program for biofilm organisms including *L. pneumophila* and *M. avium*. Such a program is outside the scope of UCMR and should be conducted through separate research studies.

With respect to monitoring ammonia, AWWA does not recommend monitoring ammonia in UMCR4. The collection of ammonia in the absence of a host of other data elements would be very challenging to interpret and use constructively. A substantial body of literature exists on nitrification, including a number of papers by EPA researchers that illustrate that forecasting and controlling nitrification is not possible using a single indicator like ammonia.[19, 20] The presence of ammonia (or in the instance of nitrification, the loss of ammonia) is not a "contaminant", nor is the presence of nitrification inherently a health concern. Consequently, utility monitoring of ammonia in finished water in the final UCMR4 is not appropriate under either SDWA Section 1445(a)(2) or Section 1445(a)(1)(A).

While AWWA appreciates the Agency looking for opportunities to consolidate around groups of chemicals that can be analyzed using a single analytical method (e.g., EPA Method 525.3), it is not appropriate to include contaminants that represent little opportunity for risk reduction, because it is possible to measure them. In comments on the CCL4 proposal, AWWA indicated that there was already sufficient information for EPA to make a negative regulatory determination for disulfoton. Neither EPA or AWWA has identified hexazinone as a priority drinking water contaminant for evaluation.[21, 22] Vinclozolin is a registered pesticide; consequently, it is regulated under the Federal Insecticide, Fungicide, and Rodenticide Act and the Food Quality Protection Act. As part of re-registration EPA prepared an analysis of the risks posed by Vinclozolin and explicitly considered models of high-risk exposure scenarios via drinking water. The Agency concluded:

> "Model estimates of potential drinking water exposure from ground and surface water sources **are not of concern for vinclozolin**." [emphasis added][23]

Consequently, while Vinclosolin is proposed for inclusion on CCL4, it is not a relevant analyte for UCMR monitoring.

*"Exhibit 3 that you think represent a lower priority than your new recommendation(s) or that should otherwise be removed from the list; the recommended analytical method(s) for any new*

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[19] Odell, L.H., G.J. Kirmeyer, A. Wilczak, J.G. Jacangelo, J.P. Marcinko, R.L. Wolfe, Controlling Nitrification in Chloraminated Systems, 1996, Journal AWWA, page 86 – 98.
[20] AWWA, Nitrification Prevention and Control in Drinking Water, AWWA Manual M56, Second Edition, 2013.
[21] EPA CCL4 Docket: EPA–HQ–OW–2012–0217
[22] AWWA, AWWA Recommendations for Contaminant Candidate List 4 (CCL4), 2015, [http://www.awwa.org/Portals/0/files/legreg/documents/2015CCLAWWAReport.pdf]
[23] EPA, RED Facts, Vinclozolin, EPA-738-F-00-021, 2000, [http://iaspub.epa.gov/apex/pesticides/f?p=CHEMICALSEARCH:31:::NO:1,3,31,7,12,25:P3_XCHEMICAL_ID:4400]



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*contaminant(s) that you propose; and other relevant details (e.g., reporting level, sampling location and sampling frequency)."*

AWWA's CCL3 comments identified a number of contaminants with higher priority for collection of occurrence information, specifically: 1,4-dioxane, molybdenum, and 1,1-dichloroethane. These three contaminants are being monitored in UCMR3 and despite 0, 34, and 1 water systems to-date, respectively, observing these high priority contaminants at levels above the health reference level.[24]

EPA's proposed UCMR4 already includes many of the contaminants AWWA identified in its CCL4 analysis: anatoxin-a, cylindrospermopsin, microcystin-LA, microcystin-LR, microcystin-RR, and microcystin-YR, Chlorpyrifos, and manganese. AWWA also recommended monitoring the following in UCMR4:

1. microcystin-LW,
2. 3-Hydroxycarbofuran,
3. Azinphos-methyl,
4. Saxitoxin, and
5. Saxitoxin-related paralytic shellfish toxins.[25]

There is sufficient information to consider microcystin-LW, 3-Hydroxycarbonfuran, and Azinophos-methyl for inclusion in UCMR4. Exhibit 2 summarizes the relevant details for monitoring under UCMR4.

Exhibit 2. Recommended Additions to UCMR4 Monitoring

| Analyte | Available Methods | Reporting Level (µg/L) | Relevant Systems | Sampling Locations | Sampling Frequency |
|---|---|---|---|---|---|
| microcystin-LW | EPA 544 | * | Surface Water | Same as other cyanotoxins | Same as other cyanotoxins |
| 3-Hydroxycarbofuran | EPA 531,2 | 0.029 | All systems | Entry Point to Distribution System | Same as other pesticides |

[24] EPA, October 2015 UCMR 3 Data Summary for Chemical Contaminants, EPA 815-S-15-003, [http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3]. It should be noted that there are 325 systems identified with 1,4-dioxane levels observed above the 1 in 1,000,000 risk level but none above the 1 in 10,000 risk level.

[25] AWWA, AWWA Recommendations for Contaminant Candidate List 4 (CCL4), 2015, [http://www.awwa.org/Portals/0/files/legreg/documents/2015CCLAWWAReport.pdf]



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| Analyte | Available Methods | Reporting Level (µg/L) | Relevant Systems | Sampling Locations | Sampling Frequency |
|---|---|---|---|---|---|
| Azinphos-methyl | EPA 525 | ** | All systems | Entry Point to Distribution System | Same as other pesticides |

Notes:
* Reporting level should be comparable to other six microcystins which EPA proposes to monitor using Method 544. Inclusion in UCMR4 would necessitate locating a suitable standard for development of a final MRL, calibration, and QA/QC.

** Reporting level would need to be established through an inter-laboratory method performance study.

There is an opportunity to remove contaminants from the proposed UCMR4 list in order to both make room within the analyte cap set in SDWA for UCMR4 and better align the UCMR4 rulemaking with public health priorities.

## Burden and Logistics

### UCMR4 Monitoring by Groundwater Systems

AWWA recommends that UCMR4 contaminants monitoring other than DBP monitoring, be reduced to a single sample per point of entry for groundwater systems. Other comments speak to an alternative monitoring strategy for UCMR4 DBPs. Moving to a single sample per EPTDS will result in a sufficiently robust dataset for the purposes UCMR monitoring is intended to serve. This suggestion is meant to compliment not replace representative monitoring.

A detailed analysis of UCMR3 data, based primarily on the June 2015 National Contaminant Occurrence Database, but also supported by some analysis of the October 2015 NCOD release demonstrate that there is little statistical basis for UCMR4 to include 2 samples for water systems that rely on ground water supplies. Rather, a single sample would provide data of equal robustness. This general statement is true across the families of compounds analyzed in UCMR3. There were specific instances where the nature of the contaminant or analytical method does warrant consideration before reducing monitoring to a single sample per point of entry. Instances warranting more careful evaluation include:

1. Where the performance of the method leads to high variability (*e.g.*, total chromium), and
2. When the expected variations in water treatment plant operations are likely to change the concentration of the target analyte in finished water (*e.g.*, disinfection practice and chlorate).



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See Attachment 2 for a preliminary summary of this analysis.

### Basing UCMR Applicability on Retail Population

In developing UCMR3, EPA chose to base the rule's applicability on retail population. As a consequence there are unintended complications in the implementation of UCMR4 monitoring, including:

1. Where wholesalers routinely assist their consecutive systems meet monitoring requirements, the current approach penalizes a collaborative and efficient sampling strategy.
2. If UCMR only collects consecutive system data then there is not a mechanism to collect the treatment and source water data currently envisioned.
3. Is inequitable without providing higher quality data. A wholesale distribution system network will collect many more samples and incur the higher associated sampling expense than a single water system of a similar size.

AWWA recommends that where wholesale and consecutive systems offer to provide a combined monitoring framework, that UCMR4 allow such submittals. The required number of samples should be no more than required of a single city of the same service population. Since monitoring under UCMR is a mandatory responsibility, systems participating in such a combined monitoring framework would be beholden to each other with respect to rule compliance. Where consecutive systems monitor as a standalone entity, they should not be responsible under this rulemaking for source water data and treatment information. The source and treatment information targeted by this data collection effort is the responsibility of the wholesale supplier and if the submitted dataset characterized only the consecutive system, the data would be misleading during subsequent analysis.

### Transparency in Rulemaking Process

Significant UCMR4 details should have been more clearly highlighted in the proposed rule notice. Federal Register notices often require a detailed understanding of the topic at hand and it can be challenging for the Agency to highlight all significant changes from past practice and their import. But, it is not reasonable for substantial expansions of the rule's scope to be relegated to footnotes. The following are examples where the current notice, and by extension the associated Information Collection Request (ICR) do not clearly articulate the proposed data collection and the associated burden:



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1. "TOC and bromide must be collected at the same time as HAA samples. These indicator samples must be collected at a single source water intake"[26]
2. "Temperature and pH must be measured at the same time as cyanotoxin samples at the source water intake ..."[27]
3. "Systems must assign a sample event code for each contaminant listed in Exhibit 1. Sample event codes must be assigned by the PWS for each sample event.[28]

### Use of Dedicated Data Portal

The proposed UCMR4 specifies that "Information that must be submitted using EPA's electronic data reporting system must be submitted through: *http://www2.epa.gov/dwucmr*." EPA is simultaneously developing the CMDP. CMDP is scheduled to be operational in 2017. The proposed UCMR data collection substantially overlaps with data currently submitted by water systems for compliance and will be submitted through CMDP. EPA's data collection should leverage existing compliance data submittals rather than require separate testing, analysis, and reporting to a parallel data system. Use of CMDP does not test the statutory objectives of the SDWA's unregulated contaminant monitoring provision, as is the case with the proposed rule construct. Compliance data would also be more robust in that data for TOC, pH, and individual HAAs would be much denser and reflect each system's current compliance status.

### Data Elements

AWWA has commented previously that understanding UCMR contaminant occurrence necessitates collection of appropriate ancillary data elements.[29] The current proposal includes a very lengthy list of data elements and element definitions that as a practical matter will lead to data entry errors and fail in many instances to meaningfully inform subsequent data analysis. This latter point is important to bear in mind as UCMR collects a snapshot of contaminant occurrence. This snapshot is not a sufficient to intuit the effects of treatment on occurrence beyond gross categorical binning. Consequently, AWWA recommends that EPA simplify the data elements and data definitions substantially.

AWWA's earlier comments also stipulated inclusion of ancillary data elements should occur after a dialogue with stakeholders on how to effectively collect that information.[30] The proposed data definitions for treatment and UCMR4 data collection scheme are unlikely to lead to improved UCMR analysis. At a minimum EPA should:

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[26] 80 FR 76921
[27] 80 FR 76921
[28] 80 FR 76921
[29] AWWA, Comment Letter on Proposed UCMR3 (Docket ID No. OW–2009–0090), May 2, 2011.
[30] AWWA, Comment Letter on Proposed UCMR3 (Docket ID No. OW–2009–0090), May 2, 2011.



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1. Simplify the data definitions for disinfection and treatment, reducing the number of oxidant options and focusing specifically on primary and secondary disinfection.
2. Limit treatment characterization to (no treatment, primary disinfection only, conventional treatment, softening, carbon contactors, and nanofiltration/reverse osmosis).
3. Eliminate secondary disinfectant definition "CAC", where "CAC" is chlorine and chloramines being mixed.
4. Eliminate excessive QA/QC tracking, such as data elements for extraction batch identification code, extraction date, analysis date, sample analysis type, additional value, and sample event code.

As previously noted, the submittal of additional laboratory QA/QC is not a wise use of limited resources. EPA is implementing UCMR4 with limited resources and is unlikely to have the necessary support system for qualifying laboratory information management system (LIMS) data uploads prior to UCMR laboratory approval. Absent such software, the limited value provided by this additional QA/QC data is not worth the transactional burden on laboratories or the potential for water system non-compliance due to failure of EPA QA/QC review to occur in a timely manner. EPA's experience to-date with this type of QA/QC data has been limited to contractual obligations with UCMR laboratories processing small system samples – this experience is substantially different from setting a regulatory requirement to which all water systems conducting monitoring at their own expense through multiple commercial laboratories must adhere. This provision is also an impediment to AWWA's recommendation that EPA use CMDP to achieve some of the data collection objectives described in the UCMR4 proposal.

The use of the Sample Event Code data element is another opportunity for an extraneous data element to lead to inadvertent non-compliance or, a transactional cost for participating water systems and EPA. Compliance with UCMR is based on meeting the monitoring requirements. This proposed data element does not contribute toward that task but it does create the opportunity for data entry errors.

### Statistical Basis for the Small System Sample

The UCMR4 proposal preamble introduces the concept of State Implementation Plans and the statistical premise for the UCMR4 small system sample.[31] The statistical premise cited for the small system sample is an analysis prepared in 1999.[32] The referenced analysis does not address the current UCMR4's proposed changes including:

[31] 80 FR 76901

[32] EPA, Statistical Design and Sample Selection for the Unregulated Contaminant Monitoring Regulation (1999).



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1. Utilizing a stratified sampling construct for cyanotoxin monitoring,
2. Eliminating monitoring in December, January, and February, and
3. Collecting data representative of untreated source water.

While the 1999 analysis spoke directly to the size of the representative sample, it was premised solely on the objective of describing contaminant occurrence in finished water.

## Summary

AWWA supports a robust UCMR monitoring program so that EPA is able to meet its statutory requirements when determining whether or not a national regulation is needed and what an appropriate drinking water standard might be. Sound national occurrence information is critical to the regulatory determinations EPA must make in assessing whether a national regulation will provide a meaningful opportunity for risk reduction. The proposed UCMR4 is a step in the right direction for the development of sound national occurrence data, but several critical revisions are needed in the final UCMR4 for cyanotoxins, DBPs, and other issues.



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# Attachment A: Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) Extension: Brominated Disinfection Byproducts Analysis

The following report is an interim work product. The research team is preparing a paper for submission to a peer-reviewed journal. A copy of the accepted paper will be forwarded to the Agency once it is published.

# WITAF #266
# Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) Extension: Brominated Disinfection Byproducts Analysis

**Draft Report**

**February 2, 2016**

**Submitted to American Water Works Association**

**Prepared by Corona Environmental Consulting, LLC**



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# 1 Introduction

## 1.1 Background

Reducing exposure to disinfection byproducts (DBPs) remains a concern for the national drinking water utility community. The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) (USEPA, 2006) is the most recent regulatory change the drinking water community has addressed to reduce DBP exposure, with its April 1, 2012 compliance monitoring deadline for Community Water Systems (CWSs) and Non-Transient Non-Community Water Systems (NTNCWSs) serving at least 100,000 people. The WITAF #266 Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) study (Seidel et al., 2015), funded and directed by the American Water Works Association, was implemented to assess DBP occurrence since the implementation of the Stage 2 DBPR. The study collected DBP data from state regulatory agencies for all but five states, provided quality assurance for data from >95% of very large CWSs, and housed the data in a well-documented database. The study developed a preliminary assessment of the impacts of the Stage 2 DBPR using the compiled data, which is sufficiently representative of national DBP data to allow characterization of current DBP exposures and evaluation of trends.

Brominated DBPs are understood to pose a greater health risk than their fully chlorinated counterparts for both regulated classes of DBPs, trihalomethanes (THMs) and haloacetic acids (HAAs) (Richards et al., 2007). An important concern regarding the implementation of the Stage 2 DBPR is how the occurrence of the three brominated THM species (THM3) and six brominated HAA species (HAA6-Br) have changed overall and in comparison to changes in total trihalomethane sum (TTHM), the sum of the five regulated haloacetic acids (HAA5), and the sum of all nine haloacetic acids (HAA9), as a result of treatment changes to meet the regulation. The preliminary analysis conducted through the WITAF #266 study suggests that a decrease in chloroform concentrations, and not in the brominated THM species, may have occurred on a national scale since the implementation of the Stage 2 DBPR. This study aims to further investigate the extent of brominated DBP formation through analyzing brominated DBPs, specifically HAA9 and HAA6-Br, and bromine incorporation factor trends. Bromine incorporation factors, also known as bromine fractions, are calculated based on the relative number of bromine substitutions in the species in a given DBP class to the total number of halogen substitutions (Obolensky & Singer, 2005).

While the WITAF #266 database contains a rich temporal and geographic span of TTHM, THM species, HAA5 and HAA5 species data, data for the four unregulated haloacetic acids (HAA4) are limited. Modeling techniques for estimating concentrations of the HAA4 species allow for estimating HAA9 and HAA6-Br concentrations in instances where THM species and HAA5 species concentrations are known. The resulting modeled HAA9 and HAA6-BR occurrence data developed using the WITAF #266 database can provide insights into the impact of the Stage 2 DBPR on the occurrence of brominated DBPs on a national scale. An analysis of the brominated DBPs, specifically modeled HAA9 and HAA6-Br, will allow important questions to be answered, such as

- How have HAA9 and HAA6-Br concentrations changed over time, given the implementation of the Stage 1 and 2 DBP Rules?
- How have bromine incorporation factors changed over time, given the implementation of the Stage 1 and Stage 2 DBP Rules?



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## 1.2 Project Goals

The objectives of this project were

- Modeling brominated disinfection byproduct concentrations, specifically haloacetic acid 9 (HAA9) that is a focus of the Fourth Unregulated Contaminant Monitoring Rule, using existing data from the WITAF 266 database including total trihalomethane (TTHM) and TTHM species, haloacetic acid 5 (HAA5), and HAA5 species.
- Comparing and validating calculated bromine incorporation factor values and modeled HAA9 concentrations with observed data where available.
- Analyzing the modeled HAA9 data pre- and post-State 2 Disinfection Byproduct Rule implementation and over time and geographically.

The analysis of brominated DBPs occurrence conducted in this study provides an important understanding, particularly for future regulations that may include separate consideration of brominated THM and HAA species in addition to the currently regulated sums.

# 2 Methods and "Representativity"

## 2.1 Modeling Approach for HAA4 Species and HAA9

While the WITAF #266 database contains a wealth of data for TTHM, THM species, HAA5 and HAA5 species, there is very limited data for HAA4 species available. Modeling the HAA4 species provides an opportunity to model HAA9, as well as HAA6-Br. Modeled HAA9 and HAA6-Br concentrations can be compared with HAA5 concentrations to analyze relative changes in brominated DBPs before and after the implementation of the Stage 2 DBPR. For samples in which THM species concentrations and HAA5 species concentrations are known, HAA4 species can be estimated using the following equations:

$$[BrCl_2AA] = [Cl_3AA] \times [CHBrCl_2]/[CHCl_3] \quad (1)$$

$$[Br_2ClAA] = [Cl_3AA] \times [CHBr_2Cl]/[CHCl_3] \quad (2)$$

$$[Br_3AA] = [Cl_3AA] \times [CHBr_3]/[CHCl_3] \quad (3)$$

$$[BrClAA] = 0.5\ [\langle CHBrCl_2 + CHBr_2Cl\rangle\ Cl_2AA]/CHCl_3 \quad (4)$$

in which BrClAA, $BrCl_2AA$, $Br_2ClAA$, $Br_3AA$, $Cl_2AA$, and $Cl_3AA$ refer to the molar concentrations of bromochloro-, bromodichloro-, dibromochloro-, tribromo-, dichloro-, and trichloro-acetic acids, respectively, and $CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, and $CHBr_3$ refer to the molar concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, respectively. Eq 1-3 were developed and validated by Roberts et al. (2001) using data from the Information Collection Rule, based on equal bromine incorporation among corresponding trihalomethane species and trihaloacetic acid species relative to the fully-chlorinated species. Eq 4 was developed by Shoaf & Singer (2007) using the assumption the degree of bromine incorporation is an average of the extent of bromine incorporation in bromodichloromethane and dibromochloromethane relative to chloroform.

To validate this modeling approach, THM species and HAA9 species concentration data for a given sample event were merged together using sample information, where available, provided in the WITAF #266 database, including Sample ID, Collection Date, Sample Type, Sample Point Type, Sample Point Description, Facility Name, and Facility ID. Data records from water utilities in fourteen states included



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sufficient sample information to develop unique sample identifiers for a given sample event for merging THM species concentration data, and in thirteen states for merging HAA5 species concentration data. Sample data for merging all THM and HAA9 species in a given sample event were available for five water utilities for modeling validation. Molar concentrations were calculated for each DBP species' mass concentrations, and the HAA4 species were modeled using Eq 1-4. The corresponding mass concentrations were calculated for the modeled HAA4 molar concentrations. The observed HAA4 species concentrations were then added to the observed HAA5 species concentrations to determine the observed HAA9 concentrations, and similarly, the modeled HAA4 species concentrations were added to the observed HAA5 species concentrations to calculate the modeled HAA9 concentrations. Figure 1 shows the modeled HAA9 concentrations versus the observed HAA9 concentrations; the corresponding $R^2$ value is 0.9 demonstrating a good fit for the modeling approach based upon the limited observed HAA9 values available in the WITAF #266 database.

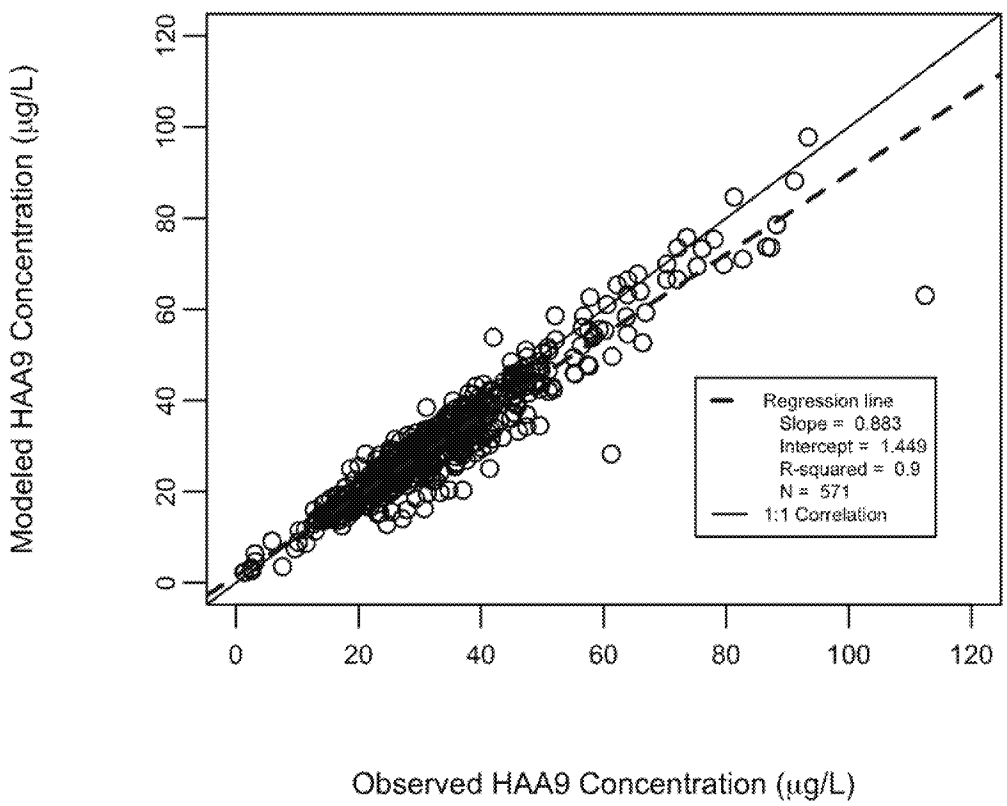


*Figure 1 Modeled HAA9 Concentration versus Observed HAA9 Concentration*

While this modeling approach illustrated in Figure 1 produced good results, HAA4 species could only be modeled for sample data from 55 systems in 13 states, due to limited sample information for merging species data. In the preliminary analysis of the WITAF #266 study, running annual averages of the 95$^{th}$ percentile concentration by PWS were validated and used as a representative non-locational statistical



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surrogate to represent locational running annual averages (LRAAs). In a similar manner, this study developed a second modeling approach by calculating quarterly 95th percentile concentrations by PWS for each THM and HAA9 species, and merging the resulting quarterly 95th percentile concentrations by PWS for modeling HAA4 species and HAA9. Using this approach, HAA4 species and HAA9 can be modeled for 243 water utilities in 23 states, which would allow for a far greater national representation in the analysis of brominated DBP occurrence.

For the quarterly 95th percentile by PWS approach, molar concentrations were calculated for each mass concentration, the HAA4 species were modeled using Eq 1-4, and corresponding mass concentrations were calculated. As with the first modeling approach where species concentrations were merged by sample information, modeled quarterly 95th percentile HAA9 concentrations by PWS were calculated by adding the modeled quarterly 95th percentile HAA4 concentrations to the observed quarterly 95th percentile HAA5 concentrations. Figure 2 shows the modeled versus observed values for the quarterly 95th percentile HAA9 concentrations. The $R^2$ value is 0.902, showing a very similar fit to the first modeling approach.

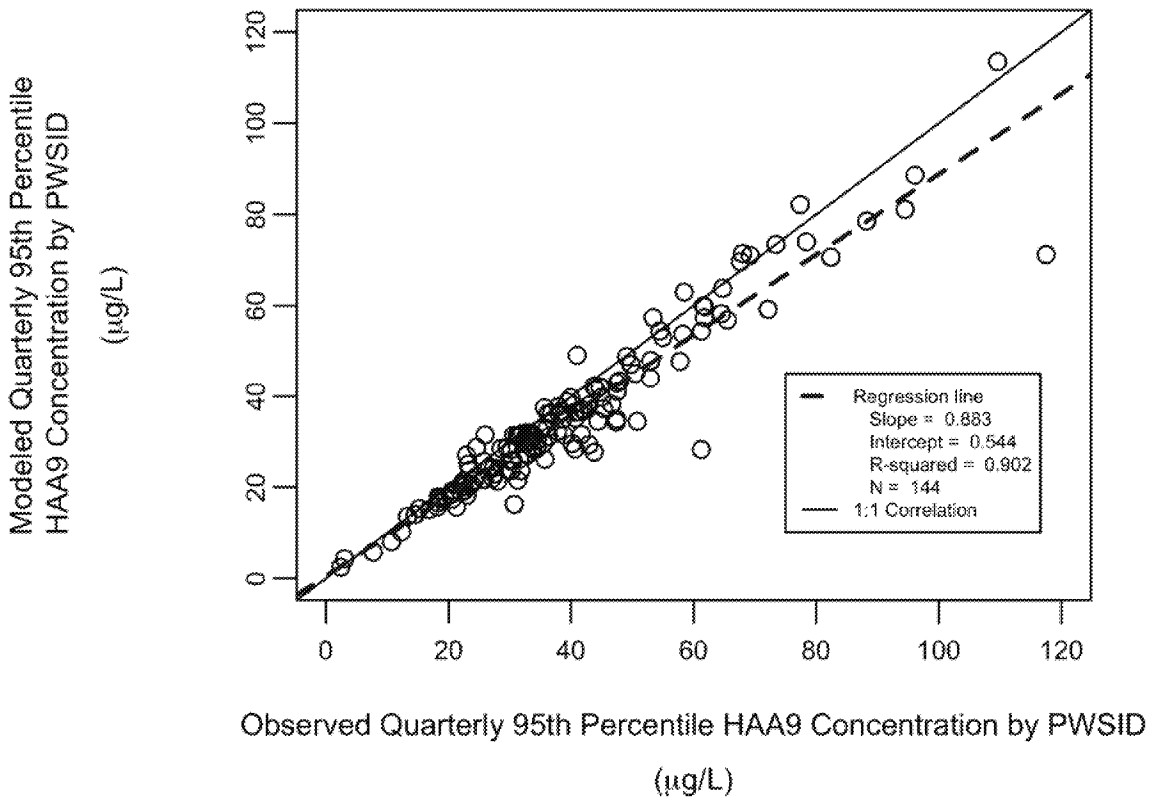


*Figure 2 Modeled Quarterly PWS 95th Percentile HAA9 Concentrations versus Observed Quarterly PWS 95th Percentile HAA9 Concentration*



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## 2.2 Approach for Calculating Bromine Incorporation Factors

The quarterly 95th percentile concentration by PWS modeling approach for HAA4 species and HAA9 can be further validated through the calculation of bromine incorporation factors (BIFs). BIFs quantify the formation of brominated DBP species within a class of DBPs relative to the total DBP formation. BIFs for THMs, dihaloacetic acids (2XAAs), and trihaloacetic acids (3XAAs) can be calculated using the following equations (Obolensky & Singer, 2005):

$$\text{THM BIF} = \frac{([CHBrCl_2] + 2\ x\ [CHBr_2Cl] + 3\ x\ [CHBr_3])}{3\ x\ ([CHCl_3] + [CHBrCl_2] + [CHBr_2Cl] + [CHBr_3])} \quad (5)$$

$$\text{2XAA BIF} = \frac{([BrClAA] + 2\ x\ [Br_2AA])}{2\ x\ ([Cl_2AA] + [BrClAA] + [Br_2AA])} \quad (6)$$

$$\text{3XAA BIF} = \frac{([BrCl_2AA] + 2\ x\ [Br_2ClAA] + 3\ x\ [Br_3AA])}{3\ x\ ([Cl_3AA] + [BrCl_2AA] + [Br_2ClAA] + [Br_3AA])} \quad (7)$$

in which BrClAA, $Br_2AA$, $Cl_2AA$, $BrCl_2AA$, $Br_2ClAA$, $Br_3AA$, and $Cl_3AA$ refer to the molar concentrations of bromochloro-, dibromo-, dichloro-, bromodichloro-, dibromochloro-, tribromo-, and trichloro-acetic acids, respectively, and $CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, and $CHBr_3$ refer to the molar concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, respectively.

BIFs were calculated for THMs, 2XAAs, and 3XAAs using Eq 5-7 using the two approaches described above for modeling HAA9. In the first approach, species concentrations data for a given sample event were merged based on sample information, and in the second approach, quarterly 95th percentile species concentrations by PWS were merged together. Once the BIFs were calculated, the distribution of BIFs for both approaches, during the two years before the Stage 2 DBPR implementation (April 1, 2010 – March 31, 2012) and for the two years after the Stage 2 DBPR implementation (April 1, 2012 – March 31, 2014) were compared to determine if they were statistically different. To do this, the 95th percentile values by PWS for the two years before the Stage 2 DBPR and the two years after the Stage 2 DBPR for BIFs from both approaches were calculated. Systems that did not have a 95th percentile value in both the two years before and the two years after were removed from the analysis. Figure 3 shows the cumulative probability distribution of the 95th percentile THM BIF values by PWS for both approaches; this analysis includes data for 52 systems in 12 states. Figure 4 and Figure 5 show the same cumulative probability distributions for the 2XAA BIF and for the 3XAA BIF, respectively. The analysis shown in both Figure 4 and Figure 5 included data for 36 systems from 9 states.



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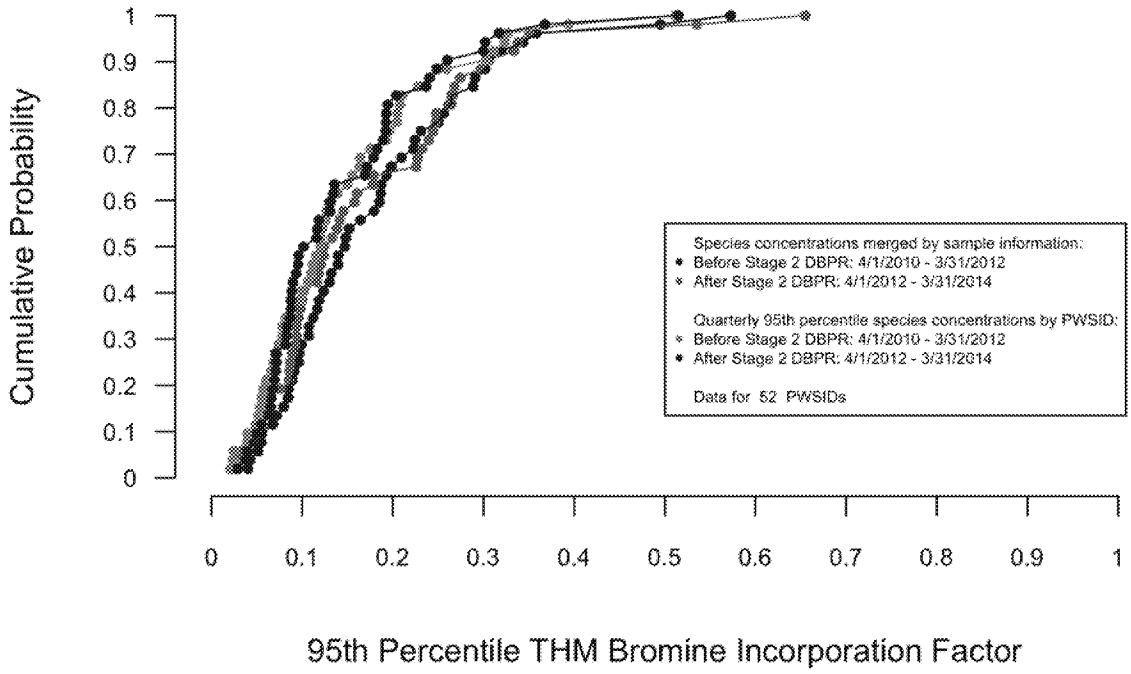


*Figure 3 Comparison of THM BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*

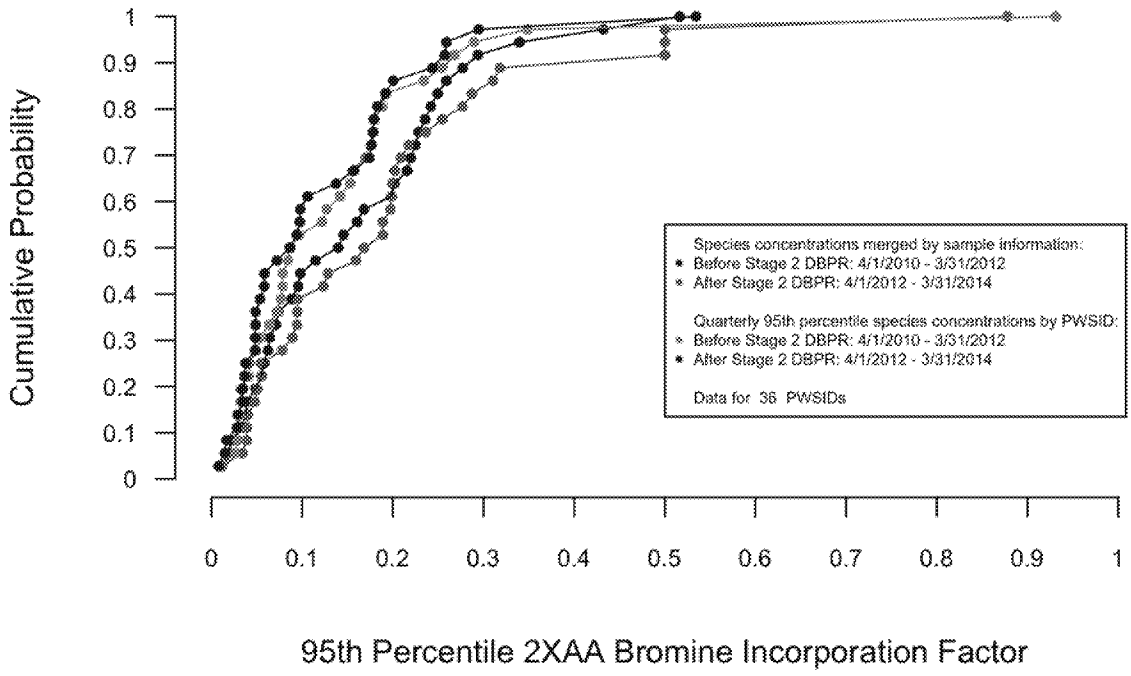


*Figure 4 Comparison of 2XAA BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*



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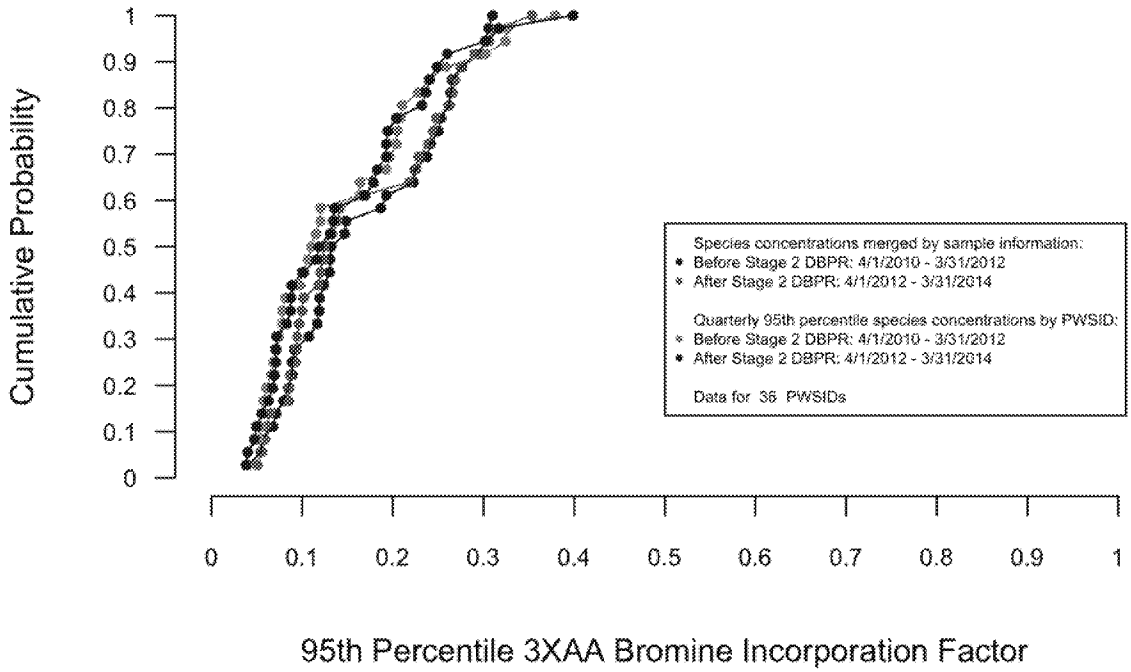


*Figure 5 Comparison of 3XAA BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*

The Kolmogorov–Smirnov (KS) two-sample test (Young, 1977) and the two *k*-sample versions of the Anderson-Darling (AD) test (Scholz & Stephens, 1987) were employed to determine if the distributions of corresponding BIFs during the same two-year time period, either the two years before or the two years after the Stage 2 DBPR, calculated through the two different approaches were statistically different. The resulting p-values for each of the tests are shown in Table 1. In all cases with a 95% confidence level, the distributions of corresponding BIFs calculated using the two different approaches are not statistically different. These findings provide justification that the approach for calculating BIFs by using quarterly 95$^{th}$ percentile species concentrations by PWS is representative of the "true" BIFs, calculated from species concentrations for a given sample event.

*Table 1 Results of Statistical Tests Comparing Distributions of PWS 95$^{th}$ Percentile BIFs Calculated Using Species Concentrations Merged by Sample Information with Corresponding PWS 95$^{th}$ Percentile Bromine Incorporation Factors Using Quarterly 95$^{th}$*

| Item | THM BIF | | 2XAA BIF | | 3XAA BIF | |
|---|---|---|---|---|---|---|
| | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* |
| *KS test p-value* | 0.07754 | 0.4206 | 0.2106 | 0.06939 | 0.3364 | 0.2123 |
| *AD test version 1 p-value* | 0.063878 | 0.40534 | 0.15616 | 0.072521 | 0.20546 | 0.24453 |
| *AD test version 2 p-value* | 0.063704 | 0.40379 | 0.15795 | 0.070525 | 0.20332 | 0.24491 |



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The results from comparing the two modeling approaches for HAA4 species and HAA9 and the two approaches for calculating the BIFs indicate the two approaches in both cases provide results that do have statistically significant difference. The sections that follow provide analysis solely based on modeling HAA4 species, HAA9, and HAA6-Br, and calculating BIFs based on quarterly 95th percentile concentrations by PWS, which is representative of results that would be seen based on using species concentrations from specific sample events.

## 2.3 National "Representativity"

The WITAF #266 database provides sufficient data for modeling HAA4 species and HAA9 concentrations, and calculating 2XAA and 3XAA BIFs using modeled species, based on quarterly 95th percentiles by PWS for 243 water utilities in 23 states. The database contains data for TTHM and HAA5 concentrations in 394 systems and 386 systems, respectively, in 44 states. An important consideration is how well the distribution of the TTHM and HAA5 concentration data in systems with sufficient data for modeling HAA9 compares to the distribution of TTHM and HAA5 concentration data in all systems where this data is available. To address this question, a similar approach as to that taken in Section 2.2 was employed. For all systems where TTHM concentrations data were available and for systems with sufficient data to model HAA9, the 95th percentile value by PWS, in the two years before the Stage 2 DBPR and in the two years after the Stage 2 DBPR, was calculated for the quarterly 95th percentile TTHM concentrations by PWS. The same analysis was conducted for HAA5 concentrations. Figure 6 shows the results for the cumulative probability distributions of 95th percentile values for TTHM data, and Figure 7 shows the corresponding results for HAA5 data.

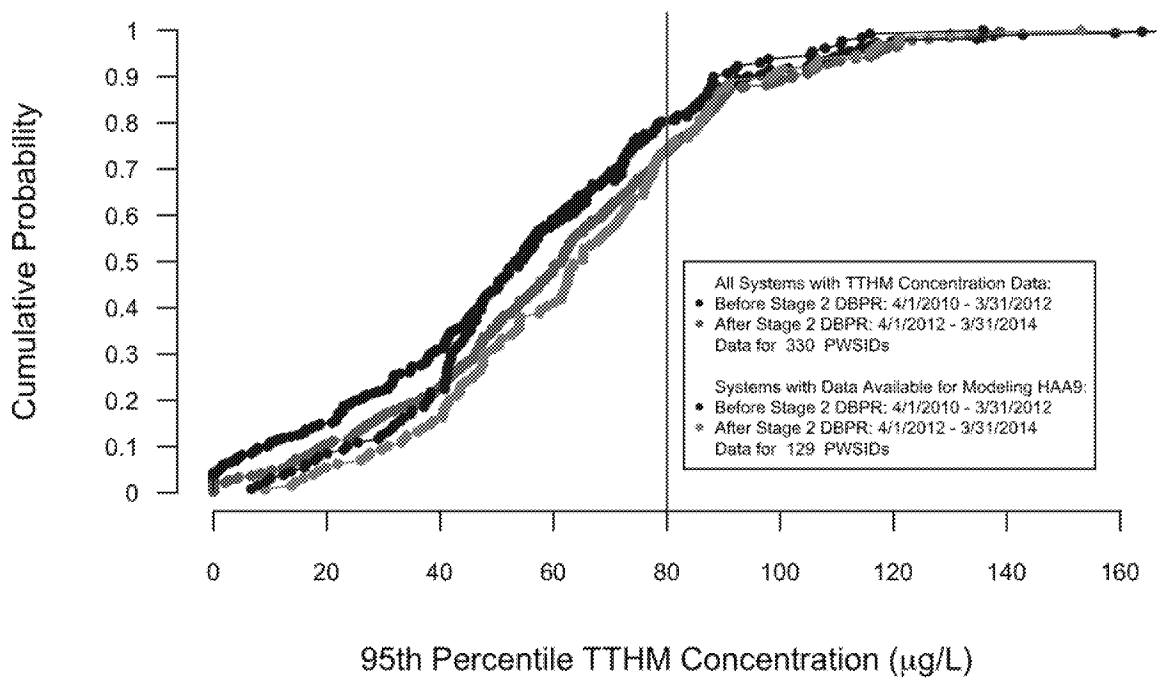


*Figure 6 Cumulative Distributions of PWS 95th Percentile Value of Quarterly PWS 95th Percentile TTHM Concentration for All Systems with TTHM Data and for Systems with THM and HAA5 Species Data for Modeling HAA9 before and after Implementation of the Stage 2 DBPR*



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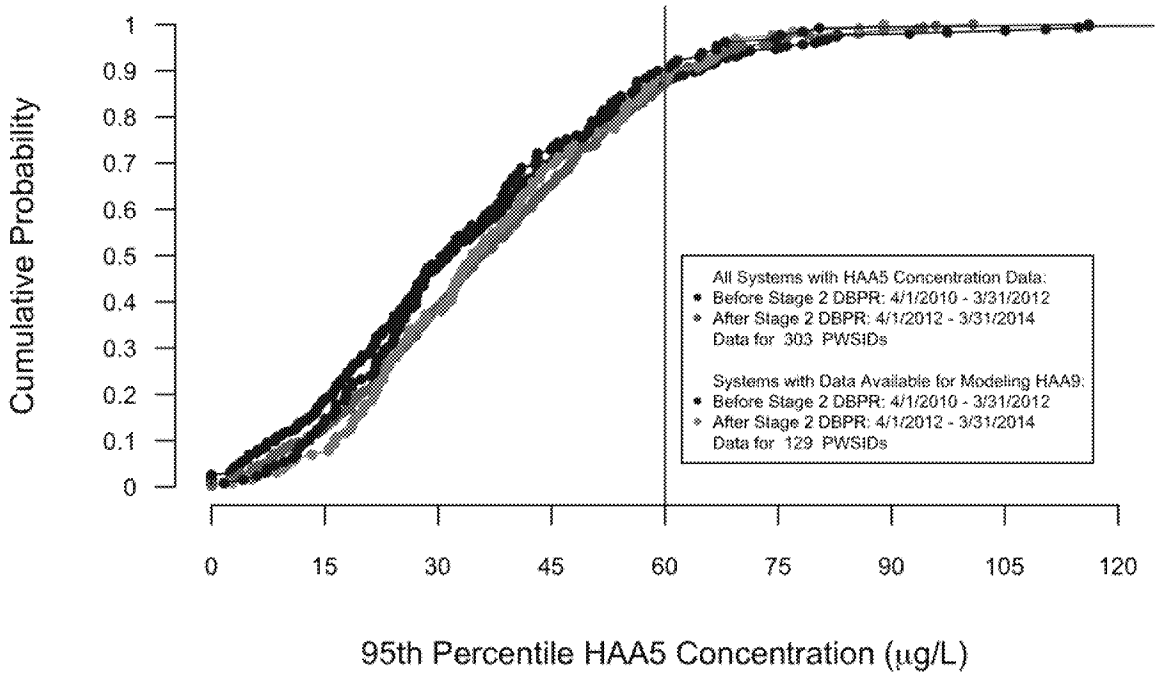


*Figure 7 Cumulative Distributions of PWS 95th Percentile Value of Quarterly PWS 95th Percentile HAA5 Concentration for All Systems with HAA5 Data and for Systems with THM and HAA5 Species Data for Modeling HAA9 before and after Implementation of the Stage 2 DBPR*

The KS two-sample test and the two *k*-sample versions of the AD test were applied to determine if there were statistically differences in the two distributions of TTHM data in each time period, and in the two distributions of HAA5 data in each time period. The resulting p-values are provided in Table 2; with a 95% confidence level, none of the distributions compared were statistically different. This result provides confidence that the distribution of modeled HAA4 species, HAA9, HAA6-Br, and the calculated 2XAA and 3XAA BIFs with modeled HAA4 species represent the "true" national distribution of HAA4 species, HAA9, HAA6-Br, and 2XAA and 3XAA BIFs.

*Table 2 Results of Statistical Tests Comparing Distributions of PWS 95th Percentile Values for Quarterly PWS 95th Percentile TTHM/HAA5 Concentrations for All Systems with TTHM/HAA5 Data with Systems with Sufficient Data for Modeling HAA9*

| Item | TTHM | | HAA5 | |
|---|---|---|---|---|
| | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* |
| *KS test p-value* | 0.1952 | 0.4972 | 0.7821 | 0.8746 |
| *AD test version 1 p-value* | 0.090358 | 0.21953 | 0.35914 | 0.69765 |
| *AD test version 2 p-value* | 0.087815 | 0.21215 | 0.35428 | 0.69304 |



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# 3 Analysis of Brominated DBP Occurrence

## 3.1 HAA9 and HAA6-Br

Analysis of HAA9 and HAA6-Br occurrence focused on modeled quarterly 95th percentile HAA9 and HAA6-Br concentrations by PWS as a representation of national HAA9 and HAA6-Br occurrence. Figure 8, Figure 9, and Figure 10 show yearly boxplots of HAA9, HAA6-Br and HAA5 quarterly 95th percentile concentrations by PWS, respectively. In each of these figures, the horizontal lines inside the boxes represent the median values, lower and upper ends of the boxes represent the 25th and 75th percentile values, the ends of the "whiskers" at the bottom and top of the boxes represent the 5th and 95th percentile values, and the circles below and above the whiskers represent values less than the 5th percentile and greater than the 95th percentile. The red horizontal line in each figure represents the maximum contaminant level (MCL) for the regulated HAA5 sum and is included as a reference point. The dataset used in this analysis is filtered so that each boxplot in Figure 8, Figure 9, and Figure 10 is based on data for the exact same 84 systems from 15 states.

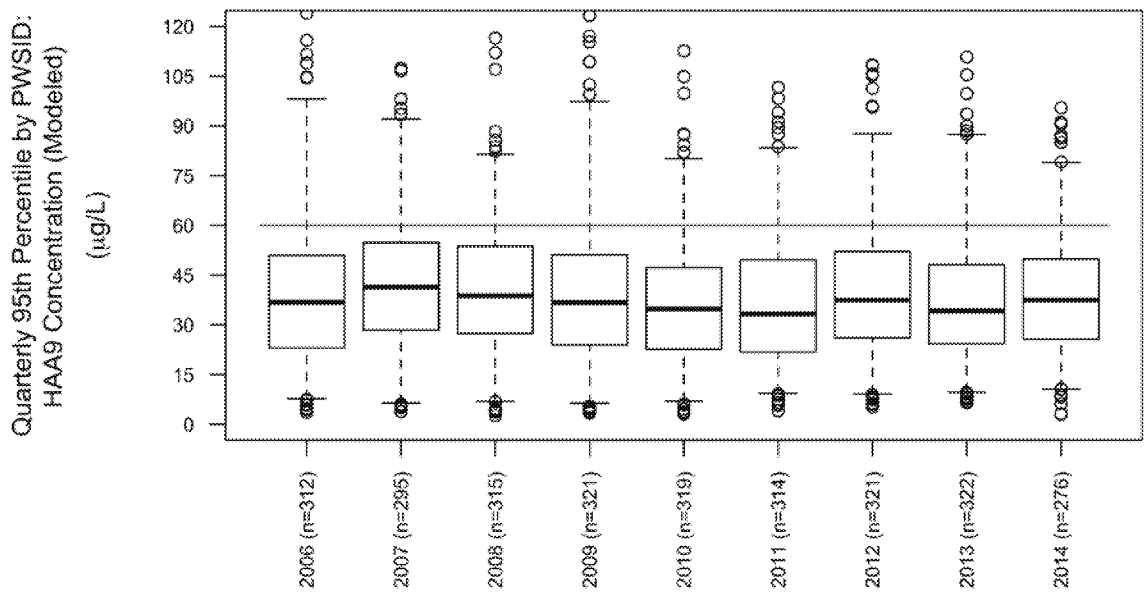


*Figure 8 Yearly Boxplots of Quarterly PWS 95th Percentile HAA9 Concentrations (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*



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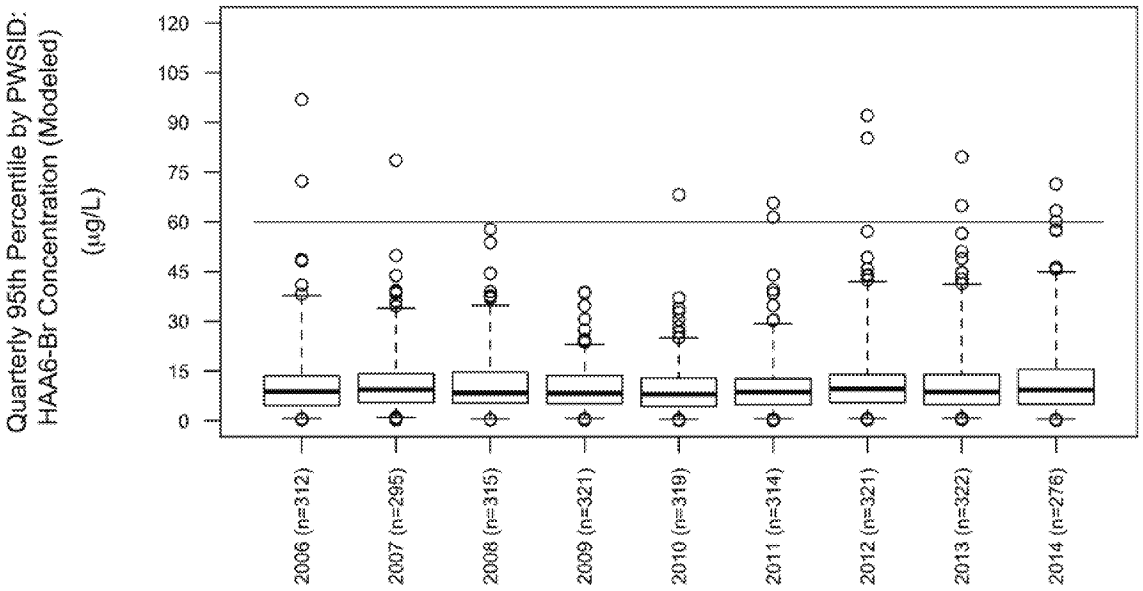


*Figure 9 Yearly Boxplots of Quarterly PWS 95th Percentile HAA6-Br Concentrations (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*

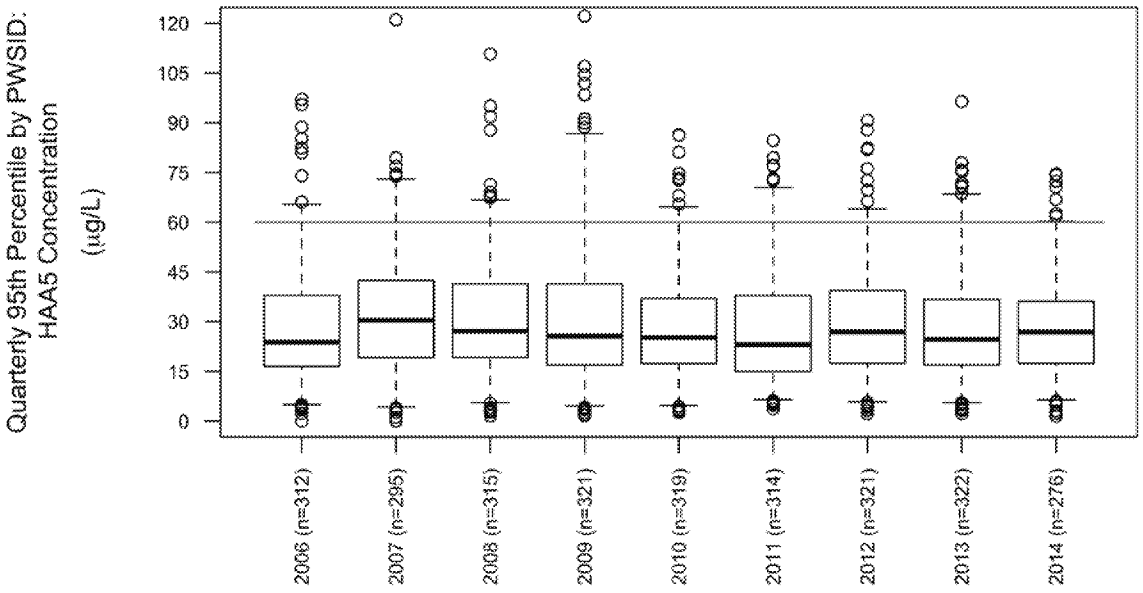




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*Figure 10 Yearly Boxplots of Quarterly PWS 95th Percentile HAA5 Concentrations for 84 Water Utilities in 15 States from 2006 – 2014*

There is some variability present in the yearly boxplots for HAA9 shown in Figure 8, although there is no clear trend over the years included in the analysis, particularly for the median, 25$^{th}$ and 75$^{th}$ percentile values. There does appear to be some decrease in 95$^{th}$ percentile and greater values over time. No significant changes are apparent in HAA9 concentrations after the Stage 2 DBPR implementation as compared with the years prior. In the yearly boxplots for HAA6-Br shown in Figure 9, there is very little variability in median and 75$^{th}$ percentile concentrations over the years of this analysis, although these values are just slightly higher in the boxplots representing years after the Stage 2 DBPR implementation (2012 – 2014) than the boxplots representing the three years prior (2009 – 2011). The 95$^{th}$ percentile and greater HAA6-Br concentrations do appear to have increased in the years after the Stage 2 DBPR implementation. Figure 10 is included in this analysis to compare changes in HAA9 and HAA6-Br over time to changes in HAA5. Once again, there is no clear trend apparent in the yearly boxplots for HAA5, although 75$^{th}$ and 95$^{th}$ percentile values appear to be relatively low in the years after the Stage DBPR implementation. Overall, this analysis suggests that there may have been less reduction in the brominated HAA species relative to the reduction in regulated HAA5 species in the few years following the Stage 2 DBPR implementation.

To further analyze any changes in HAA9 and HAA6-Br concentration before and after the implementation of the Stage 2 DBPR, the cumulative distribution of the 95$^{th}$ percentile value by PWS of modeled quarterly 95$^{th}$ percentile HAA9 and HAA6-Br concentrations by PWS in the two years before the Stage 2 DBPR implementation (April 1, 2010 – March 31, 1012) were compared with the corresponding cumulative distribution in the two years after the Stage 2 DBPR implementation (April 1, 2012 – March 31, 2014). The before and after Stage 2 DBPR cumulative distributions for HAA9 are shown in Figure 11, and the cumulative distributions for HAA6-Br are shown in Figure 12. In both cases, the cumulative distributions in the "after" time period are shifted slightly to the right, indicating overall increases in HAA9 and HAA6-Br occurrence. The greatest spread between the cumulative distributions for HAA9 occurs close to the 50$^{th}$ percentile water utility, while the greatest increases in HAA6-Br concentration appear to have occurred in water utilities with the highest HAA6-Br concentrations.



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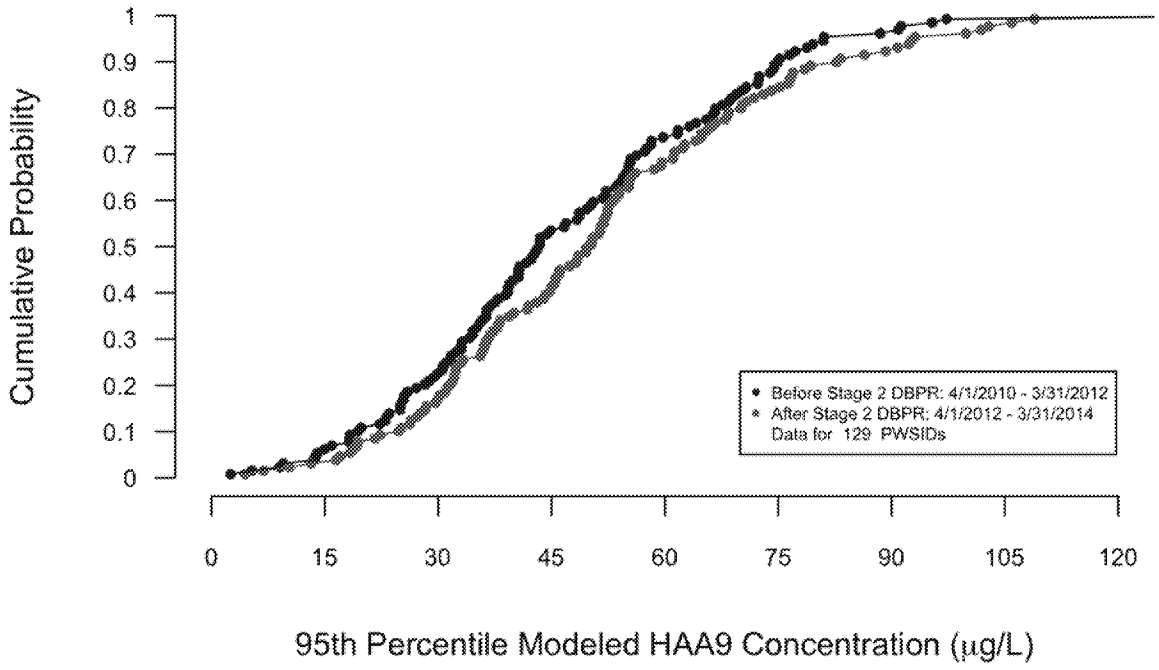


*Figure 11 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA9 Concentration before and after Implementation of the Stage 2 DBPR*

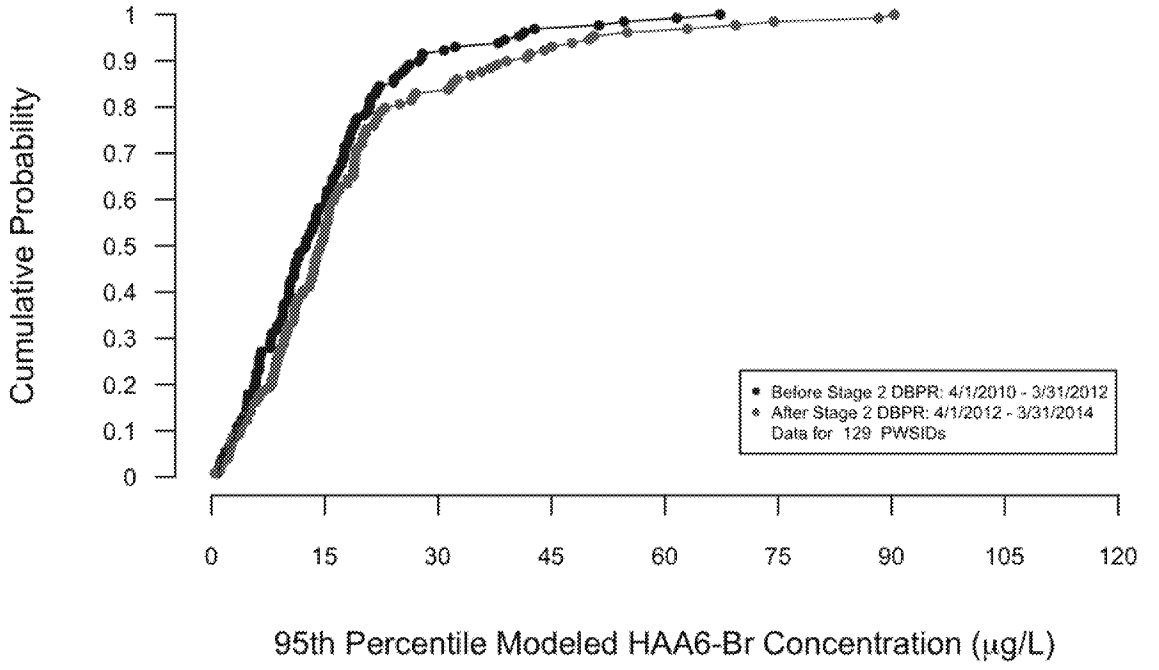


*Figure 12 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA6-Br Concentration before and after Implementation of the Stage 2 DBPR*



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To further assess impacts of the Stage 2 DBPR on HAA9 and HAA6-Br concentration, the cumulative distribution plots were modified to show the change in 95$^{th}$ percentile HAA9 and HAA6-Br concentration for individual PWSs. Figure 13 shows the same cumulative distribution for the "before" time period for HAA9 as Figure 11, and horizontal black lines extend from each 95$^{th}$ percentile HAA9 concentration before Stage 2 DBPR to the corresponding 95$^{th}$ percentile HAA9 concentration after Stage 2 DBPR, effectively showing the change in 95$^{th}$ percentile HAA9 concentration for each PWS. Figure 14 presents the same information for 95$^{th}$ percentile HAA6-Br concentration. More systems experienced increases in both HAA9 and HAA6-Br concentrations than decreases, and systems that did have decreases in HAA9 or HAA6-Br concentrations were generally systems with relatively high concentrations before Stage 2 DBPR. Very few systems show significant decrease in HAA6-Br concentrations.



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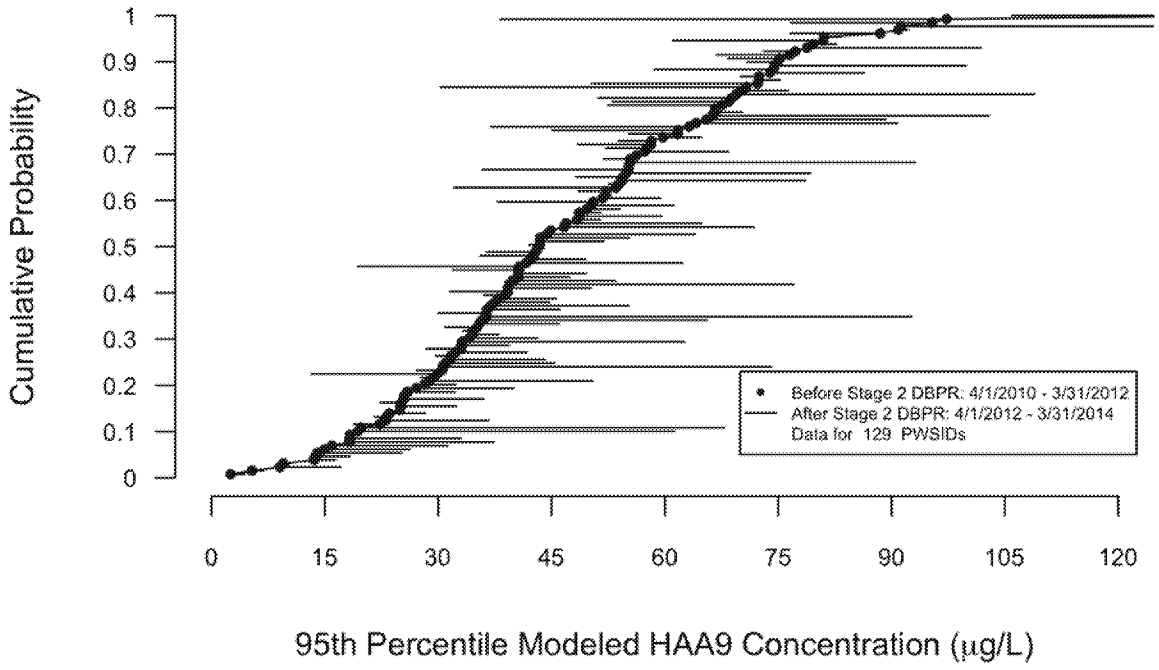


*Figure 13 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA9 Concentration Showing Impacts to Individual PWSs*

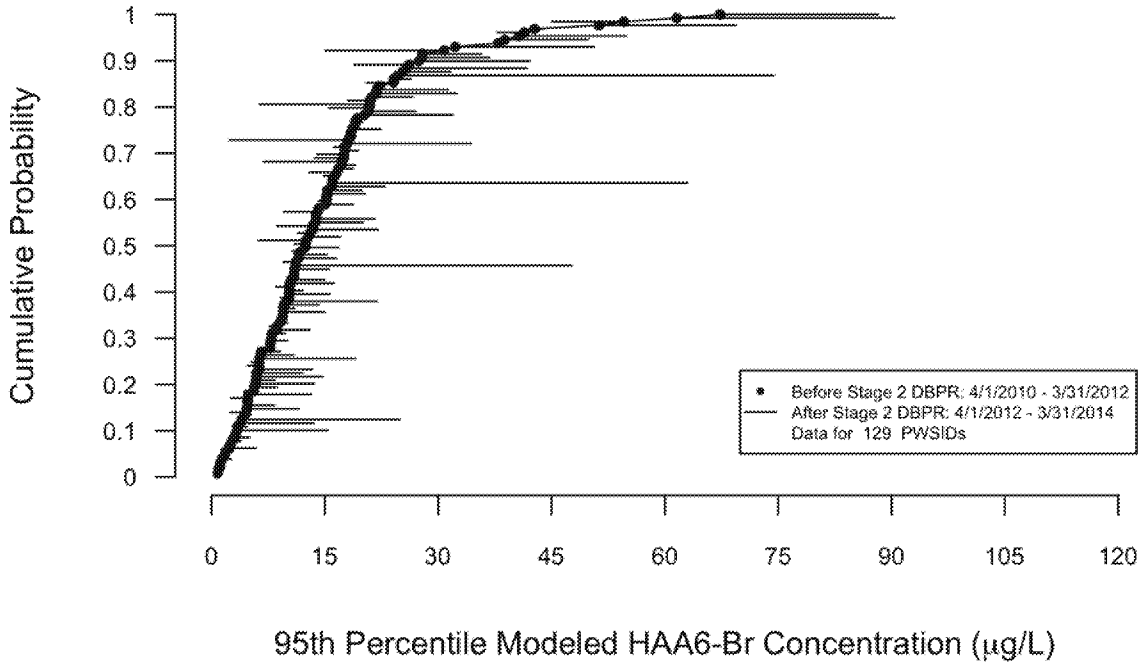


*Figure 14 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA6-Br Concentration Showing Impacts to Individual PWSs*



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## 3.2 Bromine Incorporation Factors

Further assessment of relative changes in brominated DBPs can be approached using the bromine incorporation factors for THMs, dihaloacetic acids (2XAA), and trihaloacetic acids (3XAA). Figure 15 shows yearly boxplots for quarterly 95th percentile THM BIFs by PWS from 2006 to 2014 for 130 PWSs in 18 states. Each boxplot is based on data for the same 130 systems. Overall, there is relatively little variability of the years, but a slight increase in median and 75th percentile BIF values occurred in 2011 – 2014. Figure 16 and Figure 17 show yearly boxplots for quarterly 95th percentile 2XAA and 3XAA BIF, respectively, by PWS, from 2006 to 2014 for 84 PWS in 15 states. Similar to the THM BIF boxplots, the yearly boxplots for 2XAA and 3XAA BIFs show relatively little variability, besides an increase in the 75th percentile values in 2013 and 2014 and a slightly increasing trend for the 95th percentile values.

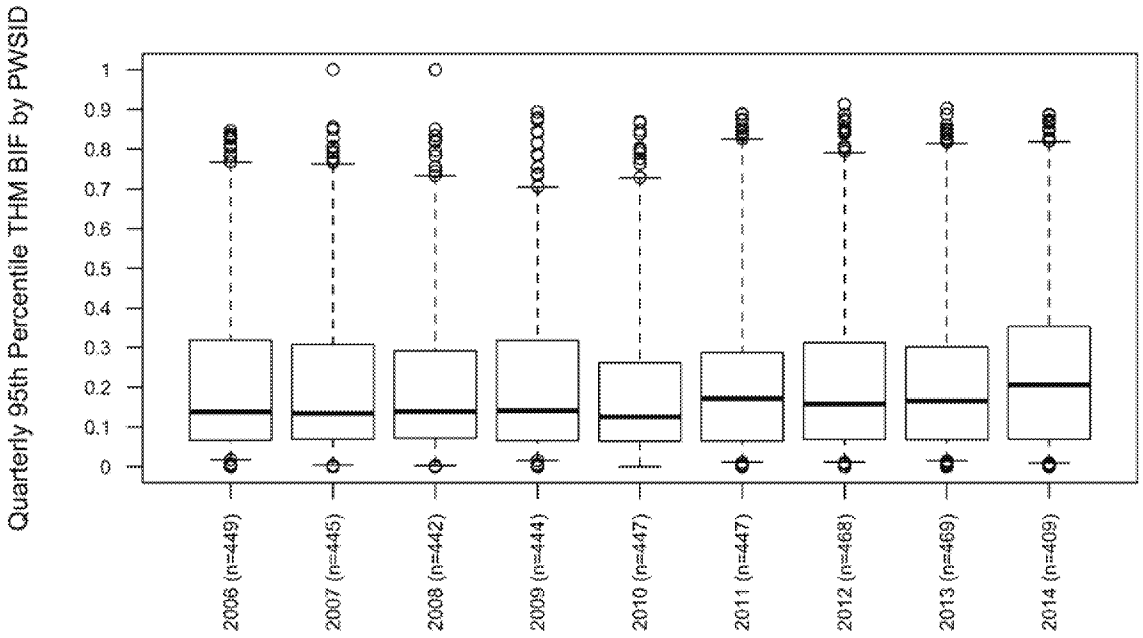


*Figure 15 Yearly Boxplots of Quarterly PWS 95th Percentile THM BIFs (Modeled) for 130 Water Utilities in 18 States from 2006 – 2014*



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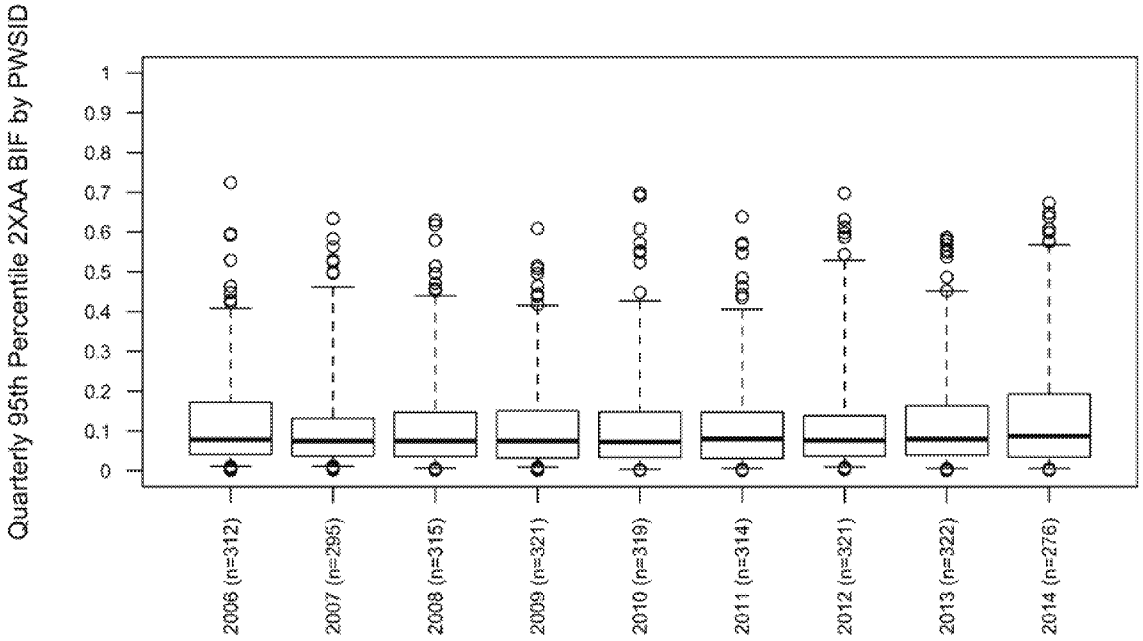


*Figure 16 Yearly Boxplots of Quarterly PWS 95th Percentile 2XAA BIFs (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*



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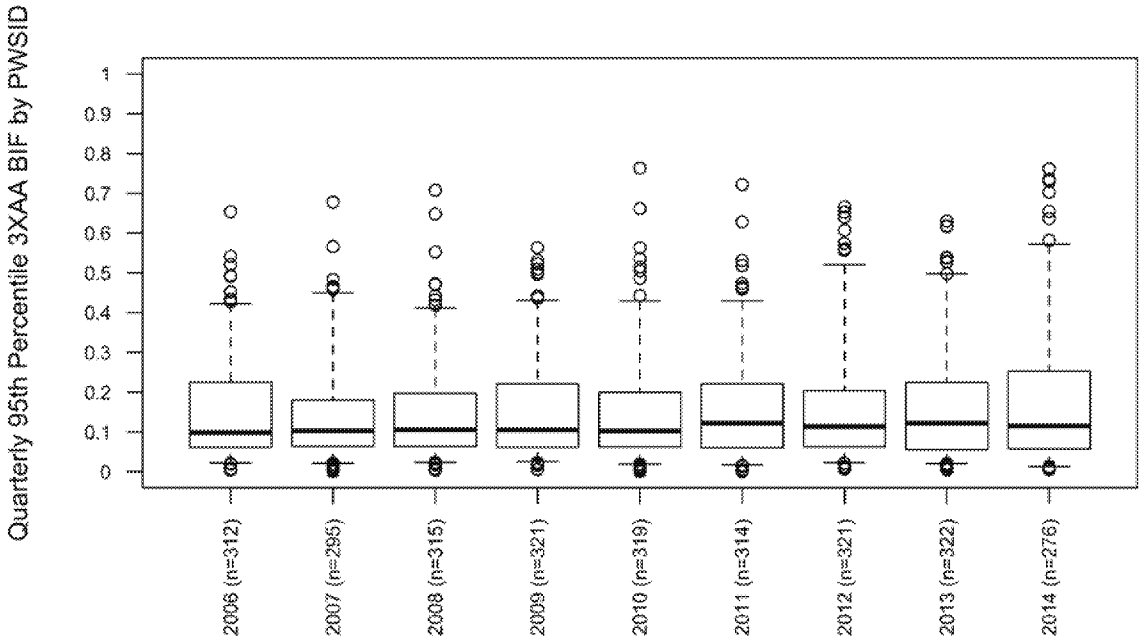


*Figure 17 Yearly Boxplots of Quarterly PWS 95th Percentile 3XAA BIFs (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*

The impact of the Stage 2 DBPR on bromine incorporation factors is further investigated by comparing cumulative distributions of the 95$^{th}$ percentile values by PWS of quarterly 95$^{th}$ percentile BIFs by PWS before and after Stage 2 DBPR. Figure 18, Figure 19 and Figure 20 show this analysis for THM, 2XAA, and 3XAA BIFs, respectively. In all three cases, the before and after cumulative distributions of BIFs are very close, but exhibit increases in BIF values for utilities in approximately the 50$^{th}$ – 85$^{th}$ percentile for the THM and 2XAA BIFs and in approximately the 60$^{th}$ – 90$^{th}$ percentile for the 3XAA BIF.



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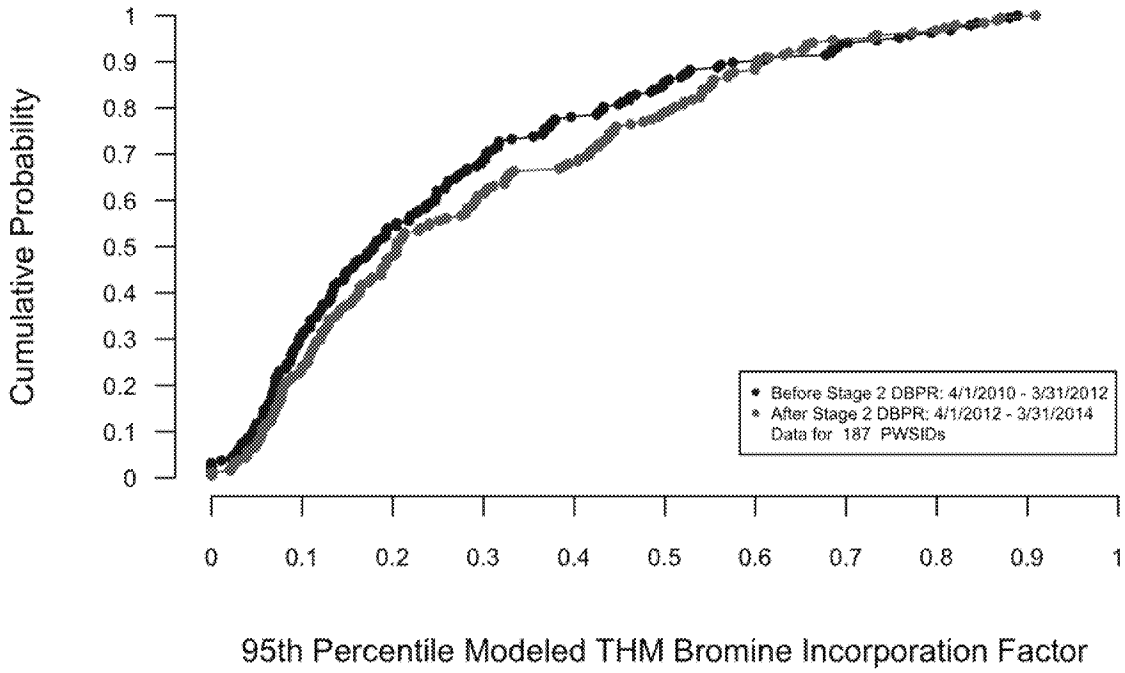


*Figure 18 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile THM BIF before and after Implementation of the Stage 2 DBPR*

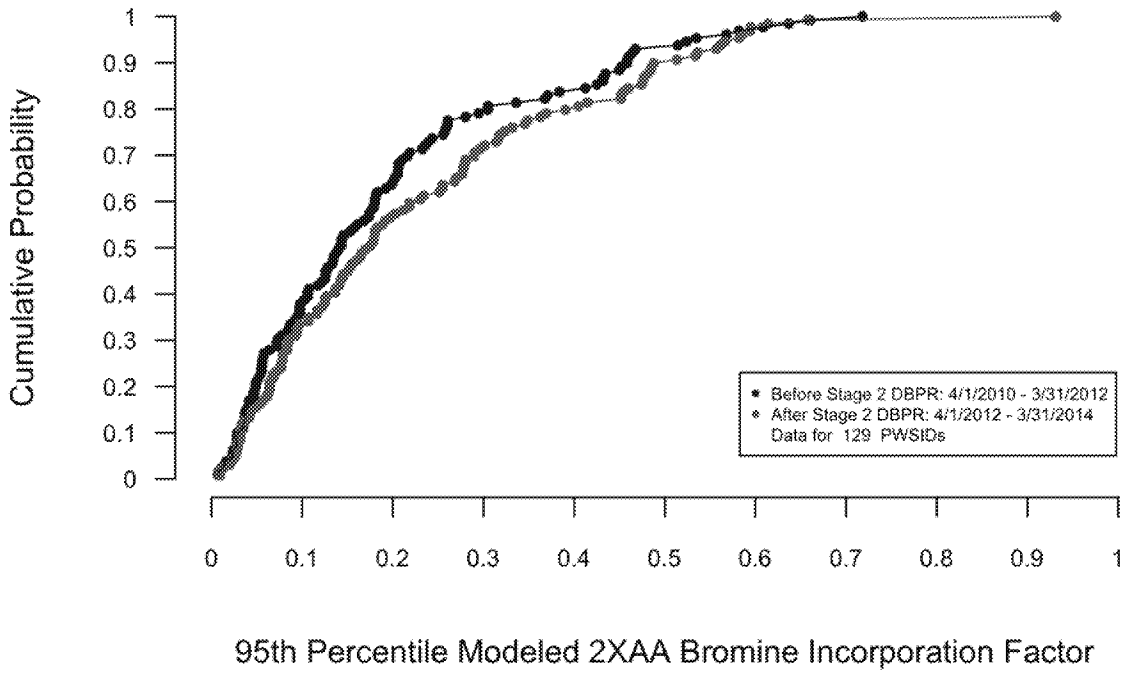


*Figure 19 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 2XAA BIF before and after Implementation of the Stage 2 DBPR*



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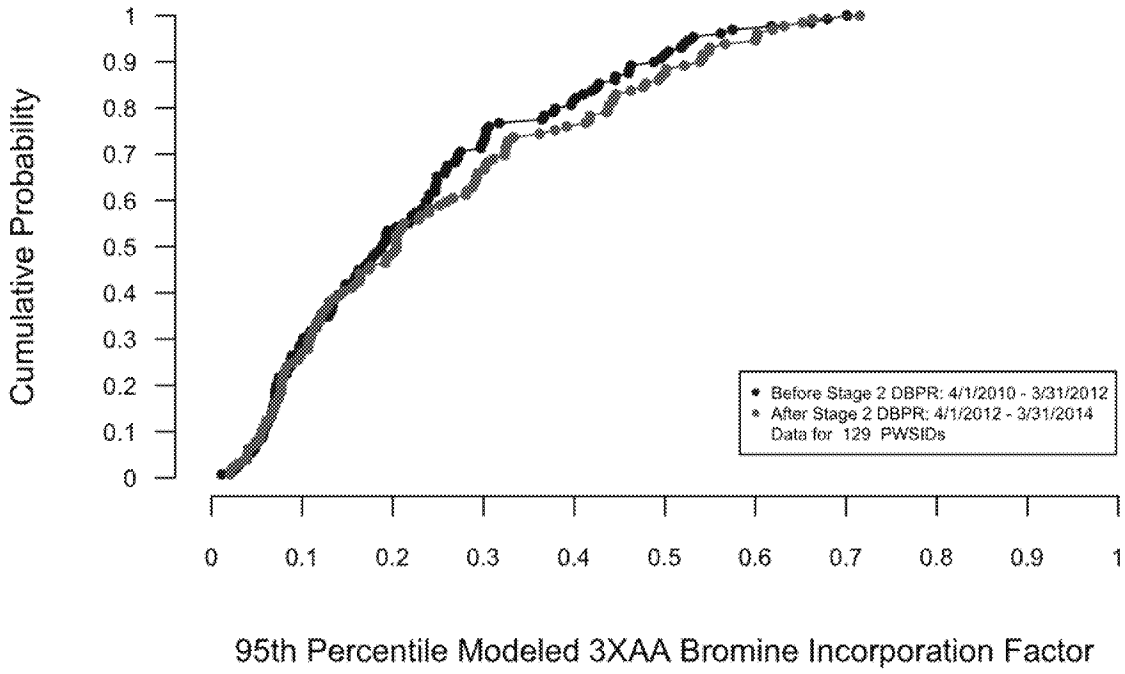


*Figure 20 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 3XAA BIF before and after Implementation of the Stage 2 DBPR*

As done previously for the HAA9 and HAA6-Br occurrence analysis, the cumulative distribution plots for the 95$^{th}$ percentile BIF values in Figure 18, Figure 19, and Figure 20 were modified to show impacts for individual PWSs. Figure 21, Figure 22, and Figure 23 show the same before cumulative distributions as in Figure 18, Figure 19, and Figure 20, and to illustrate the change in BIF values for each PWS, a horizontal black is drawn from each system's 95$^{th}$ percentile BIF value before Stage 2 DBPR to its 95$^{th}$ percentile BIF value after Stage 2 DBPR. While both increases and decreases occurred for the THM, 2XAA, and 3XAA 95$^{th}$ percentile BIF values, the changes with the greatest magnitudes tend to be increases from before Stage 2 DBPR to after.



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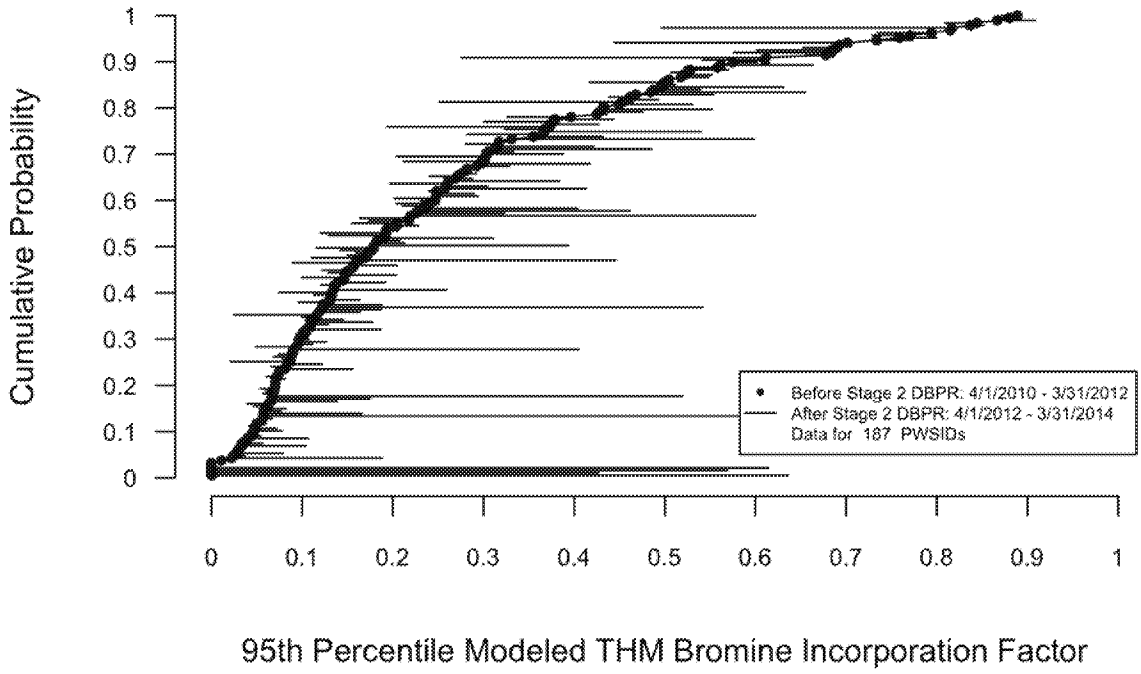


*Figure 21 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile THM BIF Showing Impacts to Individual PWSs*

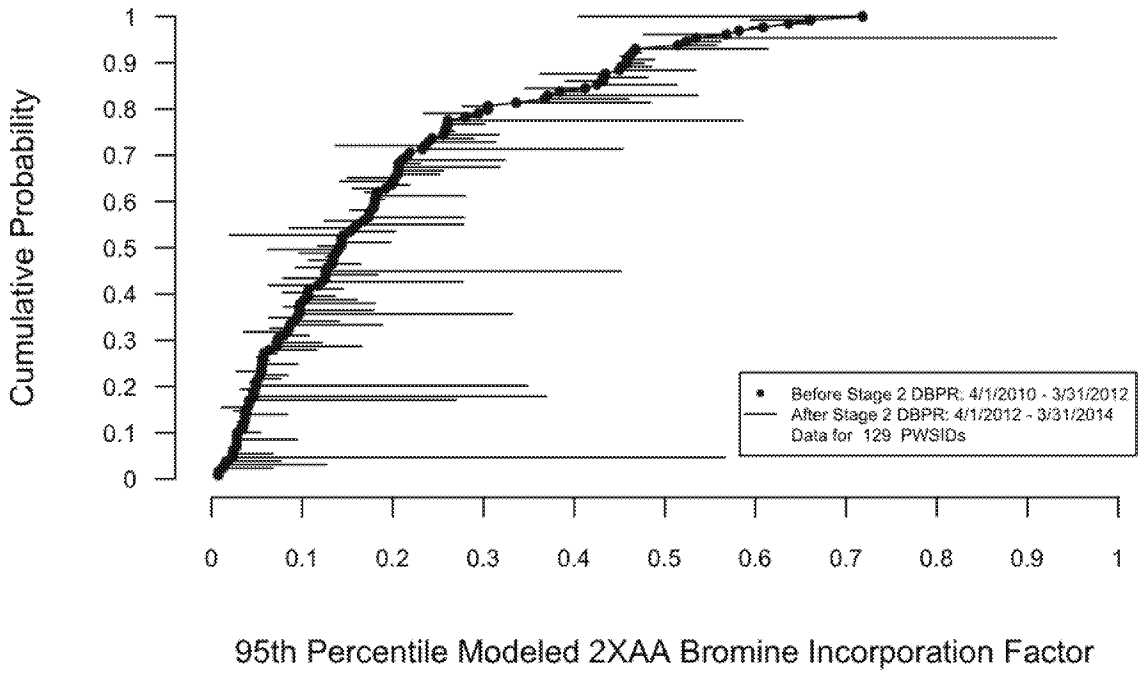


*Figure 22 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 2XAA BIF Showing Impacts to Individual PWSs*



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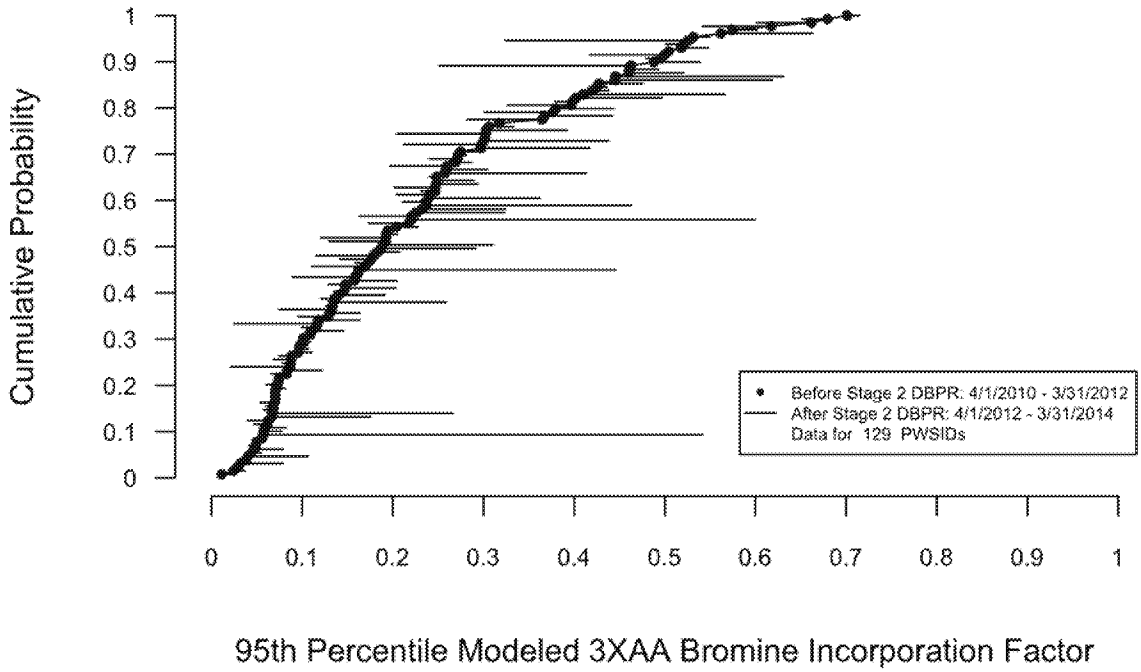


*Figure 23 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 3XAA BIF Showing Impacts to Individual PWSs*

# 4 Summary

The WITAF #266 database was used to assess the occurrence of brominated DBPs through modeling HAA4 species and HAA9 sums, validating the modeled HAA9 sums using observed HAA9 concentration data, and calculating bromine incorporation factors for THMs, dihaloacetic acids (2XAA), and trihaloacetic acids (3XAA). The "representativity" of the modeled HAA4 species, HAA9 and HAA6-Br concentrations was validated by analyzing distributions of TTHM and HAA5 data for two cases: for all systems with TTHM or HAA5 data, and for systems with THM and HAA5 species for modeling HAA9. An alternative approach to modeling HAA4 species, HAA9 and HAA6-Br, and calculating BIFs was developed due to a lack of necessary sample information to merge species concentrations for a given sampling event. The alternative approach used quarterly PWS 95$^{th}$ percentile species concentrations, which were then merged based on the PWS and quarter, as a surrogate for species concentration data. Analyses to validate this approach were presented.

This study demonstrates that the WITAF #266 database provides sufficient DBP data to analyze the occurrence of brominated DBPs, particularly before and after the implementation of the Stage 2 DBPR. This analysis is important in understanding how concentrations of unregulated HAAs, HAA9, and HAA6-Br concentrations have changed over time, and can be used to inform future regulatory decisions regarding the consideration of regulations based on brominated THM and HAA species in addition to the currently regulated sums.



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# Attachment B: Preliminary Analysis of UCMR3 Data and Potential Impact on UCMR4

The following report is an interim work product. The research team is preparing a paper for submission to a peer-reviewed journal. A copy of the accepted paper will be forwarded to the Agency once it is published.

**Analysis of UCMR 3 Data and Potential Impact on UCMR 4 (manuscript in preparation)**

## Introduction

As part of the analysis of UCMR 3 data to determine whether it makes sense to recommend changes in sampling strategy to EPA for the UCMR 4 sampling framework, we did a detailed analysis of UCMR 3 data, initially based on the June 2015 National Contaminant Occurrence Database, but followed up by also doing some additional analyses of the October 2015 NCOD release.

We focused on several things.

- Any differences in frequency of occurrence based on PWS population. We obtained population data from EPA and then plotted frequency of occurrence for each contaminant by population band (<10K, 10-25K, 25-50K, 50K-100K, and >100K).
- Covariance plots of SE1 vs SE2 for groundwaters for each contaminant
- Probability distributions for groundwater systems for each contaminant for SE1 vs SE2
- Probability distributions for surface water systems for each contaminant for SE1 vs SE2 vs SE3 vs SE4
- Covariance plots of SE1 vs SE2 and Covariance plots of SE3 vs SE4 for surface water systems.

Corona Environmental (Tim Bartrand and Saul Rosen) performed statistical analyses of the paired samples and the probability plots using R.

Based on EPA's proposal to only have UCMR 4 sampling take place between March and November, Corona also did a statistical analysis of the same data based on only March-November samples to determine whether that would change any conclusions regarding differences between sampling periods.

## Background

In the UCMR 4 proposal information collection document (EPA 815-B-15-003), EPA has indicated that the analysis of the UCMR data are based on the following criteria (note highlighted sections). EPA does indicate that they may look at measures for each EPTDS for each PWS, but there is no indication that they have ever done that, and in the NCOD and the periodic data releases, they focus strictly on frequency of detection by count and PWS and % exceeding an HRL. The UCMR sampling strategy is not fundamentally focused around evaluating variability at any single utility or sampling point, but rather on national occurrence trends.

*The first stage of analysis, Stage 1, provides a straightforward evaluation of occurrence for simple and conservative assessments of contaminant occurrence. The Stage 1 analysis of the UCMR data consists of non-parametric, unweighted counts and simple descriptive statistics of analytical results for each of the contaminants. These occurrence analyses are conducted at the sample level, PWS level and population-served level. For each contaminant, occurrence measures include the number and percent of samples with analytical detections and the minimum, median, maximum, and 99th percentile values of those detections. PWS-level occurrence measures include the number and percent of PWSs with one or more*



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*analytical detections and the number and percent of PWSs with two or more analytical detections of a given contaminant. Population-served occurrence measures include: the number and percent of population served by PWSs with one or more analytical detections, and the number and percent of population served by PWSs with two or more analytical detections of a given contaminant. Similar measures may also be conducted for each EPTDS for each PWS. Since these contaminant and PWS- level occurrence measures are based on raw occurrence data (that have not been adjusted for population-weighting and sampling), they are less accurate representations of national occurrence than occurrence measures based on adjusted occurrence data.*

**Data Analysis –Groundwater systems**

In our view, a "table" tells a thousand words. The tables below and statistical analyses for the data are for groundwater samples courtesy of Corona Environmental. The statistical evaluation compares the probability plots for the two sample events. We have also included covariant plots and a separate analysis of paired SE1 and SE2 samples using the Wilcoxon Rank Sum test. For purposes of statistical analysis any result which was non detect in the UCMR 3 database was assigned a value of 0.



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**Table 1. Summary of Statistical Tests Comparing Sample Events for GW systems.**

| | all data | | | | | | Exclude Dec-Feb | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Contaminant** | **K-S *p*** | **Mann-Whitney *p*** | ***N* both above DL** | ***N* one below DL** | ***N* both below DL** | ***% detects*** | **K-S *p*** | **Mann-Whitney *p*** | ***N* both above DL** | ***N* one below DL** | ***N* both below DL** | ***% detects*** |
| 1,1-Dichloroethane | 1 | 0.379 | 238 | 172 | 8590 | 3.6% | | 0.927 | 126 | 94 | 4517 | 3.7% |
| 1,2,3-Trichloropropane | 1 | 0.473 | 78 | 40 | 8883 | 1.1% | | 0.643 | 47 | 23 | 4667 | 1.2% |
| 1,3-Butadiene | ID | ID | 0 | 1 | 9000 | 0.0% | | ID | 0 | 1 | 4736 | 0.0% |
| 1,4-Dioxane | 1 | 0.568 | 916 | 421 | 7589 | 12.6% | | 0.558 | 471 | 226 | 3968 | 12.5% |
| 17α-Ethynylestradiol | ID | ID | 0 | 1 | 2857 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| 17β-Estradiol | ID | ID | 0 | 3 | 2855 | 0.1% | ID | ID | 0 | 0 | 1492 | 0.0% |
| 4-Androstene-3,17-dione | ID | ID | 0 | 7 | 2851 | 0.1% | ID | ID | 0 | 2 | 1490 | 0.1% |
| Bromomethane | 1 | 0.833 | 29 | 32 | 8939 | 0.5% | 1 | 0.86 | 8 | 17 | 4712 | 0.3% |
| Chlorate | 0.00464 | 0.00717 | 6381 | 1418 | 5967 | 51.5% | 0.00282 | 0.0383 | 3309 | 714 | 3150 | 51.1% |
| Chloromethane | 1 | 0.612 | 62 | 71 | 8868 | 1.1% | 1 | 0.17 | 26 | 39 | 4672 | 1.0% |
| Chromium | $2.23\times10^{-5}$ | 0.00222 | 6402 | 2025 | 5412 | 53.6% | $2.06\times10^{-4}$ | 0.00512 | 3256 | 1124 | 2757 | 53.5% |
| Chromium-6 | 0.942 | 0.811 | 8862 | 1289 | 3686 | 68.7% | 0.82 | 0.667 | 4605 | 743 | 1887 | 68.8% |
| Cobalt | 1 | 0.489 | 224 | 194 | 13478 | 2.3% | 1 | 0.773 | 103 | 105 | 6994 | 2.2% |
| Equilin | ID | ID | 0 | 0 | 2858 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Estriol | ID | ID | 0 | 1 | 2587 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Estrone | ID | ID | 0 | 0 | 2858 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Germanium | 1 | 0.734 | 16 | 4 | 1015 | 1.7% | 1 | 0.629 | 8 | 2 | 450 | 2.0% |
| Halon 1011 | 1 | 0.049 | 30 | 129 | 8842 | 1.0% | 1 | 0.802 | 20 | 71 | 4646 | 1.2% |
| HCFC-22 | 1 | 0.967 | 221 | 143 | 8637 | 3.2% | 1 | 0.855 | 107 | 73 | 4557 | 3.0% |
| Manganese | 0.983 | 0.922 | 589 | 148 | 298 | 64.1% | 0.944 | 0.894 | 267 | 64 | 129 | 65.0% |
| Molybdenum | 0.913 | 0.913 | 5657 | 822 | 7433 | 43.6% | 0.964 | 0.728 | 2890 | 441 | 3876 | 43.2% |
| *n*-Propylbenzene | ID | ID | 1 | 6 | 585 | 0.7% | ID | ID | 1 | 2 | 248 | 0.8% |
| PFBS | ID | ID | 1 | 2 | 9164 | 0.0% | ID | ID | 0 | 0 | 4817 | 0.0% |
| PFHpA | 1 | 0.512 | 45 | 29 | 9093 | 0.6% | 1 | 0.676 | 20 | 13 | 4784 | 0.6% |
| PFHxS | 1 | 0.686 | 68 | 21 | 9078 | 0.9% | 1 | 0.994 | 30 | 14 | 4773 | 0.8% |
| PFNA | 1 | 0.317 | 5 | 6 | 9156 | 0.1% | ID | ID | 1 | 4 | 4812 | 0.1% |
| PFOA | 1 | 0.736 | 82 | 51 | 9034 | 1.2% | 1 | 0.923 | 34 | 33 | 4750 | 1.0% |
| PFOS | 1 | 0.76 | 71 | 38 | 9058 | 1.0% | 1 | 0.44 | 31 | 21 | 4765 | 0.9% |
| *sec*-Butylbenzene | ID | ID | 0 | 0 | 592 | 0.0% | ID | ID | 0 | 0 | 251 | 0.0% |
| Strontium | 0.677 | 0.373 | 13774 | 91 | 8 | 99.6% | 0.655 | 0.359 | 7127 | 61 | 5 | 99.5% |
| Tellurium | ID | ID | 0 | 0 | 1035 | 0.0% | ID | ID | 0 | 0 | 460 | 0.0% |
| Testosterone | ID | ID | 0 | 13 | 2844 | 0.2% | ID | ID | 0 | 6 | 1486 | 0.2% |
| Vanadium | 0.689 | 0.505 | 7531 | 974 | 5398 | 57.7% | 0.964 | 0.708 | 3877 | 538 | 2784 | 57.6% |



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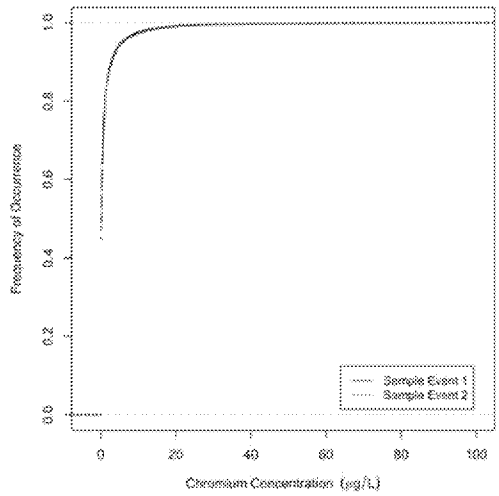
In all cases except for total chromium and chlorate, there is no statistical difference in the probability plots for sample event 1 and sample event 2. This is true even when there are a large number of non-detects. For UCMR 4, EPA has proposed only sampling between March and November. Thus the same analysis was done excluding the Dec-Feb samples. In that case there is also no significant difference between events and the overall frequency of detection is similar, suggesting that excluding the winter months would, at least for the UCMR 3 contaminants not make any difference in the data, while significantly complicating the monitoring process. If one thinks about ground water systems which are not under the direct influence of surface water and may even have travel times that are decades long, there is no reason to expect that sampling in any given month would be reflective of surface conditions at that time. Thus, even for analytes that might be seasonal in application (e.g. pesticides) ground water systems would almost certainly not reflect that seasonality.

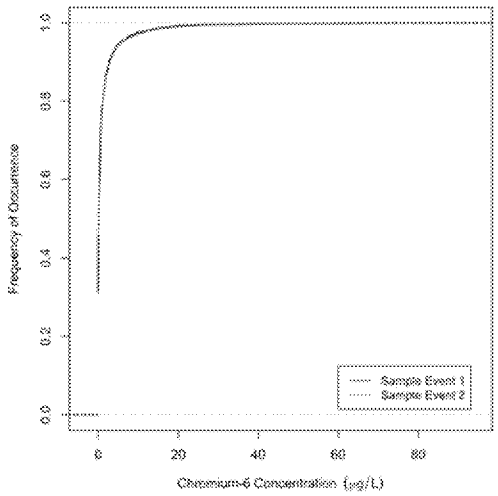
The probability plots here (figure 1) are for chlorate, total chromium, and hexavalent chromium. Just from a visual inspection it is apparent that even though individual events may have different results for a given sample site, the overall distribution of occurrence is essentially the same, as is true of hexavalent chromium also. In the case of chlorate there are differences in the extreme values.

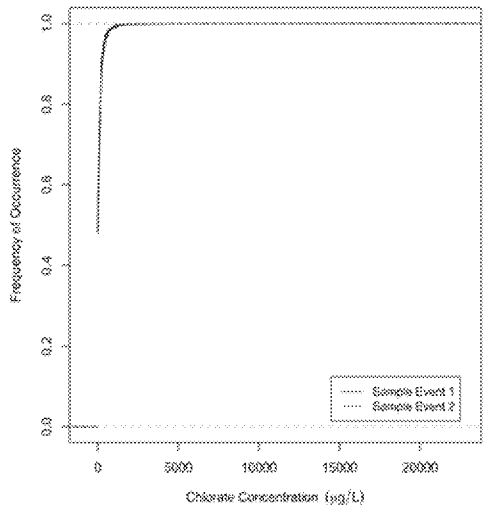
For chlorate it makes perfect sense that there could be significant differences between events, because utilities change their disinfection practices over time, which will in turn have an impact on chlorate, which is disinfection byproduct. Thus chlorate patterns would not be a cause for considering 1 vs 2 sampling events for groundwater systems, but should rather be treated like any other disinfection byproduct in terms of sampling strategy (e.g. sample only at a point in the distribution system and sample frequently enough to have a meaningful understanding of variability. It is worth noting that a visual assessment of the probability plots for chlorate (figure 1) suggests that they are not different, but likely show as statistically significant only because of differences in the extreme values.

For total chromium, the statistically significantly different results are also puzzling both because a covariance plot between the two events shows good correlation, and because when one looks at probability plots between the two sample events there is nearly perfect overlap. We suspect that the apparent statistically significant difference may relate to issues with the total chromium method accuracy and precision near the 0.2 ug/L reporting limit, coupled with the assumption of 0 for all non detect samples. Hexavalent chromium, with a much lower reporting limit, showed no significant difference between sample events. Additionally, when all non-detect samples for total chromium are excluded the correlation coefficient between sample event 1 and sample event 2 for groundwater goes from an $r^2$ of 0.705 to 0.83 and there is no statistical difference between probability plots. Thus we consider the apparent significant difference between events to be an artifact of the analytical method and not a true statistically significant difference that would justify multiple sampling rounds.

Figure 1: Probability plots for groundwater systems for SE1 and SE2 for chromium, hexavalent chromium, and chlorate.




Although not shown here, there is no difference in the nature of the plots if one excludes the December-February data. Thus no information is gained by restricting sampling periods. Table 1 also demonstrates that there is no difference in overall frequency of occurrence for any contaminant when one excludes the winter months.

The following plots (figures 2-5) are covariance plots of sample event 1 vs sample event 2 for each contaminant with even as little as 1% overall occurrence. Without referring to the statistical analysis it is clear that in most cases there is a high degree of covariance between events, even if the overall correlation coefficient is in some cases low, mainly because of limited occurrence.

The covariance, coupled with the probability plots and statistical evaluation of those plots all suggest that there is no information which is gained by having multiple sample events for groundwater systems.



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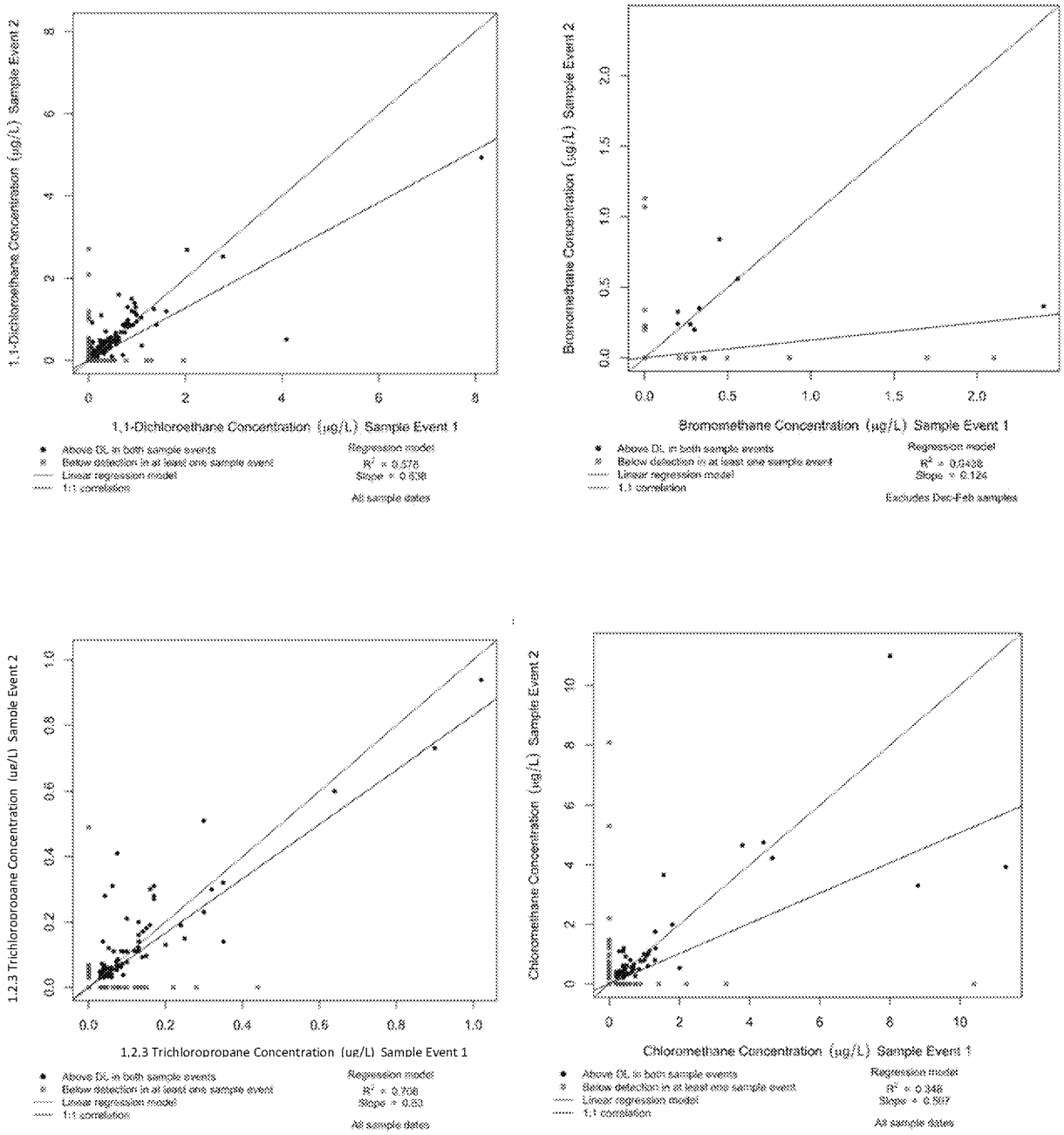
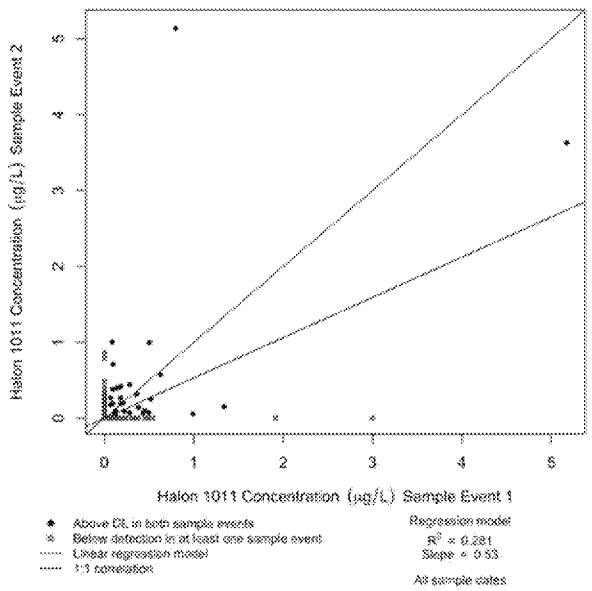
Figure 2a: Covariance plots for groundwater systems for VOC contaminants with sufficient data for statistical analysis. Plots below are based on using all samples (not excluding the winter months).




Halon 1011 Concentration (µg/L) Sample Event 2
Halon 1011 Concentration (µg/L) Sample Event 1
0
1
2
3
4
5
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.281
Slope = 0.53
All sample dates

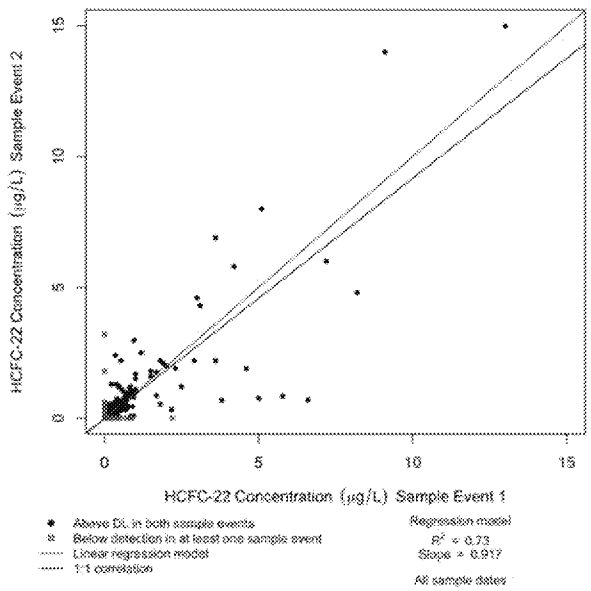
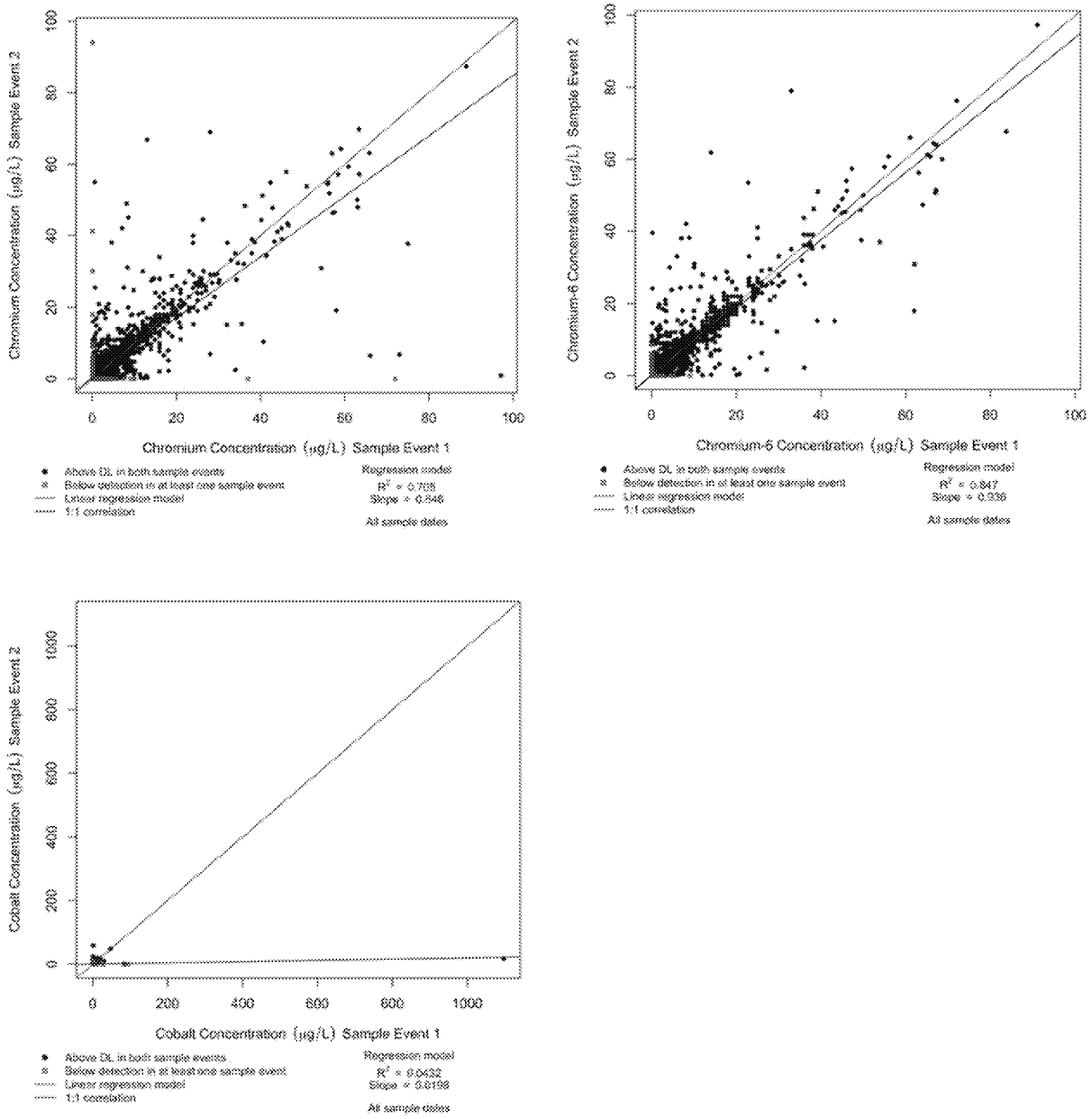
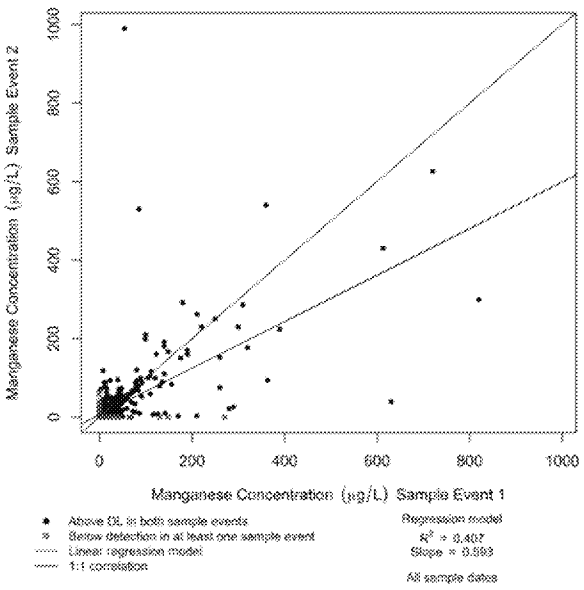
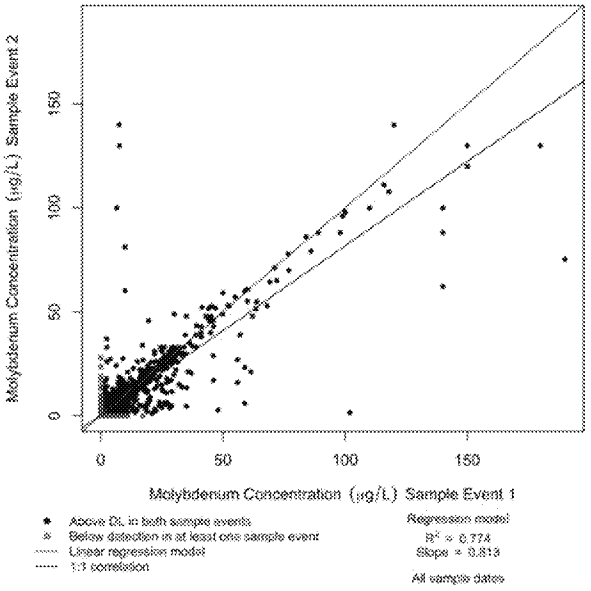
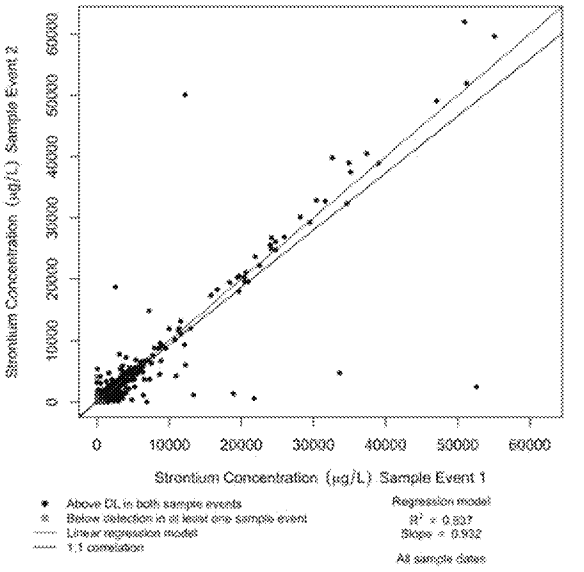

HCFC-22 Concentration (µg/L) Sample Event 2
HCFC-22 Concentration (µg/L) Sample Event 1
0
5
10
15
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.73
Slope = 0.917
All sample dates

Figure 3: Covariance plots for groundwater systems for metals. Plots below are based on using all samples (not excluding the winter months). Figure includes data for manganese and germanium (small systems data only, but planned for inclusion in UCMR 4.




Manganese Concentration (µg/L) Sample Event 2
Manganese Concentration (µg/L) Sample Event 1
0
200
400
600
800
1000
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.407
Slope = 0.593
All sample dates


Molybdenum Concentration (µg/L) Sample Event 2
Molybdenum Concentration (µg/L) Sample Event 1
0
50
100
150
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.774
Slope = 0.813
All sample dates


Strontium Concentration (µg/L) Sample Event 2
Strontium Concentration (µg/L) Sample Event 1
0
10000
20000
30000
40000
50000
60000
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.937
Slope = 0.932
All sample dates

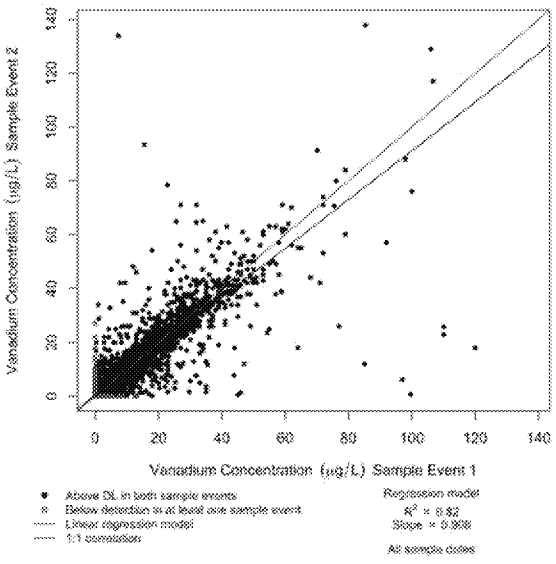
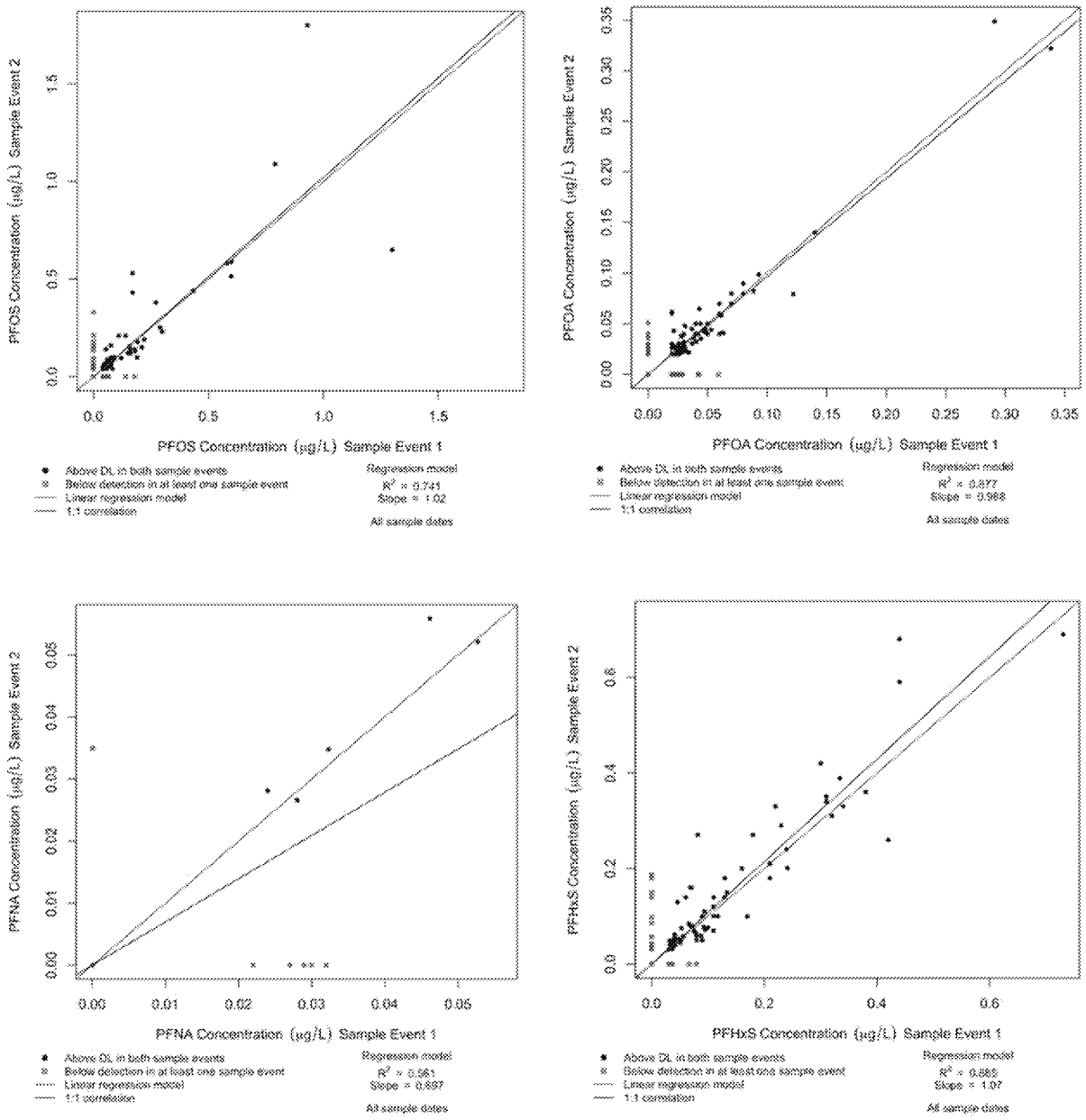

Vanadium Concentration (µg/L) Sample Event 2
Vanadium Concentration (µg/L) Sample Event 1
0
20
40
60
80
100
120
140
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.92
Slope = 0.868
All sample dates

Figure 4: Covariance plots for groundwater systems for PFC contaminants with sufficient data for statistical analysis. Plots below are based on using all samples (not excluding the winter months).



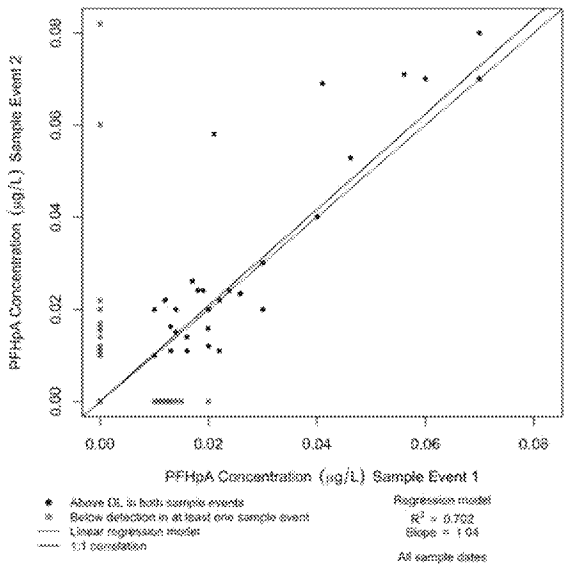
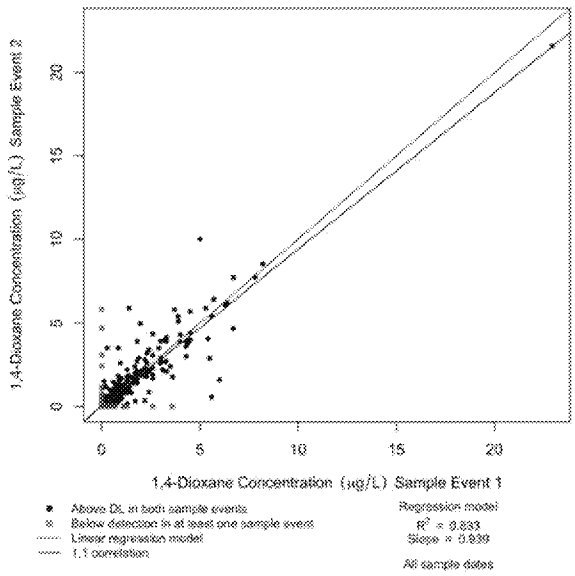
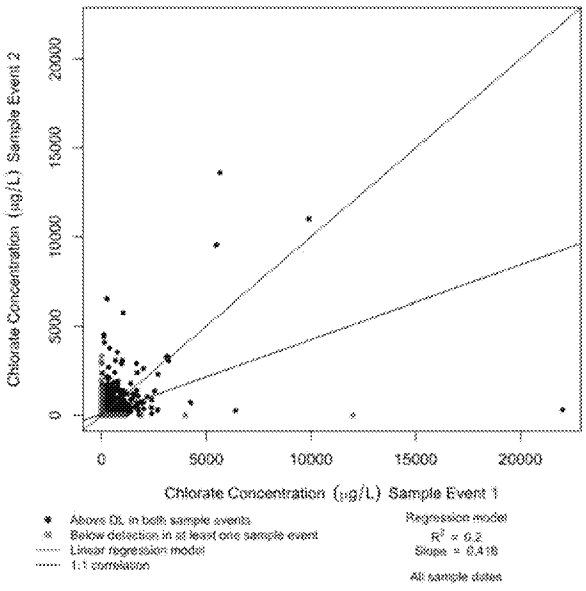



Figure 5: Covariance plot for groundwater systems for 1,4-dioxane and chlorate. Plots below are based on using all samples (not excluding the winter months).



**System size impact on results.**

The current UCMR construct calls for using a statistical sampling of small systems (< 10K population) and sampling all larger systems. Because one factor in interpreting UCMR data is the population impacted by contaminants it is important to determine the extent of variation in contaminant occurrence as a function of population size. The June, 2015 data from the NCOD was merged with population information from EPA and frequency of occurrence plotted for each contaminant as a function of system size. This analysis does not take into account the range of concentrations or the frequency with which contaminants may exceed the current health reference level (HRL), but rather focuses solely on the detection frequency as this is one factor EPA had indicated is a consideration in regulatory decision making. It is clear from the plots below (figure 6-10) that there **are differences** in frequency of occurrence for most contaminants as a function of population size, with greater frequency occurring in systems serving > 100K population, as would be expected in general for anthropogenic contaminants, where urban areas are more subject to potential contamination. In some cases the frequency of occurrence in the >100K systems may be more than double that of smaller systems, which may provide some justification for regulation, even though overall occurrence is low. This same pattern is true even for contaminants that are predominantly naturally occurring (e.g. the metals). EPA should perform a similar analysis of the data focusing not just on detection frequency but also on relative concentration levels. This analysis suggests that if EPA were to consider a statistical subset of systems serving >10K population for future UCMRs, including potentially UCMR 4, as a way of reducing the overall burden on utilities, it would be especially important that it be a robust analysis. We don't think there is sufficient time between now and the beginning of UCMR 4 to consider that approach for this round.

Figure 6: Frequency of occurrence for chlorate and 1,4-dioxane by population served.

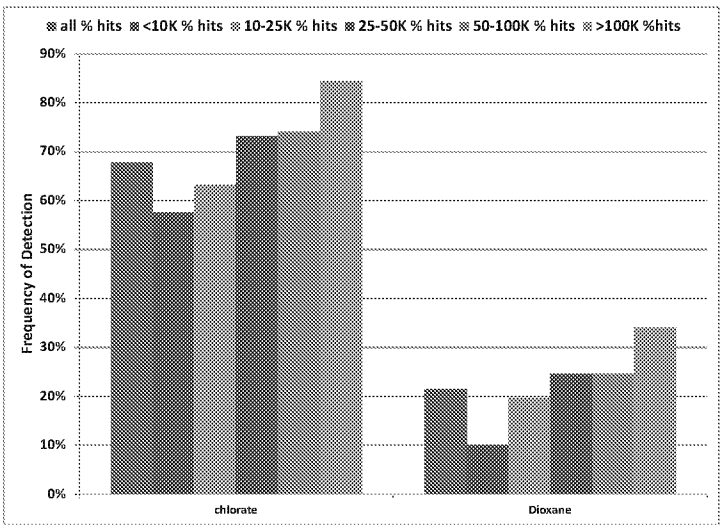
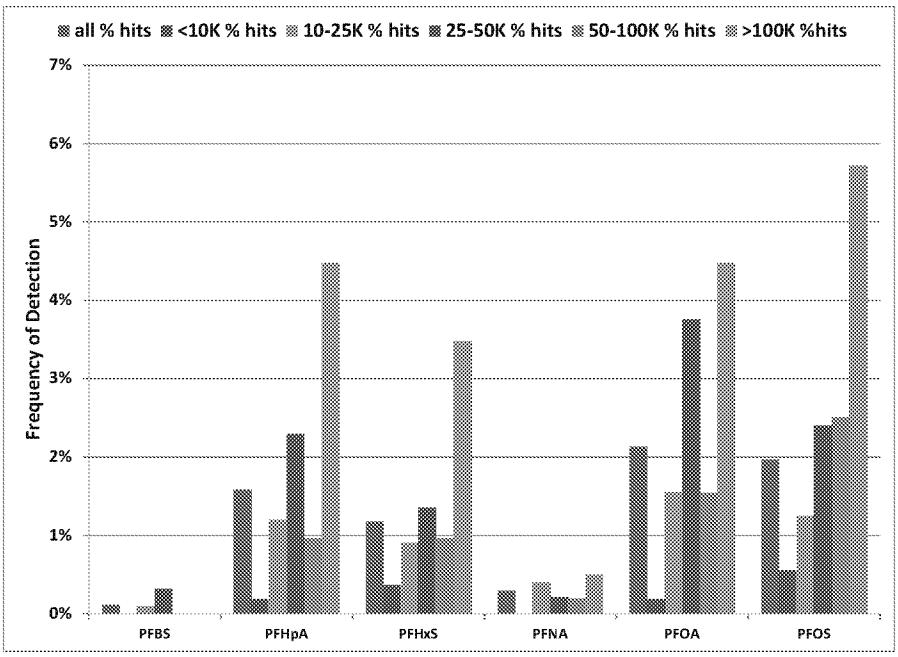
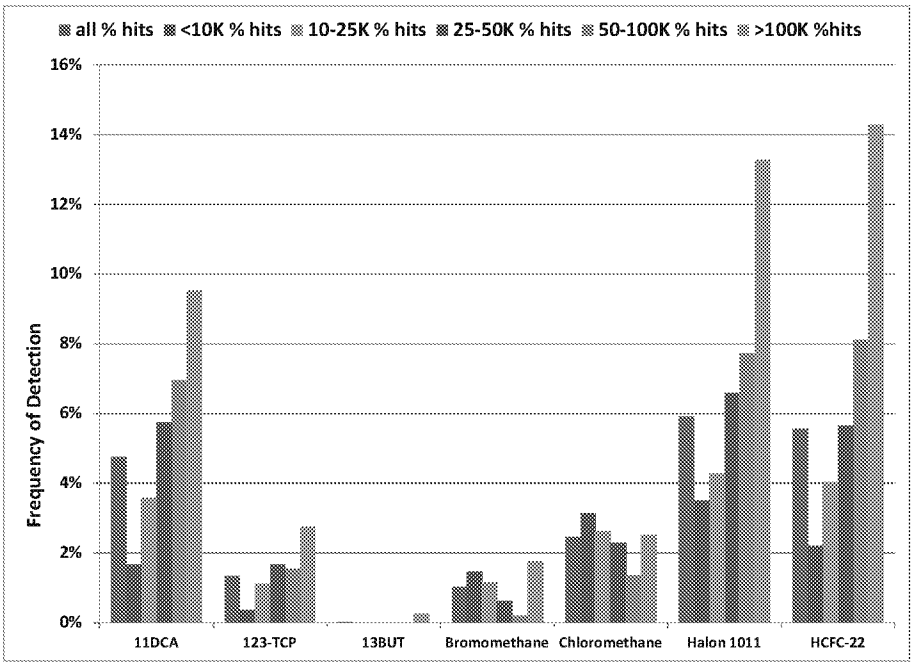


Figure 7: Frequency of occurrence for PFCs by population served.




For the PFCs, very large systems (>100K) in general have a much greater likelihood of detection than smaller systems. This may be a cause for considering potential regulation.

Figure 8: Frequency of occurrence for VOCs by population served.




VOCs show the same pattern as PFCs, a much greater likelihood of detection in 100K+ systems.



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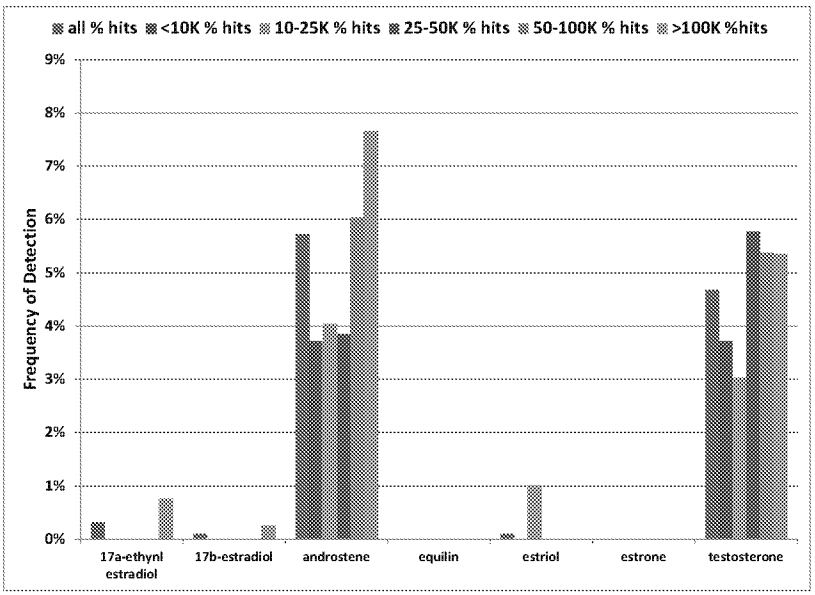
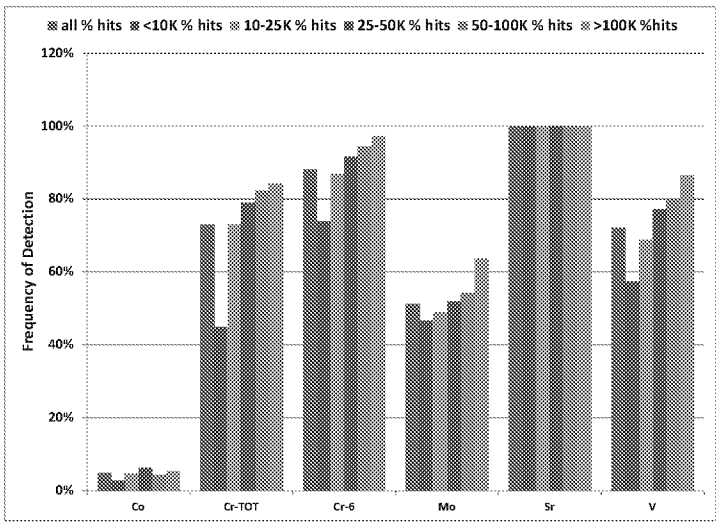
Figure 9: Frequency of occurrence for hormones by population served.




Even though the frequency of occurrence is relatively high (~5% of systems with detects for testosterone and androstenedione), there is no clear trend with population size. This is most likely due to the fact that detection levels overall are very close to the minimum reporting levels, as one would expect the hormones to show a major anthropogenic impact (e.g. more population = more hormone detections). When detected, hormones are almost always a single detection and not repeated on additional sampling events, making it more likely that at least some of the detects may be artifacts of some sort.

Figure 10: Frequency of occurrence for metals by population served




For the metals the difference across system size is less marked than for some of the anthropogenic contaminants, but there are still trends suggesting greater occurrence in larger systems, and thus also larger population impacts.

Message

**From**: Parris, Brenda [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=D341D3EEAF9D4C689ADAC8E32BC1E510-BPARRIS]
**Sent**: 8/3/2016 7:07:37 PM
**To**: Carroll, Gregory [Carroll.Gregory@epa.gov]
**CC**: Hautman, Dan [Hautman.Dan@epa.gov]
**Subject**: GAO - Compress monitoring to two years instead of three.
**Attachments**: Presentation_UCMR4_StakeholderMeeting_All_508.pdf; AWWA_UCMR4_StakeholderPresentations_140625.pdf; UCMR4StakeholderMeetingNotes_160802_NotesForGAOReview.docx; Workgroup_MeetingMinutes_140219_Final_GAO.docx

Hello Greg,

1. Presentation_UCMR4_StakeholderMeeting_All_508 – June 25, 2014 – before we proposed in December 2015.
    - Section 5 – Potential changes starts on page 25 (slide 49). The potential change specifically talked about compressing the monitoring to two years instead of three is on page 32, slide 64.
1. UCMR4StakeholderMeetingNotes_160802_NotesForGAOReview – I highlighted the sections that talk about the 2-3 year change. The notes do not reflect the sentiment in the room that Stakeholders were not happy with that potential change.
2. The AWWA presentation does not talk about a compressed monitoring schedule. Deliberative Process / Ex. 5 Deliberative Process / Ex. 5.
3. Workgroup_MeetingMinutes_140219 – the only meeting minutes where we talk about the topic. I highlighted yellow the discussion. I checked all the other meeting minutes and it was not captured. Deliberative Process / Ex. 5 Deliberative Process / Ex. 5

I know we dropped that as a potential option for the proposal Deliberative Process / Ex. 5

Deliberative Process / Ex. 5.

Thank you,
Brenda

United States Environmental Protection Agency

# Public Meeting and Webinar:

## Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) Meeting Presentations

Held June 25, 2014

USEPA, Office of Ground Water and Drinking Water

Office of Water (MLK 140) EPA 815-A-14-001 June 2014

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# Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

Public Meeting and Webinar

June 25th, 2014

Meeting starts at 9:00 a.m. E.T.

USEPA

Office of Ground Water and Drinking Water



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Figure 1

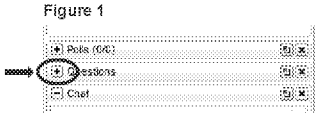


Figure 2

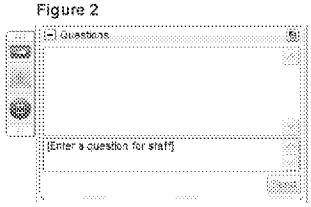

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Figure 3

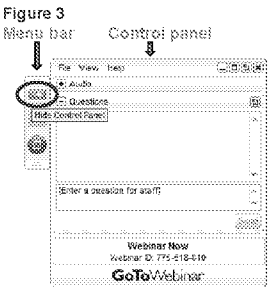


Figure 4

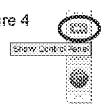



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Figure 5

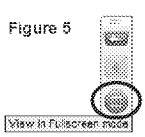
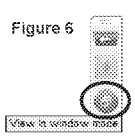



Figure 6



# WELCOME

## Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

Public Stakeholder Meeting and Webinar

June 25, 2014 U.S. Environmental Protection Agency 5

## General Meeting Information

- Purpose
  - Review the status of EPA's efforts in the areas of analyte selection, analytical methods, sampling design, determination of minimum reporting levels, and other possible revisions relative to the rule
- Webinar lines are muted to minimize background noise.
- On-site attendees:
  - Please mute electronic devices/cell phones.
  - Bathrooms in hall, follow signs; need door key cards, which should be returned after use.
  - Lunch break will be at 11:45; list of restaurants available at registration table.

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# Agenda

| | |
|---|---|
| 8:30-9:00 | Stakeholder Sign-in |
| 9:00-9:20 | Welcome – Introduction and Agenda |
| 9:20-9:50 | Overview of the UCMR Program |
| 9:50-10:30 | UCMR 3 Status |
| 10:30-10:45 | BREAK |
| 10:45-11:30 | UCMR 4 Potential Sampling Design Change Relative to UCMR 3 |
| 11:30-11:45 | Discussion |
| 11:45-1:15 | LUNCH |
| 1:15-3:00 | UCMR 4 Candidate Selections and Rationale |
| 3:00-3:15 | BREAK |
| 3:15-3:45 | Approval of Laboratories Supporting UCMR 4 |
| 3:45-5:00 | Discussion |

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# Overview of the Unregulated Contaminant Monitoring Program

Public Meeting and Webinar
Washington D.C.

June 25th, 2014 – 9:20 a.m.

Brenda Parris
USEPA, OGWDW, SRMD
Technical Support Center
Cincinnati, Ohio

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# Overview

- Unregulated Contaminant Monitoring (UCM) program
- Regulatory background for UCMR
  - Safe Drinking Water Act (SDWA) authority
  - Relationship to Contaminant Candidate List (CCL)
- Unregulated Contaminant Monitoring Rule (UCMR) approach
  - UCMR cycles
  - UCMR implementation



# Safe Drinking Water Act

- Passed in 1974, amended in 1986 and 1996
- Authorized EPA to set enforceable health standards for contaminants in drinking water
  - National Primary Drinking Water Standards (NPDWS)
- Outlined a sound science approach to NPDWS development that required consideration of:
  - Occurrence Data
  - Health Effects Data
  - Cost Benefit Analysis

# Unregulated Contaminant Monitoring

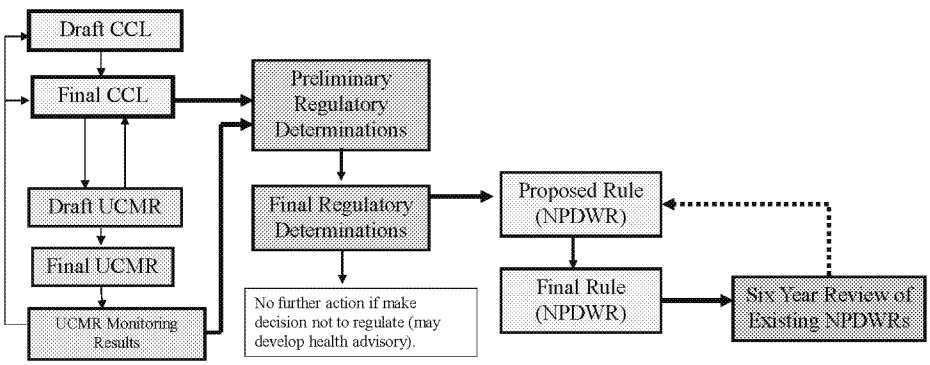
- 1986 SDWA amendments were the basis for the original UCM program
- UCM Rounds 1 (1988-1992, 62 contaminants) & 2 (1993-1997, 48 contaminants)
  - State drinking water programs managed the original UCM program
  - Public water systems (PWSs) serving > 500 people were required to monitor



# Safe Drinking Water Act

- 1996 SDWA amendments changed the process of developing and reviewing NPDWS
  - Contaminant Candidate List
  - **Unregulated Contaminant Monitoring Rule**
  - Regulatory Determination
  - Six-Year Review

# General Flow of Regulatory Process




At each stage, need increased specificity and confidence in the type of supporting data used (e.g. health and occurrence).



# Contaminant Candidate List

- SDWA requires EPA to list unregulated contaminants that may require a national drinking water regulation in the future
- Every five years CCL defines unregulated contaminants for which EPA needs
  - Occurrence data
  - Analytical methods
  - Potential health effects
  - Evaluation of treatment techniques

# Contaminant Candidate List

- EPA considered approximately 7,500 potential chemical and microbial contaminants
- Screening process based on a contaminant's potential to occur in public water systems (PWSs) and the potential for public health concerns
- Further detailed evaluations, public input, and expert judgment and review are used in the final contaminant selection
- Final CCL 3 published October 8, 2009
  - 104 chemicals or chemical groups and 12 microbiological contaminants
- CCL 4 is in development

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# Unregulated Contaminant Monitoring Rule

- 1996 Safe Drinking Water Act Amendments
  - Redesigned the UCM program and included these requirements:
    - Monitor no more than 30 contaminants per 5-year cycle
    - Monitor only a representative sample of PWSs serving 10,000 or fewer people
    - Store analytical results in the National Contaminant Occurrence Database (NCOD)
    - Direct implementation – EPA managed program in partnership with States
    - EPA funds testing/analytical costs for small PWSs

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## Objective of UCMR Program

- Develop a list of contaminants, largely based on CCL, every five years
- Collect occurrence data for suspected drinking water contaminants that do not have health-based standards set under SDWA
- Occurrence information is used to support future regulatory decision-making
- Supports the Administrator's determination of whether (or not) to regulate a contaminant under the drinking water program

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## Unregulated Contaminant Monitoring Rule

- UCMR groups contaminants into three tiers based on their priority and analytical methodologies
  - Assessment Monitoring (List 1)
    - Employs commonly used analytical techniques
  - Screening Survey (List 2)
    - Uses more recently developed analytical techniques
  - Pre-Screen Testing (List 3)
    - Utilizes new or specialized techniques

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# UCMR 1

- UCMR 1 (2001-2005, 26 contaminants)
  - Published in Federal Register (FR) on September 17, 1999
  - Required all large PWSs and a nationally representative sample of small PWSs serving ≤10,000 people to monitor for contaminants on List 1
  - Required a random selection of 300 large and small PWSs to monitor for contaminants on List 2



# UCMR 2

- UCMR 2 (2007-2011, 25 contaminants)
  - Published in Federal Register (FR) on January 4, 2007
  - More PWSs included under List 2 Screening Survey than for UCMR 1 to provide more representative results
  - Define monitoring schedules to improve compliance

# UCMR 3

- UCMR 3 (2012-2016, 30 contaminants)
  - Currently ongoing - monitoring ends in 2015, data review will occur in 2016
  - Published in Federal Register (FR) on April 16, 2012



# UCMR Implementation

- OGWDW, SRMD, Technical Support Center (Cincinnati)
  - Review and track PWS applicability and monitoring progress
  - Coordinate Laboratory Approval Program
  - Provide technical support for Regions, States, PWSs and laboratories
  - Coordinate outreach
  - Assist and support Regional compliance efforts

# UCMR Implementation

- OGWDW, SRMD, Technical Support Center (Cincinnati)
  - Small PWS support
    - Maintain lab and implementation contracts to support UCMR
    - Manage sample kit distribution
    - Responsible for data review and reporting
    - Prepare data for NCOD
  - Large PWS support
    - Extract data from the Safe Drinking Water Accession and Review System (SDWARS) for evaluation and reporting to NCOD
    - Support SDWARS reporting system and users

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# Extended UCMR Implementation Team

- OGWDW, DWPD, Infrastructure Branch
  - Responsible for SDWARS
- EPA Regional Offices
  - Coordinate State partnership agreements
  - Assist States and PWSs with UCMR requirements, compliance and enforcement
- Partnering States
  - Support various levels of monitoring coordination

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# Status of the Third Unregulated Contaminant Monitoring Rule (UCMR 3)

Public Meeting and Webinar
Washington D.C.

June 25th, 2014 – 9:50 a.m.

Gregory J. Carroll
USEPA, OGWDW, SRMD
Technical Support Center
Cincinnati, Ohio

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# Overview

- Timing, Activities and Applicability
- Monitoring
  - List 1, List 2, List 3
- Reporting
  - Current Status
- Occurrence Data
  - NCOD
- Preparation for UCMR 4

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## Time Line of UCMR 3 Activities

| 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|
| **Pre-monitoring Implementation**<br>• Lab Approval<br>• Notifications<br>• SDWARS Registration<br>  • Inventory<br>  • Schedule | **Sampling and Reporting Period**<br>One consecutive 12-month period during January 2013 - December 2015 (monitoring can span more than one calendar year, as long as conducted during a consecutive 12-month period). | | | **Post-monitoring Phase**<br>• Complete Resampling<br>• Conclude Data Reporting<br>• Finalize NCOD<br>• Continue Enforcement |

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## System Definitions and Sizes

- **Public water system** (PWS) provides water for human consumption through pipes or other constructed conveyances to at least 15 service connections or serves an average of at least 25 people for at least 60 days a year.
  - **Community Water System (CWS)** supplies water to the same population year-round.
  - **Non-Transient Non-Community Water System (NTNCWS)** regularly supplies water to at least 25 of the same people at least six months per year, but not year-round. Examples include schools, factories, office buildings, and hospitals that have their own water systems.
  - **Transient Non-Community Water System (TNCWS)** provides water in a place such as a gas station or campground where people do not remain for long periods of time.

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# UCMR 3 System Applicability

| Assessment Monitoring (List 1 Contaminants) | | |
|---|---|---|
| *System Type* | *Systems Serving > 10,000* | *Systems Serving ≤ 10,000* |
| CWS & NTNCWS | All systems (~4,200) | 800 randomly selected systems |
| TNCWS | No requirements | No requirements |
| **Screening Survey (List 2 Contaminants)** | | |
| *System Type* | *Systems Serving > 10,000* | *Systems Serving ≤ 10,000* |
| CWS & NTNCWS | All systems(~410) serving more than 100,000, and ~320 randomly selected systems serving 10,001 to 100,000 | 480 randomly selected systems |
| TNCWS | No requirements | No requirements |
| **Pre-Screen Testing (List 3 Contaminants)** | | |
| *System Type* | *Systems Serving > 1,000* | *Systems Serving ≤ 1,000* |
| CWS, TNCWS & NTNCWS | No requirements | 800 randomly selected systems |

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# UCMR 3 Monitoring

- PWSs must monitor during a consecutive 12-month period between 2013 - 2015
- Number of times a PWS samples is directly related to the sample point source
  - Surface water and ground water under the direct influence of surface water – must monitor quarterly during their 12-month schedule (sample three months apart)
  - Ground water – must monitor twice during their 12-month schedule (sample five to seven months apart)

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# UCMR 3 Monitoring Lists

- **Assessment Monitoring** (List 1 Contaminants) relies on common analytical method technologies used by drinking water laboratories
- **Screening Survey** (List 2 Contaminants) monitoring uses more specialized analytical method technologies
- **Pre-Screen Testing** (List 3 Contaminants) relies on newer method technologies not as commonly used by drinking water laboratories

  UCMR 3 Pre-Screen Testing involves ground water systems that:
  - Serve less than 1,000 people
  - Do not disinfect
  - Are located in vulnerable areas of karst or fractured bedrock

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# UCMR 3 Sampling Locations

| Contaminant Type | Sampling Location Type |
|---|---|
| **Assessment Monitoring: List 1 Contaminants** | |
| Volatile Organic Compounds | EPTDS |
| Synthetic Organic Compound (1,4-dioxane) | EPTDS |
| Perfluorinated Compounds | EPTDS |
| Oxyhalide Anion (chlorate) | EPTDS and DSMRT |
| Metals | EPTDS and DSMRT |
| Chromium-6 | EPTDS and DSMRT |
| **Screening Survey: List 2 Contaminants** | |
| Hormones | EPTDS |
| **Pre-Screen Testing: List 3 Contaminants** | |
| Viruses | EPTDS |

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# UCMR 3 List 1 Contaminants

| Assessment Monitoring: List 1 Contaminants | MRL (µg/L) |
|---|---|
| **Volatile Organic Compounds – EPA Method 524.3** | |
| chloromethane (methyl chloride) | 0.2 |
| bromomethane (methyl bromide) | 0.2 |
| chlorodifluoromethane (HCFC-22) | 0.08 |
| bromochloromethane (halon 1011) | 0.06 |
| 1,1-dichloroethane | 0.03 |
| 1,2,3-trichloropropane | 0.03 |
| 1,3-butadiene | 0.1 |
| **Synthetic Organic Compound – EPA Method 522** | |
| 1,4-dioxane | 0.07 |

EPA will pay for all analytical and shipping costs associated with List 1 monitoring at small systems (≤ 10,000).

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# UCMR 3 List 1 Contaminants

| Assessment Monitoring: List 1 Contaminants | MRL (µg/L) |
|---|---|
| **Perfluorinated Compounds– EPA Method 537** | |
| perfluorooctane sulfonic acid (PFOS) | 0.04 |
| perfluorooctanoic acid (PFOA) | 0.02 |
| perfluorononanoic acid (PFNA) | 0.02 |
| perfluorohexane sulfonic acid (PFHxS) | 0.03 |
| perfluoroheptanoic acid (PFHpA) | 0.01 |
| perfluorobutanesulfonic acid (PFBS) | 0.09 |
| **Oxyhalide Anion – EPA Method 300.1; SM 4110D; ASTM D6581-08** | |
| chlorate | 20 |

EPA will pay for all analytical and shipping costs associated with List 1 monitoring at small systems (≤ 10,000).

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# UCMR 3 List 1 Contaminants

| Assessment Monitoring: List 1 Contaminants | MRL (µg/L) |
|---|---|
| **Metals – EPA Method 200.8; SM 3125; ASTM D5673-10** | |
| cobalt | 1 |
| molybdenum | 1 |
| strontium | 0.3 |
| vanadium | 0.2 |
| chromium | 0.2 |
| **Chromium-6 – EPA Method 218.7** | |
| chromium-6 | 0.03 |

EPA will pay for all analytical and shipping costs associated with List 1 monitoring at small systems (≤ 10,000).

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# UCMR 3 List 2 Contaminants

| Screening Survey: List 2 Contaminants | MRL (µg/L) |
|---|---|
| **Hormones – EPA Method 539** | |
| 17-β-estradiol | 0.0004 |
| 17-α-ethynylestradiol (ethinyl estradiol) | 0.0009 |
| 16-α-hydroxyestradiol (estriol) | 0.0008 |
| equilin | 0.004 |
| estrone | 0.002 |
| testosterone | 0.0001 |
| 4-androstene-3,17-dione | 0.0003 |

EPA will pay for all analytical and shipping costs associated with List 2 monitoring at small systems (≤ 10,000).

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# UCMR 3 List 3 Contaminants

| Pre-Screen Testing: List 3 Contaminants | Detection Assay |
|---|---|
| **Microbiological Contaminants – EPA Method 1615** | |
| enterovirus | Cell culture; qPCR |
| norovirus | qPCR |
| **Microbiological Indicators** | |
| total coliforms | |
| *E. coli* | |
| *Enterococci* | |
| bacteriophage | |
| aerobic spores | |

EPA will collect the samples from List 3 sampling locations, and will pay for all analytical and shipping costs associated with viruses and indicators at these small systems (≤ 1,000).



# UCMR 3 Responsibilities

- Small PWSs serving 10,000 or fewer people are not responsible for the costs associated with analyses and shipping
  - EPA engages States and PWSs to collect samples for List 1 and List 2
  - EPA collects samples for List 3
  - EPA coordinates sample analyses with contracted laboratories and funds the analyses
  - EPA examines the results along with quality control data and generates reports

# UCMR 3 Responsibilities

- Large PWSs serving more than 10,000 people are responsible for the costs associated with analyses
  - PWS coordinates sample analyses with an approved laboratory
  - Laboratories post the data to the Safe Drinking Water Accession and Review System (SDWARS 3)
  - PWS reviews and can act upon
    (e.g., approve) data in SDWARS 3
    States and EPA review results

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# UCMR 3 Occurrence Data

- Updated quarterly and posted in the National Contaminant Occurrence Database (NCOD)
- Quarterly updates can be accessed from
  - http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/data.cfm#ucmr2013
  - Zipped file contains a summary document (PDF), occurrence data (.txt), disinfectant residual type (.txt) and U.S. postal service zip code(s) for all areas served by a PWS (.txt)
- Data will continue to be added and may be corrected on further review
  - Use caution when interpreting the data before the dataset is complete (mid-late 2016)

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# UCMR 3 Results To-Date

- OGWDW posted PWS results (submitted through April 2014) to the web (NCOD)
- Chemicals are studied at levels that are often significantly below those in previous UCMRs
- The detection of a UCMR 3 analyte above the MRL does not represent cause for concern, in and of itself
- The data should be judged considering health effects information (reference concentration)

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# UCMR 3 Preliminary Results

- ~3500 sample results from ~400 PWSs for hormones
- ~18,000 sample results from ~1900 PWSs for metals, chlorate
- ~11,000 sample results from 1800-1900 PWSs for other chemicals
- ~1/3 of data that will ultimately be collected

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## Preliminary Data Summary Points

- Metals
  - Many PWSs had **detections** of metals (i.e., above the MRL)
  - Between 0-3% of sample results were above the Reference Concentration (Ref Conc)
  - Vanadium above the Ref Conc at ~3% of PWSs; strontium above the Ref Conc at 1%; other metals measured above the Ref Conc by less than 1% of PWSs
- Chlorate
  - Many of the PWSs (~10,000 of ~18,000) had **detections** of chlorate
  - 35% of the PWSs had chlorate measurements above the Ref Conc

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## Preliminary Data Summary Points

- 1,4-dioxane
  - ~400 of ~1800 PWSs had **detections** of 1,4-dioxane
  - ~7% above the $10^{-6}$ Ref Conc of 0.35 µg/L; none above the $10^{-4}$ Ref Conc of 35 µg/L
- Volatile Organic Compounds (VOCs)
  - One or more VOCs **detected** by 104 of the ~1800 PWSs that reported data
  - Relatively few VOC measurements above the Ref Conc
  - 1,2,3-trichloropropane measured by ~1.4% of PWSs above the $10^{-4}$ Ref Conc; detected above MRL by ~1.7% (MRL > $10^{-6}$ Ref Conc)

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## Preliminary Data Summary Points

- Perfluorinated Compounds (PFCs)
  - 36 of the ~1900 PWSs **detected** one or more PFCs
  - 6 PWSs measured PFOS above the Ref Conc
  - Ref Conc currently only available for PFOA and PFOS
- Hormones
  - 17 of the ~400 PWSs **detected** one or more hormones
  - Ref Conc available for the 5 estrogenic hormones, not the 2 androgenic hormones
  - None of the PWSs had (estrogenic) hormone measurements above the Ref Conc

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## Preliminary Virus Data

- Pre-Screen Testing at 800 small GW systems for norovirus, enterovirus, and "indicator" organisms
- Field samples collected from ~376 PWSs; data available for ~173
  - 133 indicator detections
    - 26 enterococci
    - 9 bacteriophage
    - 84 aerobic spores
    - 2 *E. coli*
    - 12 total coliform
  - 3 norovirus detections

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## Timing for UCMR 3 and UCMR 4

- UCMR 3 monitoring activities are scheduled to end in December 2015
- UCMR 3 data will be finalized in 2016
- EPA anticipates proposing UCMR 4 in mid 2015
- UCMR 4 is anticipated to be final in late 2016
- Implementation activity for UCMR 4 expected to begin in 2017 with monitoring expected to begin in January 2018

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## Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

Public Stakeholder Meeting and Webinar

*Morning Break*

Resume at 10:45 a.m.

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# UCMR 4
# Potential Sampling Design Changes Relative to UCMR 3

Public Meeting and Webinar
Washington D.C.

June 25th, 2014 – 10:45 a.m.

Brenda Parris
USEPA, OGWDW, SRMD
Technical Support Center
Cincinnati, OH

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## Overview

- Background for the Unregulated Contaminant Monitoring Rule (UCMR) sampling design
- UCMR 4 sampling design considerations
- Approach to tiered monitoring
  - Assessment Monitoring (List 1)
  - Screening Survey (List 2)
  - Pre-Screen Testing (List 3)
- Potential changes between UCMR 3 and UCMR 4
- Implementation considerations

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# UCMR Background

- UCMR program designed for Safe Drinking Water Act (SDWA) specifications
- Under § 1445(a)(2)(A) of SDWA, as amended in 1996, EPA required to:
  - "vary the frequency and schedule for monitoring ...based on the number of persons served by the system, the source of supply, and the contaminants likely to be found;"
  - ensure "that only a representative sample of systems serving 10,000 persons or fewer are required to monitor;" and
  - "pay the reasonable cost of such testing and laboratory analysis..." for small systems

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# PWS Types

- Community water system
  - Public Water System (PWS) that supplies water to the same population year-round
- Non-transient non-community water system
  - PWS that supplies water to at least 25 of the same people at least six months per year, but not year-round
    - Schools
- Transient non-community water system
  - PWS that provides water where people do not remain for long periods of time
    - Gas stations and campgrounds

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## PWS Sizes

- Small PWSs serve 10,000 people or less
- Large PWSs serve 10,001-100,000 people
- "Extra large" PWSs serve over 100,001 people



## Sampling Design Considerations

- UCMR 4 expected to be based on the sampling and statistical design used in UCMR 1, 2 and 3
  - Vetted with stakeholders
  - Peer reviewed
  - Three rounds of public comment

# Sampling Design Considerations

**Data Quality Objectives**

- Unbiased national exposure estimates; small margin of error
- Account for differential occurrence
- Stratify across system size and source water type to account for differences
- Multiple sample events over multiple years to address temporal variability
- Allocation across states proportional to population served; at least two per state

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# Assessment Monitoring (List 1): Statistical Approach

- Expect to maintain same statistical design for Assessment Monitoring used in UCMR 1, 2 and 3
  - Nationally representative sample of 800 small systems
  - Census of large water systems
- Small system statistical sample combined with large system census data provides a powerful tool for assessing contaminant occurrence

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## Sample Allocation for Small Systems in Assessment Monitoring (List 1)

| Size Category | Ground Water Systems | Surface Water Systems | Total |
|---|---|---|---|
| 500 and under | 85 | 10 | ***95*** |
| 501 to 3,300 | 223 | 83 | ***306*** |
| 3,301 to 10,000 | 220 | 179 | ***399*** |
| **Total** | **528** | **272** | **800** |

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## Screening Survey (List 2): Statistical Approach

- Designed to ensure the data can be used to support regulatory determinations and rule development (if warranted)
- Account for possible laboratory capacity issues related to use of recently developed or technically complex methods

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## Screening Survey (List 2): Statistical Approach

- Considering similar approach as UCMR 2 and 3:
  - National sample of 800 systems, allocated across systems serving 100,000 or fewer:
    - Small system (serving 10,000 or fewer) sample would not overlap with Assessment Monitoring
    - Sample again allocated across strata of system size and source water type
  - Census of all systems serving 100,001 and over (~400 systems)
    - Adds further confidence in the sampling results by including a census of the largest systems
- **Total number of systems ~1,200**

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## UCMR Pre-Screen Testing (List 3)

- Envisioned for use with methods that are in the early stages of development, and/or very specialized (such as those for viruses or DNA/microchips)
- May be conducted by limited number of PWSs identified as vulnerable (by EPA and/or State agencies)
- **Not** currently anticipated to be utilized for UCMR 4

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## UCMR 4 Implementation Considerations

- The same sampling frequency used in UCMR 3 for Assessment Monitoring (AM) and Screening Survey (SS) is expected to be utilized for the majority of potential UCMR 4 analytes
  - Surface water systems (including groundwater under the direct influence of surface water) would sample four times during their year of monitoring
  - Ground water systems would sample two times during their year of monitoring
- Considering altering the sampling frequency for selected AM and/or SS analytes in UCMR 4

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## Potential Change Between UCMR 3 and UCMR 4: Monitoring

- Selective monitoring for List 1 and 2 contaminants, such as cyanotoxins and pesticides?
  - **UCMR 3:** Selective monitoring was conducted with List 3 viruses but has not been conducted with List 1 or 2 contaminants
  - **UCMR 4 potential change:** Target the monitoring of cyanotoxins and potentially pesticides by sampling in the warmer months of the year and only sampling surface water or ground water under the direct influence of surface water?
  - **Reason for considering change:**
    - To obtain more accurate occurrence data on contaminants whose concentrations fluctuate
    - Target timeframes when the contaminant is most likely to found, vulnerable period(s)

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## UCMR 4 Implementation Considerations

- Same monitoring schedule anticipated for AM and SS
  - Months assigned to ensure coverage of temporal vulnerability and variability
  - System monitoring spread across 3-year period to provide temporal coverage and to accommodate lab capacity
    - Year and months of monitoring assigned to small systems
    - Large systems can re-define their year and month(s) of monitoring

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## Potential Change Between UCMR 3 and UCMR 4: Monitoring

- Reduce the period of UCMR monitoring?
  - **UCMR 3:** 3 years were allocated for sample monitoring
  - **UCMR 4 potential change:** Compress the monitoring period to 2 years?
  - **Reason for considering change:**
    - UCMR data would be available earlier to support regulatory determinations

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## UCMR 4 Implementation Considerations

- Sampling locations for potential AM and SS chemicals
  - All chemicals would be sampled at the entry points to the distribution systems (EPTDSs)
  - Metals, if any, would also be sampled at the distribution maximum residence time (DSMRT) location in the distribution systems
  - Some adjustment in sampling locations may be warranted depending on the final selection of UCMR 4 contaminants

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## Potential Change Between UCMR 3 and UCMR 4: QC Data

- Collect additional quality control (QC) data in SDWARS?
  - **UCMR 3:** EPA collects more extensive small system QC data from contract laboratories, large systems report limited QC data
  - **UCMR 4 potential change:** Require similar QC data to be submitted for both large and small systems?
  - **Reason for considering change:**
    - Ensure a more robust dataset

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# Potential Change Between UCMR 3 and UCMR 4: SDWARS

- Improve SDWARS reporting functionality?
  - **UCMR 3:** Compliance reports offer a summary of the reporting status of **individual** PWSs and if they have fulfilled their monitoring requirements
  - **UCMR 4 potential change:** Update the functionality of SDWARS to include compliance reports for **multiple** PWSs **simultaneously**?
  - **Reason for considering change:**
    - Facilitates compliance tracking by the Regions and States

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# Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

## Discussion

**11:30 a.m. – 11:45 a.m.**

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# Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

Public Stakeholder Meeting and Webinar

*Lunch Break*

Meeting will resume at 1:15 p.m.

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# UCMR 4 Candidate Selection, Rationale and Method Considerations

Public Meeting and Webinar
Washington D.C.

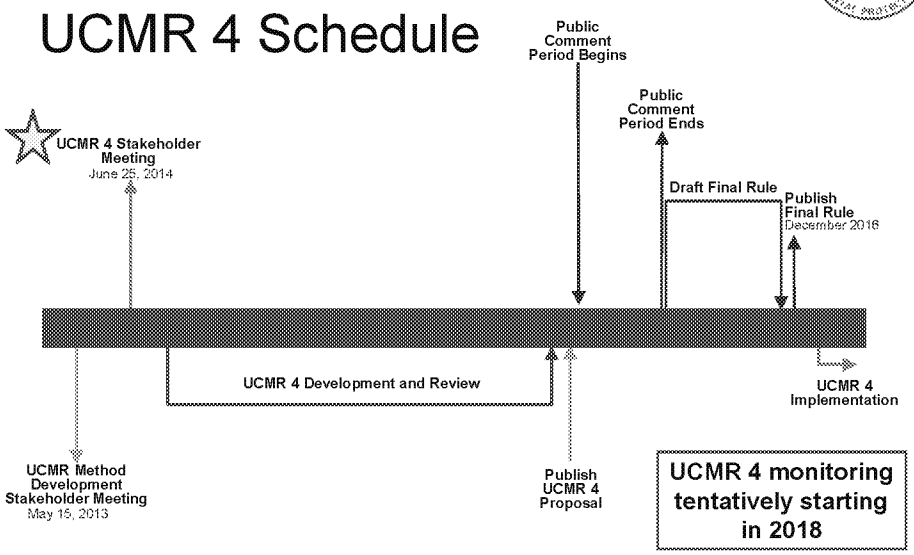
June 25th, 2014 – 1:15 p.m.

Melissa Simic and Steve Wendelken
United States Environmental Protection Agency
Office of Ground Water and Drinking Water
Technical Support Center

# Overview

- UCMR 4 Schedule
- Candidate Selection Process and Rationale
- Method Considerations
- Health and Occurrence Data with Sources
- Contaminant Specific Information by Method
- Other UCMR 4 Contaminants Under Consideration

# UCMR 4 Schedule



# UCMR 4 Prioritization Process

**CCL 3 [106 chemicals + 12 microbes]**
**+ 48 CCL 4 nominations[1] = 166 contaminants**

- Not currently regulated or previous regulatory determination
- Not monitored for on UCMR 2 or UCMR 3
- Low national occurrence is not anticipated
- Have a completed drinking water method

45 CCL + 48 related non-CCL analytes
[16 methods]

Most contaminants in method group:
- Have an available health assessment to facilitate regulatory determinations and/or high public concern
- Have critical health endpoints, probable carcinogens, active pesticides
- Have an occurrence data gap

**UCMR 4 Candidates:**
31 CCL + 18 related non-CCL analytes [9 methods]
+ other contaminants under consideration[2]

- Workgroup and stakeholder input
- Cost-effective method group
- Implementation considerations

Propose up to 30 contaminants for comment

**After considering comments, publish up to 30 contaminants for UCMR 4 monitoring tentatively starting in 2018**

*[1] 59 unique CCL 4 nominations; 11 removed because already on CCL 3 or regulated*
*[2] Nitrate/Nitrite, 4 unregulated brominated DBPs*

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# CCL and Related Candidates for UCMR 4

## Assessment Monitoring (List 1)

| | |
|---|---|
| **Method 200.8 – 7 Analytes** | |
| Germanium | |
| Manganese (CCL 4 nomination) | |
| Nickel | |
| Thorium | |
| **Method 525.3** | |
| Disulfoton | Profenofos |
| Ethoprop | Oxyfluorfen |
| alpha-Hexachlorocyclohexane | Vinclozolin |
| Permethrin, trans- | Dimethipin (Method 530) |
| Permethrin, cis- | Tebuconazole |
| Tribufos | |
| **Method 530 – In Development** | |
| Quinoline | |
| o-Toluidine | |
| Butylated hydroxyanisole | |
| Dimethipin (Method 525.3) | |
| **Method 538** | |
| Dicrotophos | |
| Oxydemeton-methyl | |
| Methamidophos | |
| Acephate | |
| **Method 541 – In Development** | |
| 1-Butanol | |
| 2-Propen-1-ol | |
| 2-Methoxyethanol | |

| | |
|---|---|
| **Method 542 – 10 Candidates – In Development** | |
| Erythromycin | Diclofenac |
| Triclosan (CCL 4 nomination) | Naproxen |
| Carbamazepine | Gemfibrozil |
| Diazepam | Fluoxetine |
| Sulfamethoxazole | Enalapril |
| Trimethoprim | Phenytoin |
| **Method 556.1** | |
| Formaldehyde | |
| Acetaldehyde | |

## Screening Survey (List 2)

| | |
|---|---|
| **Method 544 – 8 Analytes – In Development** | |
| Microcystin-LR | Microcystin-LF |
| Microcystin-YR | Microcystin-LY |
| Microcystin-RR | Nodularin |
| Microcystin-LA | |
| **Method 545 – 4 Analytes – In Development** | |
| Anatoxin-a | |
| Cylindrospermopsin | |

## Under Evaluation

| |
|---|
| **Potential methods being investigated** |
| *Legionella pneumophila* |

The candidates highlighted in gray are related non-CCL 3 analytes

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# Potential EPA Methods

| Assessment Monitoring (List 1) | Screening Survey (List 2) |
|---|---|
| Method 200.8 (ICP-MS) | Method 544 (LC/MS/MS) |
| Method 525.3 (GC/MS) | Method 545 (LC/ESI-MS/MS) |
| Method 530 (GC/MS) | |
| Method 538 (DAI-LC/MS/MS) | |
| Method 541 (GC/MS) | |
| Method 542 (LC/MS/MS) | |
| Method 556.1 (Fast GC) | |
| • Inductively Coupled Plasma (ICP)<br>• Gas Chromatography (GC)<br>• Direct Aqueous Injection (DAI) | • Mass Spectrometry (MS)<br>• Liquid Chromatography (LC)<br>• Electrospray Ionization (ESI) |
| • The monitoring location(s) are still being determined | |

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# Health Effects Data

- Identify health effects information compiled during CCL 3 + CCL 4 nominations
  - Potential health effects
  - Reference Dose (RfD) or other non-cancer health value
  - Cancer Slope Factor (CSF)
  - Health Reference Levels (HRLs)*
  - Cancellation Status for Pesticides
- Determine health assessment status:
  - **(1)** Available health assessment from an EPA (i.e., IRIS, OPP, OW) or comparable non-EPA source (e.g., ATSDR)
  - **(2)** Available health assessment from an EPA or comparable non-EPA source needs to be updated
  - **(3)** A health assessment is not currently available but sufficient information may exist to conduct a health assessment
  - **(4)** A health assessment is not currently available and there are substantial data needs

*Note: HRLs are risk-derived concentrations against which to evaluate the occurrence data to determine if contaminants occur at levels of potential public health concern. HRLs are not final determinations about the level of a contaminant in drinking water that must not be exceeded to protect any particular population.

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## Health Effects Data Sources

- EPA
  - Office of Pesticide Programs (OPP)
  - Integrated Risk Information System (IRIS)
  - Office of Water Health Advisory (HA)
- Agency for Toxic Substances and Disease Registry (ATSDR)
- California Office of Environmental Health and Hazard Assessment (OEHHA)
- Risk Assessment Information System (RAIS)
- Registry of Toxic Effects of Chemical Substances (RTECS)
- Joint FAO/WHO Expert Committee on Food Additives (JECFA)
  - Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO)
- Center for Disease Control (CDC)
- Single Studies

Note: The health values are derived using the health effects information available during CCL 3. The health values are subject to change as health assessments are completed or updated based on more recent health effects information.

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## Calculating CCL 3 Health Reference Levels

Non-Cancer CCL3 HRL (mg/L) = [(RfD x BW)/DWI] x RSC]

*Where:*

- RfD = Reference Dose (mg/kg-day)
  RfD = Point of Departure (POD) ÷ Uncertainty Factors (UF)
  Point of Departure = the dose (e.g., No Observed Adverse Effect Level (NOAEL) or Lowest Observed Adverse Effect level (LOAEL))
- BW = Body Weight for an adult, assumed to be 70 kilograms (kg)
- DWI = Drinking Water Intake for an adult, assumed to be 2 L/day (90$^{th}$ percentile)
- RSC = 20% Relative Source Contribution, assumed to be the level of exposure from drinking water when compared to other sources.

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## Calculating CCL 3 Health Reference Levels

**Cancer Unit Risk $(\mu g/L)^{-1}$ = CSF x [(DWI x CW)/BW]**

*Where:*

- CSF = Cancer Slope Factor $(mg/kg/day)^{-1}$
- DWI = Drinking Water Intake for an adult, assumed to be 2 L/day (90th percentile)
- CW = Unit risk concentration in drinking water of 0.001 mg/L (1 µg/L)
- BW = Body Weight for an adult, assumed to be 70 kilograms (kg)

The cancer HRL is the concentration of a contaminant in drinking water corresponding to an excess estimated lifetime cancer risk of one-in-a-million ($1 \times 10^{-6}$), calculated as follows:

**Cancer HRL (µg/L) = Risk Level of $10^{-6}$ ÷ Unit Risk $(\mu g/L)^{-1}$**

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## Occurrence Data and Information Sources

**Finished Water Data**

- Unregulated Contaminant Monitoring Rule (UCMR)
  - UCMR 1 Screening Survey/Assessment Monitoring (2001 – 2003)
- National Inorganics and Radionuclides Survey (NIRS) (1984 – 1986)
- Disinfection By-Product Information Collection Rule (DBP-ICR) Data (1997 – 1998)
- U.S. Department of Agriculture Pesticide Data Program (PDP)
- Pesticides Pilot Monitoring Program (PPMP)
- California Department of Health Services (CAL DHS)
- Small-Scale Local Occurrence Studies

Note: Occurrence results are presented as a number or percent of detects at systems/sites. Where available, a statement is included about the maximum concentration being above or below the health reference level (HRL).

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# Occurrence Data and Information Sources (cont.)

**Supplemental Drinking Water and Ambient Water Data**

- United States Geological Survey (USGS), Ambient Water
  - National Water Quality Assessment Program (NAWQA)
  - National Reconnaissance of Emerging Contaminants (NREC)
  - National Random and Focused Source Water Surveys (with AWWARF)
  - Special reports
- Other specialized studies and literature

**Production, Release, Usage and Other Data**

- Toxic Release Inventory (TRI)
- National Center for Food and Agricultural Policy (NCFAP)
- OPP Reregistration Eligibility Document (RED)
  - Data from pesticide registrants
- Chemical Update System/Inventory Update Reporting Program (CUS/IUR)
- Cancellation Status for Pesticides
- Persistent, Bioaccumulative and Toxic (PBT) Profiler

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# Metals

## EPA Method 200.8 (ICP/MS), 1994

*Determination of trace elements in waters by inductively coupled plasma - mass spectrometry*, revision 5.4

| Analytes | |
|---|---|
| • **Manganese (2)** | • **Germanium (4)** |
| • Nickel | • Thorium |

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## Manganese: Background

- Heavy metal element found in over 100 naturally occurring minerals, including silicates, carbonates, sulfides, oxides, phosphates and borates; ubiquitous in soil, water, food and air
- Small amounts found in foods are an essential nutrient for humans and animals
- Commercially imported manganese compounds include ferromanganese (used in the production of steel), manganese sulfate (fertilizer), manganese dioxide (matches, batteries, fireworks) and potassium permanganate (wastewater and drinking water treatment chemical)
- Common manganese compounds range from insoluble to moderately soluble in water

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## Manganese: Health Effects

- Health Assessment Status = 2
  - 1995 IRIS Risk Assessment
- RfD = 0.047 mg/kg-day
  - Critical Effect = Central nervous system effects
  - NOAEL = 0.14 mg/kg-day; UF = 3 [Reflects a modifying factor of 3 to adjust for increased bioavailability when in drinking water]
- HRL: 300 µg/L (non-cancer)
- Sensitive populations: Children, the elderly, pregnant women, iron deficient individuals, and individuals with impaired liver function
  - Recent studies indicate concern for neurological effects in children and infants

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## Manganese: Occurrence

- National Inorganics and Radionuclides Survey (NIRS), Finished Water, 1984-1986 (MRL = 1 µg/L):
  - 672 detections (median = 11.96 µg/L) out of 989 sites; Maximum detect (1,341 µg/L) > HRL (300 µg/L)
- USGS, National Water-Quality Assessment Program (NAWQA), Ambient Water, 1992-2001:
  - 6,447 detections (median = 19 µg/L) out of 8,002 sites; Maximum detect (70,000 µg/L) > HRL (300 µg/L)
- USGS, Toccalino et al., 2010, Ambient Water:
  - 543 detections (median = 8.99 µg/L) out of 808 samples; Maximum detect (1,923 µg/L) > HRL (300 µg/L)
- Toxic Release Inventory – Total:
  - 15,872,968 lbs/yr in 48 states in 2010

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## Germanium: Background

- Naturally-occurring element in earth's crust and oceans, widely distributed in low concentrations in oxide and sulfide minerals; commercially available in combination with other elements and produced mainly as a byproduct of zinc ore processing
- Used primarily in infrared optics, fiber-optic systems, electronics and solar electric applications
- Some germanium compounds (e.g., germanium dioxide) are water soluble

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## Germanium: Health Effects

- Health Assessment Status = 4
  - Registry of Toxic Effects of Chemical Substances (RTECS): Single Study (Obara et al. 1991)
- RfD-like = 0.0001 mg/kg-day
  - Critical Effect = Kidney, Ureter, Bladder - changes in tubules (including acute renal failure, acute tubular necrosis)
  - LOAEL = 0.318 mg/kg-day*; Default UF = 3,000
- CCL 3 HRL: 0.744 µg/L (non-cancer)
- Sensitive populations: Individuals with compromised renal function

*OW did not obtain the same LOAEL as RTECS using the data in the identified paper. Based on OW's evaluation of the dose information in the report, the LOAEL should be about ten times larger (i.e., 3.18 mg/kg-day)

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## Germanium: Occurrence

- National Inorganics and Radionuclides Survey (NIRS), Finished Water, 1984-1986 (MRL = 22 µg/L):
  - 4 detections (median = 220 µg/L) out of 989 PWSs; Minimum detection (26 µg/L) > HRL (0.744 µg/L)
- Chemical Update System / Inventory Update Reporting:
  - <500K lbs/yr in 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

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# Semivolatile Organic Chemicals

## EPA Method 525.3 (GC/MS), 2012

*Determination of semivolatile organic chemicals in drinking water by solid phase extraction and capillary column gas chromatography/mass spectrometry, version 1.0*

| Analytes | |
|---|---|
| • **Disulfoton (1)** | • **Tribufos (1)** |
| • **Ethoprop (1)** | • **Profenofos (1)** |
| • **Alpha-Hexachlorocyclohexane (2)** | • **Oxyfluorfen (2)** |
| • **Permethrin, trans - (1)** | • **Vinclozolin (2)** |
| • **Permethrin, cis- (1)** | • **Dimethipin (method 530) (1)** |
| • **Tebuconazole (1)** | |

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# Disulfoton: Background

- Organophosphate pesticide; used as an insecticide; currently registered for use on over 35 crops, plus domestic outdoor use on potted plants and ornamentals
- Production cancelled 2009 (74 FR 48551)
- Expected to be not very mobile to moderately mobile in water, based on physical and chemical properties
- Projected half-life in water is 7 - 41 days (PBT Profiler)
- The PBT Profiler (2009) predicts that 17% of disulfoton will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Moderately persistent in the environment

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## Disulfoton: Health Effects

- Health Assessment Status = 1
  - 2006 OPP Risk Assessment
- RfD = 0.00013 mg/kg-day
  - Critical Effect = Plasma, RBC, brain and corneal cholinesterase (ChE) inhibition
  - NOAEL = 0.013 mg/kg-day; UF = 100
- CCL3 HRL: 0.91 µg/L (non-cancer)
- Sensitive populations: None identified

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## Disulfoton: Occurrence

- UCMR 1 Screening Survey, Finished Water, 2001-2003 (MRL = 0.5 µg/L):
  - No detections of 2k samples in 295 systems
- USDA, Pesticide Data Program (PDP), Finished Water, 2001-2009 (min detect = N/A):
  - No detections in 4k samples
- USGS, Toccalino et al. 2010, Ambient Water (MRL = 0.01 - 0.02 µg/L)
  - No detections in 647 samples/systems
- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 1,196,066 lbs/yr in 33 states in 1997

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## Ethoprop: Background

- A phosphorodithioate pesticide; used as an insecticide
- Expected to be moderately mobile in water, based on physical and chemical properties
- PBT Profiler (2009) predicts 23% of ethoprop will partition to water when modeled in a four-compartment system (water, air, soil and sediment)

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## Ethoprop: Health Effects

- Health Assessment Status = 1
  - 2001 OPP Risk Assessment
- RfD = 0.0001 mg/kg-day*
  - Critical Effect = Plasma cholinesterase (ChE) inhibition
  - NOAEL = 0.01 mg/kg-day; UF = 100
- CCL 3 HRL: 0.7 µg/L (non-cancer)
- Sensitive populations: None identified

*Note: 2006 OPP Risk Assessment; RfD = 0.0014 Brain ChE inhibition; Likely carcinogen; CSF = 0.0261 mg/kg-day$^{-1}$

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## Ethoprop: Occurrence

- USGS, National Water-Quality Assessment Program (NAWQA), Ambient Water, 1992-2001:
  - 84 detections (median = 0.011 µg/L) out of 7,118 sites; Maximum detection (1.95 µg/L) > HRL (0.7 µg/L)
- Pesticide Pilot Monitoring Program (PPMP), Finished Water, 1999:
  - 0 detections out of 228 samples
- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 1,010,807 lbs/yr in 28 states in 1997
- EPA OPP estimate of pesticide usage:
  - 691,000 lbs/yr (2006 estimate)
- Toxic Release Inventory – Total:
  - 77,786 lbs/yr in 4 states in 2004; 35,660 lbs/yr in 2 states in 2010

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## alpha-Hexachlorocyclohexane: Background

- A cyclic halogenated alkane; component of lindane, formerly used as an insecticide
- Expected to be not very to moderately mobile in water, based on physical and chemical properties
- The PBT Profiler (2009) predicts that 6% of alpha-hexachlorocyclohexane will partition to water when modeled in a four-compartment system (water, air, soil and sediment)

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## alpha-Hexachlorocyclohexane: Health Effects

- Health Assessment Status = 2
  - 1987 IRIS Risk Assessment
- Slope Factor = 6.3 $(mg/kg\text{-}day)^{-1}$
- Cancer Class = B2
  - Sufficient evidence of carcinogenicity in animals
- CCL 3 HRL: 0.006 µg/L (cancer)
- Sensitive populations: Children may be more sensitive, but no definitive studies

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## alpha-Hexachlorocyclohexane: Occurrence

- USGS, National Water Quality Assessment Program (NAWQA), Ambient Water, 1992-2001 (MRL = 0.002 µg/L):
  - 21 detections (median = 0.011 µg/L) out of 7,119 sites; Maximum detection (0.21 µg/L) > HRL (0.006 µg/L)
- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - No data in 1997
- Chemical Update System / Inventory Update Reporting:
  - No Reports in 2002
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

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## Permethrin, cis- and trans-: Background

- Permethrin is a substituted diphenyl ether; used as an insecticide
- Expected to be not very to moderately mobile in water, based on physical and chemical properties
- The PBT Profiler (2009) predicts that 2% of permethrin will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- May or may not be persistent in the environment

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## Permethrin, cis- and trans-: Health Effects

- Health Assessment Status = 1
  - 2009 OPP Risk Assessment
- Slope Factor = 0.0096 $(mg/kg\text{-}day)^{-1}$
- Cancer Class = L
  - Likely to be carcinogenic to humans
- CCL 3 HRL: 3.65 µg/L (cancer)
- Sensitive populations: None identified

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## Permethrin, cis- and trans-: Occurrence

- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 1,066,056 lbs/yr in 48 states in 1997
- EPA OPP estimate of pesticide usage:
  - 2 million lbs/yr (2007 estimate)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - 17,979 lbs/yr in 7 states in 2004; 2,116 lbs/yr in 5 states in 2010

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## Tribufos: Background

- Alkylated phosphorotrithioate pesticide; used as an insecticide and cotton defoliant
- Mobility in water uncertain, physical and chemical properties provide conflicting indications
- The PBT Profiler (2009) predicts that 14% of tribufos will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

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## Tribufos: Health Effects

- Health Assessment Status = 1
  - 2006 OPP Risk Assessment
- RfD = 0.001 mg/kg-day
  - Critical Effect = Plasma cholinesterase (ChE) inhibition
  - NOAEL = 0.1 mg/kg-day; UF = 100
- CCL 3 HRL: 7 µg/L (non-cancer)
- Sensitive populations: None identified

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## Tribufos: Occurrence

- Pesticide Pilot Monitoring Program (PPMP), Finished Water, 1999:
  - 0 detections out of 221 samples
- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 4,918,265 lbs/yr in 16 states in 1997
- EPA OPP estimate of pesticide usage:
  - 4.5 million lbs/yr (2006 estimate)
- Chemical Update System / Inventory Update Reporting:
  - 10K – 500K lbs/yr in 2002; <500K lbs/yr in 2006
- Toxic Release Inventory – Total:
  - 7 lbs/yr in 1 state in 2004; 9 lbs/yr in 2 states in 2010

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## Profenofos: Background

- A phosphorothioate pesticide, applied as an insecticide
- Mobility in water uncertain, physical and chemical properties provide conflicting indications
- The PBT Profiler (2009) predicts that 9% of profenofos will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Persistent in the environment

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## Profenofos: Health Effects

- Health Assessment Status = 1
  - 2006 OPP Risk Assessment
- RfD = 0.00005 mg/kg-day
  - Critical Effect = Plasma and RBC cholinesterase (ChE) inhibition
  - NOAEL = 0.005 mg/kg-day; UF = 100
- CCL 3 HRL: 0.35 µg/L (non-cancer)
- Sensitive populations: None identified

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## Profenofos: Occurrence

- Pesticide Program Monitoring Program (PPMP), Finished Water, 1999:
  - 0 detections out of 221 samples
- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 879,776 lbs/yr in 14 states in 1997
- EPA OPP estimate of pesticide usage:
  - 775,000 lbs/yr (2006 estimate)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - 255 lbs/yr in 1 state in 2004; no data 2010

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## Oxyfluorfen: Background

- A substituted diphenyl ether; used as a herbicide
- Expected to be not very to moderately mobile in water, based on physical and chemical properties
- The PBT Profiler (2009) predicts that 5% of oxyfluorfen will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Persistent in the environment

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## Oxyfluorfen: Health Effects

- Health Assessment Status = 2
  - 1986 IRIS Risk Assessment
- RfD = 0.003 mg/kg-day
  - Critical Effect = Liver toxicity (e.g., increased liver weight and lesions)
  - NOAEL = 0.3 mg/kg-day; UF = 100
- CCL 3 HRL: 21 µg/L (non-cancer)
- Sensitive populations: Individuals with pre-existing liver conditions

*Note: 2002 OPP Risk Assessment, RfD = 0.03 mg/kg-day based on liver toxicity

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## Oxyfluorfen: Occurrence

- Pesticide Pilot Monitoring Program (PPMP), Finished Water, 1999:
  - 0 detections out of 221 samples
- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 705,255 lbs/yr in 37 states in 1997
- EPA OPP estimate of pesticide usage:
  - 761,000 lbs/yr on average between 1990 and 1999; usage increasing
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - 5 lbs/yr in 2 states in 2004; 2,503 lbs/yr in 1 state in 2010

June 25, 2014 U.S. Environmental Protection Agency 110

## Vinclozolin: Background

- An oxazolidine pesticide; used as a fungicide
- Expected to be moderately to very mobile in water, based on physical and chemical properties
- The PBT Profiler (2009) predicts that 12% of vinclozolin will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 111

## Vinclozolin: Health Effects

- Health Assessment Status = 2
  - 2000 OPP Risk Assessment
- RfD = 0.012 mg/kg-day
  - Critical Effect = Lesions in the lungs, liver, ovaries and eye
  - NOAEL = 1.2 mg/kg-day; UF = 100
- CCL 3 HRL: 84 µg/L (non-cancer)
- Sensitive populations: Fetuses, neonates, and adolescents during puberty could be a sensitive population

June 25, 2014 U.S. Environmental Protection Agency 112

## Vinclozolin: Occurrence

- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 121,959 lbs/yr in 26 states in 1997
- EPA OPP estimate of pesticide usage:
  - 141,000 lbs/yr in 2000; expected to drop to 71,000 lbs/yr after the phase-out of several uses was completed in 2004
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

June 25, 2014 U.S. Environmental Protection Agency 113

## Dimethipin: Background

- A cyclic dithiane pesticide; used as an herbicide and plant growth regulator
- Expected to be very mobile in water, based on physical and chemical properties
- The PBT Profiler (2009) predicts that 46% of dimethipin will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Moderately persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 114

## Dimethipin: Health Effects

- Health Assessment Status = 1
  - 2005 OPP Risk Assessment
- RfD = 0.0218 mg/kg-day
  - Critical Effect = Kidney, lungs, duodenum, liver, glandular stomach, heart, aortic artery and testes toxicity. Decreased body weight gain
  - NOAEL = 2.18 mg/kg-day; UF = 100
- CCL 3 HRL: 153 µg/L (non-cancer)
- Sensitive populations: Non identified

June 25, 2014 U.S. Environmental Protection Agency 115

## Dimethipin: Occurrence

- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 282,458 lbs/yr in 14 states in 1997
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - 250 lbs/yr in 1 state in 2004; 87 lbs/yr in 1 state in 2010

June 25, 2014 U.S. Environmental Protection Agency 116

## Tebuconazole: Background

- A substituted triazole pesticide; used as a fungicide
- Expected to be moderately to very mobile in water, based on physical and chemical properties
- The PBT Profiler (2009) predicts that 9% of tebuconazole will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 117

## Tebuconazole: Health Effects

- Health Assessment Status = 1
  - 2008 OPP Risk Assessment
- RfD = 0.03 mg/kg-day
  - Critical Effect = Decreased body weights, absolute brain weights, brain measurements and motor activity in offspring
  - LOAEL = 8.8 mg/kg-day; UF = 300
- CCL 3 HRL: 210 µg/L (non-cancer)
- Sensitive populations: Infants and children

June 25, 2014 U.S. Environmental Protection Agency 118

## Tebuconazole: Occurrence

- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 478,568 lbs/yr in 16 states in 1997
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

June 25, 2014 U.S. Environmental Protection Agency 119

## Semivolatile Organic Chemicals

Draft EPA Method 530 (GC/MS)
Anticipated Publication Year 2014

*Determination of select semivolatile organic chemicals in drinking water by solid phase extraction and capillary column gas chromatography/mass spectrometry*

| Analytes | |
|---|---|
| • **Quinoline (1)** | • **Butylated hydroxyanisole (3)** |
| • **o-Toluidine (4)** | • **Dimethipin (1) (method 525.3)** |

June 25, 2014 U.S. Environmental Protection Agency 120

## Quinoline: Background

- Fused aromatic amine; used as a pharmaceutical (anti-malarial) and flavoring agent, also produced as a chemical intermediate
- Mobility in water uncertain, physical and chemical properties provide conflicting indications
- PBT Profiler (2009) predicts 31% of quinoline will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 121

## Quinoline: Health Effects

- Health Assessment Status = 1
  - 2001 IRIS Risk Assessment
- Slope Factor = 3 $(mg/kg\text{-}day)^{-1}$
- Cancer Class = B2
  - Sufficient evidence of carcinogenicity in animals
- CCL 3 HRL: 0.01 µg/L (cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 122

## Quinoline: Occurrence

- Chemical Update System / Inventory Update Reporting:
  - 10K – 500K lbs/yr in 2002; 1M – <10M lbs/yr in 2006
- Toxic Release Inventory – Total:
  - 28,629 lbs/yr in 8 states in 2004; 15,789 lbs/yr in 9 states in 2010

June 25, 2014 U.S. Environmental Protection Agency 123

## o-Toluidine: Background

- Aminated aromatic compound; used in production of dyes, rubber, pharmaceuticals and pesticides
- Expected to be moderately to very mobile in water based on physical and chemical properties
- PBT Profiler (2009) predicts 41% of o-toluidine will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 124

## o-Toluidine: Health Effects

- Health Assessment Status = 4
  - California Office of Environmental Health and Hazard Assessment (OEHHA), 2008: Study not provided
- Slope Factor = 0.18 $(mg/kg\text{-}day)^{-1}$
- IARC Cancer Group = 2A
  - Probably carcinogenic to humans
- CCL 3 HRL: 0.194 µg/L (cancer)
- Sensitive populations: Infants and children

June 25, 2014 U.S. Environmental Protection Agency 125

## o-Toluidine: Occurrence

- Chemical Update System / Inventory Update Reporting:
  - >10M – 50M lbs/yr in 2002; 10M – <50M lbs/yr in 2006
- Toxic Release Inventory – Total:
  - 10,774 lbs/yr in 9 states in 2004; 6,623 lbs/yr in 1 state in 2010

June 25, 2014 U.S. Environmental Protection Agency 126

## Butylated hydroxyanisole: Background

- Alkylated methoxyphenol; used as an antioxidant in foods, particularly those with high fat content and packaged foods
- Expected to be moderately mobile to not very mobile in water, based on physical and chemical properties
- PBT Profiler (2009) predicts 15% of butylated hydroxyanisole will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Projected half-life in water is 38 days (PBT Profiler)
- Moderately persistent in the water

June 25, 2014 U.S. Environmental Protection Agency 127

## Butylated hydroxyanisole: Health Effects

- Health Assessment Status = 3
  - Registry of Toxic Effects of Chemical Substances (RTECS), 2006: Single Study (Adelaide, S.A., Australia 1959)
- RfD-like = 0.000083 mg/kg-day
  - Critical Effect = Changes in liver weight
  - LOAEL = 0.249 mg/kg-day; Default UF = 3,000
- CCL 3 HRL: 0.581 µg/L (non-cancer)
- Sensitive populations: Fetus and neonate may be sensitive to neurodevelopmental effects from exposure to high levels

June 25, 2014 U.S. Environmental Protection Agency 128

## Butylated hydroxyanisole: Occurrence

- USGS, National Reconnaissance of Emerging Contaminants (NREC), Ambient Surface Water, 1999-2004:
  - 2 detections (median = 0.1 µg/L) in 85 sites; Median of detections < HRL (0.581 µg/L)
- USGS, Koplin, et al., 2002, Ambient Water:
  - 2.4% detection rate (median = 0.1 µg/L) out of 85 sites; Maximum detect (0.2 µg/L) < HRL
- USGS, Focazio, et al., 2008, Ambient Water:
  - No detects out of 73 sites
- Chemical Update System / Inventory Update Reporting:
  - 10K – 500K lbs/yr in 2002; <500K lbs/yr in 2006
- Toxic Release Inventory – Total:
  - No data in 2004; No data in 2010

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## Presenter

**Steve Wendelken, USEPA**

June 25, 2014 U.S. Environmental Protection Agency 130

# Organic Contaminants

## EPA Method 538 (DAI-LC/MS/MS), 2009

*Determination of selected organic contaminants in drinking water by direct aqueous injection-liquid chromatography/tandem mass spectrometry, version 1.0*

| Analytes | |
|---|---|
| • **Dicrotophos (1)** | • **Methamidiphos (1)** |
| • **Oxydemeton-methyl (1)** | • **Acephate (1)** |



# Dicrotophos: Background

- Organophosphate pesticide; used as an insecticide on cotton
- Expected to be moderately mobile to very mobile in water, based on chemical and physical properties
- The PBT Profiler (2009) predicts that 39% of dicrotophos will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Moderately persistent in the environment

## Dicrotophos: Health Effects

- Health Assessment Status = 1
  - 2006 OPP Risk Assessment
- RfD = 0.00007 mg/kg-day
  - Critical Effect = Plasma, RBC and brain cholinesterase (ChE) inhibition
  - LOAEL = 0.02 mg/kg-day; UF = 300
- CCL 3 HRL: 0.49 µg/L (non-cancer)
- Sensitive populations: None identified

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## Dicrotophos: Occurrence

- Pesticide Pilot Monitoring Program (PPMP), Finished Water, 1999:
  - 0 detections
- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 359,726 lbs/yr in 13 states in 1997
- OPP Pesticide Usage Estimate
  - 500,000 lbs/yr (2006 estimate)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

June 25, 2014 U.S. Environmental Protection Agency 134

## Oxydemeton-methyl: Background

- Thiophosphate pesticide, used as an insecticide on broccoli, lettuce and other crops
- Expected to be very mobile in water based on chemical and physical properties
- The PBT Profiler (2009) predicts that 39% of oxydemeton-methyl will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Moderately persistent in the environment

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## Oxydemeton-methyl: Health Effects

- Health Assessment Status = 1
  - 2006 OPP Risk Assessment
- RfD = 0.00013 mg/kg-day
  - Critical Effect = RBC and brain cholinesterase (ChE) inhibition
  - NOAEL = 0.013 mg/kg-day; UF = 100
- CCL 3 HRL: 0.91 µg/L (non-cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 136

## Oxydemeton-methyl: Occurrence

- Pesticide Pilot Monitoring Program (PPMP) Finished Water, 1999:
  - 0 detections
- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 154,227 lbs/yr in 19 states in 1997
- OPP Pesticide Usage Estimate
  - 145,000 – 186,000 lbs/yr (2006 estimate)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

June 25, 2014 U.S. Environmental Protection Agency 137

## Methamidophos: Background

- Phosphoramidothioate pesticide used as an insecticide on potatoes and other crops; also a degradation product of acephate, an organic phosphoramide insecticide
- Expected to be very mobile in water, based on chemical and physical properties
- The PBT Profiler (2009) predicts that 39% of methamidophos will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Moderately persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 138

## Methamidophos: Health Effects

- Health Assessment Status = 1
  - 2006 OPP Risk Assessment
- RfD = 0.0003 mg/kg-day
  - Critical Effect = Brain cholinesterase (ChE) inhibition
  - NOAEL = 0.03 mg/kg-day; UF = 100
- CCL 3 HRL: 2.1 µg/L (non-cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 139

## Methamidophos: Occurrence

- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 965,584 lbs/yr in 39 states in 1997
- OPP Pesticide Usage Estimate
  - 640,000 lbs/yr (2006 estimate)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

June 25, 2014 U.S. Environmental Protection Agency 140

## Acephate: Background

- Organic phosphoramide pesticide; used as an insecticide on cotton, tobacco and other crops
- Expected to be very mobile in water, based on chemical and physical properties
- Projected half-life in water of 38 days (PBT Profiler)
- PBT Profiler (2009) predicts 46% of acephate will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 141

## Acephate: Health Effects

- Health Assessment Status = 1
  - 2006 OPP Risk Assessment
- RfD = 0.0012 mg/kg-day
  - Critical Effect = Brain cholinesterase (ChE) inhibition
  - NOAEL = 0.12 mg/kg-day; UF = 100
- CCL 3 HRL: 8.4 µg/L (non-cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 142

## Acephate: Occurrence

- National Center for Food and Agricultural Policy (NCFAP) Pesticide Application:
  - 2,462,354 lbs/yr in 35 states in 1997
- EPA OPP estimate of pesticide usage:
  - 4-5 million lbs/yr (2006 estimate)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - 20,751 lbs/yr in 5 states in 2004; 5,816 lbs/yr in 2 states in 2010

June 25, 2014 U.S. Environmental Protection Agency 143

## Alcohols

### Draft EPA Method 541 (GC/MS)
### Anticipated Publication Year 2014

*Analysis of low molecular weight alcohols in drinking water by gas chromatography mass spectrometry*

| Analytes | |
|---|---|
| • **1-Butanol (2)** | • **2-Methoxyethanol (3)** |
| • **2-Propen-1-ol (2)** | |

June 25, 2014 U.S. Environmental Protection Agency 144

## 1-Butanol: Background

- Alkyl alcohol compound; used as a paint solvent and food additive, also formed as a chemical intermediate
- Expected to be moderately mobile to very mobile in water, based on chemical and physical properties
- PBT Profiler (2009) predicts 40% of 1-butanol will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 145

## 1-Butanol: Health Effects

- Health Assessment Status = 2
  - 1987 IRIS Risk Assessment
- RfD = 0.1 mg/kg-day
  - Critical Effect = Abnormally diminished activity in the body/organs; inability to control muscles
  - NOAEL = 125 mg/kg-day; UF = 1,000
- CCL 3 HRL: 700 µg/L (non-cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 146

## 1-Butanol: Occurrence

- Chemical Update System / Inventory Update Reporting:
  - >1B lbs/yr in 2002; ≥1B lbs/yr in 2006
- Toxic Release Inventory – Total:
  - 17,648,846 lbs/yr in 44 states in 2004; 11,093,815 lbs/yr in 47 states in 2010

June 25, 2014 U.S. Environmental Protection Agency 147

## 2-Propen-1-ol: Background

- Alkene/alcohol compound; chemical intermediate used in the manufacturing of flavorings and perfumes
- Expected to be moderately mobile to very mobile in water, based on chemical and physical properties
- PBT Profiler (2009) predicts 48% of 2-propen-1-ol will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 148

## 2-Propen-1-ol: Health Effects

- Health Assessment Status = 2
  - 1987 IRIS Risk Assessment
- RfD = 0.005 mg/kg-day
  - Critical Effect = Impaired renal function and increased relative liver, spleen and kidney weights
  - NOAEL = 4.8 mg/kg-day; UF = 1,000
- CCL 3 HRL: 35 µg/L (non-cancer)
- Sensitive populations: Individuals with impaired pulmonary function may be particularly sensitive to the toxic effects of allyl alcohol through inhalation

June 25, 2014 U.S. Environmental Protection Agency 149

## 2-Propen-1-ol: Occurrence

- Chemical Update System / Inventory Update Reporting:
  - >100M – 500M lbs/yr in 2002; 100M – <500M lbs/yr in 2006
- Toxic Release Inventory – Total:
  - 604,872 lbs/yr in 13 states in 2004; 445,833 lbs/yr in 13 states in 2010

June 25, 2014 U.S. Environmental Protection Agency 150

## 2-Methoxyethanol: Background

- Monoalkylated alcohol; used in synthetic cosmetics, perfumes, fragrances, hair preparations, skin lotions and other consumer products
- Expected to be moderately mobile to very mobile in water, based on chemical and physical properties
- PBT Profiler (2009) predicts 45% of 2-methoxyethanol will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 151

## 2-Methoxyethanol: Health Effects

- Health Assessment Status = 3
  - Risk Assessment Information System (RAISHE): Single Study (Gulati, et al. 1990)
- RfD-like = 0.003 mg/kg-day
  - Critical Effect = Reproductive effects
  - LOAEL = 9 mg/kg-day; Default UF = 3,000
- CCL 3 HRL: 21 µg/L (non-cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 152

## 2-Methoxyethanol: Occurrence

- Chemical Update System / Inventory Update Reporting:
  - >10M – 50M lbs/yr in 2002; 1M – <10M lbs/yr in 2006
- Toxic Release Inventory – Total:
  - 153,774 lbs/yr in 16 states in 2004; 23,240 lbs/yr in 16 states in 2010

June 25, 2014 U.S. Environmental Protection Agency 153

## Pharmaceuticals

### Draft EPA Method 542 (LC/MS/MS)

### Anticipated Publication Year 2014

*Determination of pharmaceuticals and personal care products (PPCP) in drinking water by solid phase extraction (SPE) and liquid chromatography electrospray ionization tandem mass spectrometry*

| Analytes | |
|---|---|
| • **Erythromycin (3)** | • **Triclosan (1)** |
| • Carbamazepine | • Naproxen |
| • Diazepam | • Gemfibrozil |
| • Sulfamethoxazole | • Fluoxetine |
| • Trimethoprim | • Enalapril |
| • Diclofenac | • Phenytoin |

June 25, 2014 U.S. Environmental Protection Agency 154

## Erythromycin: Background

- Used in pharmaceutical formulations as an antibiotic
- Expected to be moderately mobile to very mobile in water, based on chemical and physical properties
- Projected half-life in water of 180 days (PBT Profiler)
- The PBT Profiler (2009) predicts that 6% of erythromycin will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 155

## Erythromycin: Health Effects

- Health Assessment Status = 3
  - Joint FAO/WHO Expert Committee on Food Additives (JECFA), 2006
- Acceptable Daily Intake (ADI) = 0.0007 mg/kg-day
  - Critical Effect = Inhibition of beneficial gastrointestinal bacteria
- CCL 3 HRL: 4.9 µg/L (non-cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 156

## Erythromycin: Occurrence

- USGS, National Reconnaissance of Emerging Contaminants (NREC), Ambient Surface Water, 1999-2004:
  - 22 detections (median = 0.1 µg/L) out of 104 sites; Maximum detect (1.7 µg/L) < HRL (4.9 µg/L)
- USGS, Focazio, et al., 2008, Ambient Water:
  - Maximum detect value = 0.3 µg/L; Maximum < HRL (4.9 µg/L)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

June 25, 2014 U.S. Environmental Protection Agency 157

## Triclosan: Background

- Antimicrobial agent found in many personal care products such as soaps, toothpaste; also used in many other products including clothing and plastics
- Expected to be not very mobile to immobile in water, based on chemical and physical properties
- Projected half-life in water of 60 days (PBT Profiler)
- The PBT Profiler (2009) predicts that 7% of triclosan will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 158

## Triclosan: Health Effects

- Health Assessment Status = 1
  - 2008 OPP Risk Assessment
- RfD = 0.3 mg/kg-day
  - Critical Effect = Vomiting, diarrhea, loss of appetite
  - NOAEL = 30 mg/kg-day; UF = 100
- HRL: 2,100 µg/L (non-cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 159

## Triclosan: Occurrence

- USGS, National Reconnaissance of Emerging Contaminants (NREC), Ambient Ground Water, 1999-2004:
  - Median = 0.19 µg/L; < HRL (2,100 µg/L)
- USGS, NREC Ambient Surface Water, 1999-2004:
  - Median = 0.17 µg/L; < HRL (2,100 µg/L)
- USGS, Hopple, et al., 2008, Finished Water:
  - Maximum detect value = 0.065 µg/L; Maximum < HRL
- USGS, Kolpin , et al., 2002, Ambient Water:
  - 49 detections (maximum = 2.3 µg/L, median = 0.14 µg/L) out of 85 sites; Maximum detect (2.3 µg/L) < HRL (2,100 µg/L)

June 25, 2014 U.S. Environmental Protection Agency 160

# Carbonyl Compounds

## EPA Method 556.1 (Fast GC), 1999

*Determination of carbonyl compounds in drinking water by fast gas chromatography, revision 1.0*

| Analytes | |
|---|---|
| • **Formaldehyde (2)** | • **Acetaldehyde (4)** |

June 25, 2014 U.S. Environmental Protection Agency 161

# Formaldehyde: Background

- Aliphatic aldehyde; used as a fungicide and tissue preservative
- Drinking water disinfection byproduct (from chlorination, ozonation)
- Present in smoked foods and in living systems as a metabolic intermediate
- Expected to be very mobile in water, based on chemical and physical properties
- The PBT Profiler (2009) predicts that 44% of formaldehyde will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 162

## Formaldehyde: Health Effects

- Health Assessment Status = 2
  - 1990 IRIS Risk Assessment
- RfD = 0.2 mg/kg-day
  - Critical Effect = Reduced weight gain; decreased absolute heart, liver, testes and kidney weights; increased relative brain weights
  - NOAEL = 15 mg/kg-day; UF = 100
- CCL 3 HRL: 1,400 µg/L (non-cancer)
- Sensitive populations: Deficiencies of folic acid and factors causing low activity of aldehyde reductase may increase the toxicity of formaldehyde

June 25, 2014 U.S. Environmental Protection Agency 163

## Formaldehyde: Occurrence

- Disinfection By-product Information Collection Rule DBP-ICR, Finished Water, 1997-1998:
  - 126 detections (median = 7.6 µg/L) out of 227 sites using ozone; Maximum detect (30.6 µg/L) < HRL (1,400 µg/L) (only at plants with ozone)
- Chemical Update System / Inventory Update Reporting:
  - >1B lbs/yr in 2002; ≥1B lbs/yr in 2006
- Toxic Release Inventory – Total:
  - 26,992,234 lbs/yr in 46 states in 2004; 19,381,048 lbs/yr in 45 states in 2010

June 25, 2014 U.S. Environmental Protection Agency 164

## Acetaldehyde: Background

- Aliphatic aldehyde; used as a pesticide and a food additive, also formed as a chemical intermediate in production of other substances
- Drinking water disinfection byproduct (from chlorination, ozonation)
- Expected to be moderately mobile to very mobile in water, based on chemical and physical properties
- The PBT Profiler (2009) predicts that 49% of acetaldehyde will partition to water when modeled in a four-compartment system (water, air, soil and sediment)
- Not persistent in the environment

June 25, 2014 U.S. Environmental Protection Agency 165

## Acetaldehyde: Health Effects

- Health Assessment Status = 4
  - Registry of Toxic Effects of Chemical Substances (RTECS), 2008
- RfD-like = 0.00333 mg/kg-day
  - Critical Effect = Behavioral changes in motor activity (specific assay)
  - LOAEL 10 mg/kg-day; Default UF = 3,000
- CCL 3 HRL: 23.3 µg/L (non-cancer)
- Sensitive populations: Individuals with polymorphism of the aldehyde dehydrogenase (ALDH) gene

June 25, 2014 U.S. Environmental Protection Agency 166

## Acetaldehyde: Occurrence

- Disinfection By-Product Information Collection Rule (DBP-ICR), Finished Water, 1997-1998:
  - 27 detections (median = 7.4 µg/L) out of 236 sites using ozone; Maximum detect (18.3 µg/L) < HRL (23.3 µg/L)
- California Department of Health Services, Finished Water (CAL DHS):
  - 3 detections (median = 2 µg/L) out of 8 sites; Maximum detect (24 µg/L) > HRL
- Chemical Update System / Inventory Update Reporting:
  - >100M – 500M lbs/yr in 2002; 100M – <500M lbs/yr in 2006
- Toxic Release Inventory – Total:
  - 14,683,890 lbs/yr in 38 states in 2004; 9,926,083 lbs/yr in 38 states in 2010

June 25, 2014 U.S. Environmental Protection Agency 167

## Cyanotoxins

### Draft EPA Method 544 (LC/MS/MS)
### Anticipated Publication Year 2014

*Determination of microcystins and nodularin in drinking water by solid phase extraction and liquid chromatography/tandem mass spectrometry*

| Analytes | |
|---|---|
| • **Microcystin-LR (3)** | •Microcystin-LF |
| • Microcystin-RR | •Microcystin-LY |
| • Microcystin-YR | •Nodularin |
| • Microcystin-LA | |

June 25, 2014 U.S. Environmental Protection Agency 168

## Microcystin-LR: Background

- Cyanotoxin (toxin produced and released by cyanobacteria) that targets the liver
- Insufficient data to characterize mobility in water or environmental persistence

June 25, 2014 U.S. Environmental Protection Agency 169

## Microcystin-LR: Health Effects

- Health Assessment Status = 3
  - Single Study (Ueno, Makita, Nagata et al. 1999)
- RfD-like = 0.000003 mg/kg-day
  - Critical Effect = Liver effects
  - NOAEL = 0.003 mg/kg-day; Default UF = 1,000
- CCL 3 HRL: 0.021 µg/L (non-cancer)
- Sensitive populations: None identified

June 25, 2014 U.S. Environmental Protection Agency 170

## Microcystin-LR: Occurrence

- US and Canadian drinking water (bloom area, source, finished water):
  - 542 detections out of 677 sites; Typical maximum (0.1 µg/L) < HRL (0.021 µg/L)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

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## Cyanotoxins

Draft EPA Method 545 (LC/ESI-MS/MS)
Anticipated Publication Year 2014

*Determination of cylindrospermopsin and anatoxin-a in drinking water by liquid chromatography electrospray ionization tandem mass spectrometry*

| Analytes | |
|---|---|
| • **Anatoxin-a (4)** | • **Cylindrospermopsin (3)** |

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## Anatoxin-a: Background

- Cyanotoxin (toxin produced and released by cyanobacteria) that targets the nervous system
- Insufficient data to characterize mobility in water or environmental persistence

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## Anatoxin-a: Health Effects

- Health Assessment Status = 4
  - Single Study (Astrachan and Archer, 1981)
- RfD-like = 0.0005 mg/kg-day
  - Critical Effect = Mortality in rats (7-day)
  - NOAEL = 0.5 mg/kg-day; Default UF = 1,000
- CCL 3 HRL: 3.5 µg/L (non-cancer)
- Sensitive populations: People using anticholinergic agents for therapeutic purposes could be at risk of increased side effects after exposure to anatoxin-a, due to the potential for the additivity of adverse effects

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## Anatoxin-a: Occurrence

- CyanoHABs - The Florida Experience, 2000:
  - Maximum detect (~10 µg/L); Maximum detect > HRL (3.5 µg/L)
- UCMR 1 Meeting summary:
  - 4% detection rate in Lake Champlain
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

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## Cylindrospermopsin: Background

- Cyanotoxin (toxin produced and released by cyanobacteria) that affects the liver and kidney
- Insufficient data to characterize mobility in water or environmental persistence

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## Cylindrospermopsin: Health Effects

- Health Assessment Status = 3
  - Single Study (Humpage and Falconer, 2003)
- RfD-like = 0.00003 mg/kg-day
  - Critical Effect = Increased kidney weight
  - NOAEL = 0.03 mg/kg-day; Default UF = 1,000
- CCL 3 HRL: 0.21 µg/L (non-cancer)
- Sensitive populations: Children; individuals with liver or kidney disease

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## Cylindrospermopsin: Occurrence

- CyanoHABs - The Florida Experience, 2000:
  - Maximum detect (~100 µg/L); Maximum detect > HRL (0.21 µg/L)
- UCMR 1 Meeting summary:
  - Maximum detect (90 µg/L); Maximum detect > HRL (0.21 µg/L)
- Chemical Update System / Inventory Update Reporting:
  - No data in 2002 or 2006
- Toxic Release Inventory – Total:
  - No data in 2004 or 2010

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# *Legionella pneumophila*

## Under Evaluation: Potential methods being investigated

| Analytes |
| --- |
| • ***Legionella pneumophila*** |



# Legionella: Background

- *Legionella* bacteria are aerobic gram-negative rods associated with respiratory infections
- *Legionella* are ubiquitous in fresh and marine waters; exist in varied temperatures, pH levels and nutrient and oxygen contents
- EPA is leading a multi-agency taskforce to develop a document characterizing the effectiveness of available treatment technologies for control of *Legionella* as well as the regulatory implications for consecutive systems that may become PWSs after installing additional treatment. The document is scheduled to be completed by Spring 2015

## Legionella: Health Effects

- Legionellosis
  - Major risk factors: immunosuppression, smoking, travel, use of undisinfected well water, chronic heart or lung disease and chronic renal failure
  - Community or hospital acquired legionellosis can occur
  - Approximately 1,000-2,000 cases are reported to CDC each year
  - Prompt diagnosis and treatment results in 95-99% recovery rates
  - Mortality in untreated cases is approximately 15% of previously healthy patients and 75% of severely immunocompromised patients
- Pontiac Fever
  - Resembles an acute allergic reaction
  - Self-limiting; no specific treatment is advised and hospitalization is not required

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## Legionella: Occurrence

- Can colonize plumbing fixtures, hot water tanks, warm water spas and cooling towers
- May have evolved a symbiotic relationship with free-living amoebae, which may facilitate movement and colonization of domestic and industrial water systems
- Colonization of hot water systems in hospitals has resulted in numerous hospital outbreaks
- Community acquired cases are typically associated with cooling towers or untreated well water exposures
- 52 documented waterborne disease outbreaks affecting 225 people caused by *L. pneumophila* as reported by CDC between 1990 and 2010
  - Outbreaks associated with drinking water exposure mostly due to premise plumbing colonization, which is not under jurisdiction of the water utility

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# Other UCMR 4 Contaminants Under Consideration

## Presenter

**Melissa Simic, USEPA**



# Other UCMR 4 Contaminants Under Consideration

- Nitrate/Nitrite (currently regulated)
  - Nitrate and nitrite levels may increase in the distribution system, especially when chloramines are used as residual disinfectants
  - Currently, monitoring is only required at the entry point to the distribution system and is not required in the distribution system or for all consecutive systems
  - UCMR 4 data could be used to better characterize the exposure of nitrite and nitrate in the distribution system on a national scale

## Other UCMR 4 Contaminants Under Consideration

- 4 unregulated brominated DBPs (bromochloroacetic acid, bromodichloroacetic acid, dibromochloroacetic acid, and tribromoacetic acid)
  - Monitor at Stage 2 DBPR compliance locations
  - Brominated haloacetic acids (HAAs) may pose higher health risks than chlorinated species
  - UCMR 4 data could help inform brominated HAA occurrence and exposure relative to the regulated HAA5 (i.e., monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, dibromoacetic acid)

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# Appendices

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# Appendix A: Unregulated CCL 3 Contaminants 106 Chemicals and 12 Microbes

**Chemicals**
1,1,1,2-Tetrachloroethane
1,1-Dichloroethane
1,2,3-Trichloropropane
1,3-Butadiene
1,3-Dinitrobenzene
1,4-Dioxane
17 alpha-Estradiol
**1-Butanol**
**2-Methoxyethanol**
**2-Propen-1-ol**
3-Hydroxycarbofuran (degradate)
4,4'-Methylenedianiline
**Acephate**
**Acetaldehyde**
Acetamide
Acetochlor
Acetochlor ethanesulfonic acid (ESA)
Acetochlor oxanilic acid (OA)
Acrolein
Alachlor ethanesulfonic acid (ESA)
Alachlor oxanilic acid (OA)
**alpha-Hexachlorocyclohexane**
**Anatoxin-a**
Aniline
Bensulide
Benzyl chloride
**Butylated hydroxyanisole**
Captan
Chlorate (also D-DBP)
Chloromethane (Methyl chloride)
Clethodim
Cobalt
Cumene hydroperoxide
**Cylindrospermopsin**
**Dicrotophos**
**Dimethipin**
Dimethoate
**Disulfoton**
Diuron
Equilenin
Equilin
**Erythromycin**
Estradiol (17-beta)
Estriol
Estrone
Ethinyl Estradiol (17-alpha)
**Ethoprop**
Ethylene glycol
Ethylene oxide
Ethylene thiourea
Fenamiphos
**Formaldehyde**
**Germanium**
Halon 1011 (Bromochloromethane)
HCFC-22
Hexane
Hydrazine
Mestranol
**Methamidophos**
Methyl bromide (Bromomethane)
Methyl tert-butyl ether
Metolachlor
Metolachlor ethanesulfonic acid (ESA)
Metolachlor oxanilic acid (OA)
**Microcystin-LR**
Molinate
Molybdenum
Nitrobenzene
Nitroglycerin
N-Methyl-2-pyrrolidone
N-Nitrosodiethylamine (NDEA)
N-nitrosodimethylamine (NDMA)
N-Nitroso-di-n-propylamine (NDPA)
N-Nitrosodiphenylamine
N-nitrosopyrrolidine (NPYR)
Norethindrone (19-Norethisterone)
n-Propylbenzene
**o-Toluidine**
Oxirane, methyl-
**Oxydemeton-methyl**
**Oxyfluorfen**
Perchlorate
Perfluorooctane sulfonic acid (PFOS)
Perfluorooctanoic acid (PFOA)
**Permethrin (cis, trans)**
**Profenofos**
**Quinoline**
RDX
sec-Butylbenzene
Strontium
**Tebuconazole**
Tebufenozide
Tellurium
Terbufos
Terbufos sulfone
Thiodicarb
Thiophanate-methyl
Toluene diisocyanate
**Tribufos**
Triethylamine
Triphenyltin hydroxide (TPTH)
Urethane
Vanadium
**Vinclozolin**
Ziram

**Microbes**
Adenovirus
Caliciviruses
*Campylobacter jejuni*
Enterovirus
*Escherichia coli (O157)*
*Helicobacter pylori*
Hepatitis A virus
**Legionella pneumophila**
*Mycobacterium avium*
*Naegleria fowleri*
*Salmonella enterica*
*Shigella sonnei*

**UCMR 4 Candidates**

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# Appendix B: CCL 4 Nominations

**Chemicals**
3-chloro-4-dichloromethyl-5-hydroxy-2(5H)-furanone1,1,1,2-Tetrachloroethane
Alkylphenol mono- to tri-oxylates
Amoxicillin
Azinphos-methyl
Bacitracin zinc
Bentazone
Benzyl butyl phthalate
Bisphenol A
Bromoxynil
Carbaryl
Chlorothalonil
Chlorpyrifos
Dibutyl phthalate
Dicamba
Dichlorvos
Dicofol
Dicyclohexyl phthalate
Diethyl phthalate
Di-isononyl phthalate
Dimethyl phthalate
Di-n-octyl phthalate
Endosulfan
Fluometuron
Linezolid
Linuron
Malathion
**Manganese**
Methicillin
Methyl parathion
Nonylphenol
Nonylphenol ethoxylate
Octylphenol
Octylphenol ethoxylate
Oxacillin
Penicillin
Phosmet
Progesterone
Spiramycin
Testosterone
Trichlorfon
Triclocarban
**Triclosan**
Tylosin
Vancomycin
Virginiamycin
Chlorate (also D-DBP)
Chloromethane (Methyl chloride)
Clethodim
Cobalt
Cumene hydroperoxide

**Microbes**
*Toxoplasma gondii*
*Vibrio cholerae*

**UCMR 4 Candidates**

Note: There were a total of 59 unique nominations for CCL 4. Only 48 are presented here because eleven contaminants were removed for either having an existing NPDWR or are already on CCL 3.

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# Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

Public Stakeholder Meeting and Webinar

*Afternoon Break*

Resume at 3:15 p.m.

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# Approval of Laboratories Supporting UCMR 4

Public Meeting and Webinar
Washington D.C.

June 25th, 2014 – 3:15 p.m.

Brenda Parris
USEPA, OGWDW, SRMD
Technical Support Center
Cincinnati, OH

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# Overview

- Expected approach to the UCMR 4 Laboratory Approval Program
- Maintaining approval



# General Expectations

- Laboratory Approval Program expected to be similar to the process used in UCMR 3
- Water systems would need to use EPA UCMR-approved laboratories for analysis
- Labs would need to meet the required equipment, laboratory performance and data reporting criteria to become approved
- Labs would still need to be approved to support UCMR 4 even if already certified by state, primacy entity or accredited through the National Environmental Accreditation Program (NELAP) for a particular method being used for compliance monitoring

# General Procedure

- **Step 1:** Request to participate and register
- **Step 2:** Application
- **Step 3:** EPA review of application
- **Step 4:** Proficiency Testing
- **Step 5:** EPA approval

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# Step 1

- Request to participate and register
  - Submit a written participation request to EPA Laboratory Approval Coordinator
  - EPA provides registration material
  - Submit complete registration material within 90 days of Final Rule publication in Federal Register
  - EPA provides a custom application package based on registration information

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# Step 2

- Application Package
  - Separate application for each method
  - Lab would receive a copy of the Laboratory Approval Manual
  - Completed package would be submitted within 210 days of publication of the Final Rule in the Federal Register

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# Laboratory Approval Manual

- Procedures for obtaining UCMR approval and procedures for revocation of approval
- Quality Assurance requirements
- Quality Control requirements
  - Initial demonstration of capability
  - Initial calibration
  - Continuing calibration checks
  - Surrogate and internal standard criteria
  - Reagent blanks and fortified blanks
  - Quality control samples
  - Spiked field samples
  - Field blank criteria (if required by the method)
- Sample handling requirements

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## Step 2 continued

- Completed application package anticipated to include:
  - Precision, accuracy and minimum reporting level (MRL) studies with documentation
  - Documentation of certification or accreditation of drinking water compliance analyses/selected methods as requested
  - Personnel and quality assurance information
  - Description of analytical equipment and sample handling procedures

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## Step 3

- Review of Application Package
  - EPA would review the package and could request more information
  - Email notifying lab would be sent following EPA's confirmation of successful completion of the application package
  - Once the application has been accepted, the lab could participate in the corresponding PT studies

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# Step 4

- Proficiency Testing
  - EPA would provide PT samples
  - Labs would analyze PT sample(s) for each method
  - Labs would likely have several opportunities to analyze PT samples
  - Only one successful analysis of PT samples per method would be required

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# Step 5

- EPA Approval
  - Once all steps are completed, EPA would grant formal written approval (for each method, as appropriate)

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# Maintaining Approval

- Adhere to quality assurance/quality control (QA/QC) measures in both the methods and the Laboratory Approval Manual
- Post occurrence data and required QC data via the Safe Drinking Water Accession and Review System (SDWARS) within prescribed timeframe
- Participate and pass on-site and/or paper audits
- Respond to requests for data outside of SDWARS

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# Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

## Public Presentations – 3:45 p.m.

**Pre-registered speakers only**

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# Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

## Discussion



## Closing Remarks

- On-site attendees must turn in any door keycards to the sign-in desk.
- Meeting materials were sent to all registered participants; if you did not receive a copy, please email UCMRwebinar@cadmusgroup.com and we will send you a copy.

United States
Environmental Protection
Agency

# Meeting Summary:

## Public Stakeholder Meeting Regarding Revisions to the Unregulated Contaminant Monitoring Rule

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Section 2: Presentation Summaries and Audience Discussion ..... 19

Welcome – Peter Grevatt, OGWDW Director ..... 19

Overview of the Unregulated Contaminant Monitoring Program – Brenda Parris ..... 19

Status of the Third Unregulated Contaminant Monitoring Rule – Greg Carroll ..... 21

UCMR 4 Potential Sampling Design Changes Relative to UCMR 3 – Brenda Parris ..... 22

UCMR 4 Candidate Selection, Rationale and Method Considerations - Melissa Simic and Steve Wendelken ..... 28

Approval of Laboratories Supporting UCMR 4 – Brenda Parris ..... 29



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# Section 1: Introduction and Overview

The United States Environmental Protection Agency (EPA) Office of Ground Water and Drinking Water, Standards and Risk Management Division, Technical Support Center (TSC) hosted a public meeting and webinar on Wednesday, June 25, 2014 to discuss the approach to the fourth Unregulated Contaminant Monitoring Rule (UCMR 4) for public drinking water systems. EPA presented information concerning the status of the agency's efforts in the areas of analyte selection, analytical methods, sampling design, and other possible revisions relative to the current rule.

The public meeting was held at The Cadmus Group, Inc. at 1555 Wilson Blvd. Suite 300, Arlington, VA 22209. The meeting was also broadcast via webinar, which allowed on-line attendees to listen to and view the meeting discussion and presentations.

Morning presentations focused on the progress of chemical method development and afternoon presentations on microbial method development.

There were 371 participants: 33 in-person attendees and an additional 338 participants via webinar. Participants included representatives from federal agencies (12%), laboratories (13%), non-government organizations (4%), PWSs (56%), and others (15%). A full listing of participants can be found in Exhibits 1 and 2. Exhibit 3 presents the meeting agenda. Summaries of the presentations and question and answer discussions are provided in Section 2 of this document.

### Exhibit 1: In-Person Attendees

| First | Last | Organization | Organization Type |
|---|---|---|---|
| Ali | Arvanaghi | EPA | Federal (EPA or Non-EPA) |
| Zeno | Bain | EPA | Federal (EPA or Non-EPA) |
| Scott | Biernat | Association of Metropolitan Water Agencies | Non-governmental organization |
| Susan | Bowman | Cadmus | Other |
| Eric | Burneson | EPA | Federal (EPA or Non-EPA) |
| Greg | Carroll | EPA | Federal (EPA or Non-EPA) |
| Jimmy | Chen | EPA | Federal (EPA or Non-EPA) |
| Becki | Clark | EPA | Federal (EPA or Non-EPA) |
| Tara | Fortier | Cadmus | Other |
| Peter | Grevatt | EPA | Federal (EPA or Non-EPA) |



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| First | Last | Organization | Organization Type |
|---|---|---|---|
| Samantha | Hall | Environmental Working Group | Non-governmental organization |
| Stephanie | Ishii | American Water Works Association | Non-governmental organization |
| Paul | Jackson | Pace Analytical Services, Inc. | Laboratory or laboratory organization |
| Ambrie | Johnson | Chickasaw Nation | Other |
| Frank | Letkiewicz | Cadmus | Other |
| Maria | Lopez-Carbo | EPA | Federal (EPA or Non-EPA) |
| Wynne | Miller | EPA | Federal (EPA or Non-EPA) |
| Brenda | Parris | EPA | Federal (EPA or Non-EPA) |
| Cindy | Roberts | EPA | Federal (EPA or Non-EPA) |
| Linda | Robins | Chickasaw Nation | Other |
| Sam | Rucinski | American Water Works Association | Non-governmental organization |
| Meredith | Russell | EPA | Federal (EPA or Non-EPA) |
| Yury | Shtarkman | EPA | Federal (EPA or Non-EPA) |
| Melissa | Simic | EPA | Federal (EPA or Non-EPA) |
| Maureen | Stone | Cadmus | Other |
| Pamela | Sun | EPA | Federal (EPA or Non-EPA) |
| Jim | Taft | ASDWA | Other |
| Rebecca | Tortorello | EPA | Federal (EPA or Non-EPA) |
| Clifton | Townsend | EPA | Federal (EPA or Non-EPA) |
| Steve | Via | American Water Works Association | Non-governmental organization |
| Patricia | Ware | Bloomberg BNA | Other |
| Steve | Wendelken | EPA | Federal (EPA or Non-EPA) |
| Yi | Yang | AB SCIEX | Other |



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**Exhibit 2: Webinar Attendees [Note to EPA: Should this be moved to an appendix?]**

| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Phillip | Adams | NM Dept. of Health | Laboratory or laboratory organization |
| Gene | Agnew | Chickaloon Native Village | Other |
| John | Ahearn | Colton Water Department | Public water system |
| Mike | Ali | Elsinore Valley MWD | Public water system |
| Jared | Allemand | Lafourche Parish Water District No. 1 | Public water system |
| Ana | Ananda | Public | Public water system |
| Brent | Andrews | City of Richland | Public water system |
| Cynthia | Andrews-Tate | Long Beach Water Department | Public water system |
| Umesh | Asrani | Port St. Lucie Utility Systems Dept. | Public water system |
| Jeffrey | Auer | Town of West Springfield DPW Water Division | Public water system |
| Frank | Ayala | Liberty Utilities Company | Public water system |
| John | Bachman | GLEC | Other |
| Joseph | Baier | Consultant | Non-governmental organization |
| Chris | Bailey | City of Albany | Public water system |
| Rita | Bair | EPA Region 5 | Federal (EPA or Non-EPA) |
| Lonnie | Banks | Richmond Utilities | Public water system |
| Jennifer | Becker | South Island Public Service District | Laboratory or laboratory organization |
| Jason | Bell | Paradise Irrigation District | Public water system |
| Andrea | Bennett | EPA | Federal (EPA or Non-EPA) |
| Bob | Blackman | Rainier View Water Co. | Public water system |
| Jennifer | Blossom | LCRA | Laboratory or laboratory organization |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Steven | Bonaker | Navy | Federal (EPA or Non-EPA) |
| Susan | Bowman | Cadmus | Other |
| Ann | Bradley | Integral Consulting | Other |
| Scott | Brezinski | NJ American Water | Public water system |
| Jamilya | Briggs | DeKalb County Government | Public water system |
| Jo | Brown | City of Tulsa | Laboratory or laboratory organization |
| Glen | Brown | BSK Associates | Laboratory or laboratory organization |
| Doug | Brune | EPA Region 7 | Federal (EPA or Non-EPA) |
| Jeremy | Buckingham | RRWA | Public water system |
| Rick | Buckner | City of Minden Louisiana | Public water system |
| Ron | Burton | City of Azle | Public water system |
| Jian | Cai | Westchester County Labs | Laboratory or laboratory organization |
| Jeff | Caldwell | City of Anderson, SC | Public water system |
| Eric | Campbell | City of Lakeland | Public water system |
| Natalie | Cannon | EPA | Federal (EPA or Non-EPA) |
| Clint | Cannon | Barrow County Water | Public water system |
| Calvin | Canton | Naval Air Station | Public water system |
| Aspa | Capetanakis | NYC DEP | Public water system |
| Thomas | Carpenter | EPA SAB | Federal (EPA or Non-EPA) |
| Alex | Chakmak | Golden State Water Company | Public water system |
| Katherine | Chandler | Cel Analytical Inc. | Laboratory or laboratory organization |
| Cathy | Chang | Water Replenishment District of Southern California | Other |
| Sanwat | Chaudhuri | Utah Department of Health | Laboratory or laboratory organization |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| James | Cherry | Virginia Beach Public Utilties | Public water system |
| Dennis | Cindric | Franklin Water Utility | Public water system |
| Ken | Clark | City of Boulder, Colorado | Public water system |
| Catherine | Cogswell | Loudoun Water | Public water system |
| Corrie | Collins | Dothan Utilities | Other |
| Teresa | Combs | State of Alaska Drinking Water Program | Other |
| John | Consolvo | Philadelphia Water Dept | Public water system |
| Eddie | Cope | Anne Arundel County Water Ops. | Public water system |
| Brooks | Corley | City of Gainesville | Public water system |
| Guy | Crawford | CH2MHILL | Public water system |
| James | Crawford | City of Fort Lauderdale | Public water system |
| Greg | Crocker | Iowa Association of Municipal Utilities | Non-governmental organization |
| Cheri | Cuellar | City of Grand Prairie | Public water system |
| Kevin | Culver | Aqua Illinois | Public water system |
| Lisa | Daniels | PA DEP | Other |
| Yeggie | Dearborn | Cel Analytical Inc. | Laboratory or laboratory organization |
| Mike | Delaney | Massachusetts Water Resources Authority | Laboratory or laboratory organization |
| Jestine | Dewerdt | Mount Pleasant Waterworks | Public water system |
| Patricia | Dipiero | Lee County Utilities | Public water system |
| Larry | Donmoyer | NAVFAC | Federal (EPA or Non-EPA) |
| Joyce | Donohue | EPA | Federal (EPA or Non-EPA) |
| Wendy | Drake | EPA | Federal (EPA or Non-EPA) |
| Kevin | Durk | SCWA | Laboratory or laboratory organization |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Andreas | Eddy | City of Fairfield, Ohio Water Division | Public water system |
| Jessica | Edwards-Brandt | DC Water | Public water system |
| Virginia | Eisenbrey | Artesian Water Company Inc. | Public water system |
| David | Enlow | City of Camden Water Plant | Public water system |
| Gerald | Erb | Bonita Springs Utilities | Other |
| Chris | Eubanks | City of Grapevine | Public water system |
| Marianne | Evangelista | City of Highland Park | Public water system |
| Kim | Evans | NY State Dept. of Health | Other |
| Chuck | Ewen | City of Macomb, Illinois | Public water system |
| Glenn | Farber | EPA | Federal (EPA or Non-EPA) |
| Jeff | Feltz | City of Gahanna, OH | Public water system |
| Tammy | Filliater | Great Falls Water Treatment Plant | Public water system |
| Veronica | Flores | Sandia Pueblo | Public water system |
| William | Frazier | City of High Point | Public water system |
| Marian | Fugitt | Florida DEP | Other |
| Mary | Fuller | SC Dept of Health & Env Control | Other |
| Joshua | Gabel | City of Meridian Water Division | Public water system |
| Mary | Gaither | Trinity River Authority | Laboratory or laboratory organization |
| Kyle | Galpin | West Sound Utility District | Public water system |
| Cynthia | Garcia | City of Peoria Arizona | Public water system |
| Cindy | Garcia | City of Peoria | Laboratory or laboratory organization |
| Mitch | Gertz | Solvay | Other |
| William | Giglio | NJDWSC | Public water system |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Mike | Giles | San Francisco Public Utilities Commission | Laboratory or laboratory organization |
| Cathey | Gillingham | City of Tulsa | Public water system |
| Robert | Giraud | DuPont Company | Other |
| Carla | Glaser | NYC DEP | Public water system |
| Janell | Goatson | Arizona Department of Environmental Quality | Other |
| Lyle | Godfrey | Arkansas Department of Health | Other |
| Ronin | Goodall | Moulton Niguel Water District | Public water system |
| Nikki | Gordon | City of Corpus Christi | Public water system |
| Christopher | Gorski | Antea Group | Non-governmental organization |
| Paul | Gowan | STARLiMS Corporation | Other |
| Sarah | Grant | Sacramento County Water Agency | Public water system |
| Fredianne | Gray | EPA Region 10 | Federal (EPA or Non-EPA) |
| Charles | Gray Iii | Chesterfield County Rural Water | Public water system |
| Andy | Groeper | Suburban Laboratories, Inc | Laboratory or laboratory organization |
| Randy | Hagan | Rancho California Water District | Public water system |
| Michael | Haley | City of Friendswood | Public water system |
| Scott | Hallenberg | Tacoma Water | Public water system |
| David | Hamby | Harris County Water Works | Public water system |
| Rebecca | Hamel | Town of Gilbert | Public water system |
| Justin | Hanks | Southern Nevada Water Authority | Laboratory or laboratory organization |
| Damaris | Hanson | City of Morro Bay | Public water system |
| Reed | Harlan | City of Escondido | Public water system |
| Michelle | Harmstead | BSK Associates | Laboratory or laboratory organization |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Kim | Harris | EPA Region 5 | Federal (EPA or Non-EPA) |
| David | Hatley | Trinity River Authority of Texas | Laboratory or laboratory organization |
| Sarah | Hausman | InoMedic Health Applications, LLC | Public water system |
| Leesa | Head | TN Division of Water Resources | Other |
| Jim | Heckman | City of Maumee | Public water system |
| Douglas | Heinrichs | Monroe Twp | Public water system |
| Michael | Heintz | Assoc of Public Health Laboratories | Non-governmental organization |
| April | Helbert | Washington Co. Service Authority | Public water system |
| John | Hemauer | West Bend Water Utility | Public water system |
| Douglas | Henston | Pristinet | Other |
| Charles | Hertz | Aqua Pennsylvania, Inc. | Public water system |
| Robert | Hilbrandt Jr | Westchester County Dept. of Labs & Research | Laboratory or laboratory organization |
| Klaus | Hoehna | City of Pendleton | Public water system |
| Carl | Hogberg | Texas Dept of Helath Services | Laboratory or laboratory organization |
| Edith | Holmes | City of Dublin | Public water system |
| Michelle | Hoover | EPA Region 3 | Federal (EPA or Non-EPA) |
| Michael | Horgan | Fluid imaging technology | Other |
| Shawn | Horsley | City of Ormond Beach | Public water system |
| Jeff | Houchin | CH2MHILL | Public water system |
| Kevin | Howard | Berea Municipal Utilites | Public water system |
| Mark | Hyde | City of Harker Heights | Public water system |
| Shawn | Igoe | City of Monrovia | Public water system |
| John | Jackson | City of Carrollton | Public water system |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| James | Jacobus | Minnesota Department of Health | Other |
| Theodore | Jamison | City of LaGrange, Water Dept. | Public water system |
| Benjamin | Jefferson | Arkansas Department of Health | Laboratory or laboratory organization |
| Denzel | Jines | Navy | Public water system |
| Todd | Johnson | Minnesota Department of Health | Other |
| Stacy | Jones | Indiana Department of Environmental Management | Other |
| Stacy | Joyce | City of Corona | Public water system |
| Phil | Kagarice | Town of Addison | Public water system |
| Mohammad | Karim | CH2MHILL | Other |
| Fred | Kent | Babcock Laboratories, Inc | Laboratory or laboratory organization |
| William | Kent | Columbus Water Works | Public water system |
| Jason | Kesterson | QEC | Non-governmental organization |
| Djanette | Khiari | Water Research Foundation | Other |
| Carol | King | EPA | Federal (EPA or Non-EPA) |
| Susan | Kinkade | City of Phoenix | Public water system |
| Richard | Kirsch | Missouri DNR | Laboratory or laboratory organization |
| Kenny | Kline | Six Mile Water District | Public water system |
| Anna | Kootstra | Village of Wauconda | Public water system |
| John | Krause | NBU | Public water system |
| Bill | Krebs | Mantua Twp MUA | Public water system |
| Alfred | Kwolek | RI DOH Office of Drinking Water | Other |
| Nicomedes | Lacson | JCSD | Public water system |
| Mike | Lankford | The Gadsden Water Works & Sewer Board | Public water system |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Tina | Lasher | Suffolk County Water Authority | Public water system |
| Kaying | Lee | City of Pomona | Public water system |
| Jason | Leggett | Madison Utilities | Public water system |
| Vanessa | Leiby | WWEMA | Non-governmental organization |
| France | Lemieux | Helath Canada | Other |
| Bruce | Li | Eurofins Eaton Analytical | Laboratory or laboratory organization |
| Suzy | Lindblom | Mobile Area Water and Sewer System | Public water system |
| Brian | Little | City of Carrollton | Public water system |
| Barbara | Loner | Williamsport Municipal Water Authority | Public water system |
| Barbara | Losey | RegNet Environmental Services | Other |
| Derek | Losh | EPA | Federal (EPA or Non-EPA) |
| Gary | Lynch | Park Water Company | Public water system |
| Regina | Lynde | Arizona Water Company | Public water system |
| Charles | Maddox | Austin Water Utility | Public water system |
| Susan | Magness | ALS | Laboratory or laboratory organization |
| Bill | Maier | Board of Water & Light | Public water system |
| Juan | Manzano | City of Delray Beach | Public water system |
| John | Mariani | Mahwah Water Dept | Public water system |
| Timothy | Marshall | Marietta BLW | Public water system |
| Laila | Martin | Seminole County | Public water system |
| John | Martin | Cadmus | Non-governmental organization |
| Brian | Matthews | City of Palm Coast | Public water system |
| John | Matthews | NASA - Kennedy Space Center | Federal (EPA or Non-EPA) |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Eugene | Mcadams | City of Palm Coast | Public water system |
| Patrick | Mccool | Great Lakes Environmental Center | Laboratory or laboratory organization |
| Rupert | Mccormack | public utility | Public water system |
| David | Mckee | Waterford Township | Public water system |
| Taryn | Mcknight | TestAmerica | Laboratory or laboratory organization |
| Orin | Mcmonigle | Lorain Water Plant | Public water system |
| Dorren | Mcnichols | United Water Toms River | Public water system |
| Suril | Mehta | EPA | Federal (EPA or Non-EPA) |
| Ken | Mendenhall | Columbus Water Works | Public water system |
| Kay | Merrill | City of Morro Bay | Public water system |
| Corey | Millard | U.S. Silver and Gold | Public water system |
| Jill | Miller | SCRWA | Other |
| Jeff | Miller | Baton Rouge Water CO | Public water system |
| Nina | Miller | EPCOR Water | Public water system |
| Tami | Minigh | City of Daytona Beach | Laboratory or laboratory organization |
| Michelle | Moore | GLEC | Other |
| Amy | Mora | Eastern Municipal Water District | Public water system |
| Jennifer | Morales | Arkansas Department of Health-Public Health | Laboratory or laboratory organization |
| Alie | Muneer | EPA | Federal (EPA or Non-EPA) |
| Sue | Murphy | Solano Irrigaion District | Public water system |
| Joanne | Nardone | PA DEP | Other |
| Adrianna | Negreros | Golden State Water Company | Public water system |
| Cindy | Nettrour | American Water Central Laboratory | Laboratory or laboratory organization |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Lindsay | Neun | City of Santa Cruz | Public water system |
| Tuan | Ngo | City of North Richland Hills | Public water system |
| Caroline | Nguyen | WSSC | Public water system |
| Linda | Nietsche | Aqua Water Supply Corporation | Public water system |
| Pauline | Norris | Western Kentucky University | Laboratory or laboratory organization |
| Kurt | Novy | City of Flagstaff | Public water system |
| Julia | Nussbaum | Stanford University | Other |
| Alma | Ortega | Otay Water District | Laboratory or laboratory organization |
| Scott | Osborn | Oconomowoc Utilities | Public water system |
| Darrell | Osterhoudt | ASDWA | Non-governmental organization |
| Monica | Ottens | Louisville Water | Public water system |
| Marie | Owens | Jordan Valley WCD | Public water system |
| Amanda | Palleschi | Inside EPA | Other |
| Anthony | Palombi | Atlantic City MUA | Public water system |
| John | Paniccia | Broward County Water & Wastewater Services | Public water system |
| Sachin | Patel | CT DPH Drinking Water Section | Other |
| Andrew | Patterson | Vista Analytical Laboratory | Laboratory or laboratory organization |
| Kenneth | Pelletier | MassDEP - DWP | Other |
| Kiersy | Pena-Bratucu | City of North Miami Beach | Laboratory or laboratory organization |
| Ismael | Perez | City of Inglewood | Public water system |
| Russ | Perkinson | EPA | Federal (EPA or Non-EPA) |
| Christopher | Perry | City of Hurst | Public water system |
| Leon | Peterson | Salt Lake Ciy Corp. | Public water system |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Rosie | Pindilli | MWC | Public water system |
| Paul | Ponturo | H2M architects+engineers | Other |
| Jeff | Pope | Cedar River Water & Sewer | Public water system |
| David | Posey | Fayetteville Public Utilities | Public water system |
| David | Pranitis | Passaic Valley Water Commission | Public water system |
| Cindy | Proffitt | City of Amarillo | Public water system |
| Oscar | Quinones | SNWA | Public water system |
| Paul | Race | Municipal water system | Public water system |
| Richard | Radcliff | Beam, Longest & Neff | Other |
| Scott | Rampenthal | Orange County Utilities | Public water system |
| Karen | Randazzo | SCWA | Public water system |
| Don | Rankin | City of Topeka Utilities Division | Public water system |
| Bob | Reed | City of Clermont | Public water system |
| Denise | Reichard | NAVFAC | Federal (EPA or Non-EPA) |
| Allison | Reinert | Hazen and Sawyer | Non-governmental organization |
| Paul | Reinsch | City of Saginaw Water Treatment Division | Public water system |
| Lois | Rellergert | City of Fort Collins | Public water system |
| Andrew | Resek | City of Crystal Lake | Public water system |
| Jeni | Richardson | City of Albany | Public water system |
| David | Rindal | Minnesota Department of Health | Other |
| Paul | Rochelle | MWDSC | Public water system |
| Daniel | Romero | State of Colorado | Other |
| Rhonda | Rosenbaum | Ray Water Company | Public water system |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Clark | Ross | Salt River Pima Maricopa Indian Community | Public water system |
| Larry | Roy | Village of Grafton Water Utility | Public water system |
| Ed | Rufener | Public Works | Public water system |
| Steve | Saffels | City of Plant City | Public water system |
| Richard | Sakaji | EBMUD | Public water system |
| Nancy | Sampson | City of Aurora | Public water system |
| Shar | Samy | ALS - Environmental | Laboratory or laboratory organization |
| Lily | Sanchez | Orange County Water District | Laboratory or laboratory organization |
| Lori | Sarti | City of Antioch | Public water system |
| Joe | Schrader | City of Kalispell | Public water system |
| Mike | Sedon | Cranberry Township | Public water system |
| Stephanie | Sessoms-Midgett | EPA Region 2 | Federal (EPA or Non-EPA) |
| Chip | Shaddix | Fitzgerald Utilities | Public water system |
| Jamie | Shakar | City of Tallahassee | Laboratory or laboratory organization |
| Chet | Shastri | City of Fort Wayne | Public water system |
| Jin | Shin | WSSC | Public water system |
| Yury | Shtarkman | EPA | Federal (EPA or Non-EPA) |
| Pamela | Shubat | Minnesota Department of Health | Public water system |
| Charles | Shurtleff | MassDEP | Other |
| Robin | Silva-Wilkinson | GLEC | Other |
| Doug | Sims | Auburn Water System | Public water system |
| James | Sinclair | Federal | Federal (EPA or Non-EPA) |
| Theresa | Slifko | MWD | Public water system |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| James | Smallwood | San Jacinto River Authority | Public water system |
| Gary | Smith | Trinity River Authority of Texas | Public water system |
| Gerald | Smith | Minnesota Department of Health | Other |
| Jason | Smith | City of Sidney | Public water system |
| Greg | Smith | GLEC | Non-governmental organization |
| Paul | Snegirev | Newberg | Public water system |
| Brenda | Snyder | CIty of Toledo | Public water system |
| Craig | Sollberger | Bayou Liberty Water Assn. | Public water system |
| Janet | Spencer | Stafford County, Virginia | Public water system |
| Kendra | Stanciel | Local Government | Laboratory or laboratory organization |
| Lori | Stenzel | Illinois American Water Company | Public water system |
| Maureen | Stone | Cadmus | Other |
| Joshua | Strauss | Town of Tonawanda Water Treatment Plant | Public water system |
| Katie | Strothman | Sanders | Laboratory or laboratory organization |
| Alysa | Suero | EPA Region 3 | Federal (EPA or Non-EPA) |
| Jonmark | Sullivan | MCB Quantico | Federal (EPA or Non-EPA) |
| John | Tallent | City of Richland | Public water system |
| Jason | Taylor | Public Works | Public water system |
| Craig | Thompson | West Yost Associates | Other |
| Lynn | Thorp | Clean Water Action | Non-governmental organization |
| Marcie | Tidd | EPA Region 8 | Federal (EPA or Non-EPA) |
| Doug | Tompkins | Berkeley County Water and Sanitation | Public water system |
| Rebecca | Trenholm | Southern Nevada Water Authority | Public water system |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Matt | Trotter | Cedar Falls Utilities | Public water system |
| Elizabeth | Turner | NTMWD | Public water system |
| John | Turner | City of Fort Morgan | Public water system |
| Mignonne | Twine | City of Norfolk | Public water system |
| Mary | Tyer | Global Water Resources | Public water system |
| Bret | Van Ausdall | Utah Public Health Lab | Laboratory or laboratory organization |
| Catherine | Vogel | Noblis | Other |
| Mary Carol | Wagner | Northern Kentucky Water District | Public water system |
| Alexandra | Wahlstrom | Concord Water & Sewer Division | Public water system |
| Brandi | Wallace | Fort Wayne City Utilities | Public water system |
| Xiaoyan | Wang | UCT | Other |
| Paul | Ward | village of palm springs | Public water system |
| Patricia | Ware | Bloomberg BNA | Other |
| Susan | Watson | Lake Kilby WTP - City of Portsmouth | Public water system |
| Anna | Weber | Cadmus | Other |
| Ying | Wei | City of Houston | Public water system |
| Douglas | Weir | TestAmerica | Laboratory or laboratory organization |
| William | Weirich | Wyandotte Wayer | Public water system |
| Geri | Wellborn | City of Norman, OK | Public water system |
| Teresa | Wells | EPA | Federal (EPA or Non-EPA) |
| Linda | Welsh | City of Lake Charles Water System | Public water system |
| Jason | Wen | City of Downey | Public water system |
| David | White | Dalton Utilities | Laboratory or laboratory organization |



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| First Name | Last Name | Organization | Organization Type |
|---|---|---|---|
| Anthony | Whitehead | Greenville Utilities Commission | Public water system |
| Debbie | Willard | Liberty Utilities | Public water system |
| Joey | Williams | Palmetto State Utility Services, Inc. | Public water system |
| Sidney | Williams | Silverdale Water District | Public water system |
| Amanda | Williams | Palmdale Water District | Public water system |
| Tim | Wilson | Marshalltown Water Works | Public water system |
| John | Wilson | Metropolitan Washington Airports Authority | Public water system |
| Donna | Wingle | Lehigh County Authority | Public water system |
| Christy | Wixom | Public Works | Public water system |
| Brian | Wright | Truckee Donner Public Utility District | Public water system |
| Kourtney | Wunschel | Attleboro Water Dept | Public water system |
| Mark | Yeager | City of Albany, Oregon | Public water system |
| Heidi | Yelin | Commonwealth Utilities Corporation | Public water system |
| Pony | Yim | Zone 7 Water Agency | Public water system |
| Lee | Yoo | Orange County Water District | Laboratory or laboratory organization |
| Chris | Young | EPA Contractor | Laboratory or laboratory organization |
| Myra | Zabec-Thompson | Charlotte Mecklenburg Utility Dept. | Laboratory or laboratory organization |
| Cindy | Ziernicki | Helix Water District | Public water system |



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Exhibit 3: Meeting Agenda

**STAKEHOLDER MEETING REGARDING REVISIONS TO THE UNREGULATED CONTAMINANT MONITORING RULE**

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June 25, 2014

Arlington Virginia

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| | |
|---|---|
| **8:30-9:00** | Stakeholder Sign-in |
| **9:00-9:20** | Welcome – Introduction and Agenda |
| **9:20-9:50** | Overview of the UCMR Program |
| **9:50-10:30** | UCMR 3 Status |
| **10:30-10:45** | **BREAK** |
| **10:45-11:30** | UCMR 4 Potential Sampling Design Changes Relative to UCMR 3 |
| **11:30-11:45** | Discussion |
| **11:45-1:15** | **LUNCH** |
| **1:15-3:00** | UCMR 4 Candidate Selections and Rationale |
| **3:00-3:15** | **BREAK** |
| **3:15-3:45** | Approval of Laboratories Supporting UCMR 4 |
| **3:45-5:00** | Discussion |



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# Section 2: Presentation Summaries and Audience Discussion

## Welcome – Peter Grevatt, OGWDW Director

Peter Grevatt thanked attendees for joining and for their interest, noting that the Unregulated Contaminant Monitoring Rule (UCMR) is a work in progress. The early timing of this stakeholder meeting was purposeful: EPA wants to consider public input early in the process, to incorporate your thoughts on current plans, and to share ideas freely. UCMR provides us with national exposure data on unregulated contaminants; we want to know what is going on in the nation's water. UCMR supports the regulatory determination process and development of drinking water standards for health risk reduction. It reassures the public on emerging issues, and looks for contaminants that are most important and most relevant.

Under UCMR 3, we are looking for lower contaminant levels than we have in the past. We have been asked if we are chasing every molecule. No, EPA thinks it is important to look at low levels when it is cost effective, so that the data collected are relevant to future decisions. Although the Safe Drinking Water Act (SDWA) mandates the UCMR program, EPA has discretion over implementation and we want the benefit of best information and technology for designing UCMR 4. The Contaminant Candidate List (CCL) is consulted first. But while CCL is a key driver, it is not the only driver. EPA can consider other priorities. The UCMR process will lead to some negative regulatory determinations, and while it is the case that positive determinations are of the most interest, the negatives are also important to reassure the public that a particular contaminant is not a problem. We cannot predict the regulatory outcome for any contaminant, but we want to do the work now so the decision can be based on the best science available. With each UCMR cycle we aim to improve. Many of the changes implemented for UCMR 3 are the result of stakeholder input.

## Overview of the Unregulated Contaminant Monitoring Program – Brenda Parris

Brenda Parris presented information and background for the UCMR program, including: regulatory background; SDWA authority; the programmatic relationship with the CCL; as well as a summary of UCMR approach, cycles, and implementation. The information presented can be viewed on slides 8 through 24 of the meeting presentation.

**ADDITIONAL DISCUSSION DETAILS:**

A detailed graph of the regulatory process flow was presented (see slide 13). It illustrates how the UCMR program fits into the regulatory development process.

CCL is the primary mechanism for the identification of contaminants that may require regulation, while UCMR provides EPA with the data necessary to determine if a contaminant occurs at frequencies and levels of public health concern. Both CCL and UCMR are components of the risk management process, and they support and inform each other. The data generated from UCMR is then used in the preliminary regulatory determination process, when the agency can either decide that no further action is needed or to develop a National Primary Drinking Water Regulation.

Specifically, every five years EPA defines a new list (CCL) of unregulated contaminants that may require a national primary drinking water regulation in the future. The CCL addresses data needs for each contaminant based on occurrence data gaps, analytical methods development, potential health effects, and the evaluation of treatment techniques. The objectives are fairly simple: the UCMR program is to develop a list of



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contaminants every five years, largely based on the CCL, then collect occurrence data on the suspected drinking water contaminants that do not have health-based standards set under the SDWA.

UCMR is a primary source of occurrence and exposure information that the agency uses to support future regulatory decisions for contaminants of concern. To help prioritize we use three monitoring lists.

The Technical Support Center (TSC), based in Cincinnati, has been given the task of implementing UCMR. TSC is responsible for reviewing and tracking public water system (PWS) applicability and monitoring progress; coordinating laboratory approval program; providing technical support for regions, states, PWSs, and laboratories; and coordinating outreach using the internet, notices, and reminders. TSC is responsible for SDWARS in the Central data exchange. DWPD is responsible for SDWARS in CDX. Regions coordinate state partnerships and, depending on the specific agreement, can support many aspects of implementation.

**QUESTIONS AND ANSWERS:**

Following the presentation on UCMR program background, EPA addressed questions from both in-person and online attendees.

**Question:** What is the justification for looking at such low levels?

**EPA Response:** Health effects data can change, EPA wants to avoid monitoring for a contaminant under a round of UCMR at a level that might not be low enough for new health effects data that comes in later indicting the health effects are a concern. We don't want to waste time and money. The HRLs for some UCMR contaminants are in the sub ppb levels. For example, some VOCs and some of the hormones. In many cases the health effects data are still evolving so by measuring at lower levels we can support future RegDet.

**Question:** Will UCMR 4 sample sewage effluent?

**EPA Response:** UCMR does not cover sewage effluent, only drinking water.

**Question:** Please clarify how CCL feeds into UCMR.

**EPA Response:** UCMR first looks at CCL to get an idea of which contaminants to consider. UCMR also looks at emerging contaminants for possible changes since the last CCL. The arrows go back and forth. CCL feeds UCMR, and UCMR informs CCL.

**Question:** How many contaminants have been regulated as a result of UCMR data?

**EPA Response:** Currently no new regulations are a result of UCMR, but negative determinations have been made based on UCMR 1 and 2. Perchlorate is the only positive determination based on UCMR, and is currently in development.

**Question:** Has there been any consideration by EPA to address the statutory limits that confine the UCMR program, such as limiting to 30 contaminants?

**EPA Response:** U.S. Government Accountability Office (GAO) is preparing for congressional consideration of the statute. There are pros and cons to the limit of 30.

**Question:** What does EPA estimate the total cost for large water systems for the UCMR 4 cycle testing?



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**EPA Response:** It's early in process and costs have not been estimated, although they are not anticipated to be any higher than in other UCMR cycles. The estimated costs and the details behind costs will be available for the public to read and comment on. EPA has a vested interest in keeping costs low because it pays for small systems. The average cost over the 5-year-span is $14.7 million, UCMR 3 about $12 million. EPA does not anticipate UCMR 4 will be higher. Costs are heavily impacted by laboratory costs and the analytes chosen. EPA tries to look for methods that cover more than one analyte for cost effectiveness.

**Question:** Please clarify when you say "it's not a concern in drinking water" if something has a negative RegDet – that this means it's not a concern nationally (based on occurrence data), but it still could be a concern in some local areas.

**EPA Response:** Yes, UCMR is a national program, local areas may have a concern that could be addressed by states and regions, or a Health Advisory can be developed for those areas.

**Question:** What is the penalty for non-compliance?

**EPA Response:** The states and EPA regions enforce compliance, although historically this has not been an issue; UCMR has very high compliance rates. UCMR 2 was 99%; UCMR 3 is about 98%. We credit the systems, states and regions for these great compliance numbers. We have tried to make things easier, and the requirements have become more familiar with each cycle. Systems do use the built-in flexibility for changing their monitoring schedules when needed.

## Status of the Third Unregulated Contaminant Monitoring Rule – Greg Carroll

Greg Carroll presented information on the status of the current UCMR cycle, including: monitoring, reporting, occurrence data, and preparation for UCMR 4. The information presented can be viewed on slides 25 through 47 of the meeting presentations.

### ADDITIONAL DISCUSSION DETAILS:

The table on slide 27 of the presentation summarizes the timeline of UCMR activities. This timeline is specific to UCMR 3, but representative of any typical 5-year cycle. During the first year (2012) there is a lot of preliminary planning and work done by TSC and other partners. This includes: the laboratory approval process; state notifications to water systems that are subject to monitoring; registration by systems on web-based reporting system (SDWARS); and other activities such as contracting with labs for analysis. Years 2, 3, and 4 (2013-2015) are the core sampling and reporting period. And, during year 5 (2016), post monitoring work is conducted, including: resampling if needed; and final data reporting. It will be late 2016 before a final summary of UCMR 3 will be available. There is a good degree of overlap in timing between carrying out UCMR 3 and preparing for UCMR 4.

The design for UCMR 3 is very similar to UCMR 2. As presented in slide 29, EPA estimates that approximately 4,200 water systems serving more than 10,000 people are monitoring for List 1 Contaminants. Eight hundred smaller systems serving fewer than 10,000 people also monitor. EPA also estimates that approximately 410 water systems serving more than 100,000 people and approximately 320 water systems serving 10,000 or fewer people will monitor for List 2 contaminants. Lastly, 800 randomly selected water systems serving 1,000 or fewer people will monitor for List 3 contaminants. PWSs must monitor during a consecutive 12-month period between 2013 and 2015, and the number of times a PWS must sample is directly related to the sample point source



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Some additional UCMR 3 details worth noting:

- Zip codes are being collected to allow for environmental justice analyses; to look for localization of contaminants in potential EJ areas.
- To date, there have been three norovirus detections. Indicators were detected much more frequently than the viruses themselves. Although it is tempting to say there is not a good correlation, there are not enough data to know that yet.

EPA hopes to propose UCMR 4 in mid-2015, publish in late 2016, begin implementation in 2017, and begin monitoring on January 2018. The final UCMR 3 was published May 2012 and monitoring began in January 2013. EPA knew it was tight, and it proved to be challenging. As a result, TSC is highly motivated to get the UCMR 4 rule finalized at least a year before the start of monitoring, to allow more time to prepare for sample collection.

**QUESTIONS AND ANSWERS:**

Following the presentation on the status of UCMR 3, EPA addressed questions from both in-person and online attendees.

**Question:** Are all large PWS required to monitor under UCMR 3 and 4?

**EPA Response:** For UCMR 3 all large PWSs are monitoring for Assessment Monitoring contaminants, with a subset for Screening Survey contaminants. All very large systems are monitoring for both lists.

**Question:** Have VOCs been monitored in wastewater or air?

**EPA Response:** UCMR monitors for drinking water only. Perhaps other groups within EPA are looking for VOCs in wastewater or air.

**Question:** How would a system know whether to reject data, and what are the next steps?

**EPA Response:** Perhaps the systems identified an issue with quality control, or the sample was not taken from the correct location. We do not expect systems to reject data based on a judgment call. Then the system would notify the lab and work out a schedule to resample.

**Question:** We are a wholesaler with no residential connections. Although we supply water to five communities which supply a total of about 200,000, we were not invited to participate in UCMR 3. Will we be invited to participate in UCMR 4? All of our customer cities were part of UCMR 3.

**EPA Response:** This remains to be seen. We get PWS data from SDWIS Fed (regarding applicability), and the states and regions are responsible for updating information in that system. EPA works with states and region to identify applicable water systems. If you are a system that thinks you are applicable to the UCMR program, you can email the UCMR coordinator (UCMR_sampling_coordinator@epa.gov), who will work with you, and your state/region to determine your applicability. It is possible some notifications fell through the cracks, so please follow up if you think you should be participating.

## UCMR 4 Potential Sampling Design Changes Relative to UCMR 3 – Brenda Parris



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Brenda Parris presented information on sampling design including: approach to tiered monitoring, potential changes between UCMR 3 and UCMR 4, and implementation. The information presented can be viewed on slides 49 through 67 of the meeting presentations.

**ADDITIONAL DISCUSSION DETAILS:**

EPA believes that the combination of the nationally representative sample of small systems and a census of large systems will provide a powerful tool for assessing contaminant occurrence in PWSs. Slide 57 of the presentation outlines the small system size categories for List 1: 95 systems serving 500 or fewer; 306 systems serving between 501 and 3,300; and 399 systems serving between 3,301 and 10,000; for a total of 800 systems.

In general, the tradeoff between conducting a census and a survey of large PWSs is a balance of precision and cost: larger sample sizes lower uncertainty, but increase cost; smaller sample sizes reduce cost, but increase uncertainty. Temporal and spatial variability in terms of the frequency and magnitude of occurrence introduce uncertainty into the sample design. Even with a very well designed statistical sample, sampling error and uncertainty will exist, especially if EPA wants to analyze occurrence within subsets of the strata (e.g., surface water vs. ground water; geographic location). If anything other than a census is used for rule development, EPA would likely need to apply statistical models to the data to account for the uncertainties within individual size strata. A census of large systems will help reduce uncertainty as much as possible; and will minimize the possibility of missing contaminant occurrence at the largest systems (e.g., MWD-SC; MWRA) serving the largest share of the population. UCMR 2 modified the Screening Survey approach to increase sample size and increase confidence in the sample to ensure the data can be used to support regulatory determinations and rule development, if warranted. If a highly toxic contaminant is found to occur with some significance during a Screening Survey, EPA would not necessarily have to conduct Assessment Monitoring because the Screening Survey sample size may provide sufficient data. EPA could potentially regulate sooner (if warranted) and protect public health sooner. This approach accounts for possible laboratory capacity issues related to use of uncommon methods or recently developed or technically complex methods.

Small systems sample under only one UCMR component. However, borrowing from the Assessment Monitoring design, since UCMR 2, Screening Survey now includes further confidence in the sampling results by including a census of the largest of systems. Sample of approximately 800 systems, allocated across systems serving 100,000 or fewer, and re divided uniformly among the same 10 strata, as those in past Screening Surveys, though the largest systems in the sample would be capped at those which serve 50,001 to 100,000. This includes a census of "very large" systems (serving 100,001 and over, ~400 systems). This census of very large systems will help minimize overall uncertainty, and is designed to be used in both regulatory determination and rule development. (Statistical models would still likely be used for rule development purposes to account for uncertainties within individual size strata of the sample.) Using a census of only the "very large" systems minimizes the possibility of missing contaminant occurrence at the largest systems (e.g., MWD-SC; MWRA), while keeping the number of "mid-sized" systems required to conduct Screening Surveys as low as possible. Small systems selected for Assessment Monitoring will not be the same as those selected for Screening Survey.

Pre-screen Testing is envisioned for use with methods that are in the early stages of development, and/or methods that are very specialized or limited in applicability (such as those for viruses or DNA/microchips). It was envisioned in the UCMR 1 cycle to be conducted by up to 200 PWSs that would be identified by state agencies as vulnerable to the List 3 contaminants; a targeted sampling to assess occurrence in the most vulnerable settings, and could help to guide the next steps for contaminant evaluation and methods



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development. Neither UCMR 1 nor UCMR 2 conducted Pre-screen Testing. UCMR 3 has included List 3, Pre-screen Testing for a limited number of PWSs, identified as vulnerable by EPA or states. At this time, EPA does not anticipate using this list for UCMR 4.

**QUESTIONS AND ANSWERS:**

Following the presentation on potential sampling design changes for UCMR 4, EPA addressed questions from both in-person and online attendees.

**Question:** On slides 57 and 59 is there a gap for those systems serving between 10,000 and 100,000?

**EPA Response:** Any system serving greater than 10,000 would participate in Assessment Monitoring. A subset of 800 small systems would also participate in Assessment Monitoring. For Screening Survey every very large system serving greater than 100,000; a sample of 320 systems serving between 10,000 and 100,000; and 480 small systems would participate. Pre-screen Testing is cycle specific and it's tough to predict what it might look like.

**Question:** Consecutive systems applicability was changed from UCMR 2 to UCMR 3, they were included in UCMR 3. Will this still be the case?

**EPA Response:** Any change is possible, but no reason has been given or identified to change this approach for UCMR 4.

**Question:** What are the reporting requirements for UCMR 3?

**EPA Response:** All requirements are specified in the rule. In short, PWSs conduct monitoring and reporting based on type and size, and whether subject to Assessment Monitoring only or Assessment Monitoring and Screening Survey, or Pre-screen Testing. For large systems, the samples would need to be analyzed by an approved lab and the lab will report the data to SDWARS. Small systems are taken care of by EPA.

**Question:** We suggest that water systems randomly chosen to test for prior cycles be excluded from the requirement for UCMR 4 testing so the costs are spread more evenly and the burden is not on the same systems.

**EPA Response:** For large water systems that serve more than 10,000, they do monitor for List 1 contaminants. Small systems are randomly assigned. They have to collect the sample but EPA pays for sending of kit to lab, and analysis by lab. The 320 large systems are also randomly selected for List 2 monitoring. Should those randomly selected for UCMR 3 be taken out of consideration for UCMR 4? This is not something that has been discussed, but it can be considered.

**Question:** Where exactly on the UCMR3 website pages may we find the Reference Concentrations for List 1 and 2 contaminants? All we can find is the MRLs.

**EPA Response:** This should be easy to find by typing in UCMR 3 occurrence data in a search engine. UCMR 3 occurrence datapage is usually the first result. There are 3 links under UCMR 3. First is PDF with reference concentrations and MRLs. Other two links are zip files with actual data (thousands to millions of rows). http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/data.cfm#ucmr2013.

**Question:** Where can fact sheets on reference concentrations be found?



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**EPA Response:** The same link on the UCMR website as just noted will get you to the fact sheets.

**Question:** Would it be accurate to say that no problems are being noticed in UMCR 3?

**EPA Response:** From implementation point of view, yes. EPA does not anticipate many problems with collecting samples, water system compliance, or with the methods. Labs are able to analyze samples correctly and submit to EPA.

**Question:** Which entities are defined as stakeholders?

**EPA Response:** Anyone interested in the program including labs, instrumentation companies, states, regions, systems, general consumers and students.

**Question:** What QC data does EPA collect from small systems, but not from large systems?

**EPA Response:** One of the changes being considered is collecting similar degrees of QC information from all sizes of systems. Ultimately the laboratories do not generate additional QC data, they merely submit the QA data that is generated during the normal analytical process to EPA (e.g., spike data, surrogate data, spike data, lab reagent blanks, lab fortified spikes). This data is useful for evaluating methods moving forward. Having that data for small systems will be potentially helpful in determining if method is robust enough for national use.

**Question:** Have you considered lab capacity factors if you compress monitoring to 2 years, or apply vulnerability period monitoring?

**EPA Response:** We are not necessarily leaning towards compressing time period. It is something we're evaluating, and lab capacity will be considered. The feasibility of a compressed schedule will be based on methods and contaminants selected.

**Question:** Please explain why MRLs are so low.

**EPA Response:** One change between UCMR 2 and 3 was that the MRL is now based on an LCMRL study, so we evaluated each method to determine how low the labs could detect. Health effects data change over time and if we select a higher level than is achievable we might not have best occurrence data set and avoid needing to repeat monitoring.

**Question:** We suggest those large systems selected for UCMR 3 not be selected for UCMR 4 to reduce costs.

**EPA Response:** It would be difficult to find a mechanism to distribute costs. Implementing this would be very difficult, but EPA is eager to hear any creative ideas.

**Question:** Does a small water system have to report any results from UCMR 3 on our CCR?

**EPA Response:** Yes, CCR requirements apply to small systems.

**Question:** Is it possible for the labs to report the UCMR 4 data directly to EPA without reporting it to the water systems? This way the PWS is 'blind' to the results and does not need to alarm its customers unnecessarily each year with detected contaminants, and EPA still gets its occurrence data.



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**EPA Response:** I think you mean that if labs report results directly and only to EPA there would be no CCR obligation. Some water systems would want opportunity to review their results. Those that have found reason to withdraw data and resampling may not like the idea of being bypassed in reporting. When results are made available on website they are associated with particular water systems. It is a complicated question, and we will have to give it some additional thought.

**Question:** If the CWS is going to collect for Assessment Monitoring will it be sufficient to collect from only one entry point if the CWS has more than one?

**EPA Response:** There is a provision in UCMR 3 for groundwater systems with multiple wells. These systems can identify and propose representative sampling at a subset of their wells and either EPA or the state would review the proposal and decide if representative wells are acceptable. This approach will likely be included in UCMR 4. But we would consider other approaches if we receive comments that suggest this representative well approach is not working. The rule specifies that systems must sample at each entry point. The groundwater representative monitoring plan is very specific to groundwater systems.

**Question:** Have the UCMR 4 MRLs been proposed?

**EPA Response:** No. EPA is still determining which analytes make the most sense to include, reviewing analytical methods are most appropriate for those analytes, and reviewing labs for their capability. It costs money to run an LCMRL study, so we want to run a targeted one to avoid studying MRLs that will not be included in UCMR 4.

**Question:** If there are no problems found in previous UCMR events, is the cost justified in this program?

**EPA Response:** Regulatory determinations, with one exception, using UCMR information have been negative determinations. There is value in collecting data that leads to a negative determination. Negative determinations allow everyone to focus efforts on the remaining contaminants. For some of the monitoring underway, it remains to be seen whether it will support a negative or positive determination. As the law currently stands EPA is obligated to carry out this program. Where EPA has discretion is how, where, when, and what to monitor; this is what EPA tries to make as effective as possible.

**Question:** Can EPA provide guidance on levels that should be of concern when detected for all UCMR contaminants? There was a lack of guidance and the burden was left on the utilities and state agencies for UCMR 3.

**EPA Response:** The factsheet that accompanies summary of results on web contains health reference concentrations (peer-reviewed) that enable evaluation of health effects. By virtue of these being unregulated contaminants, it is difficult to provide very specific guidance as to what action should be taken.

**Question:** For UCMR 4, has there been any consideration of reducing CCR reporting requirements to only include levels that indicate public health effects rather than any detects (e.g., when the contaminant is detected at the laboratory's lowest detect level)?

**EPA Response:** If that is a concern, EPA will consider it for UCMR 4.



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**Question:** Is there a date for which the population of the system will be determined? For example my system was >10,000 population in 2010 and were required to participate in UCMR 3 List 1. We now have a population <10,000.

**EPA Response:** An applicability date was established for UCMR 3 and will be established for UCMR 4. In the case where a population is 10,005 at applicability date but falls below 10,000 by time of monitoring, EPA does require that monitoring occurs according to population on applicability date, unless the water system closes or there is a change in status (such as from ground to surface).

**Question:** States have been identifying problems with lag time.

**EPA Response:** Labs have 120 days to submit to SDWARS and then the PWS has 60 days to approve results, so there is a 180 day timeframe between collection and submittal. For UCMR 3 there were discussions on reducing the timeframe, but public opinion supported not changing it, so the original 180 day timeframe was maintained.

**Question:** Do contaminants with a negative determination ever get returned to CCL or get considered for future UCMR pending changes in water quality?

**EPA Response:** For UCMR, if a negative determination has been made it will generally be a lower priority for subsequent UCMR monitoring. There would have to be an additional reason to consider it. For the analytes for which a negative determination has been made, EPA reviews health information and trends in use to see if there is new information that would lead it to be re-listed or considered. This is true for all contaminants on previous UCMR cycles. For CCL yes, we look back for new health effects or occurrence data and consider relisting.

**Question:** When does a system have to report UCMR results on the CCR?

**EPA Response:** The CCR for a given year should reflect results for previous calendar year (e.g., the 2014 CCR reflects results from 2013).

**Question:** Given the correlations between indicators and some pathogens, why are more microbial contaminants not selected for the UCMR 4?

**EPA Response:** The jury is still out on the final list of UCMR 4 contaminants. We will talk about the process used to consider chemical and microbial contaminants from CCL during afternoon session. Correlations between indicators and pathogens require careful consideration.

**Question:** Why are results from laboratory analysis of the required Field Blank analysis not required to be entered into the CDX? Isn't this information important in EPA's evaluation of the reliability of the UCMR 3 analytical methodologies?

**EPA Response:** Laboratories do have to run the lab field blanks for certain methods (collected and analyzed). For small systems, that data is always submitted to EPA. One potential change for UCMR 4 is submittal of more QC data (such as field blank data from large systems). However, that would only be for methods that require a field blank. Not all methods contain a field blank component.



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## UCMR 4 Candidate Selection, Rationale and Method Considerations - Melissa Simic and Steve Wendelken

Melissa Simic and Steve Wendelken presented information and background on: UCMR 4 schedule; candidate selection process and rationale; method considerations; health and occurrence data with sources; and contaminant specific information. The information presented can be viewed on slides 70 through 188 of the meeting presentations.

**QUESTIONS AND ANSWERS:**

Following the presentation on UCMR 4 candidate selection, EPA addressed questions from both in-person and online attendees.

**Question:** Has there been any progress from OST on cyanotoxins that might change the picture?

**EPA Response:** There may be some new numbers for cylindrospermopsin, and microcystin-LR is also on the radar. Anatoxin-a is where data are lacking most. More information on these contaminants would increase the chances of including them.

**Question:** What is the difference between the Reference Concentrations and the Health Reference Levels? If they are the same, why the change in terminology?

**EPA Response:** For UCMR 3, summary document lists MRL and reference concentration. Most of those reference concentrations are HRLs developed during CCL 3, but EPA wanted to maintain opportunity to use more recently released data and increase the range and so used the more generic term, "reference concentration."

**Question:** Please explain what "partition to water when modeled in a four compartment system" means.

**EPA Response:** PBT Profiler identifies contaminants partitioning into soil, air, water, sediment. The phrase is referring to the portion of contaminant that will enter the water, rather than to soil, air, or sediment.

**Question:** Will Q-TOF be acceptable under the MS/MS methods if the DL's and QC criteria are met?

**EPA Response:** Labs can use their own chromatographic parameters as long as QC criteria is met.

**Question:** Since dicrotpohos is an insecticide used on cotton, can monitoring be restricted to those areas where cotton is grown?

**EPA Response:** It is possible that there are other uses of the contaminant (cotton may only be primary use). If there is only hyper-regional use then that will be something to consider during selection.

**Question:** Are qPCR and ELISA methods being considered for *Legionella* method development?

**EPA Response:** There is no particular method that has emerged as a strong candidate for microbiological contaminant monitoring.

**Question:** Will EPA provide some kind of summary as to why certain contaminants were NOT considered candidates for UCMR 4 (i.e., those not highlighted in Appendices A & B) were not considered?



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**EPA Response:** See the triangle figure from Melissa's presentation and the various factors that precluded it. In UCMR 3, the logic for not including contaminants was summarized in a table that listed relevant factors, such as no method.

## Approval of Laboratories Supporting UCMR 4 – Brenda Parris

Brenda Parris presented information and background on the expected approach to UCMR laboratory approval, and how labs can maintain this approval. The information presented can be viewed on slides 190 through 201 of the meeting presentations

### ADDITIONAL DISCUSSION DETAILS:

Labs are second largest stakeholder group participating today. Lab approval starts with the proposed rule (mid-2015) and is expected to be similar to the process used in UCMR 3. Water systems will need to use EPA UCMR-approved laboratories for analysis, and labs will need to meet the required equipment, laboratory performance, and data reporting criteria to become approved. Labs will still need to be approved to support UCMR 4 even if they are already certified by state, primacy entity, or accredited through the National Environmental Accreditation Program (NELAP) for a particular method being used for compliance monitoring

During UCMR 3, EPA added clarification on data reported to SDWARS, including a check of field blank criteria. If additional QC is not required by SDWARS, EPA may continue to "spot check" QC data outside of SDWARS. Labs have 120 days to report to SDWARS. QC data from method or manual not in SDWARS can be requested, for example field blank data to evaluate potential issues. One of the potential changes was to submit this automatically.

### QUESTIONS AND ANSWERS:

Following the presentation on laboratory approval, EPA addressed questions from both in-person and online attendees.

**Question:** For the VOC and organics, will you have an idea of MRL by the time UCMR 4 proposed?

**EPA Response:** MRLs will be published in the proposed rule.

**Question:** Are there any costs associated with the application or PT studies?

**EPA Response:** EPA does not charge a fee or any cost to participate in this study. The laboratory will incur their own internal costs if they choose to participate (due to the use of lab resources), but there is no external cost (from EPA).

**Question:** Would labs report to SDWARS or SDWIS-prime? Data within SDWIS is related to compliance monitoring. So if reported to SDWARS, there is only one flow of data within CDX.

**EPA Response:** Water systems have to put that data in through SDWARS. EPA has added an increased number of pop-ups and reminders, as a mechanism to help systems remember.

**Question:** Do any tribes participate in UCMR?



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**EPA Response:** There are approximately 17 tribes (large systems) that participate and about the same number of tribal systems that were selected to participate under UCMR 3 for the small system monitoring.

**Question:** Will exact method be stipulated in UCMR 4 or will alternative methods be acceptable if QA/QC criteria are met?

**EPA Response:** Exact methods will be stipulated. However historically, EPA has allowed laboratories to use alternate methods when multiple methods are available for use. In the proposal, EPA will identify specific methods. Public commenters can identify other methods, which if EPA agrees, may be included in the final rule. The final rule will stipulate methods that can be used for monitoring.

**Question:** Could you please discuss how laboratories can become EPA Contracted Laboratories for small water system?

**EPA Response:** Labs that go through lab approval process and are approved have the opportunity to become EPA contracted laboratories. There is a formal process through the contracting office. A formal request for proposals is made through the EPA contracting process.

**Question:** Can you estimate the number of future UCMR events?

**EPA Response:** If asking how many more UCMR cycles there will be, the answer is there will be a repeating 5-year cyclical process until or unless SDWA is amended since it is a legal requirement under SDWA. For lab approval PTs we have 3-7 per cycle.

**Question:** How can labs participate in the development of the methods used for UCMR 4?

**EPA Response:** With respect to UCMR 4, it is very late in the game to be developing new methods. If there are methods that are complete or close to completion, EPA can consider them. Slides from the May 2013 webinar on analytical development may contain more information about how labs can participate. We held a stakeholder meeting for methods, opened a comment period within the docket, and did not receive any comments. That would have been the appropriate time to participate in method selection.

**Question:** Will EPA consider using the HRL for the basis for CCR reporting?

**EPA Response:** That would require a change to the CCR. We will discuss this with our colleagues that run CCR program. The CCR has come up quite a bit today. Some important points have been made. We can at least consider the comments during UCMR, but we can't over commit. CCR requirements are in a separate rule, any changes would have to be made there. Discussions are ongoing within OW and agency, and with regions and states for some of these challenges, but we don't have answers today.

**Question:** Why would DBP constituents be included with the UCMR data?

**EPA Response:** EPA is looking at 4 brominated DBPs that are not currently regulated, and for which there is a degree of interest in gathering occurrence information. There is new health effects information that has led EPA to believe they may want to include them in UCMR 4.

**Question:** With all the talk on fracking, are any contaminants considered for UCMR 4 associated with that?



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**EPA Response:** EPA cross-indexed the list and there were several contaminants overlapping between the potential UCMR 4 list and the known hydraulic fracturing chemicals. The overlap included acetaldehyde, formaldehyde, and a couple others.

**Question:** Since nitrite and nitrate are regulated, why are they being considered under UCMR 4?

**EPA Response:** They are currently regulated at the entry point, but not in the distribution system. Monitoring in the distribution system could provide input as to whether they are forming in the distribution system.

**Question:** Will each contaminant include a reference concentration?

**EPA Response:** The goal is to include a reference concentration whenever possible, but not always possible. This goes back to the chicken and egg conundrum; do we wait for complete occurrence information before looking at health effects or vice versa? The challenge is that things done in series are take too long, yet sometimes we have to wait.

**Question:** How are reference concentrations determined?

**EPA Response:** Calculations were discussed in the presentations. EPA uses publically available information. The summary sheet of NCOD data provides information on source: health advisories, contaminant sheets, human health benchmark for pesticides.

**Question:** Is the data reporting process for UCMR 4 to be the same as UCMR 3?

**EPA Response:** EPA intends to continue to use web-based system, and require labs to post results directly to SDWARS. EPA is already working to make improvements to SDWARS 4.

**Question:** If the brominated HAAs are being considered, why are the iodinated HAAs not being considered?

**EPA Response:** Based on availability of health effects information. There is a lack of health effects information on iodinated HAAs.

**Question:** What is the status of Method 541 alcohols and Method 542 for pharmaceuticals?

**EPA Response:** Method 541 is currently in second lab validation. Method 542 for pharmaceuticals has been complete for a year.

**Question:** Are there any real performance difference between 542 and other pharmaceutical methods out there?

**EPA Response:** The WRF document describes a method that mirrors EPA's method. However, EPA completed the method before the WRF document was released. Both hit same end point using different paths.

**Question:** Is there a preference for fast GC over GC?

**EPA Response:** Fast GC has some advantages, including, obviously, its speed. It is an option, but with the gain in speed the operator has to be more careful. Do we care how the data are generated? No, it is the end user's choice.



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**Question:** One of the items on the table for changes in UCMR 4 is compression from 3 year to 2 years. Based on UCMR 1, 2, and 3 could you speak to experientially where EPA is on that decision? After 2 years, are you finding that you are nailing down the occurrence of the contaminant, or has the third year been critical in determining occurrence?

**EPA Response:** For UCMR 3, it remains to be seen whether there will be a difference in trends in the third year. In UCMR 1 and 2, there was not a significant difference in trends between years 1 and 2 and year 3. However, with low levels of occurrence, it is hard to judge. EPA may need to pointedly look at certain contaminants that may have had a consistent trend. Weather patterns have been changing, and with increased occurrence results, there may be a difference to be seen in UCMR 3. Faster is always better, but there can be tradeoffs to compressed monitoring. EPA is sensitive to the impact on stakeholders, and considering what may be given up with limited temporal variability. Compressing the timeline would also compress cost burden for water systems (same number of samples in fewer years).

**Question:** Does SDWA permit the allocation of one of the 30 contaminant slots to a group of contaminants instead of just one (e.g., one of the slots might be HAA4 (for the sum of four unregulated HAAs) instead of using four slots, one for each of these)?

**EPA Response:** EPA has looked at that before, and it depends on how the results would be reported to EPA. If EPA asks results to be reported for each of the HAA4, then it would count as four contaminants. If EPA asks that results for the sum of the HAA4 to be reported, it could be considered as one contaminant. EPA would need to discuss this particular example further.

**Question:** Would EPA be adverse to stakeholders following up with written comments?

**EPA Response:** EPA is always open to receiving comments from stakeholders.



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Attachment 1 - 6/22/16 EPA response to OMB

# PUBLIC SUBMISSION

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**Docket:** EPA-HQ-OW-2015-0218
Revisions to the Unregulated Contaminant Monitoring Rule (UCMR 4) for Public Water Systems

**Comment On:** EPA-HQ-OW-2015-0218-0001
Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems,

**Document:** EPA-HQ-OW-2015-0218-DRAFT-0086
Comment on EPA-HQ-OW-2015-0218-0001

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## Submitter Information

**Submitter's Representative:** Adam Carpenter
**Organization:** American Water Works Association

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## General Comment

Please see the attached file for comments from the American Water Works Association (AWWA).

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## Attachments

20160209_UCMR4_Comments

American Water Works Association

*Dedicated to the World's Most Important Resource*™

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February 9, 2016

Water Docket
U.S. Environmental Protection Agency
Mail Code 2821T
1200 Pennsylvania Avenue, NW
Washington, DC 20460

RE: Comments on "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting", Docket ID No. EPA–HQ–OW–2015–0218

Dear Sir or Madam,

The American Water Works Association (AWWA) appreciates the opportunity to comment on the Environmental Protection Agency's (EPA's) proposal for the Fourth Unregulated Contaminant Monitoring Rule (UCMR4) (80 Federal Register 76897). UCMRs have always been a critical component of the Safe Drinking Water Act (SDWA) regulatory decision-making process. AWWA supports a robust UCMR monitoring program to assist EPA in meeting its statutory requirements when determining whether or not a national regulation is needed and what an appropriate drinking water standard might be. Sound national occurrence information is critical to the regulatory determinations EPA must make in assessing whether a national regulation will provide a meaningful opportunity for risk reduction.

AWWA has previously recommended EPA include cyanotoxins and disinfection by-products (DBPs) on the Fourth Contaminant Candidate List (CCL4) in order to facilitate data collection and evaluation for potential additional risk management. AWWA agrees with the inclusion of both cyanotoxins and the nine haloacetic acids (HAAs) in the proposed UCMR4; however, revisions in the final UCMR4 for both of these groups are necessary to ensure that the monitoring data will appropriately inform future regulatory decisions.

For cyanotoxins, source water monitoring should not be included in the final UCMR4. Instead, UCMR4 monitoring for cyanotoxins should be at the Entry Point to the Distribution System (EPTDS). SDWA Section 1445(a)(2)(A) clearly states that "The

regulations shall require monitoring of ***"drinking water supplied by public water systems..."*** (emphasis added), therefore, AWWA recommends that all UCMR4 monitoring be taken at the EPTDS or at sampling locations in the distribution system. This recommendation also applies to future UCMRs.

AWWA continues to have serious concerns about the accuracy and the reliability of the enzyme-linked immunosorbent assay (ELISA) analytical method. Moreover, the Agency should not directly correlate or compare the ELISA and the LC/MS/MS data. For example, the ELISA test has not been adequately tested for matrix interferences, nor for the relative sensitivity of the vast majority of congeners and disinfection degradates. Inter-laboratory comparisons cited to-date only test for precision or reproducibility, and not for the accuracy of the method itself. Much is still unknown about how disinfection interfaces with ELISA tests, making interpretation of the information difficult. The toxicity of disinfection degradates is unknown relative to known microcystins (such as MC-LR), which is further complicated by the variability in the toxicity of the known microcystins. AWWA recommends that EPA proceed cautiously in developing its ELISA standard method. Recognizing the limitations of the ELISA methods, AWWA recommends its use for screening in the finished water with an EPTDS sample at 0.3 µg/l or at a level demonstrated as sound through EPA's ongoing method development efforts as a trigger for analysis using the LC/MS/MS method.

AWWA agrees that management of DBPs is an important regulatory issue that warrants additional research and resources, but the approach in the proposed UCMR4 is inappropriate. UCMR's mandated, national monitoring framework is not the most appropriate method to obtain reliable and robust monitoring data and meta-data for regulatory decision-making on the complex issues surrounding the formation and degradation of DBPs, assuring microbial protection, and maintaining disinfectant residuals. The meta-data that is proposed to be collected will confuse and confound future data analyses. AWWA recommends a simpler classification of treatment "bins" for UCMR4 meta-data, and EPA should better articulate the future intended use of any meta-data collected in the final UCMR4.

The monitoring frequency in the proposed UCMR4 is inappropriate. UCMR4 monitoring should be conducted quarterly as has been done in past UCMRs. Monitoring should not be "skipped" in December, January, or February. The time frame as proposed (March-November) unnecessarily constrains the monitoring with no benefit for future regulatory decisions. All nine species of HAAs and four species of THMs need to be collected from compliance samples at the same time (four quarters in one year) and at all of the Stage 2 DBPR compliance sampling locations,

and all 13 analyte results need to be reported. Additionally, disinfectant residual for these samples should be collected and analyzed at the same time.

Finally, AWWA and other stakeholders have observed the need to effectively integrate regulatory activity so that in setting new regulatory requirements, simultaneous compliance issues are not ignored and that the Agency does not inadvertently create new hazards. The management of disinfection and DBPs are a clear example where there is a long history of existing and interwoven regulatory requirements. Any monitoring and associated research on DBPs should both be robust and reliable, and be conducted in a manner that appropriately informs any potential future regulatory actions.

Attached are detailed comments that elaborate on the above, and also address other important UCMR4 issues. The ultimate goal of AWWA's recommendations is a well thought out, comprehensive and optimized UCMR4 data collection effort. Both the Agency and the water sector should move forward with reasonable expectations for UCMR4, and the monitoring effort should be complimentary with EPA's drinking water research program. Robust national occurrence data is not as meaningful for regulatory decision-making without additional research into the other considerations that must be taken into account in regulatory decision-making, especially health effects research.

Please feel free to contact AWWA if you have any questions regarding the attached or would like to discuss mechanisms to more actively engage stakeholders in crafting a cohesive strategy to collect the complete suite of data needed to support drinking water regulation development.

Best regards,

G. Tracy Mehan, III
Executive Director of Government Affairs
AWWA

cc: Eric Burneson
Brenda Paris
Melissa Simic
Zeno Bain

***What is the American Water Works Association?***

*The American Water Works Association is an international, nonprofit, scientific and educational society dedicated to providing total water solutions assuring the effective management of water. Founded in 1881, the Association is the largest organization of water supply professionals in the world. Our membership includes over 3,900 utilities that supply roughly 80 percent of the nation's drinking water and treat almost half of the nation's wastewater. Our nearly 50,000 total memberships represent the full spectrum of the water community: public water and wastewater systems, environmental advocates, scientists, academicians, and others who hold a genuine interest in water, our most important resource. AWWA unites the diverse water community to advance public health, safety, the economy, and the environment.*

Comments of the American Water Works Association
on
"Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting"

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Comments of the American Water Works Association
On
"Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting"

The following are the American Water Works Association's (AWWA's) comments on the Environmental Protection Agency's (EPA's) proposed "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems and Announcement of a Public Meeting", Docket ID No. EPA–HQ–OW–2015–0218 (80 Federal Register 76897, December 11, 2015). AWWA's comments are organized into general overarching comments, specific comments with respect to cyanotoxin monitoring, specific comments on haloacetic acid monitoring, responses to EPA's requests for comment, feedback on EPA's presentation of the burden and logistics of UCMR implementation, and a brief summary.

## Overarching Comments

AWWA supports the Proposed Fourth Unregulated Contaminant Monitoring Rule (UCMR4) as part of the suite of activities to inform regulatory decision-making; however, several important revisions need to be made in the final UCMR4.

1. Disinfection byproducts (DBPs) are an important regulatory issue that warrant additional research and resources, but the approach in the proposed UCMR4 is not an appropriate mechanism to accomplish this goal. The drinking water community needs robust and reliable UCMR monitoring data and meta-data to be collected in order to appropriately inform regulatory decision-making on the complex issues surrounding the formation and degradation of DBPs and maintaining microbial protection, disinfectant residual, and optimized corrosion control.

2. The proposed UCMR4 would collect meta-data in such a way as to confuse and confound effective analysis in the future. A simpler classification of treatment "bins" for UCMR4 meta-data would be more effective. EPA should clearly articulate the future intended use of any meta-data collected in the final UCMR4.

3. Source water monitoring for cyanotoxins should not be included in the final UCMR4. Instead, enzyme-linked immunosorbent assays (ELISAs) of finished water should first be run against a low-level calibration curve (designed specifically for values below 1µg/l), (2) re-calculated for a higher level calibration curve for values that fall above 1µg/l on the low-level calibration curve. The value reported should be the value calculated using the correct calibration curve. If the sample continues to demonstrate occurrence greater than the MRL using the correct calibration curve, then the additional analysis using EPA Method 544 should also be conducted. See



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the section "Microcystins ELISA development..." for more details on calibration curves.

4. Reconsider the proposed contaminants and revise the sampling framework for UCMR4 samples. AWWA recommends:

    a. Retaining year-round monitoring,

    b. Monitoring for the nine haloacetic acids (HAA9) in conjunction with compliance monitoring and data submittal,

    c. Reducing ground water monitoring to a single event for each EPTDS, based on our analysis of UCMR3 data that shows similar concentrations between the two sampling events, and

    d. Eliminating monitoring of the proposed alcohols and germanium to keep the total number of UCMR4 contaminants under 30 with the inclusion of the 13 species of DBPs (four trihalomethanes (THMs) and HAA9).

### Integrating SDWA Policy Development

A very positive development in the UCMR4 proposal is the forethought EPA utilized to integrate data needs across both Section 1412(b)(1)(B) (regulation of unregulated contaminants) and Section 1412(b)(9) (six-year review). The cost incurred by water systems and EPA to implement unregulated contaminant monitoring is substantial and unequitable for some systems. Consequently, the contaminants included should be carefully selected so as to make the best use of limited available resources. Equally importantly, the logistics of a national data collection effort require time yet is critical to national regulatory decisions, which cannot be made without a sound understanding contaminant occurrence. Therefore, the time spent on UCMR should not be wasted monitoring for contaminants that are unlikely to be observed, and if they are observed, unlikely to pose a significant national health consequence or to provide a "meaningful opportunity for risk reduction" through a national drinking water regulation. Thousands of non-detects in past UCMRs that have not been used to make negative regulatory determinations have not been an effective use of the drinking water community's fiscal resources.

### EPA Research Agenda Should Support SDWA Contaminant Evaluation

EPA's "Safe and Sustainable Water Resources Strategic Research Action Plan 2016 – 2019" is the latest in a series of EPA research plans that do not support the Agency's mission and mandatory duties under SDWA.[1] The lack of a cohesive and robust research plan to support regulatory actions being considered under SDWA sections 1412(b)(1)(B) and

[1] EPA, Safe and Sustainable Water Resources Strategic Research Action Plan 2016 – 2019, 2015 [http://www.epa.gov/sites/production/files/2015-10/documents/strap_2016_sswr_508.pdf]



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1412(b)(9) have resulted in the UCMR4 proposal including "make do" solutions for data collection that will pose serious challenges to data interpretation. Effectively targeted research projects could much more systematically characterize the linkages between:

1. Brominated DBP formation, influent water characteristic, and treatment scenarios.
2. Available source water indicators of cyanobacteria, treatment regimes, and observed finished water cyanotoxin levels.

The statutory mandate for UCMR is to develop the national occurrence of unregulated contaminants in ***"drinking water supplied by public water systems..."*** (emphasis added). The drinking water community has successfully implemented unregulated contaminant monitoring rule requirements for more than 30 years to serve that purpose. We also know from that history that UCMR is ill-suited to researching and developing an understanding of the underlying factors for that occurrence. For examples, see previous AWWA comments on the challenges posed analyzing UCMR2 nitrosamine occurrence data with respect to disinfection practice.[2]

## Coordinating Data Systems

The UCMR4 Federal Register notice and "DRAFT Information Collection Request for the Unregulated Contaminant Monitoring Rule (UCMR 4)" are silent with respect to which data system water systems and laboratories will be instructed to submit data. EPA's UCMR electronic data reporting system, the Safe Drinking Water Accession and Review System (SDWARS) is the implied data system on pages 80 FR 76905 and 76907 (recognition of entry points to the distribution system and laboratory applications). However, the proposed UCMR4 has no substantial discussion of the data system. For the past several years, EPA has had an ongoing collaboration with the Association of State Drinking Water Administrators (ASDWA) to develop a new electronic data portal for compliance monitoring known as the Compliance Monitoring Data Portal (CMDP). CMDP is scheduled for beta testing in 2016 and going live in 2017, one year prior to the beginning of UCMR4. Appropriate alignment of UCMR4 and CMDP is important for several reasons:

1. Coordinating compliance and UCMR4 DBP monitoring would be much more informative than separate data collection efforts,
2. Coordinating Entry Point to the Distribution System (EPTDS) monitoring locations with routine monitoring sites would be a more effective use of resources; and
3. Potentially coordination of available water system treatment information.

[2] AWWA, Comments on Revisions to the Unregulated Contaminant Monitoring Regulation (UCMR 3) for Public Water Systems, Docket ID No. OW–2009–0090, 2011



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### Application of EPA Health Advisories and Reference Levels

In June 2015, EPA finalized 10-day health advisories for microcystins and cylindrospermopsin. These advisories are described by the Agency as non-regulatory and informational. In the final UCMR4, EPA needs to clearly state the non-regulatory aspects of these numbers. In some EPA regions, the current UCMR3 monitoring data is be used to require additional treatment and abandonment of wells based on the perfluorooctane sulfonate (PFOS) observations and the provisional EPA health advisory.[3] EPA has gone to considerable length to describe the cyanotoxin health advisories as 10-day levels, and that multiple toxin observations above the health advisory levels are necessary to support risk management steps by the public.[4] AWWA recommends that EPA be explicit in the final rule that a single data point from the UCMR4 monitoring data alone is not sufficient to trigger public notice for cyanotoxins.

Similarly, in UCMR3, EPA provided reference levels that were calculated using standard procedures for computing drinking water equivalent levels (DWELs).[5] Having such health reference levels can be informative for communication with the public, but complications ensue given the health endpoints being explored in the scientific literature and mass media for compounds like microcystins, cylindrospermopsin, nodularin, manganese, DBPs, etc. Therefore, AWWA recommends that EPA carefully consider the quality of the available information for such reference levels and to thoughtfully present such levels in the final UCMR4.

## Cyanotoxin Monitoring

AWWA has several concerns and recommendation to improve the proposed cyanotoxin monitoring methodologies. The issues raised bear on both the resulting UCMR4 data and the usefulness of that data for needed analyses. The ultimate goal of any UCMR is to appropriately inform future regulatory decision-making, and we believe that our recommendations will aid in optimizing the decision-making processes.

First, EPA's proposed microcystins sampling methodology includes taking both source and finished water samples. AWWA recommends that EPA remove source water monitoring from the final UCMR4, and restructure the finished water monitoring as detailed below. We believe this is the most prudent course of action for the following reasons:

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[3] EPA, Health Advisories for Perfluorooctanoic Acid and Perfluorooctane Sulfonate in Drinking Water, 2009, [http://www.epa.gov/dwstandardsregulations/health-advisories-perfluorooctanoic-acid-and-perfluorooctane-sulfonate]

[4] EPA, Recommendations for Public Water Systems to Manage Cyanotoxins in Drinking Water, 2015, [http://www.epa.gov/nutrient-policy-data/guidelines-and-recommendations#health]

[5] EPA, October 2015 UCMR 3 Data Summary for Chemical Contaminants, EPA 815-S-15-003, [http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3].



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1. The purpose of the UCMR is to develop occurrence data for potential contaminants that may be present in ***"drinking water supplied by public water systems..."*** (emphasis added). Past UCMRs have monitored only at EPTDSs and at points within the distribution system. Source water monitoring is not appropriate under the UCMR regulatory framework, and should be undertaken in targeted research studies that collect treatment plant meta-data sufficient to support analysis.

2. In addition to the potential for existing treatment to remove cyanotoxins, treatment can also lead to the release (*e.g.*, oxidant addition) or concentration of toxins (*e.g.*, recycle streams). Using the "phased" microcystins methodology would miss both processes that increase cyanotoxins within the plant and processes that decrease cyanotoxins within the plant.

3. Because water takes time to travel through a treatment facility, sampling methodologies meant to determine treatment effectiveness must accurately account for travel time from source to the EPTDS. Taking simultaneous source and finished samples does not provide information on treatment effectiveness, but only two different sets of data that can only be analyzed independently. Because of the complexity of determining a uniform methodology to accurately measure pre- and post- treatment concentration that accounts for travel time, such data collection is appropriate as a separate research study, not as a part of UCMR.

4. EPA's proposed use of the ELISA test for microcystins on source water samples would likely create a communication challenge for water systems. Because UCMR monitoring must be reported on the system's Consumer Confidence Report (CCR), some systems will likely have readings above 0.3 µg/l in source water samples, but then non-detect in finished water samples. Consequently, these systems will report a positive source water monitoring result on their CCR. The CCR is designed to help consumers understand their drinking water quality. The inclusion of source water data, when the contaminant of concern was not actually found in the water delivered to customers, will further complicate the CCR and public understanding of their system's water quality.

5. Research on the treatment of microcystins consistently shows that very low levels of extracellular microcystins are removed with conventional water treatment, and intracellular microcystins are removed through flocculation, coagulation, and filtration processes. The phased monitoring methodology that EPA has proposed fails to account for the best available science in setting the source water screening level (0.3 µg/l). The proposed screening level is lowest readable value in the most commonly used ELISA methods, and even is typically considered "semi-quantitative". Water systems with low readings would nearly always have non-detects in finished water. The current combination of sample location and screening value contributes to implementation

burden without adding new information, as the literature has already shown that conventional treatment and disinfection remove very low levels of microcystins.

6. Removing source water monitoring would simplify the analytical method requirements. The Ohio EPA ELISA method, which is expected to share most characteristics with the EPA standard ELISA method currently in development, requires several rounds of freezing and thawing to lyse any cyanobacteria cells present in the sample and release all of their stored toxins. Conventional water treatment in most instances will remove all or nearly all of the cyanobacteria and all of the intracellular toxins contained within those cells will not be present in finished water. Unlike source water monitoring, which would require both lysed and not-lysed samples to capture both total and extracellular microcystins, finished water monitoring does not require lysing.

In summary, AWWA is concerned that the quality of occurrence data in drinking water generated by the phased methodology for microcystins would be poor. Eliminating source water monitoring and instead monitoring finished water directly, using the methodology proposed below, would generate much higher quality occurrence data that would be more useful for the purposes of determining both national occurrence and deciding whether there is or is not a meaningful opportunity for risk reduction under a future regulation.

In place of source water monitoring, EPA should restructure microcystins monitoring in finished water using the following protocol:

1. Samples to run finished water ELISA and LC/MS/MS (EPA Method 544) should be taken simultaneously.
2. ELISA results for any sample should be compared against a low-level calibration curve designed for greatest accuracy of values less than 1µg/l.
3. If the sample result is above the low-concentration calibration range, then the sample result should be compared against a higher concentration calibration curve designed for accuracy above 1µg/l.
4. The reported result should be the result using the correct calibration curve. For ELISA values above the MRL at the correct calibration curve, EPA 544 should also be run and reported.

EPA should carefully consider all of these comments to assure that useful data is on microcystins is generated without creating an overly large burden on public water systems and contributing to the other issues mentioned throughout the comments.



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## Microcystins ELISA Method Development and Lab Certification

As EPA is well aware, the ELISA calibration is logarithmic in nature.[6] Therefore, if the most accurate results are needed at relatively low levels (e.g. 0.3 µg/l), then the calibration accuracy in that range is critical. Most detected values in UCMR are expected to be at the low end of the calibration range, if detected at all. ELISA is typically calibrated over a range from 0.15 to 5 µg/l and there is seldom clear guidance regarding dilution in the test kits. AWWA recommends that in the development of the EPA version of an ELISA method, the EPA ELISA method requires that initial measurements be conducted against a calibration curve that goes no higher than 1 µg/l (e.g. 1 order of magnitude) and, if values are over-range, they should be re-calculated against either the full calibration range or that portion of the calibration range that goes from 1 to the high end. As EPA typically includes requirements for back calculation and acceptance criteria in methods, we assume this will be taken into consideration. AWWA recommends that EPA focus on evaluating calibration ranges to ensure greatest accuracy and precision, especially because values above the MRL (currently 0.3 µg/l) will trigger the more expensive LC/MS/MS method. Note also that this does not take into consideration the different responses of microcystin variants. Therefore, the more precise EPA can make their ELISA method, the lower the overall uncertainty.[7]

Use of ELISA as a screening measure under UCMR4 to measure total microcystins is only appropriate if EPA can demonstrate the method meets all applicable quality control measures expected of an EPA Standard Method. Although we commend Ohio EPA for leading initial method development, EPA should not assume that Ohio EPA has already completed all of the appropriate quality assurance/quality control (QA/QC) measures expected of an EPA standard method that is to be applied nationally. AWWA recommends that EPA independently verify all necessary procedures and performance information of the method during method development. There may be too many unknowns about interactions with degradation byproducts, interferences from other compounds, and different, but unknown, sensitivities to different congeners to pass appropriate QA/QC. EPA should be prepared to pursue alternate sampling methodologies if the ELISA method currently in development cannot pass appropriate QA/QC criteria.

Additionally, according to the UMCR4 laboratory certification manual, laboratories must be able to accurately measure down to 1/3 of the MRL to achieve certification. Given a proposed MRL of 0.3 µg/l for total microcystins, meeting the proposed certification criteria requires accurately measuring to 0.1 µg/l. It is not clear laboratories can achieve this level of performance on a consistent basis, posing a serious laboratory certification problem.

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[6] For illustratory purposes see Abraxis Microcystins/Nodularins (ADDA), ELISA Microtiter Plate Kit's User Guide, http://www.abraxiskits.com/wp-content/uploads/2014/08/Microcystin-PL-ADDA-Users-Guide-ETV-R082714.pdf (downloaded February 3, 2016).

[7] Abraxis Microcystins/Nodularins (ADDA), ELISA Microtiter Plate Kit's User Guide, http://www.abraxiskits.com/wp-content/uploads/2014/08/Microcystin-PL-ADDA-Users-Guide-ETV-R082714.pdf (downloaded February 3, 2016)



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Current ELISA methods only become semi-quantitative at 0.3 µg/l (+/- 50%) and it may not be realistic to detect down to 0.1 µg/l. EPA should carefully consider revising its performance criteria for microcystin analysis by ELISA when setting this threshold value and while testing its standard method under development. The Abraxis ADDA test has a manufacturer-supplied MRL of 0.15 µg/l. This manufacturer MRL would require EPA to either have 0.45 µg/l or higher UCMR MRL, or to change the laboratory certification processes and requirements. Any change to those requirements needs to be based upon good science.

Alternatively, EPA could fast track the development of its upcoming MMPB method, which is expected to be both more reliable and deliver more granular information for potential regulatory decision making. EPA could then add the MMPB method to UCMR as soon as it is available.[8] For this reason, and for other reasons described below, AWWA recommends that EPA raise the MRL for the ELISA method to at least 0.45 µg/l if the current Abraxis ADDA test is used, or higher if analysis of EPA's standard method currently in development indicates a higher MRL is appropriate.

Additionally, EPA Method 544 is currently used rarely and only by a handful of laboratories. Many laboratories have developed "direct injection" methods that are more straightforward, potentially less expensive, and still have a strong sensitivity (50-100 ng/l). EPA should discuss this issue with laboratories and consider the possibility of developing an EPA standard method to reduce the overall burden compared to running EPA Method 544.

## Need for Specific Cyanotoxins Analysis Plan

AWWA is concerned about how data analysis will be performed on the cyanotoxins data collected in UCMR4 as proposed. It is well known that ELISA does not measure every microcystin congener equally. That is to say a known amount of Microcystin-LR does not yield the same result on an ELISA test as the same known amount Microcystin-LA or another congener. In some cases, the same concentration of one congener can yield a result several times greater on ELISA than another congener. For example, when a total microcystins ELISA test is calibrated using Microcystin-LR (as it most commonly is), there is the possibly that any unknown congener could either:

1. Produce 10% of the response of Microcystin-LR, yet be much more toxic and present a greater health risk, under-reporting the actual concern, or

[8] MMPB analytical method is a liquid chromatography tandem mass spectroscopy (LC/MS/MS) analysis on the 3-methoxy-2-methyl-4-phenylbutyric acid molecule (MMPB) and calibrated using a certified reference standard, currently (microcystin-LR) and 4-phenylbutyric acid.



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2. Produce 10 times the response of Microcystin-LR, yet be much less toxic and therefore over-report the actual health concern.

Therefore, making comparisons between ELISA and LC/MS/MS measurements is difficult, and in some cases, such as if unknown congeners are present, can be nearly impossible without more information. Total Microcystins as measured by ELISA is *not* equal to the congeners measured by LC/MS/MS plus unknown congeners. The translation from ELISA to LC/MS/MS is not known for every compound and circumstance. Additionally, the sensitivity of ELISA known for many congeners is unknown. Finally, it is thought that ELISA picks up some cyanotoxin oxidation degradates, falsely implying greater concern than warranted by the substance that is actually present. Therefore, we recommend that EPA create a clear, transparent plan for the analysis of UCMR data to address these complexities prior to the collection of the data.

## Additional Cyanotoxins Concerns

AWWA requests that EPA explain the benefit of monitoring for nodularin based upon a total microcystins trigger. Many do not consider nodularin to be a microcystin, although it does share some structural similarities with microcystins. We cannot foresee any scenarios where this proposed methodology yields any conclusions on national occurrence for nodularin, and it appears to be included only because it is part of the EPA 544 analytical method. Simply being part of the EPA 544 method is not appropriate for the inclusion of another compound in the final UCMR4 that does not appear to inform any future regulatory decision-making.

In the supporting cost analysis, EPA has used the presumption that 20% of surface water raw / intake ELISA samples will read as 0.3 µg/l or greater. AWWA does not agree that this frequency is supported by the available evidence. There are good reasons to expect the frequency could be substantially higher. Given the potential for interference by other compounds, the tendency for ELISA to generate false positive results, and the intentional biasing towards finding greater occurrence (by concentrating the sampling in warmer months) it is more likely that the cost assumptions are incorrect. Again, AWWA recommends that EPA eliminate source water monitoring from the sampling methodology for microcystins. With this elimination, EPA will be able to more accurately estimate the projected cost of conducting sampling directly on finished water.

## Monitoring to Inform DBP Risk Management

AWWA supports the collection of occurrence data in UCMR4 in order to inform evaluating risk management decisions regarding DBPs. The development of the current DBP standards reflect an extensive body of research and substantive, fact-based, stakeholder dialogue. To make changes in the existing DBP – microbial disinfection framework will require a careful consideration of off-setting and overlapping risk management challenges.



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Given the potential for unintended, undesirable impacts, AWWA urges EPA to set objectives for UCMR4 that effectively utilize this national occurrence survey's strengths and minimizes its weaknesses. UCMR4's objectives should fit within a cohesive research and information collection strategy that includes:

1. A clearly articulated vision of data and information needs to support future risk-management decisions,
2. A cohesive research plan that reflects what information is to be developed through EPA intra- and extramural research,
3. Occurrence gaps that UCMR4 will fill, and
4. A process for engaging the drinking water sector to leverage EPA's work.

Such a strategy would need to extend beyond occurrence and treatment to health effects. While EPA has posited a premise for focusing on brominated DBPs in future decision-making, a substantive debate is ongoing on whether the drinking water community presently has sufficient evidence to warrant changing treatment practice.[9, 10] The balance of AWWA's comments on UCMR4 assume that brominated DBPs will be a substantial component of future risk management and the question at hand is what information from UCMR4 monitoring would most appropriately inform those decisions.

The proposed UCMR4 appears to incorporate the following elements to support DBP risk management evaluation:

1. The collection of HAA5, HAA6Br, and HAA9 samples from current distribution system compliance monitoring locations for the purpose of estimating the national occurrence of unregulated brominated HAAs while staying within the UCMR monitoring cap of 30 contaminants.
2. The collection of total organic carbon (TOC) and bromide at LT2ESWTR (or similar) source water monitoring locations to inform modeling the linkage between influent water quality and observed DBP formation.
3. Temperature and pH at LT2ESWTR (or similar) source water monitoring locations to inform modeling the linkage between influent water quality and observed DBP formation.

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[9] Regli, S., J. Chen, M. Messner, M.S. Elovitz, F. J. Letkiewicz, R.A. Pegram, T.J. Pepping, S.D. Richardson, and J. M. Wright, "Estimating Potential Increased Bladder Cancer Risk Due to Increased Bromide Concentrations in Sources of Disinfected Drinking Waters, 2015, Environ. Sci. Technol., 2015, 49 (22), pp 13094–13102. http://dx.doi.org/10.1021/acs.est.5b03547

[10] Hrudey S.E., Backer L.C., Humpage A.R., Krasner S.W., Michaud D.S., Moore L.E., Singer P.C., Stanford B.D., Evaluating Evidence for Association of Human Bladder Cancer with Drinking-Water Chlorination Disinfection By-Products, ,J Toxicol Environ Health B Crit Rev. 2015;18(5):213-41. doi: 10.1080/10937404.2015.1067661.

4. Data element, including primary and secondary disinfection practice and treatment information for each sample, in order to distinguish differences in DBP occurrence as a function of disinfection and treatment practice.

AWWA supports each of the above data collection objectives but does not agree that the data collected as proposed will be informative or that UCMR is the appropriate mechanism to develop data to inform the analyses envisioned.

### Applicability of HAA Monitoring

As currently proposed, HAAs are a part of Assessment Monitoring and as such must be monitored by all systems serving more than 10,000 population served. Additional regulation of HAAs would be through a potential revision of existing DBP regulations. The current DBP regulations only apply to systems that employ a chemical disinfectant. For purposes of UCMR4, EPA could substantially reduce the complexity of the data collection effort and reduce the burden of the rule on undisinfected water systems by only collecting HAA data from systems subject to the existing DBP regulations. Such an approach does inadvertently bias exposure toward systems with the potential for higher levels of HAAs but is adequate to inform the potential revision of existing DBP regulations.

### Analysis Supported by Proposed Data Collection Is Superfluous

AWWA agrees with EPA that the Agency should have actual occurrence distributions of contaminants in finished water for evaluating future regulatory decisions. This is what the SDWA requires, and is particularly true of DBPs where additional regulatory action will require modelling to estimate the impact of potential risk management strategies. The proposed collection of HAA5, HAA6Br, and HAA9 will involve significant time and expense to collect data that is not a great deal more useful than analyses that can be conducted with data already available to EPA. Attachment A illustrates how well-recognized relationships, like bromide incorporation factor (BIF), can be used to achieve the same level and quality of information that will be accrued through the proposed data collection.

### Suggestions to Streamline and Enhance HAA Data Collection

EPA should explicitly list the individual brominated HAA species not captured by current monitoring for HAA5. Those species are:

1. bromochloroacetic acid,
2. bromodichloroacetic acid,
3. chlorodibromoacetic acid, and
4. tribromoacetic acid.



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This data should be obtained by analyzing Stage 2 DBPR compliance samples for HAA9 rather than HAA5. The four currently regulated THM species data should be reported for the same samples as well.

Samples processed for compliance with UCMR4 will be of sufficient quality to allow submitting the sum of dibromoacetic acid, dichloroacetic acid, monobromoacetic acid, monochloroacetic acid, and trichloroacetic acid for compliance with Stage 2 DBPR. Such dual use of UCMR monitoring results has occurred previously and, if appropriately framed, will both improve the data available to EPA for analysis and help water systems manage the burden presented by compliance with the final UCMR4.

Stage 2 DBPR compliance monitoring is currently filed with state primacy agencies through either unique state data systems or SDWIS State, while UCMR1, 2 and 3 results have been submitted through SDWARS. These two systems are separate but not incompatible. EPA is presently developing CMDP, and it is scheduled to be operational a year prior to the beginning of UCMR4 monitoring. Utilizing a single data portal for submitting both compliance and UCMR data is appealing for multiple reasons, provided that the data portal is stable, easy to use, and thoroughly beta tested with users prior to implementation. Benefits could include:

1. A single HAA data submittal that would fulfill both compliance and UCMR4 requirements.
2. Collection of both individual TTHM and HAA species concentrations along with regulatory required TTHM and HAA5 sums.

### Utility of Source Water Bromide and TOC Data Collection

AWWA agrees with EPA that both bromide and TOC data should be collected to inform future technical analyses to support any potential DBP risk management decisions. AWWA does not concur with the premise that collecting bromide and TOC with the other data collected in UCMR4 are sufficient to develop an informative model of brominated DBP occurrence. As has been illustrated by previous dialogues around DBP/microbial risk management, understanding the underlying mechanisms of DBP formation and the complex relationships between treatment and DBP formation and degradation is important to regulatory option analysis. Consequently, AWWA suggests that targeted research studies investigating treatment alternatives, bromide and TOC control, other treatment options, and DBP formation considerations be developed.

Use of CMDP would again be helpful as a data collection alternative in lieu of UCMR. TOC removal is already a requirement for all surface water treatment plants in the US. Consequently, a substantial body of data is already being collected on influent and effluent TOC at existing water treatment plants. This data would inform both understanding DBP occurrence and our understanding of how much additional TOC reduction is potentially

available to any potential future risk management activities. Collecting TOC data from existing state data systems is challenging, but CMDP is anticipated to facilitate compiling data from existing regulatory monitoring and reporting requirements.

A better understanding of bromide occurrence will be necessary to support Agency activity. Again, this need extends beyond the capacity of UCMR monitoring. In this instance, an updated national distribution of bromide occurrence is needed, as well as an understanding of the temporal trends and regional trends in both surface and ground water supplies. Data of this type is probably best developed through a collaborative effort with USGS and dedicated research projects that evaluate not only conventional sources of water supply that currently dominate water supply portfolios but also investigate implications of using more challenging waters as water supply alternatives.

### Temperature and pH

It is not clear from the UCMR4 Federal Register notice whether EPA intends to use the collected temperature and pH data to inform evaluation of the DBP occurrence data. AWWA would strongly discourage the Agency from attempting such an approach. The collection described in the notice is for temperature and pH to be monitored in source water at the time of cyanotoxin sampling. Such samples are:

1. Not clearly connected in time with the HAA samples, and
2. Reflect source water conditions, not conditions during treatment and finished water that are pertinent to DBP formation.

AWWA recommends that disinfectant residual, temperature and pH be collected and reported at the same time as the sampling for the four THMs and HAA9 at compliance monitoring sample locations.

### Primary and Secondary Disinfection Practice and Treatment Information

As previously stated, a cohesive research plan is needed to collect data that is useful for the questions most pertinent to future risk management steps. For example, while the proposed UCMR4 collects information on TOC and bromide, it does not collect the equally, if not more, important information on oxidant addition, oxidant order of application, oxidant dose, and oxidant contact time. It should be noted that AWWA is not recommending that these be included in the final UCMR4, as these are more appropriate for targeted research studies. Consequently, the proposed UCMR4 does not, and is unlikely to, collect sufficient information to support such efforts as modeling of DBP occurrence as a function of water quality parameters and treatment.

However, AWWA recommends that the final UCMR4 collect the primary and secondary disinfectant practice in place at the time of DBP sampling. This data is critical to even



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simple evaluations of the UCMR occurrence data and is fundamental to better targeting future research.

AWWA agrees that the UCMR4 data is more informative when there is information describing the associated treatment. However, collecting this data has been problematic in previous UCMRs. If UCMR4 data were collected through CMDP as AWWA recommends, connecting the UCMR4 data to the treatment plant description maintained as a part of routine system reporting to the state is possible. Unfortunately, in the near term, at least two issues are barriers to such an approach:

1. Previous EPA analyses have found that, historically, the State data for nonparametric data elements is less complete and more likely to be inaccurate than compliance data. So, in the near-term, UCMR4 may not be able to rely exclusively on data from the state data systems and some type of hybrid data collection approach may be needed.
2. The effort to implement CMDP will not include collection of nonparametric data so the data system renewal at the federal level that would result in a refresh and updated tool for this data will not be available until PRIME is developed and implemented. PRIME's development timeline is undeterminable at this point.

## Removal of Alcohols and Germanium from UCMR4

AWWA recommends that EPA remove the Alcohols (1-butanol, 2-methoxyethanol, and 2-propen-1-ol) and germanium from UCMR4. These compounds are of low toxicity and it appears unlikely to have widespread national occurrence at levels of concern. Therefore, there is not likely to be any significant opportunity for risk reduction as required by the contaminant selection process. Therefore, we request that EPA remove these compounds to make room for higher priority data collection actions recommended elsewhere in AWWA's comments.

## Requests for Comment

*"EPA invites comment on the proposed UCMR 4 contaminants and their associated analytical methods identified in Exhibit 3, as well as any other priority contaminants commenters wish to recommend."*

In commenting on the draft CCL4, AWWA specifically recommended listing individual microcystins (i.e., MC-LR, –LA, -LW, -RR, and –YR) as well as cylindrospermopsin and anatoxin A. In keeping with AWWA's earlier recommendation, we concur that if appropriate methods and sampling methodologies are used, that occurrence data for these cyanotoxins is important and a high priority for inclusion in UCMR monitoring.



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## Selected Analytical Methods for Proposed Contaminants

AWWA reviewed the analytical methods proposed by EPA in the proposal, summarized in Exhibit 1.

Exhibit 1. Overview of Proposed UCMR4 Analytical Methods and Associated Issues

| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 1 | Total microcystins | * | * | ELISA Standard Operating Procedure (SOP) (Ohio EPA, 2015). | 0.3 |
| 2 | Microcystin-LA | * | 0.3 | EPA Method 544 | 0.008 |
| 3 | Microcystin-LF | * | 0.3 | | 0.006 |
| 4 | Microcystin-LR | 0.021 | 0.3 | | 0.02 |
| 5 | Microcystin-LY | * | 0.3 | | 0.009 |
| 6 | Microcystin-RR | * | 0.3 | | 0.006 |
| 7 | Microcystin-YR | * | 0.3 | | 0.02 |
| 8 | Nodularin | ? | NA | | 0.005 |
| 9 | Anatoxin-a | ? | NA | EPA Method 545 | 0.03 |
| 10 | Cylindrospermopsin | 1.6 | 0.7 | | 0.09 |
| 11 | Germanium | 0.744 | 7.44 | EPA Method 200.8 | 0.3 |
| 12 | Manganese | 300 | 300 | SM 3125<br>SM 3125–09<br>ASTM D5673–10 | 0.4 |



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| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 13 | alpha-Hexachlorocyclohexane | 0.006 | 0.006 | EPA Method | 0.01 |
| 14 | Chlorpyrifos | 2 | | 525.3 | 0.03 |
| 15 | Dimethipin | 153 | 153 | | 0.2 |
| 16 | Ethoprop | 0.7 | 1.25 | | 0.03 |
| 17 | Oxyfluorfen | 0.478 | 210 | | 0.05 |
| 18 | Profenofos | 0.35 | 0.35 | | 0.3 |
| 19 | Tebuconazole | 210 | 210 | | 0.2 |
| | total permethrin | 3.65 | 3.65 | | 0.04 |
| | *i.e.* | | | | |
| 20 - 23 24 25 | *The combined concentration of 4 distinct stereoisomers of (3-Phenoxyphenyl)methyl ester 3-(2,2-dichloroethenyl)-2,2-dimethyl-cyclopropanecarboxylic acid* | 3.65 | | | 0.07 |
| | Tribufos | | 7 | | |
| | HAA5 | | | EPA Method | -- |
| | HAA6Br | | | 552.3 | -- |
| | HAA9 | | | | -- |
| | *i.e.* | | | | |
| 26 | *Bromochloroacetic acid* | -- | | | *0.3* |
| 27 | *Bromodichloroacetic acid* | -- | | | *0.5* |
| 28 | *Chlorodibromoacetic acid* | -- | | | *0.3* |
| 29 | *Tribromoacetic acid* | -- | | | *2.0* |
| 30 | *Monobromoacetic acid* | -- | | | *0.3* |
| 31 | *Dibromoacetic acid* | -- | | | *0.3* |
| 32 | *Dichloroacetic acid* | 0.7 | 0 | | *0.2* |
| 33 | *Monochloroacetic acid* | 70 | 70 | | *2.0* |
| 34 | *Trichloroacetic acid* | 20 | 20 | | *0.5* |
| 35 | 1-butanol | 700 | 700 | EPA Method | 2.0 |
| 36 | 2-methoxyethanol | 21 | 21 | 541 | 0.4 |
| 37 | 2-propen-1-ol | 35 | 35 | | 0.5 |
| 38 | butylated hydroxyanisole | 0.581 | 0.581 | EPA Method | 0.03 |
| 39 | o-toluidine | 0.194 | 0.194 | 530 | 0.007 |
| 40 | quinolone | 0.01 | 0.01 | | 0.02 |
| 41 | bromide | | | | |
| 42 | pH | | | | |
| 43 | Temperature | | | | |



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| # | Proposed Analytes | HRL (µg/L) Available EPA References | HRL (µg/L) EPA Webcast (Jan, 2016) | Proposed Analytical Method | MRL (µg/L) |
|---|---|---|---|---|---|
| 44 | Total Organic Carbon | | | | |

Sources: HRLs included are from EPA HAs, Proposed CCL4 Notice Support Documents, CCL3 Support Documents, Stage 2 Disinfectant and Disinfection Byproduct Rule, and 2012 Drinking Water Standards and Health Advisories [11,12,13,14,15]

To allow for a robust analysis of HAA occurrence, AWWA suggests focusing on augmenting data collection through CDMP. While collecting secondary disinfectant residual values at the time of compliance DBP monitoring is not a typical practice, such information will be important to understanding observed HAA levels. Consequently, in addition to monitoring for HAA9 through augmenting routine compliance monitoring data collection, systems should collect pH, temperature, and either free or total chlorine concentrations as appropriate to the secondary disinfectant in use at the time and location of DBP sample collection. Field DPD observations using handheld colorimeters will be appropriate for collecting this data. Since field technicians are water system staff and not approved by EPA for UCMR monitoring, EPA will need to revise its current regulatory language on processing of UCMR samples at UCMR approved laboratories. For purposes of UCMR4 monitoring the existing analytical method performance should be sufficient for this data collection activity.[16]

*"EPA will consider raising MRLs if the Agency becomes aware of evidence that a proposed MRL is unattainable or impractical."*

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[11] EPA, 2015, 2015 Drinking Water Health Advisories for Two Cyanobacterial Toxins, 820F15003, http://www.epa.gov/nutrient-policy-data/drinking-water-health-advisory-documents (Accessed 1/3/2016)

[12] EPA, 2015, Contaminant Information Sheets (CISs) for the Draft Fourth Preliminary Contaminant Candidate List (PCCL 4) Nominated Contaminants, EPA 815-R-15-003, http://www.epa.gov/sites/production/files/2015-01/documents/815r15003.pdf (Accessed 1/3/2016)

[13] EPA, 2009, Contaminant Information Sheets for Final CCL3 Chemicals, EPA 815-R-09-012, http://nepis.epa.gov/Exe/ZyNET.exe/P100576U.TXT?ZyActionD=ZyDocument&Client=EPA&index=2006+Thru+2010&Docs=&Query=&Time=&EndTime=&SearchMethod=1&TocRestrict=n&Toc=&TocEntry=&QField=&QFieldYear=&QFieldMonth=&QFieldDay=&IntQFieldOp=0&ExtQFieldOp=0&XmlQuery=&File=D%3A%5Czyfiles%5CIndex%20Data%5C06thru10%5CTxt%5C00000011%5CP100576U.txt&User=ANONYMOUS&Password=anonymous&SortMethod=h%7C-&MaximumDocuments=1&FuzzyDegree=0&ImageQuality=r75g8/r75g8/x150y150g16/i425&Display=p%7Cf&DefSeekPage=x&SearchBack=ZyActionL&Back=ZyActionS&BackDesc=Results%20page&MaximumPages=1&ZyEntry=1&SeekPage=x&ZyPURL (Accessed 1/3/2016)

[14] EPA, 2006, 71 FR 388

[15] EPA, 2012, Drinking Water Standards and Health Advisories, EPA 822-S-12-001, http://www.epa.gov/sites/production/files/2015-09/documents/dwstandards2012.pdf (Accessed 1/3/2016)

[16] 40 CFR 23 and 40 CFR 131

In the proposed UCMR4, EPA describes its rationale for use of methods with minimum reporting levels that are lower than the health reference levels for the target analytes in UCMR4. The notice does not describe the HRLs for the majority of the UCMR4 contaminants. A retrospective review of available EPA documents found a number of analytes measured in the proposed UCMR4 for which the Agency has not previously identified an HRL.[17] In other instances, the Agency has found that there was insufficient information to compute an HRL (*e.g.*, anatoxin a, nodularin, and individual microcystins other than microcystin LR). Recognizing the limited nature of available health effects information for a number of the target contaminants, AWWA encourages the Agency to place greater value on the robustness of the reliability of the analytical methods employed in UCMR.

If EPA moves forward with the proposed analytes, the Agency should clearly and transparently communicate its rationale for each proposed analyte so that water systems that have positive observations have a sound basis for communication with the public about perceived risk.

*"[Inclusion of] the following contaminants that were considered by the workgroup, but not included in the proposed list because they were deemed a lower UCMR 4 priority than the contaminants identified in Exhibit 3: Legionella pneumophila and Mycobacterium avium (both are part of the draft CCL 4); ammonia (considered as an indicator of distribution system nitrification potential); and the pesticides vinclozolin, hexazinone and disulfoton (additional analytes in EPA Method 525.3)."*

AWWA supports the inclusion of manganese in the final UCMR4. In its comments on the Draft CCL4, AWWA recommended that manganese be included in the group for a future UCMR, and the timing is such that inclusion in the final UCMR4 is appropriate.

AWWA has noted the importance of *Legionella pneumophila* and *Mycobacterium avium* for several iterations of the SDWA CCL process.[18] While AWWA views these organisms as significant, we agree with EPA's rationale for not including these contaminants on the proposed UCMR4 and agree that they should not be included on the final UCMR4. AWWA's comments on CCL4 observed the need for a cohesive, risk-management oriented research

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[17] The HRLs referenced in EPA's January 2016 webcast generally mirror those available from previously available documents, see "Revisions to the Unregulated Contaminant Monitoring Rule for Public Water Systems" Public Webinar, January 13, 2016.

[18] AWWA Comments on Proposed CCL3 (May 2008, Docket: EPA-HQ-OW-2007-1189) [http://www.awwa.org/Portals/0/files/legreg/documents/AWWACCL3Comments.pdf] and AWWA Comments on Proposed CCL4 (April, 2015, Docket: EPA-HQ-OW-2012-0217) [http://www.awwa.org/Portals/0/files/legreg/documents/AWWACommentsDraftCCL4.pdf]



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program for biofilm organisms including *L. pneumophila* and *M. avium*. Such a program is outside the scope of UCMR and should be conducted through separate research studies.

With respect to monitoring ammonia, AWWA does not recommend monitoring ammonia in UMCR4. The collection of ammonia in the absence of a host of other data elements would be very challenging to interpret and use constructively. A substantial body of literature exists on nitrification, including a number of papers by EPA researchers that illustrate that forecasting and controlling nitrification is not possible using a single indicator like ammonia.[19, 20] The presence of ammonia (or in the instance of nitrification, the loss of ammonia) is not a "contaminant", nor is the presence of nitrification inherently a health concern. Consequently, utility monitoring of ammonia in finished water in the final UCMR4 is not appropriate under either SDWA Section 1445(a)(2) or Section 1445(a)(1)(A).

While AWWA appreciates the Agency looking for opportunities to consolidate around groups of chemicals that can be analyzed using a single analytical method (e.g., EPA Method 525.3), it is not appropriate to include contaminants that represent little opportunity for risk reduction, because it is possible to measure them. In comments on the CCL4 proposal, AWWA indicated that there was already sufficient information for EPA to make a negative regulatory determination for disulfoton. Neither EPA or AWWA has identified hexazinone as a priority drinking water contaminant for evaluation.[21, 22] Vinclozolin is a registered pesticide; consequently, it is regulated under the Federal Insecticide, Fungicide, and Rodenticide Act and the Food Quality Protection Act. As part of re-registration EPA prepared an analysis of the risks posed by Vinclozolin and explicitly considered models of high-risk exposure scenarios via drinking water. The Agency concluded:

> "Model estimates of potential drinking water exposure from ground and surface water sources **are not of concern for vinclozolin**." [emphasis added][23]

Consequently, while Vinclosolin is proposed for inclusion on CCL4, it is not a relevant analyte for UCMR monitoring.

*"Exhibit 3 that you think represent a lower priority than your new recommendation(s) or that should otherwise be removed from the list; the recommended analytical method(s) for any new*

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[19] Odell, L.H., G.J. Kirmeyer, A. Wilczak, J.G. Jacangelo, J.P. Marcinko, R.L. Wolfe, Controlling Nitrification in Chloraminated Systems, 1996, Journal AWWA, page 86 – 98.
[20] AWWA, Nitrification Prevention and Control in Drinking Water, AWWA Manual M56, Second Edition, 2013.
[21] EPA CCL4 Docket: EPA–HQ–OW–2012–0217
[22] AWWA, AWWA Recommendations for Contaminant Candidate List 4 (CCL4), 2015, [http://www.awwa.org/Portals/0/files/legreg/documents/2015CCLAWWAReport.pdf]
[23] EPA, RED Facts, Vinclozolin, EPA-738-F-00-021, 2000, [http://iaspub.epa.gov/apex/pesticides/f?p=CHEMICALSEARCH:31:::NO:1,3,31,7,12,25:P3_XCHEMICAL_ID:4400]

*contaminant(s) that you propose; and other relevant details (e.g., reporting level, sampling location and sampling frequency)."*

AWWA's CCL3 comments identified a number of contaminants with higher priority for collection of occurrence information, specifically: 1,4-dioxane, molybdenum, and 1,1-dichloroethane. These three contaminants are being monitored in UCMR3 and despite 0, 34, and 1 water systems to-date, respectively, observing these high priority contaminants at levels above the health reference level.[24]

EPA's proposed UCMR4 already includes many of the contaminants AWWA identified in its CCL4 analysis: anatoxin-a, cylindrospermopsin, microcystin-LA, microcystin-LR, microcystin-RR, and microcystin-YR, Chlorpyrifos, and manganese. AWWA also recommended monitoring the following in UCMR4:

1. microcystin-LW,
2. 3-Hydroxycarbofuran,
3. Azinphos-methyl,
4. Saxitoxin, and
5. Saxitoxin-related paralytic shellfish toxins.[25]

There is sufficient information to consider microcystin-LW, 3-Hydroxycarbonfuran, and Azinophos-methyl for inclusion in UCMR4. Exhibit 2 summarizes the relevant details for monitoring under UCMR4.

Exhibit 2. Recommended Additions to UCMR4 Monitoring

| Analyte | Available Methods | Reporting Level (µg/L) | Relevant Systems | Sampling Locations | Sampling Frequency |
|---|---|---|---|---|---|
| microcystin-LW | EPA 544 | * | Surface Water | Same as other cyanotoxins | Same as other cyanotoxins |
| 3-Hydroxycarbofuran | EPA 531,2 | 0.029 | All systems | Entry Point to Distribution System | Same as other pesticides |

[24] EPA, October 2015 UCMR 3 Data Summary for Chemical Contaminants, EPA 815-S-15-003, [http://www.epa.gov/dwucmr/occurrence-data-unregulated-contaminant-monitoring-rule#3]. It should be noted that there are 325 systems identified with 1,4-dioxane levels observed above the 1 in 1,000,000 risk level but none above the 1 in 10,000 risk level.

[25] AWWA, AWWA Recommendations for Contaminant Candidate List 4 (CCL4), 2015, [http://www.awwa.org/Portals/0/files/legreg/documents/2015CCLAWWAReport.pdf]



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| Analyte | Available Methods | Reporting Level (µg/L) | Relevant Systems | Sampling Locations | Sampling Frequency |
|---|---|---|---|---|---|
| Azinphos-methyl | EPA 525 | ** | All systems | Entry Point to Distribution System | Same as other pesticides |

Notes:
* Reporting level should be comparable to other six microcystins which EPA proposes to monitor using Method 544. Inclusion in UCMR4 would necessitate locating a suitable standard for development of a final MRL, calibration, and QA/QC.

** Reporting level would need to be established through an inter-laboratory method performance study.

There is an opportunity to remove contaminants from the proposed UCMR4 list in order to both make room within the analyte cap set in SDWA for UCMR4 and better align the UCMR4 rulemaking with public health priorities.

## Burden and Logistics

### UCMR4 Monitoring by Groundwater Systems

AWWA recommends that UCMR4 contaminants monitoring other than DBP monitoring, be reduced to a single sample per point of entry for groundwater systems. Other comments speak to an alternative monitoring strategy for UCMR4 DBPs. Moving to a single sample per EPTDS will result in a sufficiently robust dataset for the purposes UCMR monitoring is intended to serve. This suggestion is meant to compliment not replace representative monitoring.

A detailed analysis of UCMR3 data, based primarily on the June 2015 National Contaminant Occurrence Database, but also supported by some analysis of the October 2015 NCOD release demonstrate that there is little statistical basis for UCMR4 to include 2 samples for water systems that rely on ground water supplies. Rather, a single sample would provide data of equal robustness. This general statement is true across the families of compounds analyzed in UCMR3. There were specific instances where the nature of the contaminant or analytical method does warrant consideration before reducing monitoring to a single sample per point of entry. Instances warranting more careful evaluation include:

1. Where the performance of the method leads to high variability (*e.g.*, total chromium), and
2. When the expected variations in water treatment plant operations are likely to change the concentration of the target analyte in finished water (*e.g.*, disinfection practice and chlorate).



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See Attachment 2 for a preliminary summary of this analysis.

### Basing UCMR Applicability on Retail Population

In developing UCMR3, EPA chose to base the rule's applicability on retail population. As a consequence there are unintended complications in the implementation of UCMR4 monitoring, including:

1. Where wholesalers routinely assist their consecutive systems meet monitoring requirements, the current approach penalizes a collaborative and efficient sampling strategy.
2. If UCMR only collects consecutive system data then there is not a mechanism to collect the treatment and source water data currently envisioned.
3. Is inequitable without providing higher quality data. A wholesale distribution system network will collect many more samples and incur the higher associated sampling expense than a single water system of a similar size.

AWWA recommends that where wholesale and consecutive systems offer to provide a combined monitoring framework, that UCMR4 allow such submittals. The required number of samples should be no more than required of a single city of the same service population. Since monitoring under UCMR is a mandatory responsibility, systems participating in such a combined monitoring framework would be beholden to each other with respect to rule compliance. Where consecutive systems monitor as a standalone entity, they should not be responsible under this rulemaking for source water data and treatment information. The source and treatment information targeted by this data collection effort is the responsibility of the wholesale supplier and if the submitted dataset characterized only the consecutive system, the data would be misleading during subsequent analysis.

### Transparency in Rulemaking Process

Significant UCMR4 details should have been more clearly highlighted in the proposed rule notice. Federal Register notices often require a detailed understanding of the topic at hand and it can be challenging for the Agency to highlight all significant changes from past practice and their import. But, it is not reasonable for substantial expansions of the rule's scope to be relegated to footnotes. The following are examples where the current notice, and by extension the associated Information Collection Request (ICR) do not clearly articulate the proposed data collection and the associated burden:



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1. "TOC and bromide must be collected at the same time as HAA samples. These indicator samples must be collected at a single source water intake"[26]
2. "Temperature and pH must be measured at the same time as cyanotoxin samples at the source water intake ..."[27]
3. "Systems must assign a sample event code for each contaminant listed in Exhibit 1. Sample event codes must be assigned by the PWS for each sample event.[28]

### Use of Dedicated Data Portal

The proposed UCMR4 specifies that "Information that must be submitted using EPA's electronic data reporting system must be submitted through: *http://www2.epa.gov/dwucmr*." EPA is simultaneously developing the CMDP. CMDP is scheduled to be operational in 2017. The proposed UCMR data collection substantially overlaps with data currently submitted by water systems for compliance and will be submitted through CMDP. EPA's data collection should leverage existing compliance data submittals rather than require separate testing, analysis, and reporting to a parallel data system. Use of CMDP does not test the statutory objectives of the SDWA's unregulated contaminant monitoring provision, as is the case with the proposed rule construct. Compliance data would also be more robust in that data for TOC, pH, and individual HAAs would be much denser and reflect each system's current compliance status.

### Data Elements

AWWA has commented previously that understanding UCMR contaminant occurrence necessitates collection of appropriate ancillary data elements.[29] The current proposal includes a very lengthy list of data elements and element definitions that as a practical matter will lead to data entry errors and fail in many instances to meaningfully inform subsequent data analysis. This latter point is important to bear in mind as UCMR collects a snapshot of contaminant occurrence. This snapshot is not a sufficient to intuit the effects of treatment on occurrence beyond gross categorical binning. Consequently, AWWA recommends that EPA simplify the data elements and data definitions substantially.

AWWA's earlier comments also stipulated inclusion of ancillary data elements should occur after a dialogue with stakeholders on how to effectively collect that information.[30] The proposed data definitions for treatment and UCMR4 data collection scheme are unlikely to lead to improved UCMR analysis. At a minimum EPA should:

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[26] 80 FR 76921
[27] 80 FR 76921
[28] 80 FR 76921
[29] AWWA, Comment Letter on Proposed UCMR3 (Docket ID No. OW–2009–0090), May 2, 2011.
[30] AWWA, Comment Letter on Proposed UCMR3 (Docket ID No. OW–2009–0090), May 2, 2011.



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1. Simplify the data definitions for disinfection and treatment, reducing the number of oxidant options and focusing specifically on primary and secondary disinfection.
2. Limit treatment characterization to (no treatment, primary disinfection only, conventional treatment, softening, carbon contactors, and nanofiltration/reverse osmosis).
3. Eliminate secondary disinfectant definition "CAC", where "CAC" is chlorine and chloramines being mixed.
4. Eliminate excessive QA/QC tracking, such as data elements for extraction batch identification code, extraction date, analysis date, sample analysis type, additional value, and sample event code.

As previously noted, the submittal of additional laboratory QA/QC is not a wise use of limited resources. EPA is implementing UCMR4 with limited resources and is unlikely to have the necessary support system for qualifying laboratory information management system (LIMS) data uploads prior to UCMR laboratory approval. Absent such software, the limited value provided by this additional QA/QC data is not worth the transactional burden on laboratories or the potential for water system non-compliance due to failure of EPA QA/QC review to occur in a timely manner. EPA's experience to-date with this type of QA/QC data has been limited to contractual obligations with UCMR laboratories processing small system samples – this experience is substantially different from setting a regulatory requirement to which all water systems conducting monitoring at their own expense through multiple commercial laboratories must adhere. This provision is also an impediment to AWWA's recommendation that EPA use CMDP to achieve some of the data collection objectives described in the UCMR4 proposal.

The use of the Sample Event Code data element is another opportunity for an extraneous data element to lead to inadvertent non-compliance or, a transactional cost for participating water systems and EPA. Compliance with UCMR is based on meeting the monitoring requirements. This proposed data element does not contribute toward that task but it does create the opportunity for data entry errors.

### Statistical Basis for the Small System Sample

The UCMR4 proposal preamble introduces the concept of State Implementation Plans and the statistical premise for the UCMR4 small system sample.[31] The statistical premise cited for the small system sample is an analysis prepared in 1999.[32] The referenced analysis does not address the current UCMR4's proposed changes including:

[31] 80 FR 76901

[32] EPA, Statistical Design and Sample Selection for the Unregulated Contaminant Monitoring Regulation (1999).



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1. Utilizing a stratified sampling construct for cyanotoxin monitoring,
2. Eliminating monitoring in December, January, and February, and
3. Collecting data representative of untreated source water.

While the 1999 analysis spoke directly to the size of the representative sample, it was premised solely on the objective of describing contaminant occurrence in finished water.

## Summary

AWWA supports a robust UCMR monitoring program so that EPA is able to meet its statutory requirements when determining whether or not a national regulation is needed and what an appropriate drinking water standard might be. Sound national occurrence information is critical to the regulatory determinations EPA must make in assessing whether a national regulation will provide a meaningful opportunity for risk reduction. The proposed UCMR4 is a step in the right direction for the development of sound national occurrence data, but several critical revisions are needed in the final UCMR4 for cyanotoxins, DBPs, and other issues.



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# Attachment A: Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) Extension: Brominated Disinfection Byproducts Analysis

The following report is an interim work product. The research team is preparing a paper for submission to a peer-reviewed journal. A copy of the accepted paper will be forwarded to the Agency once it is published.

CORONA | ENVIRONMENTAL CONSULTING  University of Colorado Boulder

# WITAF #266
# Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) Extension: Brominated Disinfection Byproducts Analysis

**Draft Report**

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# 1 Introduction

## 1.1 Background

Reducing exposure to disinfection byproducts (DBPs) remains a concern for the national drinking water utility community. The Stage 2 Disinfectants and Disinfection Byproducts Rule (Stage 2 DBPR) (USEPA, 2006) is the most recent regulatory change the drinking water community has addressed to reduce DBP exposure, with its April 1, 2012 compliance monitoring deadline for Community Water Systems (CWSs) and Non-Transient Non-Community Water Systems (NTNCWSs) serving at least 100,000 people. The WITAF #266 Post-Stage 2 DBPR Regulated DBP Occurrence (Systems > 100,000 persons served) study (Seidel et al., 2015), funded and directed by the American Water Works Association, was implemented to assess DBP occurrence since the implementation of the Stage 2 DBPR. The study collected DBP data from state regulatory agencies for all but five states, provided quality assurance for data from >95% of very large CWSs, and housed the data in a well-documented database. The study developed a preliminary assessment of the impacts of the Stage 2 DBPR using the compiled data, which is sufficiently representative of national DBP data to allow characterization of current DBP exposures and evaluation of trends.

Brominated DBPs are understood to pose a greater health risk than their fully chlorinated counterparts for both regulated classes of DBPs, trihalomethanes (THMs) and haloacetic acids (HAAs) (Richards et al., 2007). An important concern regarding the implementation of the Stage 2 DBPR is how the occurrence of the three brominated THM species (THM3) and six brominated HAA species (HAA6-Br) have changed overall and in comparison to changes in total trihalomethane sum (TTHM), the sum of the five regulated haloacetic acids (HAA5), and the sum of all nine haloacetic acids (HAA9), as a result of treatment changes to meet the regulation. The preliminary analysis conducted through the WITAF #266 study suggests that a decrease in chloroform concentrations, and not in the brominated THM species, may have occurred on a national scale since the implementation of the Stage 2 DBPR. This study aims to further investigate the extent of brominated DBP formation through analyzing brominated DBPs, specifically HAA9 and HAA6-Br, and bromine incorporation factor trends. Bromine incorporation factors, also known as bromine fractions, are calculated based on the relative number of bromine substitutions in the species in a given DBP class to the total number of halogen substitutions (Obolensky & Singer, 2005).

While the WITAF #266 database contains a rich temporal and geographic span of TTHM, THM species, HAA5 and HAA5 species data, data for the four unregulated haloacetic acids (HAA4) are limited. Modeling techniques for estimating concentrations of the HAA4 species allow for estimating HAA9 and HAA6-Br concentrations in instances where THM species and HAA5 species concentrations are known. The resulting modeled HAA9 and HAA6-BR occurrence data developed using the WITAF #266 database can provide insights into the impact of the Stage 2 DBPR on the occurrence of brominated DBPs on a national scale. An analysis of the brominated DBPs, specifically modeled HAA9 and HAA6-Br, will allow important questions to be answered, such as

- How have HAA9 and HAA6-Br concentrations changed over time, given the implementation of the Stage 1 and 2 DBP Rules?
- How have bromine incorporation factors changed over time, given the implementation of the Stage 1 and Stage 2 DBP Rules?



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## 1.2 Project Goals

The objectives of this project were

- Modeling brominated disinfection byproduct concentrations, specifically haloacetic acid 9 (HAA9) that is a focus of the Fourth Unregulated Contaminant Monitoring Rule, using existing data from the WITAF 266 database including total trihalomethane (TTHM) and TTHM species, haloacetic acid 5 (HAA5), and HAA5 species.
- Comparing and validating calculated bromine incorporation factor values and modeled HAA9 concentrations with observed data where available.
- Analyzing the modeled HAA9 data pre- and post-State 2 Disinfection Byproduct Rule implementation and over time and geographically.

The analysis of brominated DBPs occurrence conducted in this study provides an important understanding, particularly for future regulations that may include separate consideration of brominated THM and HAA species in addition to the currently regulated sums.

# 2 Methods and "Representativity"

## 2.1 Modeling Approach for HAA4 Species and HAA9

While the WITAF #266 database contains a wealth of data for TTHM, THM species, HAA5 and HAA5 species, there is very limited data for HAA4 species available. Modeling the HAA4 species provides an opportunity to model HAA9, as well as HAA6-Br. Modeled HAA9 and HAA6-Br concentrations can be compared with HAA5 concentrations to analyze relative changes in brominated DBPs before and after the implementation of the Stage 2 DBPR. For samples in which THM species concentrations and HAA5 species concentrations are known, HAA4 species can be estimated using the following equations:

$$[BrCl_2AA] = [Cl_3AA] \times [CHBrCl_2]/[CHCl_3] \quad (1)$$

$$[Br_2ClAA] = [Cl_3AA] \times [CHBr_2Cl]/[CHCl_3] \quad (2)$$

$$[Br_3AA] = [Cl_3AA] \times [CHBr_3]/[CHCl_3] \quad (3)$$

$$[BrClAA] = 0.5\ [\langle CHBrCl_2 + CHBr_2Cl\rangle\ Cl_2AA]/CHCl_3 \quad (4)$$

in which BrClAA, $BrCl_2AA$, $Br_2ClAA$, $Br_3AA$, $Cl_2AA$, and $Cl_3AA$ refer to the molar concentrations of bromochloro-, bromodichloro-, dibromochloro-, tribromo-, dichloro-, and trichloro-acetic acids, respectively, and $CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, and $CHBr_3$ refer to the molar concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, respectively. Eq 1-3 were developed and validated by Roberts et al. (2001) using data from the Information Collection Rule, based on equal bromine incorporation among corresponding trihalomethane species and trihaloacetic acid species relative to the fully-chlorinated species. Eq 4 was developed by Shoaf & Singer (2007) using the assumption the degree of bromine incorporation is an average of the extent of bromine incorporation in bromodichloromethane and dibromochloromethane relative to chloroform.

To validate this modeling approach, THM species and HAA9 species concentration data for a given sample event were merged together using sample information, where available, provided in the WITAF #266 database, including Sample ID, Collection Date, Sample Type, Sample Point Type, Sample Point Description, Facility Name, and Facility ID. Data records from water utilities in fourteen states included



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sufficient sample information to develop unique sample identifiers for a given sample event for merging THM species concentration data, and in thirteen states for merging HAA5 species concentration data. Sample data for merging all THM and HAA9 species in a given sample event were available for five water utilities for modeling validation. Molar concentrations were calculated for each DBP species' mass concentrations, and the HAA4 species were modeled using Eq 1-4. The corresponding mass concentrations were calculated for the modeled HAA4 molar concentrations. The observed HAA4 species concentrations were then added to the observed HAA5 species concentrations to determine the observed HAA9 concentrations, and similarly, the modeled HAA4 species concentrations were added to the observed HAA5 species concentrations to calculate the modeled HAA9 concentrations. Figure 1 shows the modeled HAA9 concentrations versus the observed HAA9 concentrations; the corresponding $R^2$ value is 0.9 demonstrating a good fit for the modeling approach based upon the limited observed HAA9 values available in the WITAF #266 database.

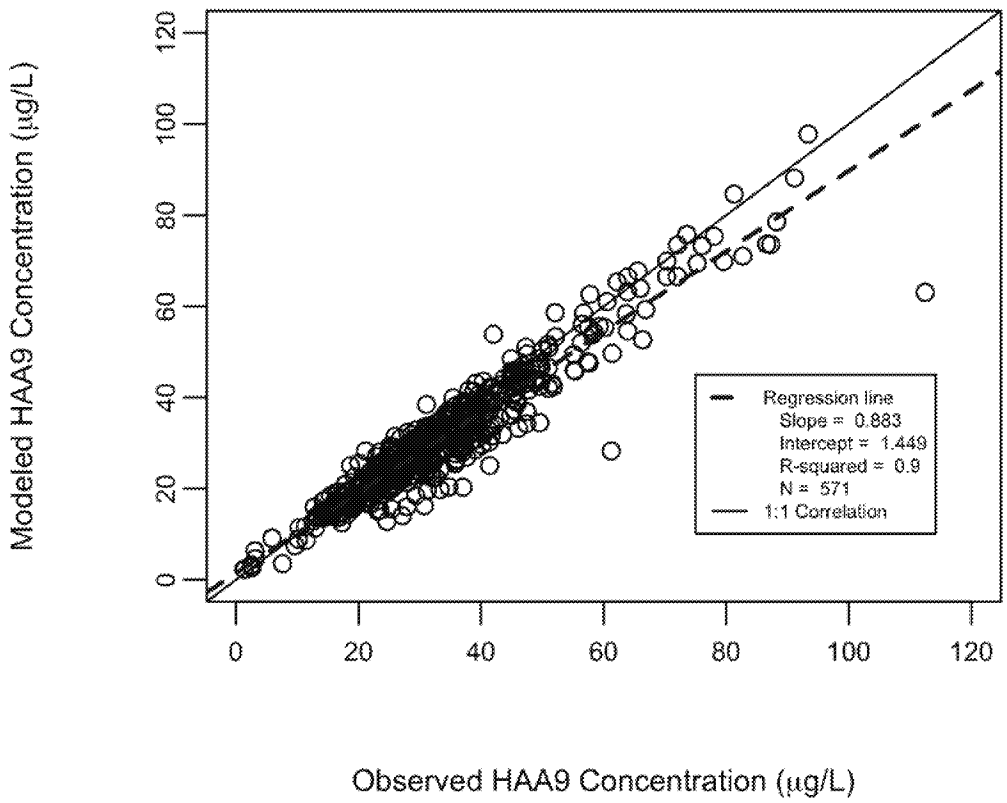


*Figure 1 Modeled HAA9 Concentration versus Observed HAA9 Concentration*

While this modeling approach illustrated in Figure 1 produced good results, HAA4 species could only be modeled for sample data from 55 systems in 13 states, due to limited sample information for merging species data. In the preliminary analysis of the WITAF #266 study, running annual averages of the 95$^{th}$ percentile concentration by PWS were validated and used as a representative non-locational statistical



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surrogate to represent locational running annual averages (LRAAs). In a similar manner, this study developed a second modeling approach by calculating quarterly 95th percentile concentrations by PWS for each THM and HAA9 species, and merging the resulting quarterly 95th percentile concentrations by PWS for modeling HAA4 species and HAA9. Using this approach, HAA4 species and HAA9 can be modeled for 243 water utilities in 23 states, which would allow for a far greater national representation in the analysis of brominated DBP occurrence.

For the quarterly 95th percentile by PWS approach, molar concentrations were calculated for each mass concentration, the HAA4 species were modeled using Eq 1-4, and corresponding mass concentrations were calculated. As with the first modeling approach where species concentrations were merged by sample information, modeled quarterly 95th percentile HAA9 concentrations by PWS were calculated by adding the modeled quarterly 95th percentile HAA4 concentrations to the observed quarterly 95th percentile HAA5 concentrations. Figure 2 shows the modeled versus observed values for the quarterly 95th percentile HAA9 concentrations. The $R^2$ value is 0.902, showing a very similar fit to the first modeling approach.

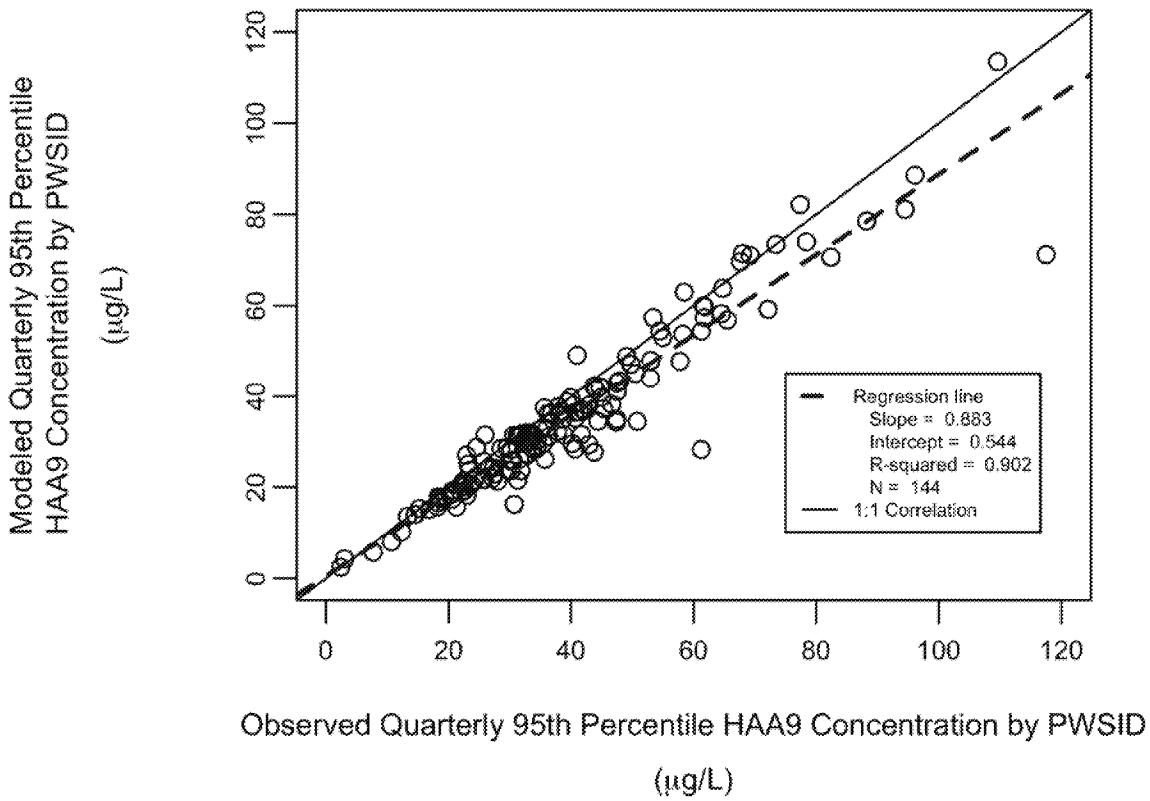


*Figure 2 Modeled Quarterly PWS 95th Percentile HAA9 Concentrations versus Observed Quarterly PWS 95th Percentile HAA9 Concentration*



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## 2.2 Approach for Calculating Bromine Incorporation Factors

The quarterly 95th percentile concentration by PWS modeling approach for HAA4 species and HAA9 can be further validated through the calculation of bromine incorporation factors (BIFs). BIFs quantify the formation of brominated DBP species within a class of DBPs relative to the total DBP formation. BIFs for THMs, dihaloacetic acids (2XAAs), and trihaloacetic acids (3XAAs) can be calculated using the following equations (Obolensky & Singer, 2005):

$$\text{THM BIF} = \frac{([CHBrCl_2] + 2\ x\ [CHBr_2Cl] + 3\ x\ [CHBr_3])}{3\ x\ ([CHCl_3] + [CHBrCl_2] + [CHBr_2Cl] + [CHBr_3])} \quad (5)$$

$$\text{2XAA BIF} = \frac{([BrClAA] + 2\ x\ [Br_2AA])}{2\ x\ ([Cl_2AA] + [BrClAA] + [Br_2AA])} \quad (6)$$

$$\text{3XAA BIF} = \frac{([BrCl_2AA] + 2\ x\ [Br_2ClAA] + 3\ x\ [Br_3AA])}{3\ x\ ([Cl_3AA] + [BrCl_2AA] + [Br_2ClAA] + [Br_3AA])} \quad (7)$$

in which BrClAA, $Br_2AA$, $Cl_2AA$, $BrCl_2AA$, $Br_2ClAA$, $Br_3AA$, and $Cl_3AA$ refer to the molar concentrations of bromochloro-, dibromo-, dichloro-, bromodichloro-, dibromochloro-, tribromo-, and trichloro-acetic acids, respectively, and $CHCl_3$, $CHBrCl_2$, $CHBr_2Cl$, and $CHBr_3$ refer to the molar concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform, respectively.

BIFs were calculated for THMs, 2XAAs, and 3XAAs using Eq 5-7 using the two approaches described above for modeling HAA9. In the first approach, species concentrations data for a given sample event were merged based on sample information, and in the second approach, quarterly 95th percentile species concentrations by PWS were merged together. Once the BIFs were calculated, the distribution of BIFs for both approaches, during the two years before the Stage 2 DBPR implementation (April 1, 2010 – March 31, 2012) and for the two years after the Stage 2 DBPR implementation (April 1, 2012 – March 31, 2014) were compared to determine if they were statistically different. To do this, the 95th percentile values by PWS for the two years before the Stage 2 DBPR and the two years after the Stage 2 DBPR for BIFs from both approaches were calculated. Systems that did not have a 95th percentile value in both the two years before and the two years after were removed from the analysis. Figure 3 shows the cumulative probability distribution of the 95th percentile THM BIF values by PWS for both approaches; this analysis includes data for 52 systems in 12 states. Figure 4 and Figure 5 show the same cumulative probability distributions for the 2XAA BIF and for the 3XAA BIF, respectively. The analysis shown in both Figure 4 and Figure 5 included data for 36 systems from 9 states.



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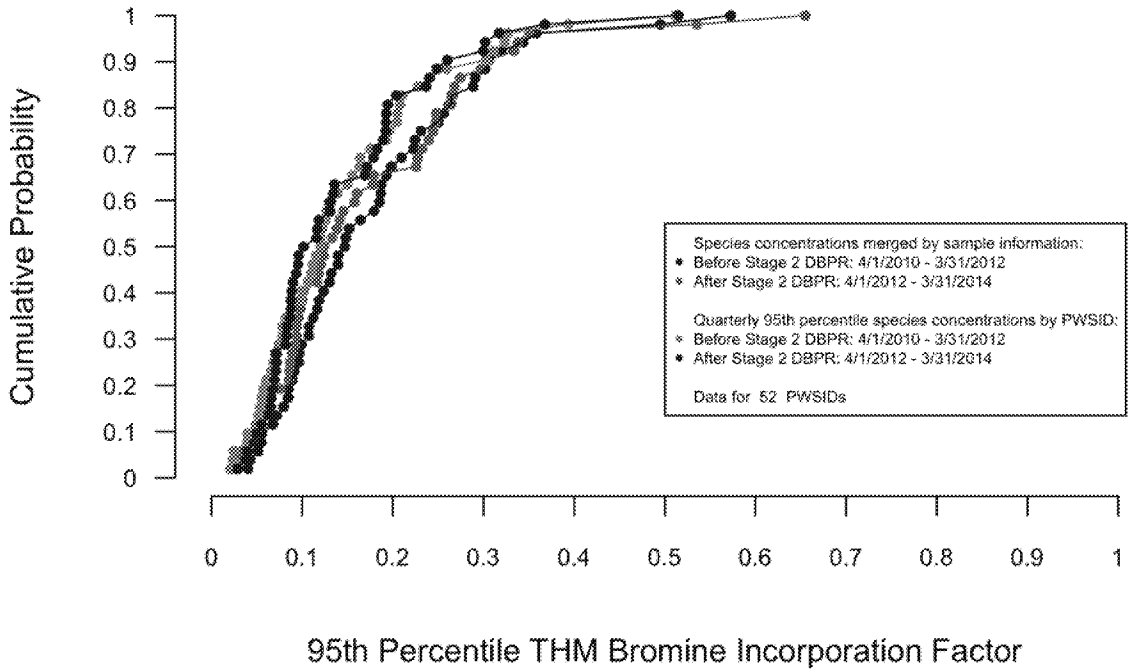


*Figure 3 Comparison of THM BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*

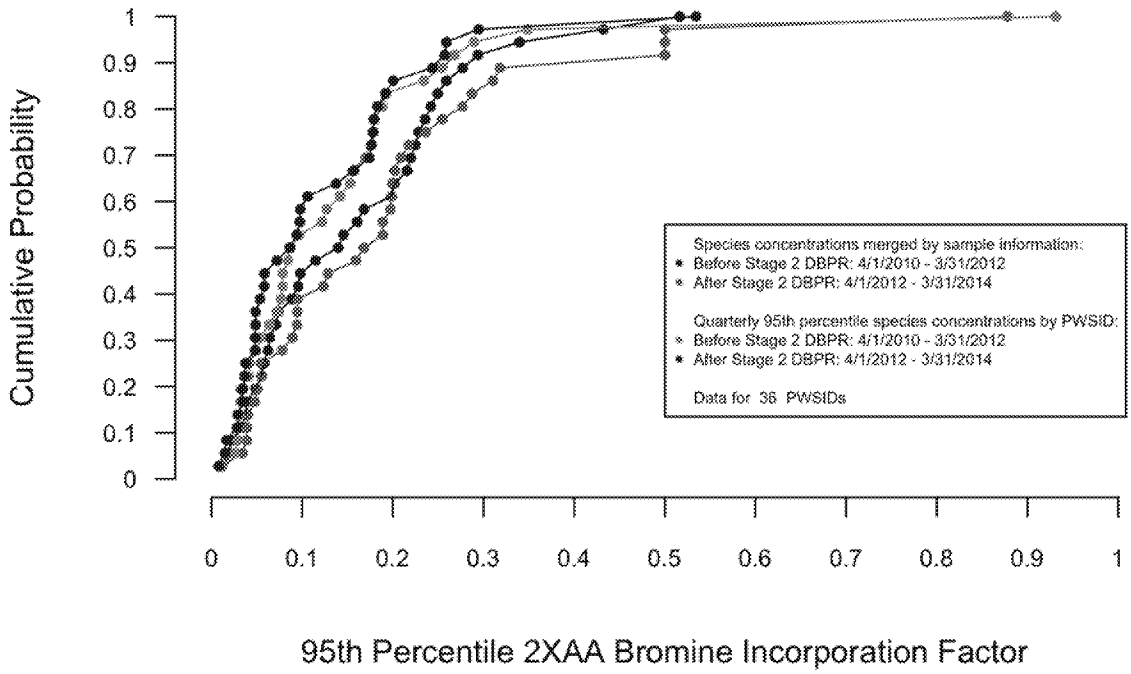


*Figure 4 Comparison of 2XAA BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*



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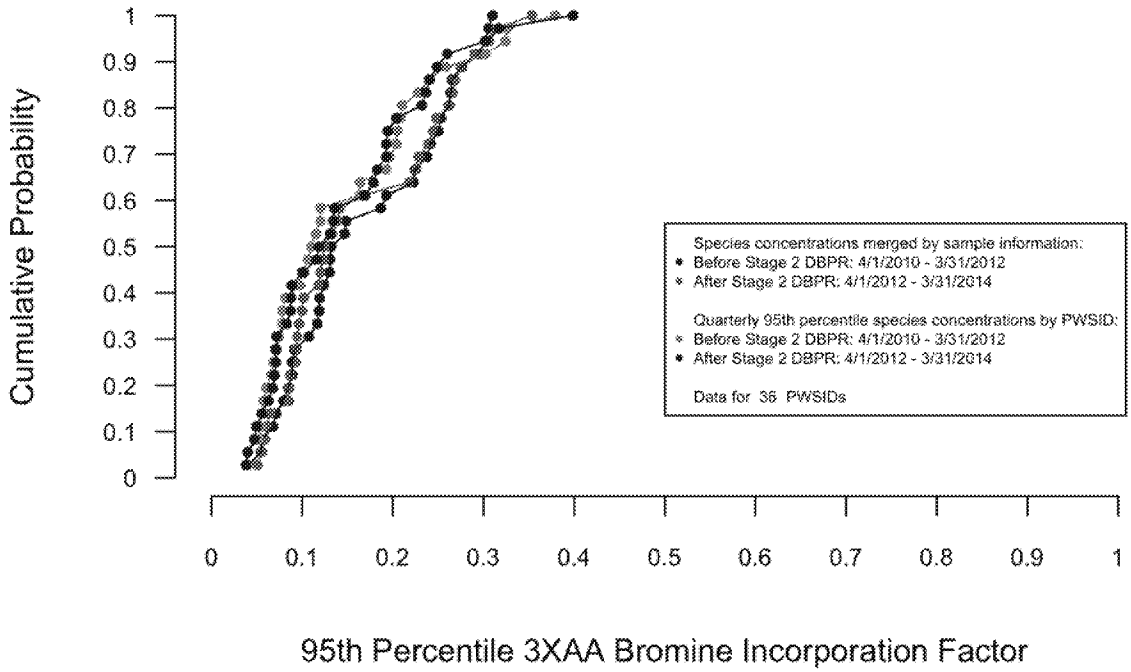


*Figure 5 Comparison of 3XAA BIFs: Calculated from Species Concentrations Merged with Sample Information versus Calculated by Merging Quarterly PWS 95th Percentile Species Concentrations*

The Kolmogorov–Smirnov (KS) two-sample test (Young, 1977) and the two *k*-sample versions of the Anderson-Darling (AD) test (Scholz & Stephens, 1987) were employed to determine if the distributions of corresponding BIFs during the same two-year time period, either the two years before or the two years after the Stage 2 DBPR, calculated through the two different approaches were statistically different. The resulting p-values for each of the tests are shown in Table 1. In all cases with a 95% confidence level, the distributions of corresponding BIFs calculated using the two different approaches are not statistically different. These findings provide justification that the approach for calculating BIFs by using quarterly 95$^{th}$ percentile species concentrations by PWS is representative of the "true" BIFs, calculated from species concentrations for a given sample event.

*Table 1 Results of Statistical Tests Comparing Distributions of PWS 95$^{th}$ Percentile BIFs Calculated Using Species Concentrations Merged by Sample Information with Corresponding PWS 95$^{th}$ Percentile Bromine Incorporation Factors Using Quarterly 95$^{th}$*

| Item | THM BIF | | 2XAA BIF | | 3XAA BIF | |
|---|---|---|---|---|---|---|
| | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* |
| *KS test p-value* | 0.07754 | 0.4206 | 0.2106 | 0.06939 | 0.3364 | 0.2123 |
| *AD test version 1 p-value* | 0.063878 | 0.40534 | 0.15616 | 0.072521 | 0.20546 | 0.24453 |
| *AD test version 2 p-value* | 0.063704 | 0.40379 | 0.15795 | 0.070525 | 0.20332 | 0.24491 |



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The results from comparing the two modeling approaches for HAA4 species and HAA9 and the two approaches for calculating the BIFs indicate the two approaches in both cases provide results that do have statistically significant difference. The sections that follow provide analysis solely based on modeling HAA4 species, HAA9, and HAA6-Br, and calculating BIFs based on quarterly 95th percentile concentrations by PWS, which is representative of results that would be seen based on using species concentrations from specific sample events.

## 2.3 National "Representativity"

The WITAF #266 database provides sufficient data for modeling HAA4 species and HAA9 concentrations, and calculating 2XAA and 3XAA BIFs using modeled species, based on quarterly 95th percentiles by PWS for 243 water utilities in 23 states. The database contains data for TTHM and HAA5 concentrations in 394 systems and 386 systems, respectively, in 44 states. An important consideration is how well the distribution of the TTHM and HAA5 concentration data in systems with sufficient data for modeling HAA9 compares to the distribution of TTHM and HAA5 concentration data in all systems where this data is available. To address this question, a similar approach as to that taken in Section 2.2 was employed. For all systems where TTHM concentrations data were available and for systems with sufficient data to model HAA9, the 95th percentile value by PWS, in the two years before the Stage 2 DBPR and in the two years after the Stage 2 DBPR, was calculated for the quarterly 95th percentile TTHM concentrations by PWS. The same analysis was conducted for HAA5 concentrations. Figure 6 shows the results for the cumulative probability distributions of 95th percentile values for TTHM data, and Figure 7 shows the corresponding results for HAA5 data.

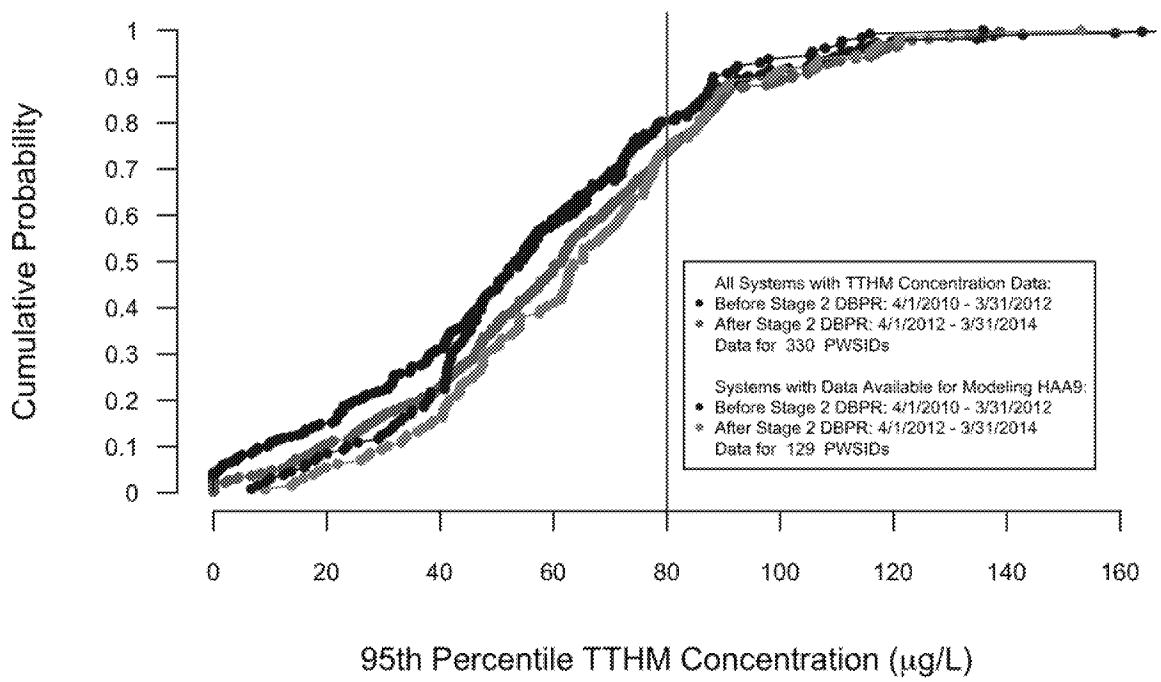


*Figure 6 Cumulative Distributions of PWS 95th Percentile Value of Quarterly PWS 95th Percentile TTHM Concentration for All Systems with TTHM Data and for Systems with THM and HAA5 Species Data for Modeling HAA9 before and after Implementation of the Stage 2 DBPR*



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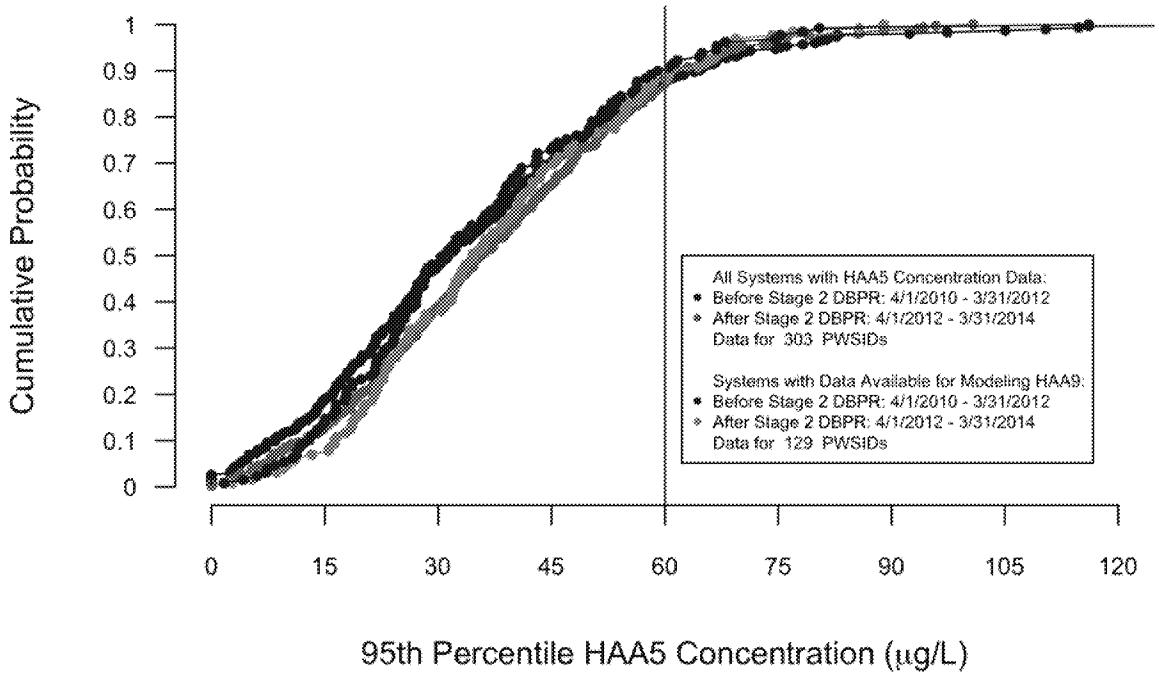


*Figure 7 Cumulative Distributions of PWS 95th Percentile Value of Quarterly PWS 95th Percentile HAA5 Concentration for All Systems with HAA5 Data and for Systems with THM and HAA5 Species Data for Modeling HAA9 before and after Implementation of the Stage 2 DBPR*

The KS two-sample test and the two *k*-sample versions of the AD test were applied to determine if there were statistically differences in the two distributions of TTHM data in each time period, and in the two distributions of HAA5 data in each time period. The resulting p-values are provided in Table 2; with a 95% confidence level, none of the distributions compared were statistically different. This result provides confidence that the distribution of modeled HAA4 species, HAA9, HAA6-Br, and the calculated 2XAA and 3XAA BIFs with modeled HAA4 species represent the "true" national distribution of HAA4 species, HAA9, HAA6-Br, and 2XAA and 3XAA BIFs.

*Table 2 Results of Statistical Tests Comparing Distributions of PWS 95th Percentile Values for Quarterly PWS 95th Percentile TTHM/HAA5 Concentrations for All Systems with TTHM/HAA5 Data with Systems with Sufficient Data for Modeling HAA9*

| Item | TTHM | | HAA5 | |
|---|---|---|---|---|
| | *Before Stage 2 DBPR* | *After Stage 2 DBPR* | *Before Stage 2 DBPR* | *After Stage 2 DBPR* |
| *KS test p-value* | 0.1952 | 0.4972 | 0.7821 | 0.8746 |
| *AD test version 1 p-value* | 0.090358 | 0.21953 | 0.35914 | 0.69765 |
| *AD test version 2 p-value* | 0.087815 | 0.21215 | 0.35428 | 0.69304 |



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# 3 Analysis of Brominated DBP Occurrence

## 3.1 HAA9 and HAA6-Br

Analysis of HAA9 and HAA6-Br occurrence focused on modeled quarterly 95th percentile HAA9 and HAA6-Br concentrations by PWS as a representation of national HAA9 and HAA6-Br occurrence. Figure 8, Figure 9, and Figure 10 show yearly boxplots of HAA9, HAA6-Br and HAA5 quarterly 95th percentile concentrations by PWS, respectively. In each of these figures, the horizontal lines inside the boxes represent the median values, lower and upper ends of the boxes represent the 25th and 75th percentile values, the ends of the "whiskers" at the bottom and top of the boxes represent the 5th and 95th percentile values, and the circles below and above the whiskers represent values less than the 5th percentile and greater than the 95th percentile. The red horizontal line in each figure represents the maximum contaminant level (MCL) for the regulated HAA5 sum and is included as a reference point. The dataset used in this analysis is filtered so that each boxplot in Figure 8, Figure 9, and Figure 10 is based on data for the exact same 84 systems from 15 states.

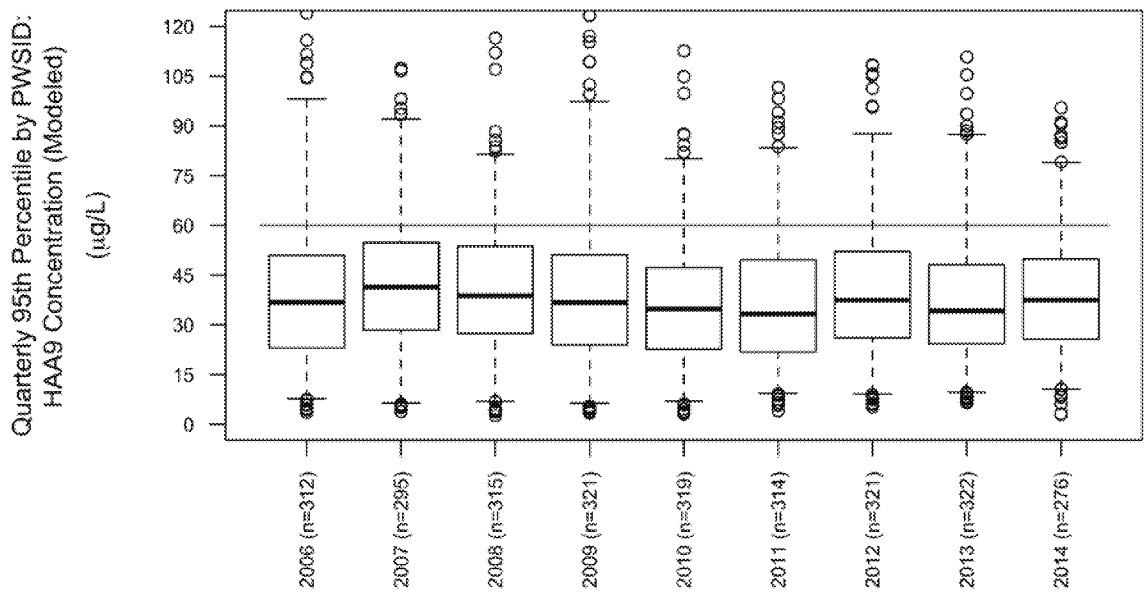


*Figure 8 Yearly Boxplots of Quarterly PWS 95th Percentile HAA9 Concentrations (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*



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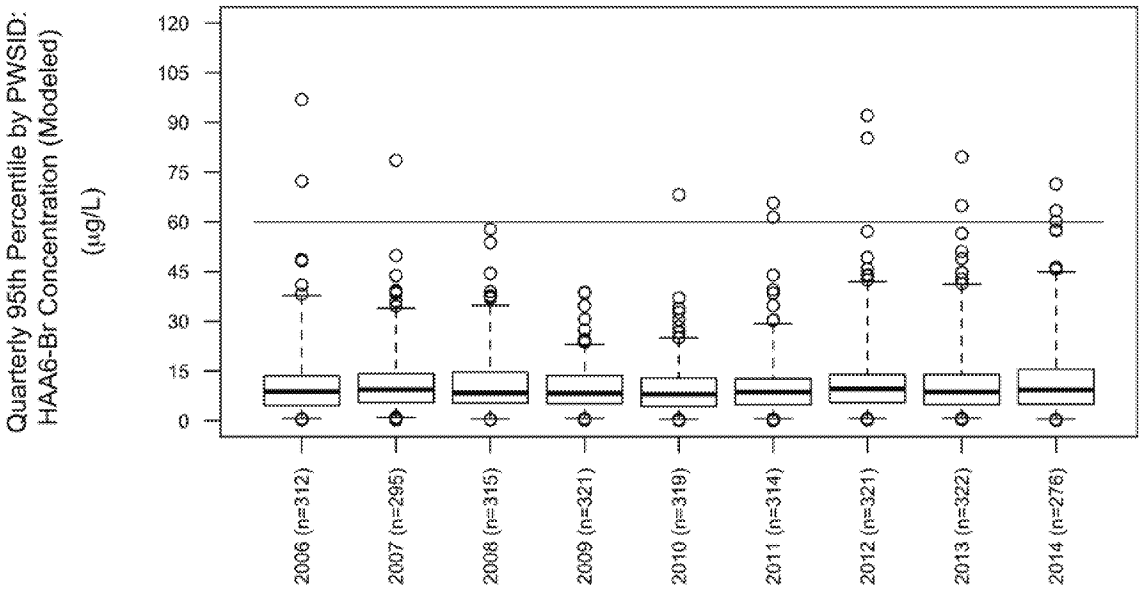


*Figure 9 Yearly Boxplots of Quarterly PWS 95th Percentile HAA6-Br Concentrations (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*

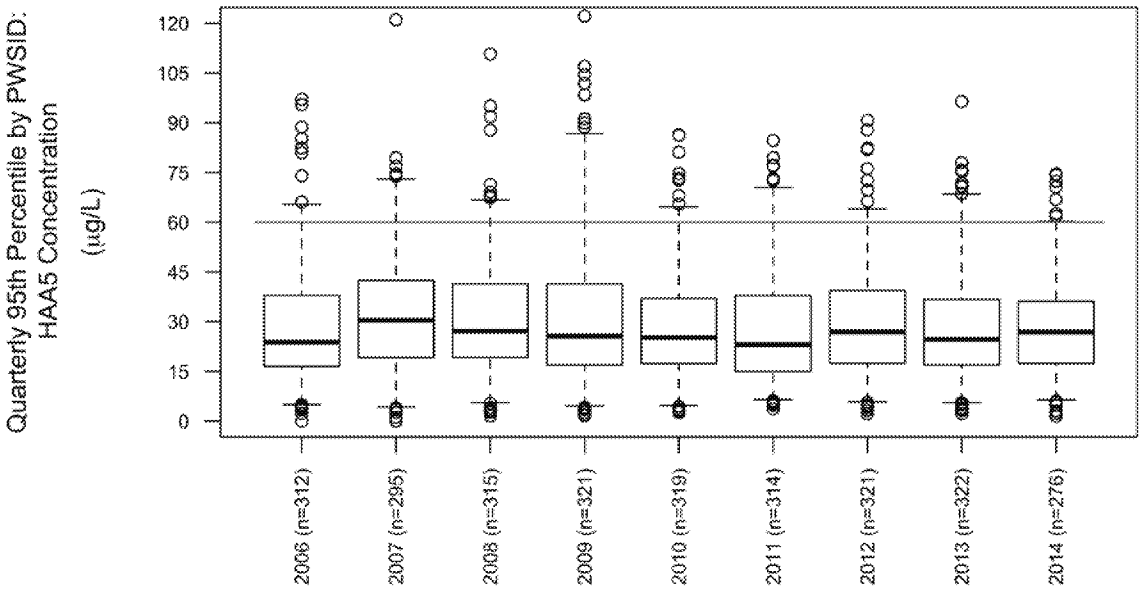




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*Figure 10 Yearly Boxplots of Quarterly PWS 95th Percentile HAA5 Concentrations for 84 Water Utilities in 15 States from 2006 – 2014*

There is some variability present in the yearly boxplots for HAA9 shown in Figure 8, although there is no clear trend over the years included in the analysis, particularly for the median, 25$^{th}$ and 75$^{th}$ percentile values. There does appear to be some decrease in 95$^{th}$ percentile and greater values over time. No significant changes are apparent in HAA9 concentrations after the Stage 2 DBPR implementation as compared with the years prior. In the yearly boxplots for HAA6-Br shown in Figure 9, there is very little variability in median and 75$^{th}$ percentile concentrations over the years of this analysis, although these values are just slightly higher in the boxplots representing years after the Stage 2 DBPR implementation (2012 – 2014) than the boxplots representing the three years prior (2009 – 2011). The 95$^{th}$ percentile and greater HAA6-Br concentrations do appear to have increased in the years after the Stage 2 DBPR implementation. Figure 10 is included in this analysis to compare changes in HAA9 and HAA6-Br over time to changes in HAA5. Once again, there is no clear trend apparent in the yearly boxplots for HAA5, although 75$^{th}$ and 95$^{th}$ percentile values appear to be relatively low in the years after the Stage DBPR implementation. Overall, this analysis suggests that there may have been less reduction in the brominated HAA species relative to the reduction in regulated HAA5 species in the few years following the Stage 2 DBPR implementation.

To further analyze any changes in HAA9 and HAA6-Br concentration before and after the implementation of the Stage 2 DBPR, the cumulative distribution of the 95$^{th}$ percentile value by PWS of modeled quarterly 95$^{th}$ percentile HAA9 and HAA6-Br concentrations by PWS in the two years before the Stage 2 DBPR implementation (April 1, 2010 – March 31, 1012) were compared with the corresponding cumulative distribution in the two years after the Stage 2 DBPR implementation (April 1, 2012 – March 31, 2014). The before and after Stage 2 DBPR cumulative distributions for HAA9 are shown in Figure 11, and the cumulative distributions for HAA6-Br are shown in Figure 12. In both cases, the cumulative distributions in the "after" time period are shifted slightly to the right, indicating overall increases in HAA9 and HAA6-Br occurrence. The greatest spread between the cumulative distributions for HAA9 occurs close to the 50$^{th}$ percentile water utility, while the greatest increases in HAA6-Br concentration appear to have occurred in water utilities with the highest HAA6-Br concentrations.



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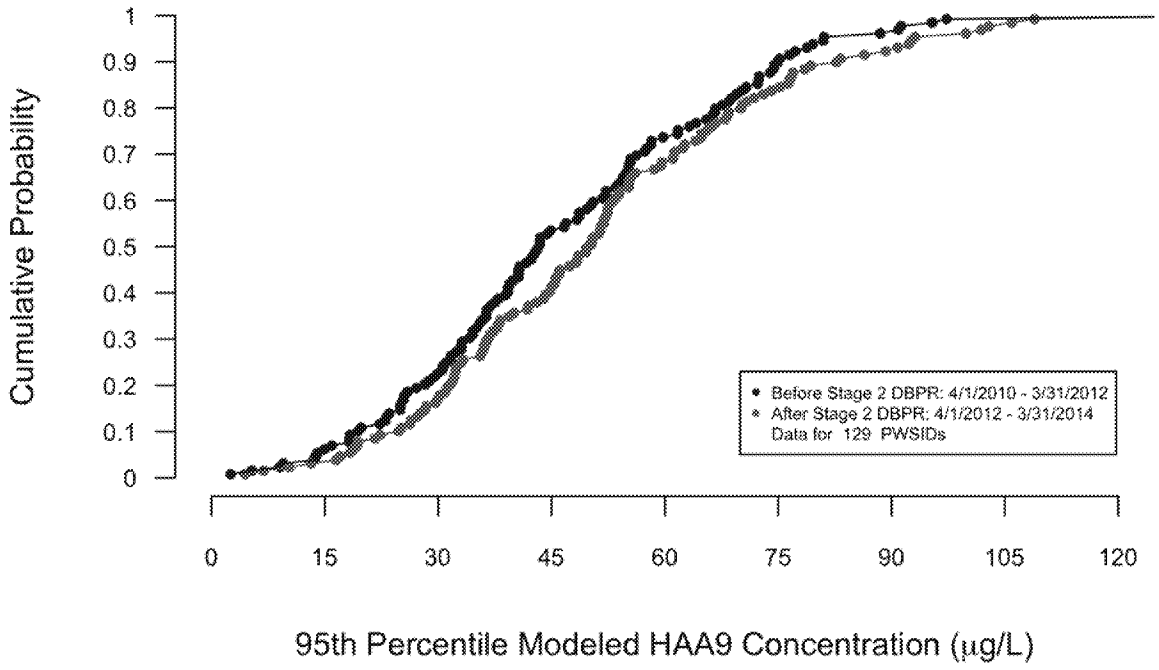


*Figure 11 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA9 Concentration before and after Implementation of the Stage 2 DBPR*

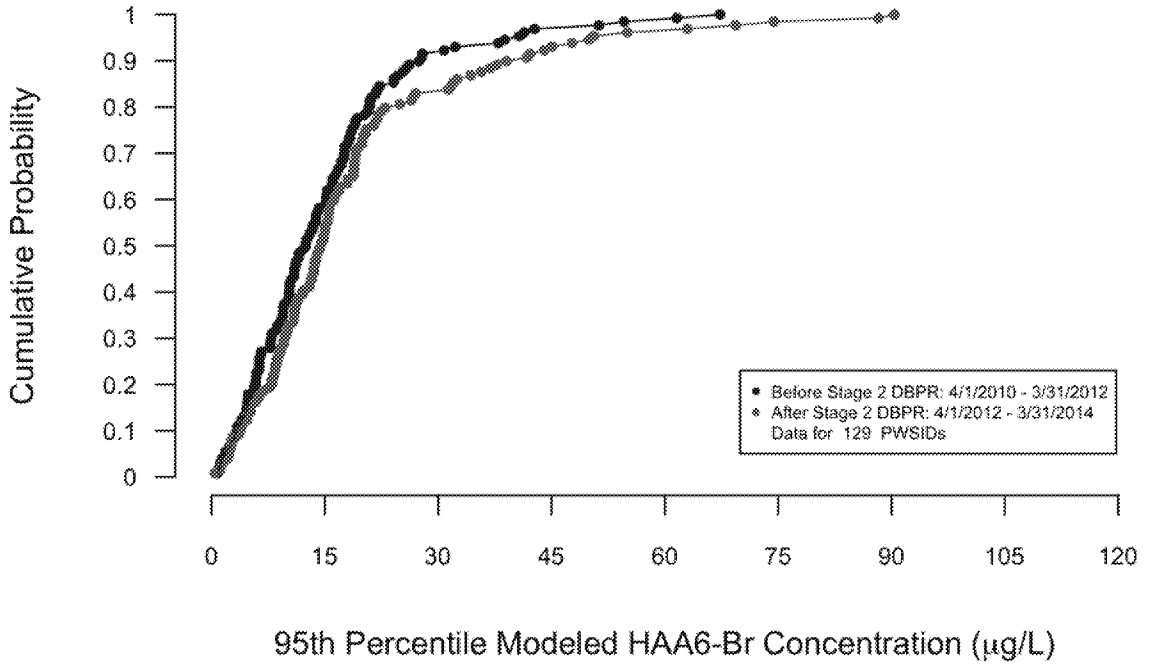


*Figure 12 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA6-Br Concentration before and after Implementation of the Stage 2 DBPR*



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To further assess impacts of the Stage 2 DBPR on HAA9 and HAA6-Br concentration, the cumulative distribution plots were modified to show the change in 95$^{th}$ percentile HAA9 and HAA6-Br concentration for individual PWSs. Figure 13 shows the same cumulative distribution for the "before" time period for HAA9 as Figure 11, and horizontal black lines extend from each 95$^{th}$ percentile HAA9 concentration before Stage 2 DBPR to the corresponding 95$^{th}$ percentile HAA9 concentration after Stage 2 DBPR, effectively showing the change in 95$^{th}$ percentile HAA9 concentration for each PWS. Figure 14 presents the same information for 95$^{th}$ percentile HAA6-Br concentration. More systems experienced increases in both HAA9 and HAA6-Br concentrations than decreases, and systems that did have decreases in HAA9 or HAA6-Br concentrations were generally systems with relatively high concentrations before Stage 2 DBPR. Very few systems show significant decrease in HAA6-Br concentrations.



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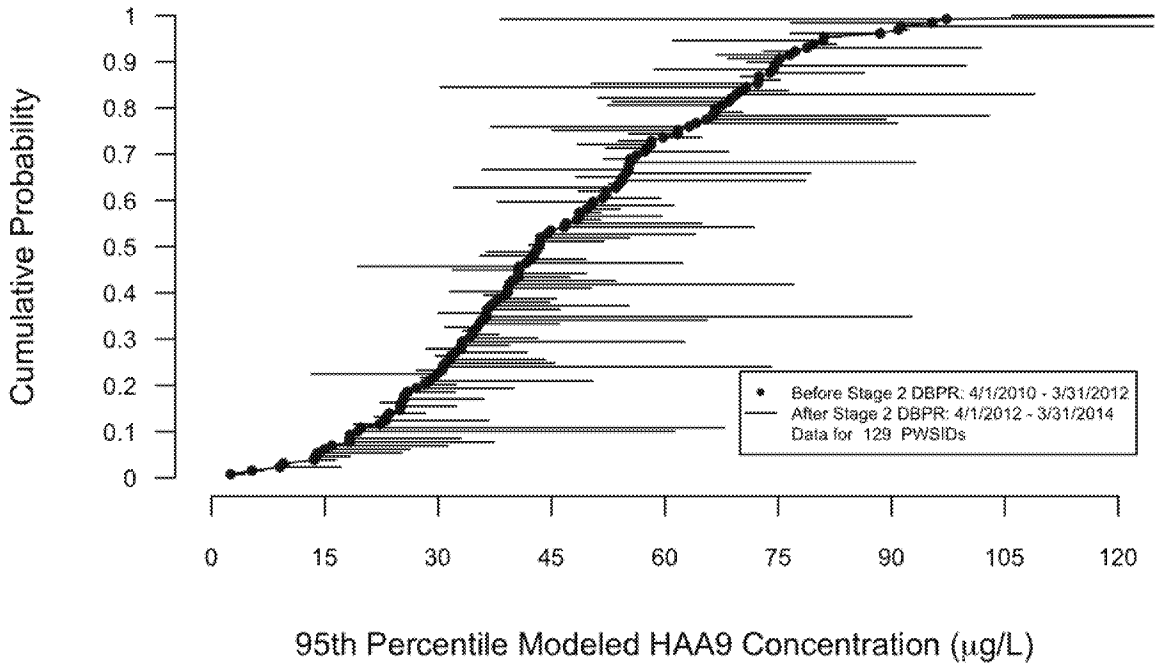


*Figure 13 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA9 Concentration Showing Impacts to Individual PWSs*

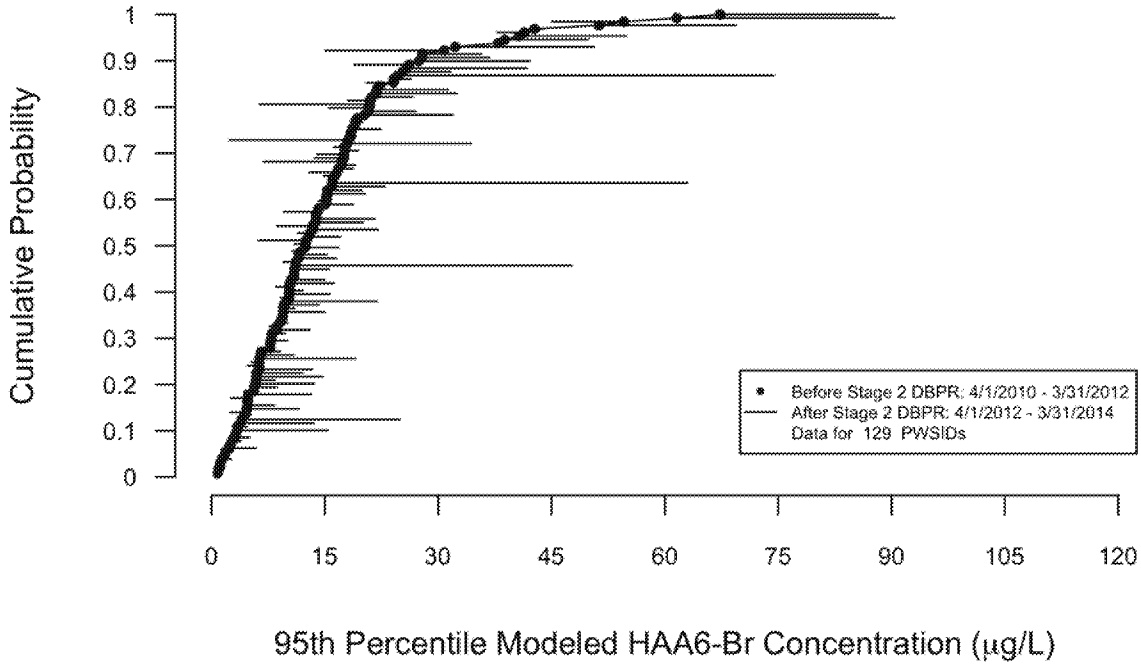


*Figure 14 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile HAA6-Br Concentration Showing Impacts to Individual PWSs*



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## 3.2 Bromine Incorporation Factors

Further assessment of relative changes in brominated DBPs can be approached using the bromine incorporation factors for THMs, dihaloacetic acids (2XAA), and trihaloacetic acids (3XAA). Figure 15 shows yearly boxplots for quarterly 95th percentile THM BIFs by PWS from 2006 to 2014 for 130 PWSs in 18 states. Each boxplot is based on data for the same 130 systems. Overall, there is relatively little variability of the years, but a slight increase in median and 75th percentile BIF values occurred in 2011 – 2014. Figure 16 and Figure 17 show yearly boxplots for quarterly 95th percentile 2XAA and 3XAA BIF, respectively, by PWS, from 2006 to 2014 for 84 PWS in 15 states. Similar to the THM BIF boxplots, the yearly boxplots for 2XAA and 3XAA BIFs show relatively little variability, besides an increase in the 75th percentile values in 2013 and 2014 and a slightly increasing trend for the 95th percentile values.

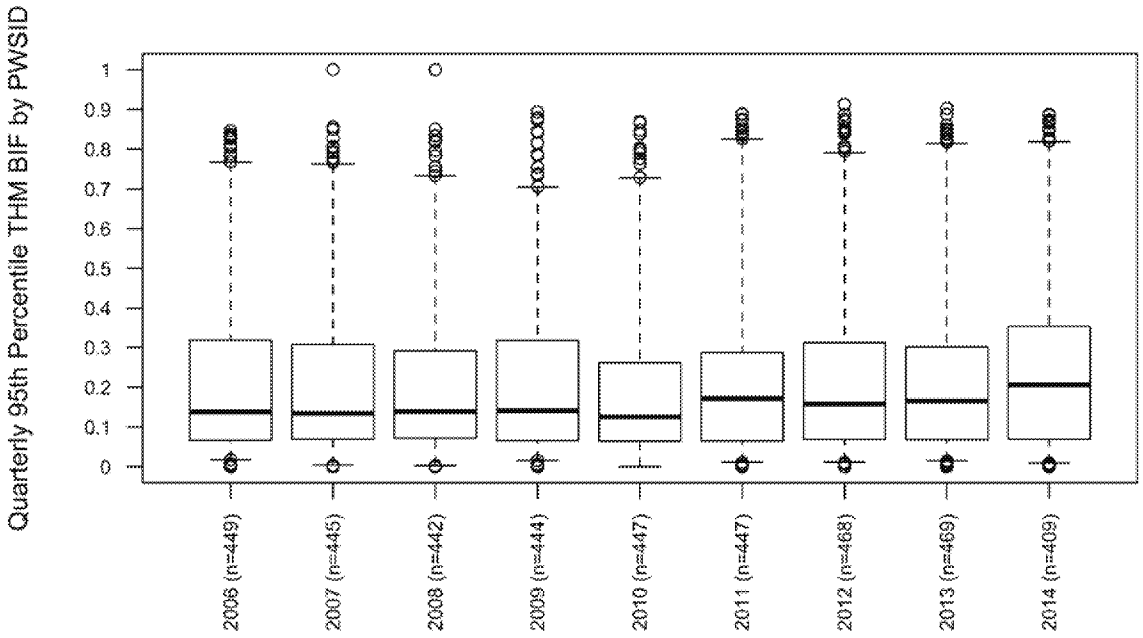


*Figure 15 Yearly Boxplots of Quarterly PWS 95th Percentile THM BIFs (Modeled) for 130 Water Utilities in 18 States from 2006 – 2014*



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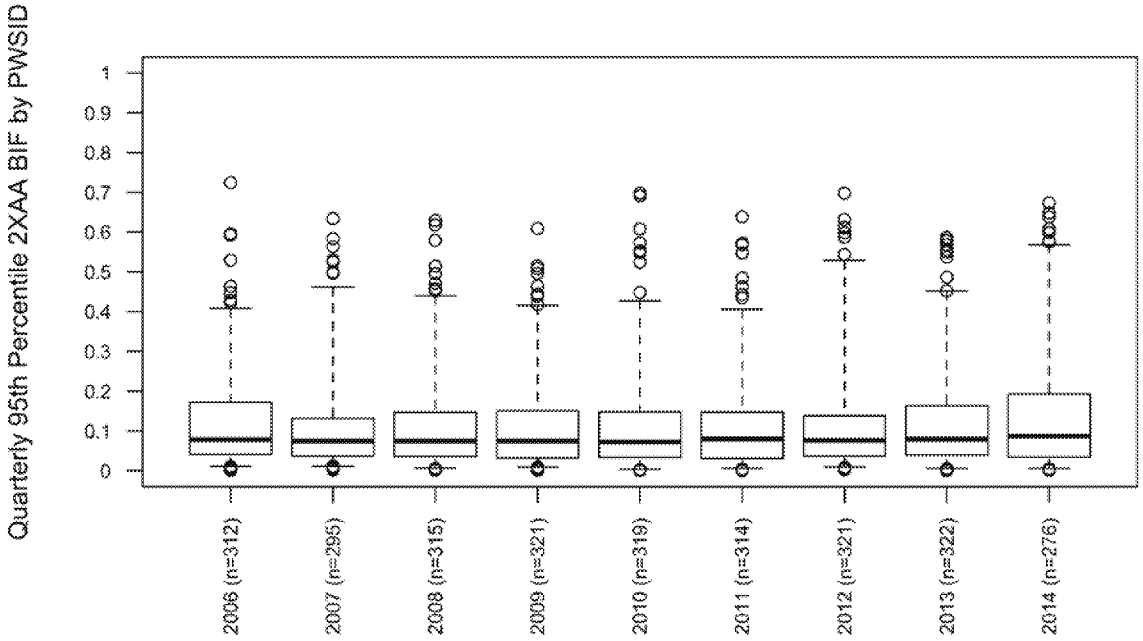


*Figure 16 Yearly Boxplots of Quarterly PWS 95th Percentile 2XAA BIFs (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*



ED_002479_00000019-00056

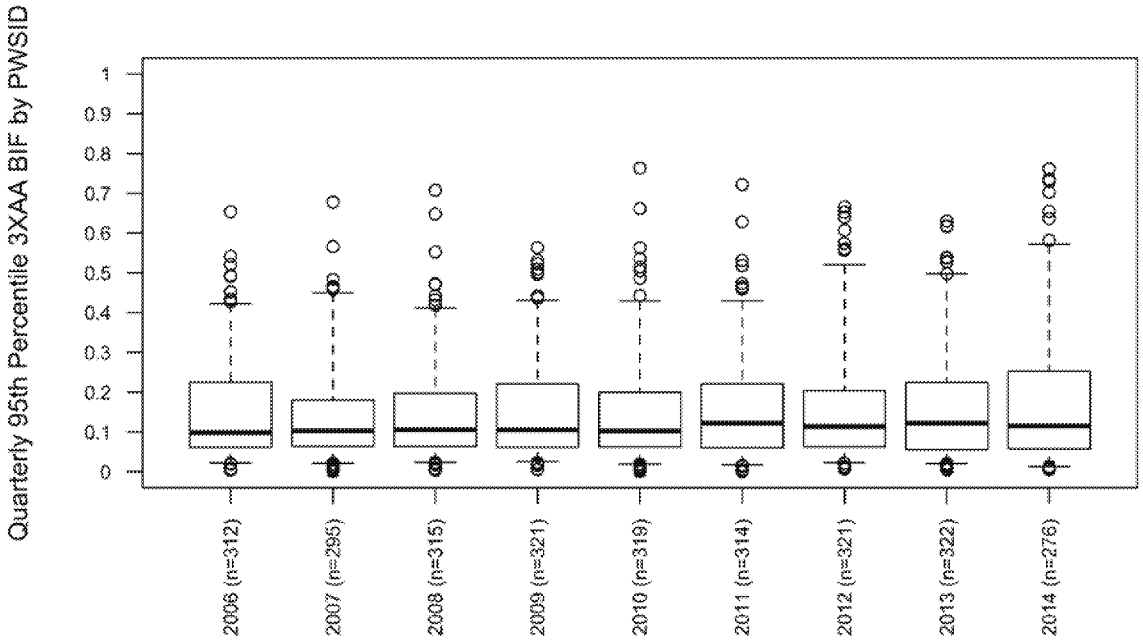


*Figure 17 Yearly Boxplots of Quarterly PWS 95th Percentile 3XAA BIFs (Modeled) for 84 Water Utilities in 15 States from 2006 – 2014*

The impact of the Stage 2 DBPR on bromine incorporation factors is further investigated by comparing cumulative distributions of the 95$^{th}$ percentile values by PWS of quarterly 95$^{th}$ percentile BIFs by PWS before and after Stage 2 DBPR. Figure 18, Figure 19 and Figure 20 show this analysis for THM, 2XAA, and 3XAA BIFs, respectively. In all three cases, the before and after cumulative distributions of BIFs are very close, but exhibit increases in BIF values for utilities in approximately the 50$^{th}$ – 85$^{th}$ percentile for the THM and 2XAA BIFs and in approximately the 60$^{th}$ – 90$^{th}$ percentile for the 3XAA BIF.



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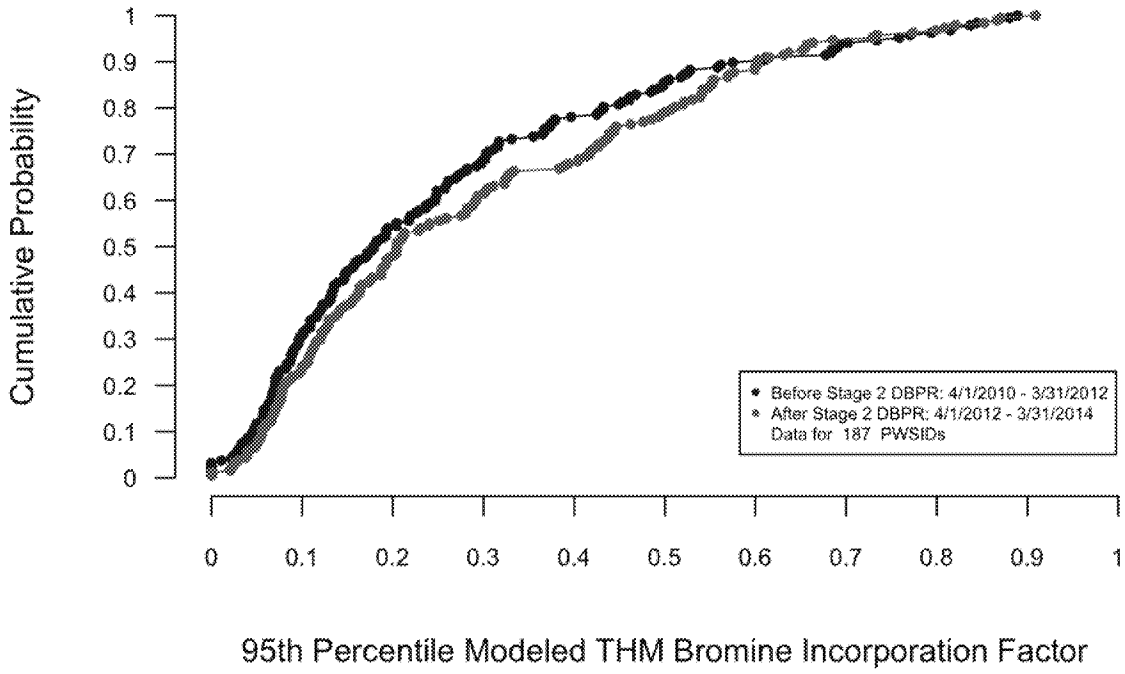


*Figure 18 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile THM BIF before and after Implementation of the Stage 2 DBPR*

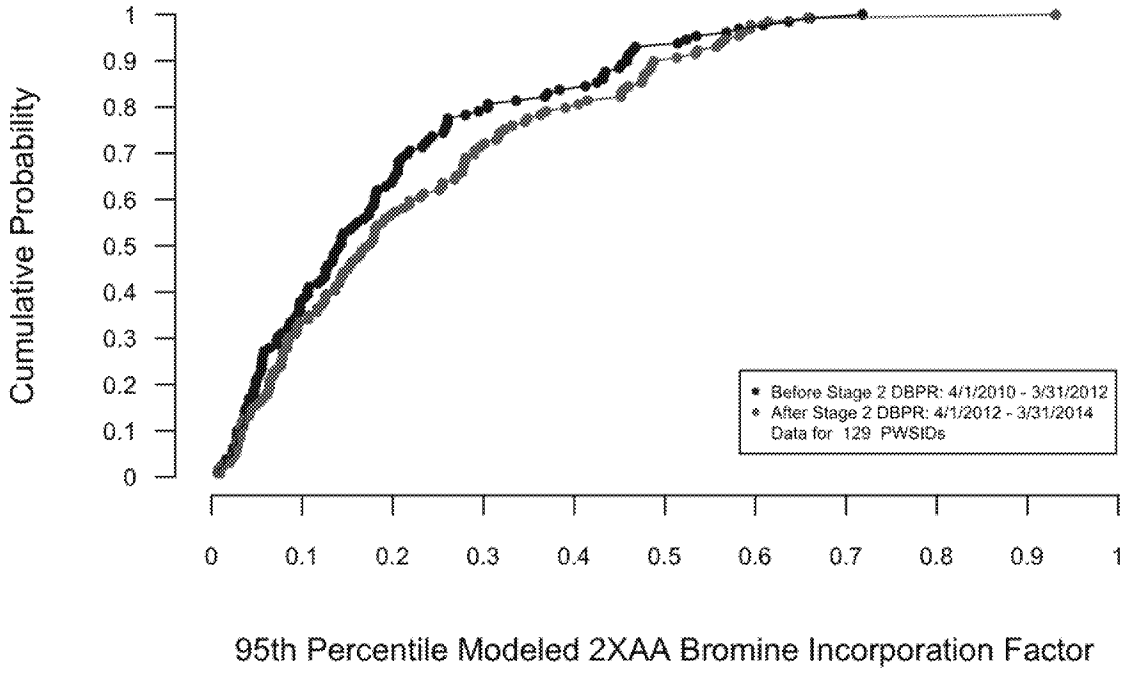


*Figure 19 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 2XAA BIF before and after Implementation of the Stage 2 DBPR*



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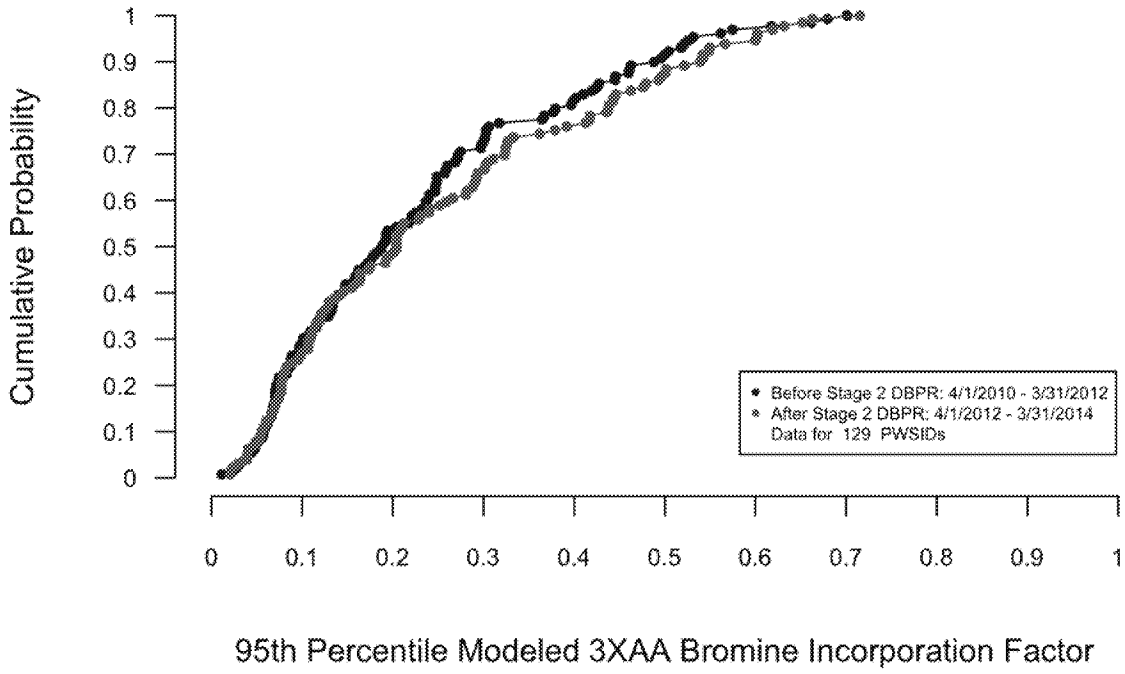


*Figure 20 Cumulative Distributions of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 3XAA BIF before and after Implementation of the Stage 2 DBPR*

As done previously for the HAA9 and HAA6-Br occurrence analysis, the cumulative distribution plots for the 95$^{th}$ percentile BIF values in Figure 18, Figure 19, and Figure 20 were modified to show impacts for individual PWSs. Figure 21, Figure 22, and Figure 23 show the same before cumulative distributions as in Figure 18, Figure 19, and Figure 20, and to illustrate the change in BIF values for each PWS, a horizontal black is drawn from each system's 95$^{th}$ percentile BIF value before Stage 2 DBPR to its 95$^{th}$ percentile BIF value after Stage 2 DBPR. While both increases and decreases occurred for the THM, 2XAA, and 3XAA 95$^{th}$ percentile BIF values, the changes with the greatest magnitudes tend to be increases from before Stage 2 DBPR to after.



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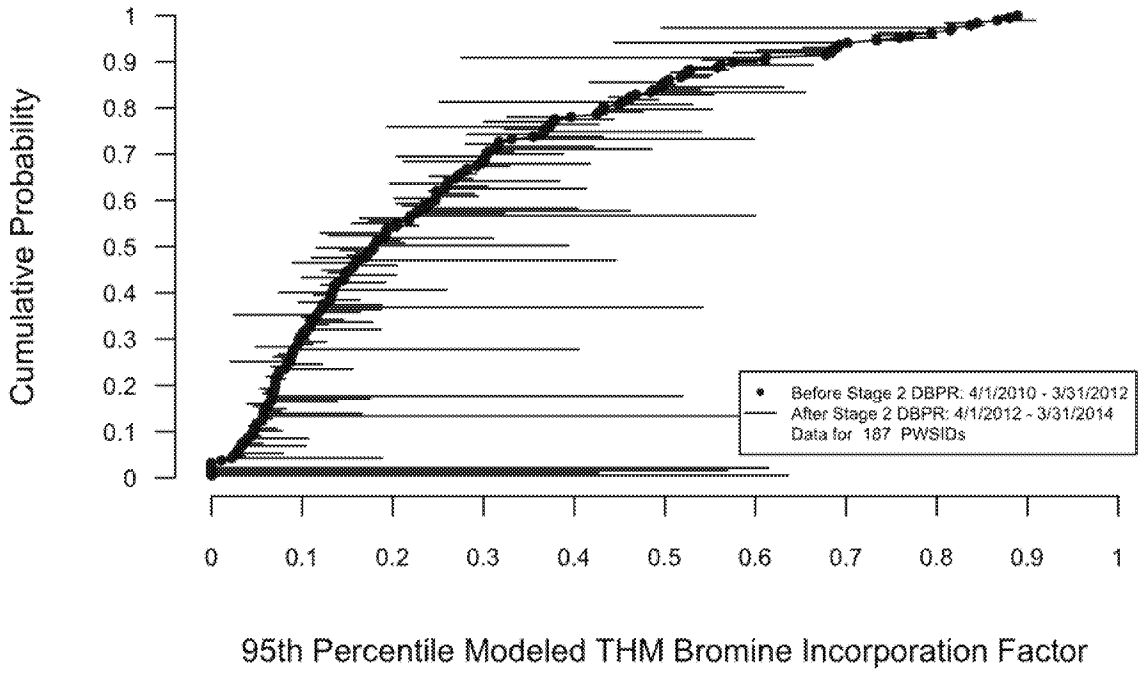


*Figure 21 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile THM BIF Showing Impacts to Individual PWSs*

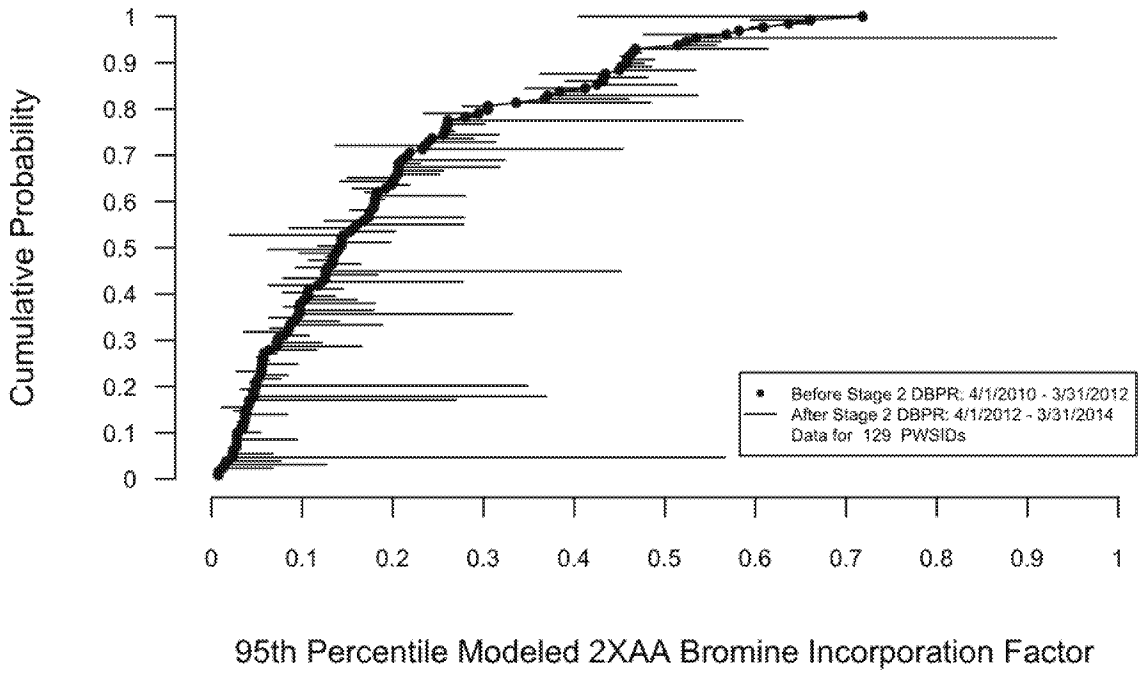


*Figure 22 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 2XAA BIF Showing Impacts to Individual PWSs*



ED_002479_00000019-00060

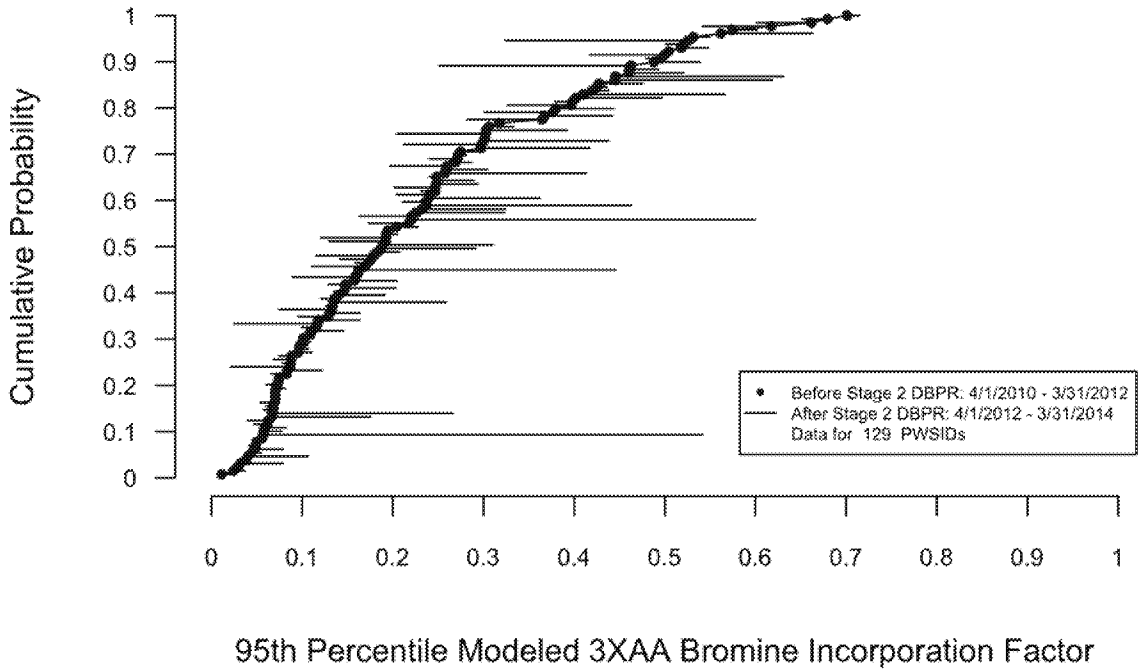


*Figure 23 Cumulative Distribution Plot of PWS 95th Percentile Value of Modeled Quarterly PWS 95th Percentile 3XAA BIF Showing Impacts to Individual PWSs*

# 4 Summary

The WITAF #266 database was used to assess the occurrence of brominated DBPs through modeling HAA4 species and HAA9 sums, validating the modeled HAA9 sums using observed HAA9 concentration data, and calculating bromine incorporation factors for THMs, dihaloacetic acids (2XAA), and trihaloacetic acids (3XAA). The "representativity" of the modeled HAA4 species, HAA9 and HAA6-Br concentrations was validated by analyzing distributions of TTHM and HAA5 data for two cases: for all systems with TTHM or HAA5 data, and for systems with THM and HAA5 species for modeling HAA9. An alternative approach to modeling HAA4 species, HAA9 and HAA6-Br, and calculating BIFs was developed due to a lack of necessary sample information to merge species concentrations for a given sampling event. The alternative approach used quarterly PWS 95$^{th}$ percentile species concentrations, which were then merged based on the PWS and quarter, as a surrogate for species concentration data. Analyses to validate this approach were presented.

This study demonstrates that the WITAF #266 database provides sufficient DBP data to analyze the occurrence of brominated DBPs, particularly before and after the implementation of the Stage 2 DBPR. This analysis is important in understanding how concentrations of unregulated HAAs, HAA9, and HAA6-Br concentrations have changed over time, and can be used to inform future regulatory decisions regarding the consideration of regulations based on brominated THM and HAA species in addition to the currently regulated sums.



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Scholz, F.W., Stephens, M.A., 1987. K-Sample Anderson-Darling Tests. Journal of the American Statistical Association 82(399):918-924.

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# Attachment B: Preliminary Analysis of UCMR3 Data and Potential Impact on UCMR4

The following report is an interim work product. The research team is preparing a paper for submission to a peer-reviewed journal. A copy of the accepted paper will be forwarded to the Agency once it is published.

**Analysis of UCMR 3 Data and Potential Impact on UCMR 4 (manuscript in preparation)**

## Introduction

As part of the analysis of UCMR 3 data to determine whether it makes sense to recommend changes in sampling strategy to EPA for the UCMR 4 sampling framework, we did a detailed analysis of UCMR 3 data, initially based on the June 2015 National Contaminant Occurrence Database, but followed up by also doing some additional analyses of the October 2015 NCOD release.

We focused on several things.

- Any differences in frequency of occurrence based on PWS population. We obtained population data from EPA and then plotted frequency of occurrence for each contaminant by population band (<10K, 10-25K, 25-50K, 50K-100K, and >100K).
- Covariance plots of SE1 vs SE2 for groundwaters for each contaminant
- Probability distributions for groundwater systems for each contaminant for SE1 vs SE2
- Probability distributions for surface water systems for each contaminant for SE1 vs SE2 vs SE3 vs SE4
- Covariance plots of SE1 vs SE2 and Covariance plots of SE3 vs SE4 for surface water systems.

Corona Environmental (Tim Bartrand and Saul Rosen) performed statistical analyses of the paired samples and the probability plots using R.

Based on EPA's proposal to only have UCMR 4 sampling take place between March and November, Corona also did a statistical analysis of the same data based on only March-November samples to determine whether that would change any conclusions regarding differences between sampling periods.

## Background

In the UCMR 4 proposal information collection document (EPA 815-B-15-003), EPA has indicated that the analysis of the UCMR data are based on the following criteria (note highlighted sections). EPA does indicate that they may look at measures for each EPTDS for each PWS, but there is no indication that they have ever done that, and in the NCOD and the periodic data releases, they focus strictly on frequency of detection by count and PWS and % exceeding an HRL. The UCMR sampling strategy is not fundamentally focused around evaluating variability at any single utility or sampling point, but rather on national occurrence trends.

*The first stage of analysis, Stage 1, provides a straightforward evaluation of occurrence for simple and conservative assessments of contaminant occurrence. The Stage 1 analysis of the UCMR data consists of non-parametric, unweighted counts and simple descriptive statistics of analytical results for each of the contaminants. These occurrence analyses are conducted at the sample level, PWS level and population-served level. For each contaminant, occurrence measures include the number and percent of samples with analytical detections and the minimum, median, maximum, and 99th percentile values of those detections. PWS-level occurrence measures include the number and percent of PWSs with one or more*



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*analytical detections and the number and percent of PWSs with two or more analytical detections of a given contaminant. Population-served occurrence measures include: the number and percent of population served by PWSs with one or more analytical detections, and the number and percent of population served by PWSs with two or more analytical detections of a given contaminant. Similar measures may also be conducted for each EPTDS for each PWS. Since these contaminant and PWS- level occurrence measures are based on raw occurrence data (that have not been adjusted for population-weighting and sampling), they are less accurate representations of national occurrence than occurrence measures based on adjusted occurrence data.*

**Data Analysis –Groundwater systems**

In our view, a "table" tells a thousand words. The tables below and statistical analyses for the data are for groundwater samples courtesy of Corona Environmental. The statistical evaluation compares the probability plots for the two sample events. We have also included covariant plots and a separate analysis of paired SE1 and SE2 samples using the Wilcoxon Rank Sum test. For purposes of statistical analysis any result which was non detect in the UCMR 3 database was assigned a value of 0.



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**Table 1. Summary of Statistical Tests Comparing Sample Events for GW systems.**

| | all data | | | | | | Exclude Dec-Feb | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Contaminant** | **K-S *p*** | **Mann-Whitney *p*** | ***N* both above DL** | ***N* one below DL** | ***N* both below DL** | ***% detects*** | **K-S *p*** | **Mann-Whitney *p*** | ***N* both above DL** | ***N* one below DL** | ***N* both below DL** | ***% detects*** |
| 1,1-Dichloroethane | 1 | 0.379 | 238 | 172 | 8590 | 3.6% | | 0.927 | 126 | 94 | 4517 | 3.7% |
| 1,2,3-Trichloropropane | 1 | 0.473 | 78 | 40 | 8883 | 1.1% | | 0.643 | 47 | 23 | 4667 | 1.2% |
| 1,3-Butadiene | ID | ID | 0 | 1 | 9000 | 0.0% | | ID | 0 | 1 | 4736 | 0.0% |
| 1,4-Dioxane | 1 | 0.568 | 916 | 421 | 7589 | 12.6% | | 0.558 | 471 | 226 | 3968 | 12.5% |
| 17α-Ethynylestradiol | ID | ID | 0 | 1 | 2857 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| 17β-Estradiol | ID | ID | 0 | 3 | 2855 | 0.1% | ID | ID | 0 | 0 | 1492 | 0.0% |
| 4-Androstene-3,17-dione | ID | ID | 0 | 7 | 2851 | 0.1% | ID | ID | 0 | 2 | 1490 | 0.1% |
| Bromomethane | 1 | 0.833 | 29 | 32 | 8939 | 0.5% | 1 | 0.86 | 8 | 17 | 4712 | 0.3% |
| Chlorate | 0.00464 | 0.00717 | 6381 | 1418 | 5967 | 51.5% | 0.00282 | 0.0383 | 3309 | 714 | 3150 | 51.1% |
| Chloromethane | 1 | 0.612 | 62 | 71 | 8868 | 1.1% | 1 | 0.17 | 26 | 39 | 4672 | 1.0% |
| Chromium | $2.23\times10^{-5}$ | 0.00222 | 6402 | 2025 | 5412 | 53.6% | $2.06\times10^{-4}$ | 0.00512 | 3256 | 1124 | 2757 | 53.5% |
| Chromium-6 | 0.942 | 0.811 | 8862 | 1289 | 3686 | 68.7% | 0.82 | 0.667 | 4605 | 743 | 1887 | 68.8% |
| Cobalt | 1 | 0.489 | 224 | 194 | 13478 | 2.3% | 1 | 0.773 | 103 | 105 | 6994 | 2.2% |
| Equilin | ID | ID | 0 | 0 | 2858 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Estriol | ID | ID | 0 | 1 | 2587 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Estrone | ID | ID | 0 | 0 | 2858 | 0.0% | ID | ID | 0 | 0 | 1492 | 0.0% |
| Germanium | 1 | 0.734 | 16 | 4 | 1015 | 1.7% | 1 | 0.629 | 8 | 2 | 450 | 2.0% |
| Halon 1011 | 1 | 0.049 | 30 | 129 | 8842 | 1.0% | 1 | 0.802 | 20 | 71 | 4646 | 1.2% |
| HCFC-22 | 1 | 0.967 | 221 | 143 | 8637 | 3.2% | 1 | 0.855 | 107 | 73 | 4557 | 3.0% |
| Manganese | 0.983 | 0.922 | 589 | 148 | 298 | 64.1% | 0.944 | 0.894 | 267 | 64 | 129 | 65.0% |
| Molybdenum | 0.913 | 0.913 | 5657 | 822 | 7433 | 43.6% | 0.964 | 0.728 | 2890 | 441 | 3876 | 43.2% |
| *n*-Propylbenzene | ID | ID | 1 | 6 | 585 | 0.7% | ID | ID | 1 | 2 | 248 | 0.8% |
| PFBS | ID | ID | 1 | 2 | 9164 | 0.0% | ID | ID | 0 | 0 | 4817 | 0.0% |
| PFHpA | 1 | 0.512 | 45 | 29 | 9093 | 0.6% | 1 | 0.676 | 20 | 13 | 4784 | 0.6% |
| PFHxS | 1 | 0.686 | 68 | 21 | 9078 | 0.9% | 1 | 0.994 | 30 | 14 | 4773 | 0.8% |
| PFNA | 1 | 0.317 | 5 | 6 | 9156 | 0.1% | ID | ID | 1 | 4 | 4812 | 0.1% |
| PFOA | 1 | 0.736 | 82 | 51 | 9034 | 1.2% | 1 | 0.923 | 34 | 33 | 4750 | 1.0% |
| PFOS | 1 | 0.76 | 71 | 38 | 9058 | 1.0% | 1 | 0.44 | 31 | 21 | 4765 | 0.9% |
| *sec*-Butylbenzene | ID | ID | 0 | 0 | 592 | 0.0% | ID | ID | 0 | 0 | 251 | 0.0% |
| Strontium | 0.677 | 0.373 | 13774 | 91 | 8 | 99.6% | 0.655 | 0.359 | 7127 | 61 | 5 | 99.5% |
| Tellurium | ID | ID | 0 | 0 | 1035 | 0.0% | ID | ID | 0 | 0 | 460 | 0.0% |
| Testosterone | ID | ID | 0 | 13 | 2844 | 0.2% | ID | ID | 0 | 6 | 1486 | 0.2% |
| Vanadium | 0.689 | 0.505 | 7531 | 974 | 5398 | 57.7% | 0.964 | 0.708 | 3877 | 538 | 2784 | 57.6% |



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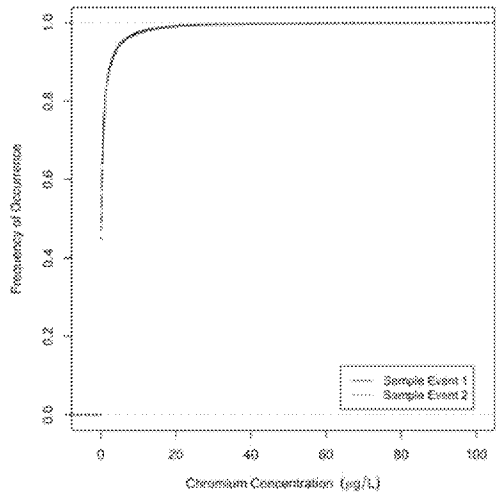
In all cases except for total chromium and chlorate, there is no statistical difference in the probability plots for sample event 1 and sample event 2. This is true even when there are a large number of non-detects. For UCMR 4, EPA has proposed only sampling between March and November. Thus the same analysis was done excluding the Dec-Feb samples. In that case there is also no significant difference between events and the overall frequency of detection is similar, suggesting that excluding the winter months would, at least for the UCMR 3 contaminants not make any difference in the data, while significantly complicating the monitoring process. If one thinks about ground water systems which are not under the direct influence of surface water and may even have travel times that are decades long, there is no reason to expect that sampling in any given month would be reflective of surface conditions at that time. Thus, even for analytes that might be seasonal in application (e.g. pesticides) ground water systems would almost certainly not reflect that seasonality.

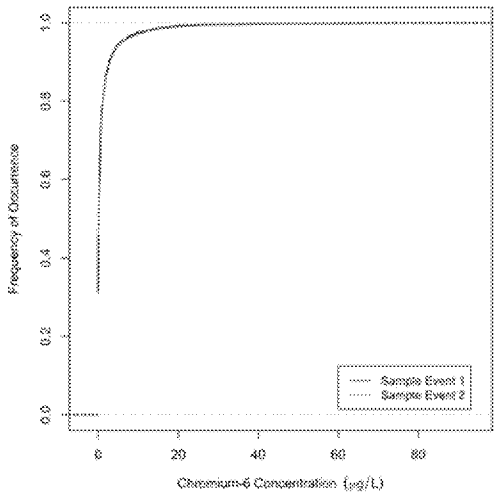
The probability plots here (figure 1) are for chlorate, total chromium, and hexavalent chromium. Just from a visual inspection it is apparent that even though individual events may have different results for a given sample site, the overall distribution of occurrence is essentially the same, as is true of hexavalent chromium also. In the case of chlorate there are differences in the extreme values.

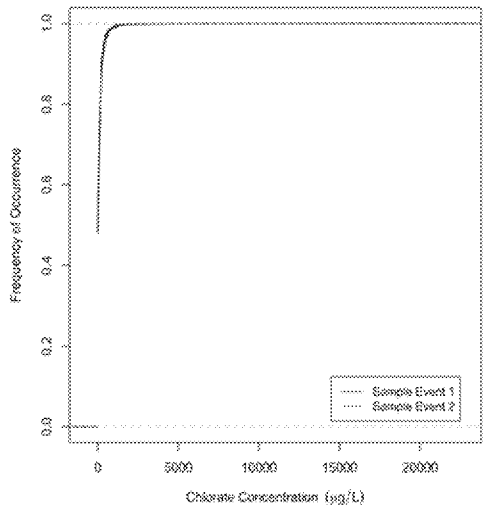
For chlorate it makes perfect sense that there could be significant differences between events, because utilities change their disinfection practices over time, which will in turn have an impact on chlorate, which is disinfection byproduct. Thus chlorate patterns would not be a cause for considering 1 vs 2 sampling events for groundwater systems, but should rather be treated like any other disinfection byproduct in terms of sampling strategy (e.g. sample only at a point in the distribution system and sample frequently enough to have a meaningful understanding of variability. It is worth noting that a visual assessment of the probability plots for chlorate (figure 1) suggests that they are not different, but likely show as statistically significant only because of differences in the extreme values.

For total chromium, the statistically significantly different results are also puzzling both because a covariance plot between the two events shows good correlation, and because when one looks at probability plots between the two sample events there is nearly perfect overlap. We suspect that the apparent statistically significant difference may relate to issues with the total chromium method accuracy and precision near the 0.2 ug/L reporting limit, coupled with the assumption of 0 for all non detect samples. Hexavalent chromium, with a much lower reporting limit, showed no significant difference between sample events. Additionally, when all non-detect samples for total chromium are excluded the correlation coefficient between sample event 1 and sample event 2 for groundwater goes from an $r^2$ of 0.705 to 0.83 and there is no statistical difference between probability plots. Thus we consider the apparent significant difference between events to be an artifact of the analytical method and not a true statistically significant difference that would justify multiple sampling rounds.

Figure 1: Probability plots for groundwater systems for SE1 and SE2 for chromium, hexavalent chromium, and chlorate.




Although not shown here, there is no difference in the nature of the plots if one excludes the December-February data. Thus no information is gained by restricting sampling periods. Table 1 also demonstrates that there is no difference in overall frequency of occurrence for any contaminant when one excludes the winter months.

The following plots (figures 2-5) are covariance plots of sample event 1 vs sample event 2 for each contaminant with even as little as 1% overall occurrence. Without referring to the statistical analysis it is clear that in most cases there is a high degree of covariance between events, even if the overall correlation coefficient is in some cases low, mainly because of limited occurrence.

The covariance, coupled with the probability plots and statistical evaluation of those plots all suggest that there is no information which is gained by having multiple sample events for groundwater systems.



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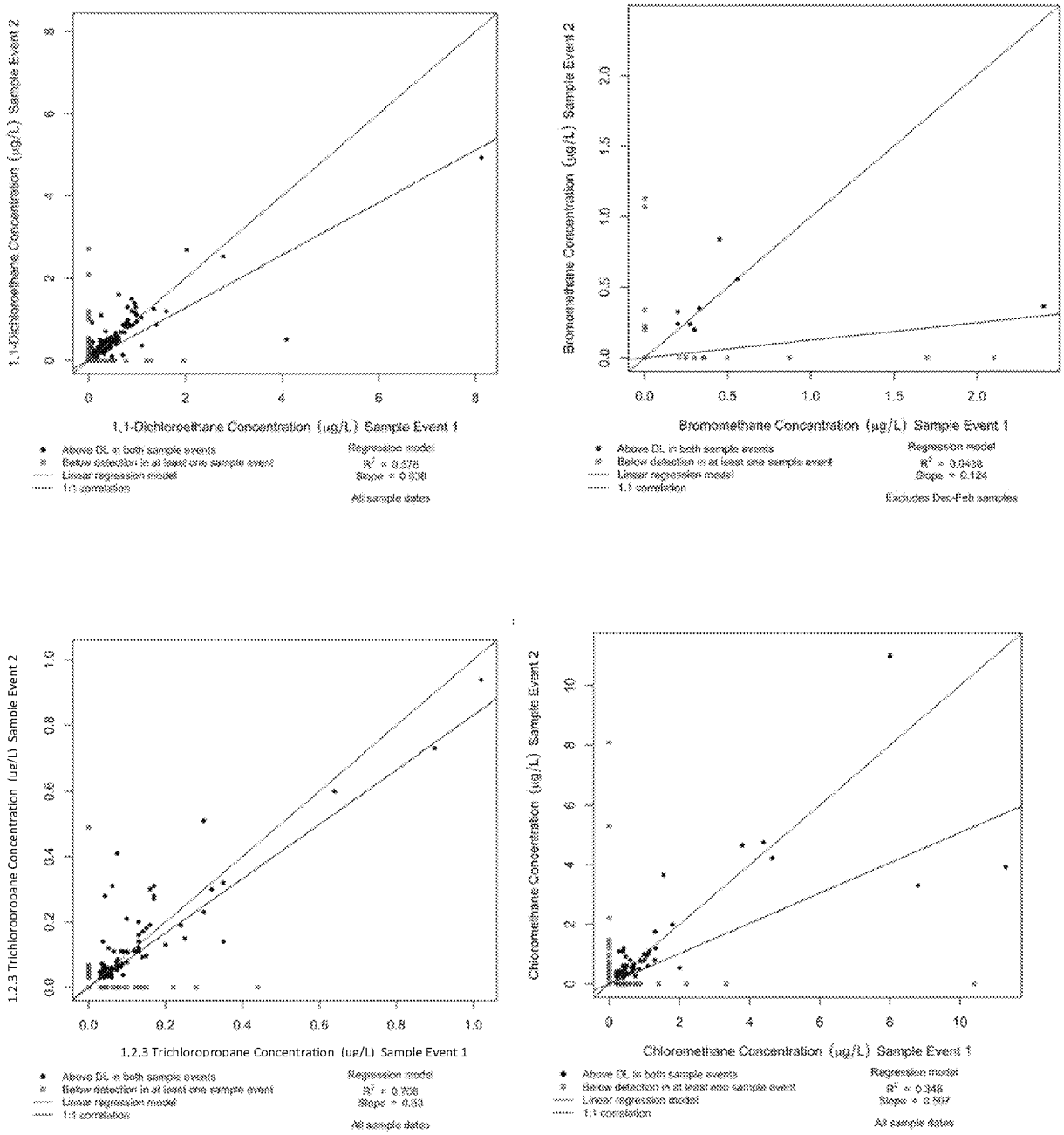
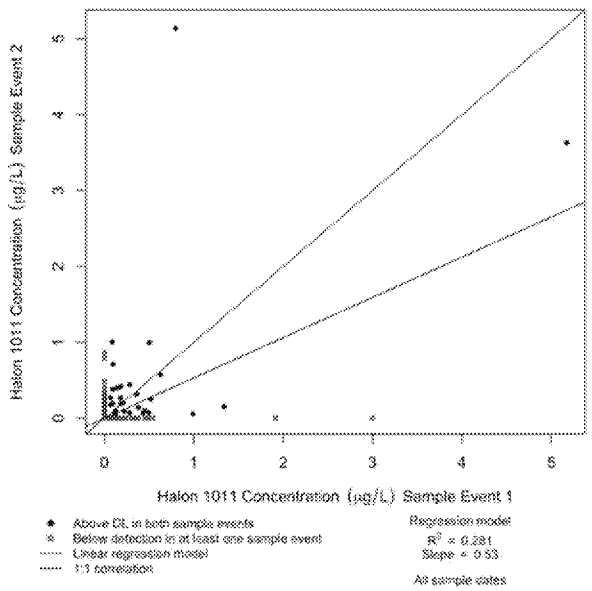
Figure 2a: Covariance plots for groundwater systems for VOC contaminants with sufficient data for statistical analysis. Plots below are based on using all samples (not excluding the winter months).




Halon 1011 Concentration (µg/L) Sample Event 2
Halon 1011 Concentration (µg/L) Sample Event 1
0
1
2
3
4
5
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.281
Slope = 0.53
All sample dates

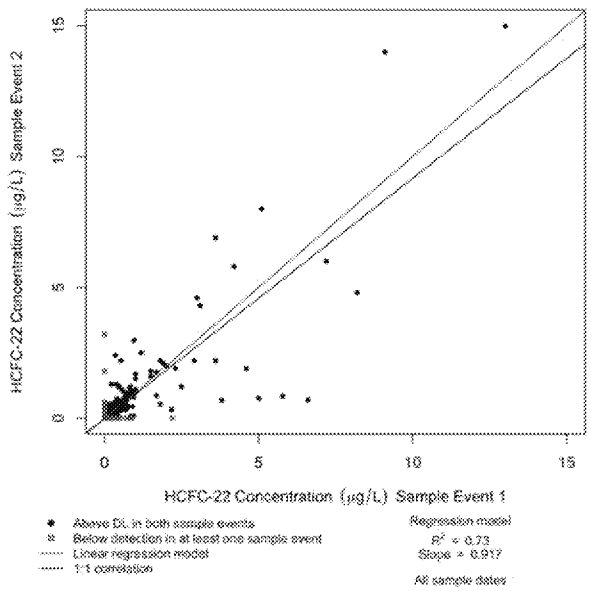
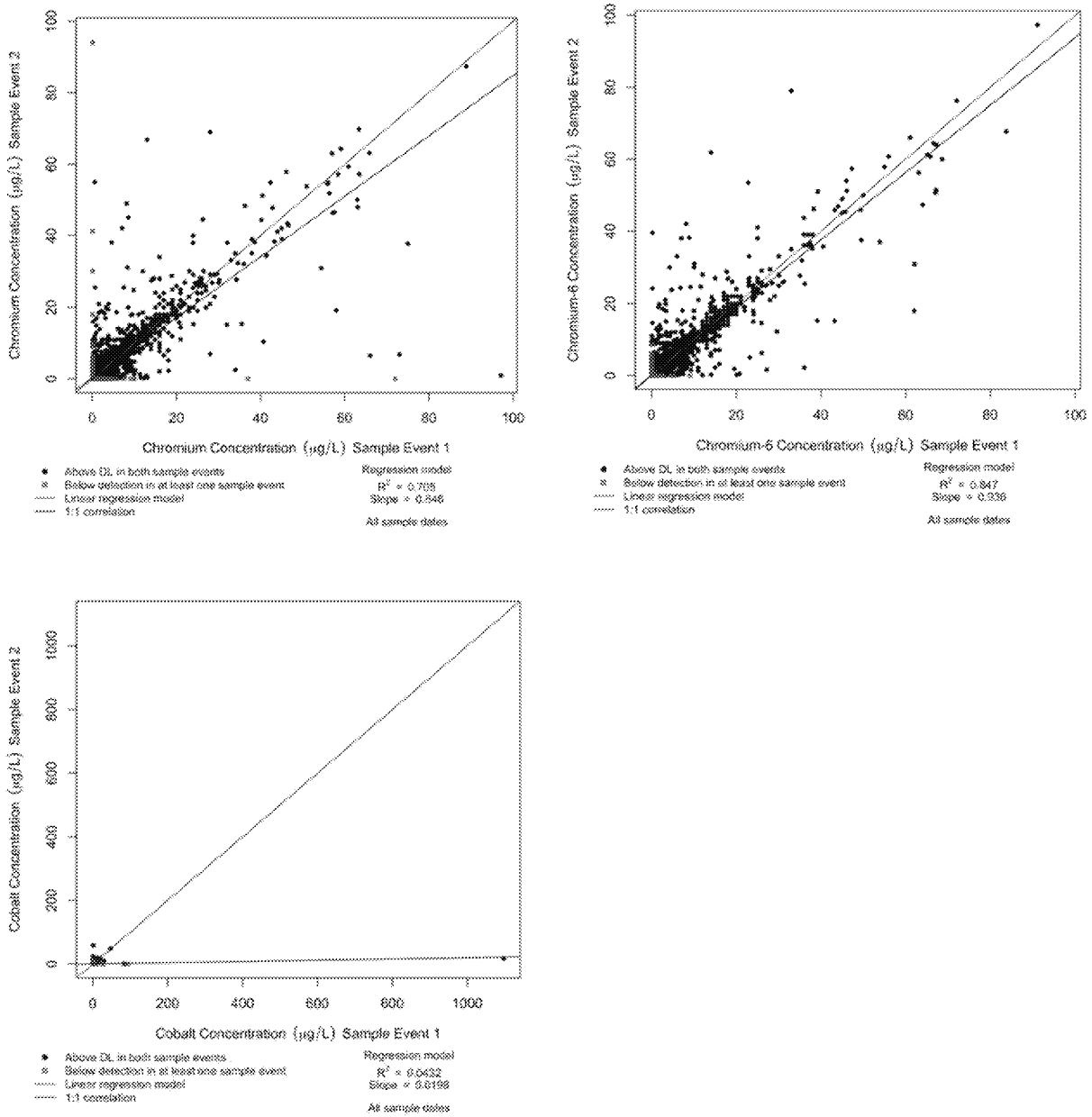
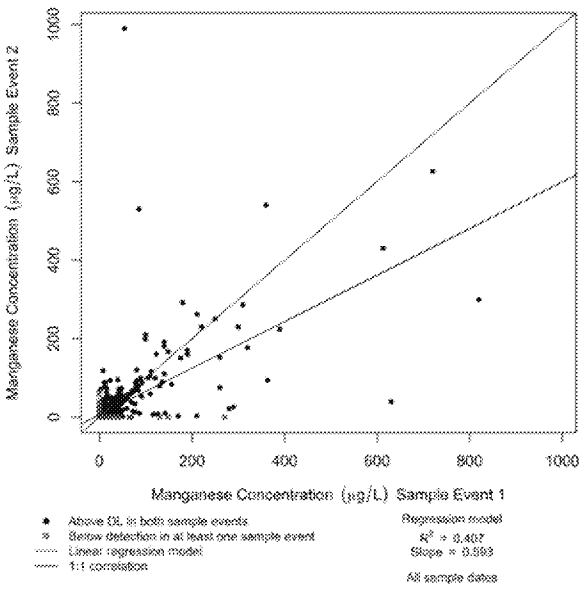
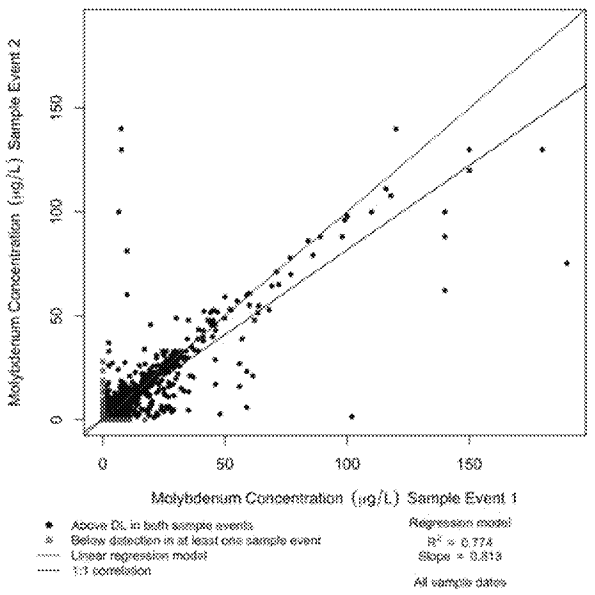
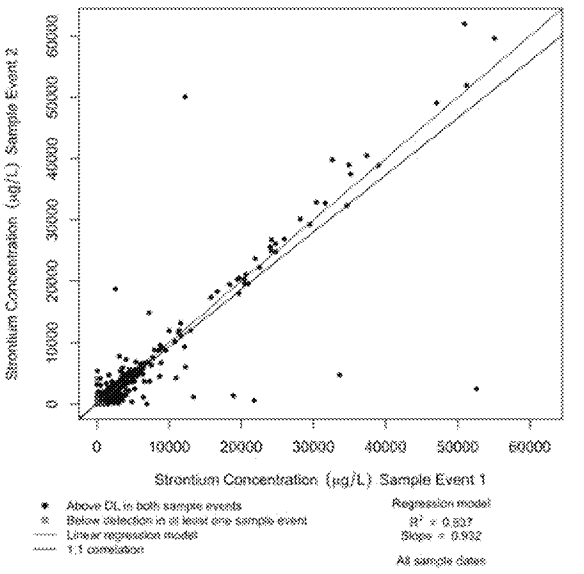

HCFC-22 Concentration (µg/L) Sample Event 2
HCFC-22 Concentration (µg/L) Sample Event 1
0
5
10
15
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.73
Slope = 0.917
All sample dates

Figure 3: Covariance plots for groundwater systems for metals. Plots below are based on using all samples (not excluding the winter months). Figure includes data for manganese and germanium (small systems data only, but planned for inclusion in UCMR 4.




Manganese Concentration (µg/L) Sample Event 2
Manganese Concentration (µg/L) Sample Event 1
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.407
Slope = 0.593
All sample dates


Molybdenum Concentration (µg/L) Sample Event 2
Molybdenum Concentration (µg/L) Sample Event 1
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.774
Slope = 0.813
All sample dates


Strontium Concentration (µg/L) Sample Event 2
Strontium Concentration (µg/L) Sample Event 1
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.937
Slope = 0.932
All sample dates

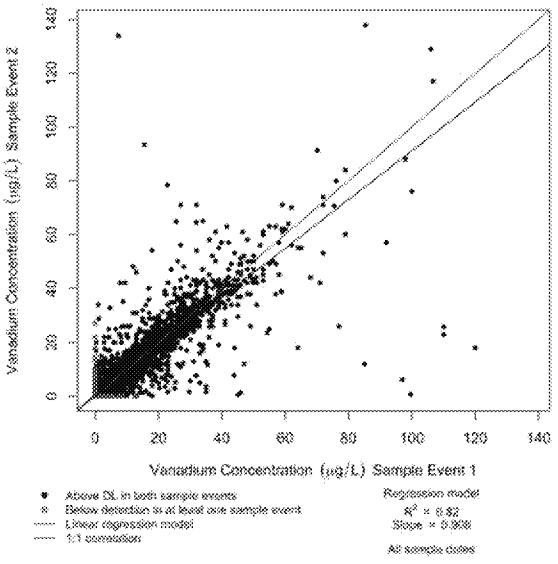
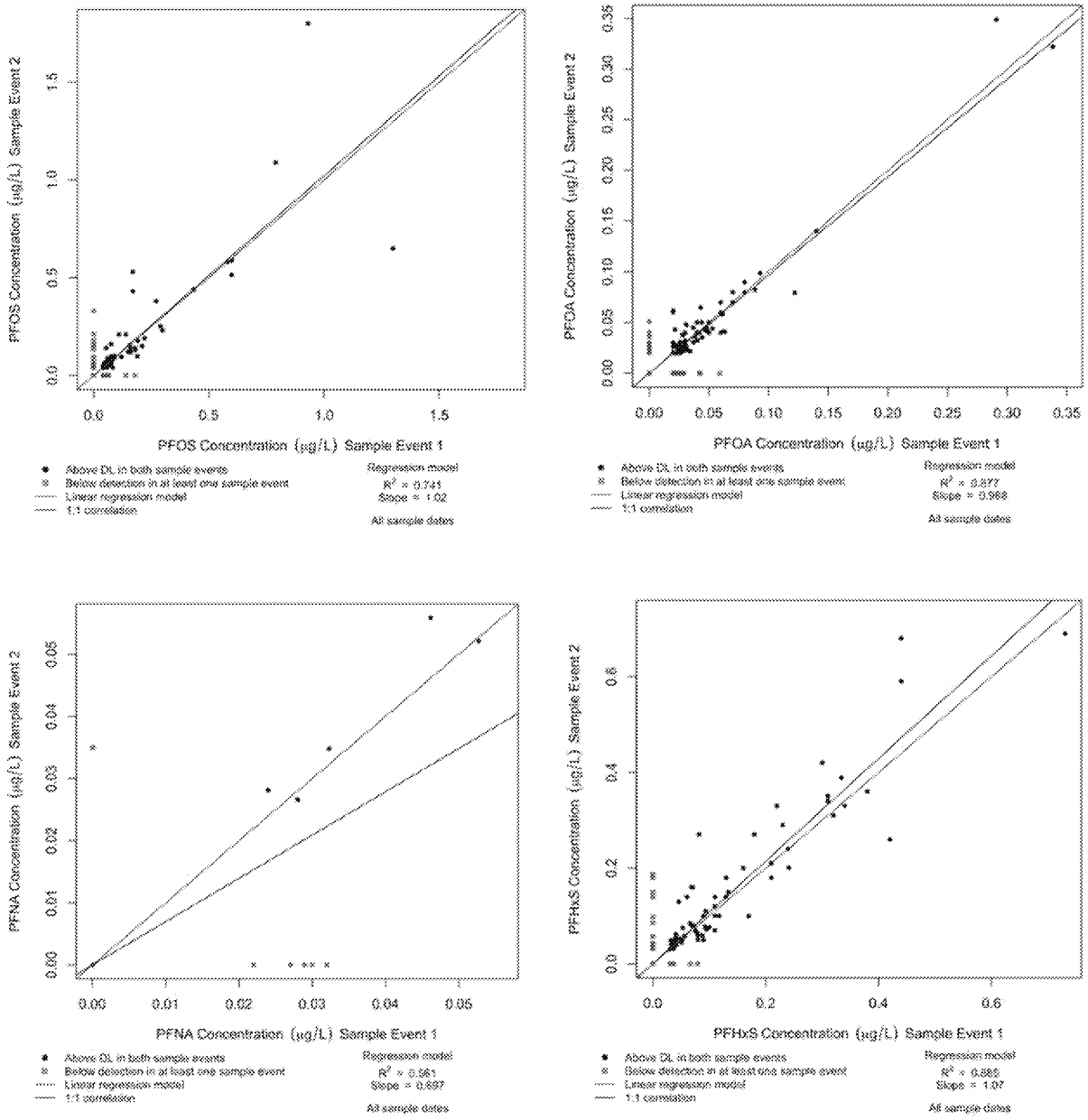

Vanadium Concentration (µg/L) Sample Event 2
Vanadium Concentration (µg/L) Sample Event 1
Above DL in both sample events
Below detection in at least one sample event
Linear regression model
1:1 correlation
Regression model
$R^2$ = 0.92
Slope = 0.868
All sample dates

Figure 4: Covariance plots for groundwater systems for PFC contaminants with sufficient data for statistical analysis. Plots below are based on using all samples (not excluding the winter months).



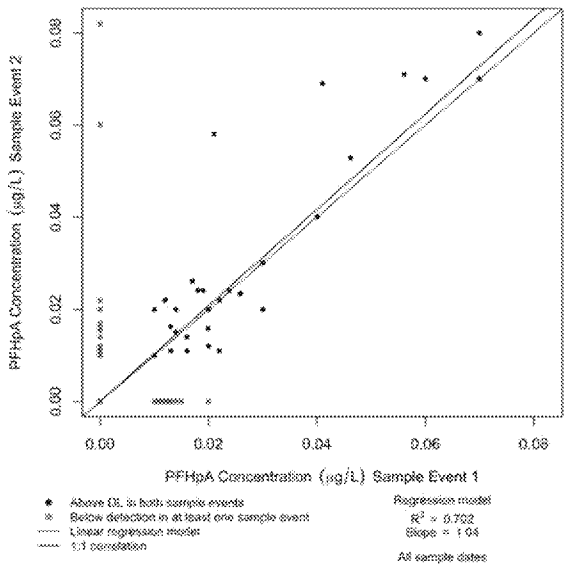
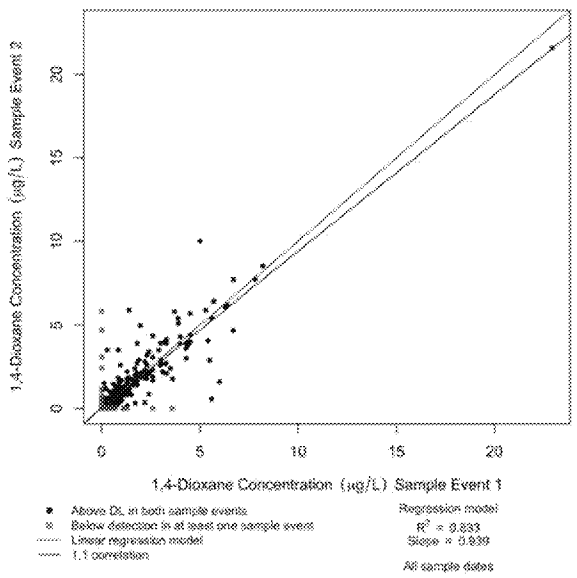
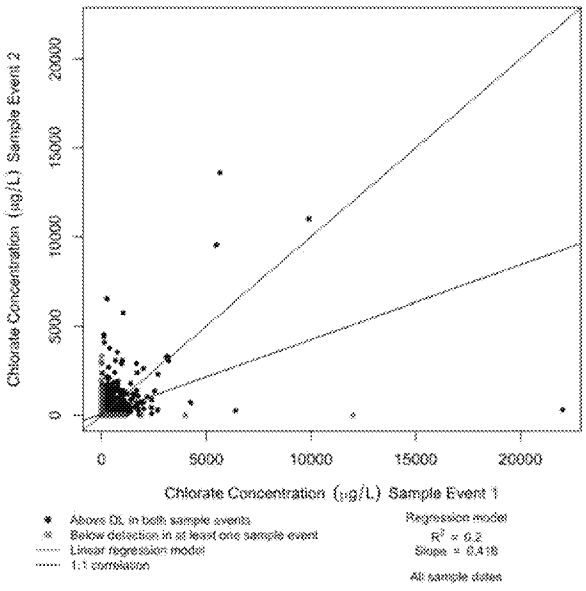



Figure 5: Covariance plot for groundwater systems for 1,4-dioxane and chlorate. Plots below are based on using all samples (not excluding the winter months).



**System size impact on results.**

The current UCMR construct calls for using a statistical sampling of small systems (< 10K population) and sampling all larger systems. Because one factor in interpreting UCMR data is the population impacted by contaminants it is important to determine the extent of variation in contaminant occurrence as a function of population size. The June, 2015 data from the NCOD was merged with population information from EPA and frequency of occurrence plotted for each contaminant as a function of system size. This analysis does not take into account the range of concentrations or the frequency with which contaminants may exceed the current health reference level (HRL), but rather focuses solely on the detection frequency as this is one factor EPA had indicated is a consideration in regulatory decision making. It is clear from the plots below (figure 6-10) that there **are differences** in frequency of occurrence for most contaminants as a function of population size, with greater frequency occurring in systems serving > 100K population, as would be expected in general for anthropogenic contaminants, where urban areas are more subject to potential contamination. In some cases the frequency of occurrence in the >100K systems may be more than double that of smaller systems, which may provide some justification for regulation, even though overall occurrence is low. This same pattern is true even for contaminants that are predominantly naturally occurring (e.g. the metals). EPA should perform a similar analysis of the data focusing not just on detection frequency but also on relative concentration levels. This analysis suggests that if EPA were to consider a statistical subset of systems serving >10K population for future UCMRs, including potentially UCMR 4, as a way of reducing the overall burden on utilities, it would be especially important that it be a robust analysis. We don't think there is sufficient time between now and the beginning of UCMR 4 to consider that approach for this round.

Figure 6: Frequency of occurrence for chlorate and 1,4-dioxane by population served.

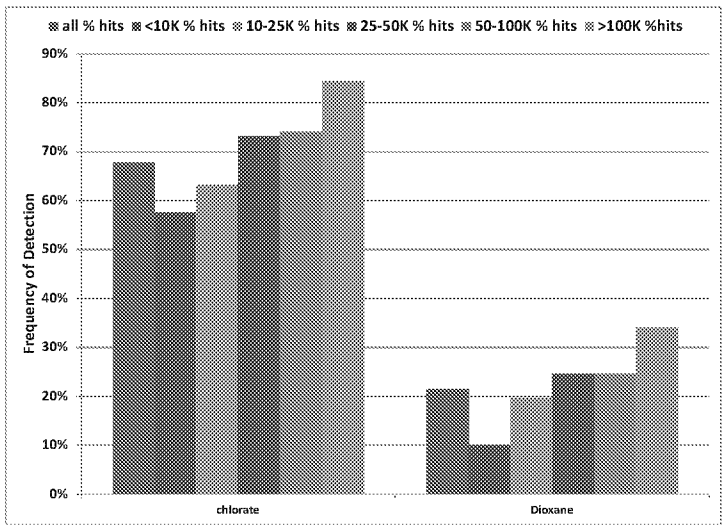
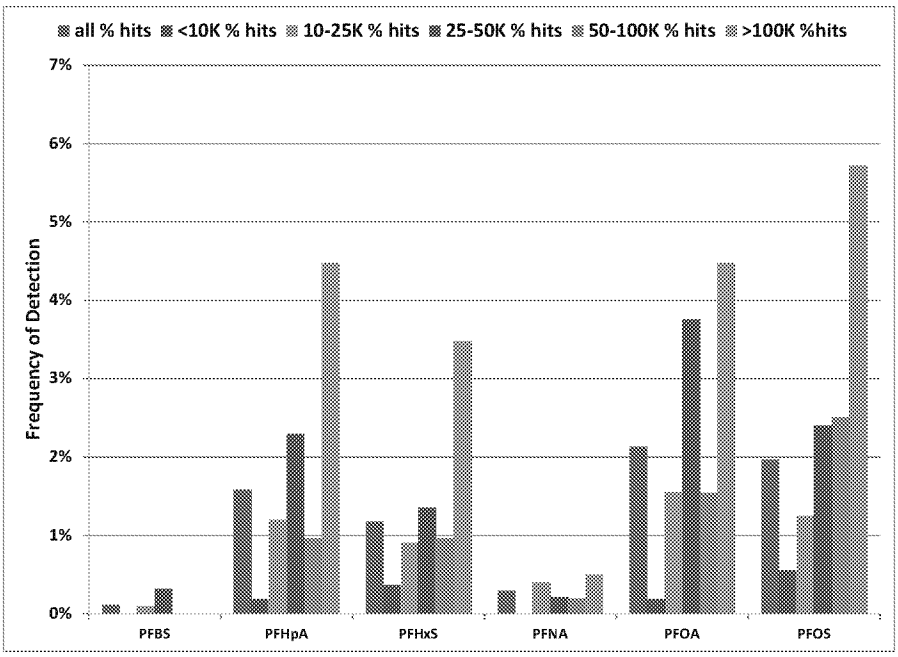
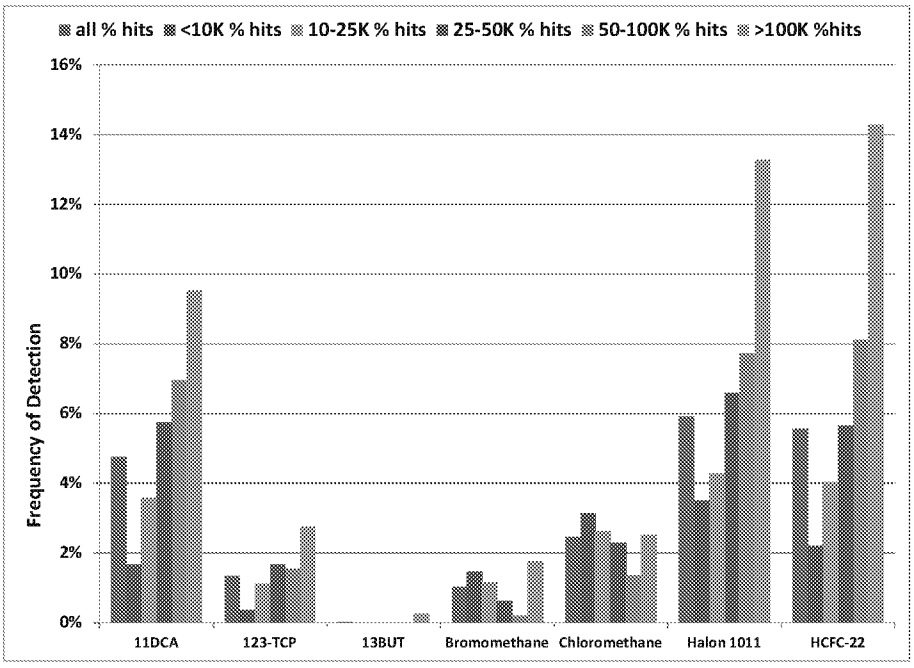


Figure 7: Frequency of occurrence for PFCs by population served.




For the PFCs, very large systems (>100K) in general have a much greater likelihood of detection than smaller systems. This may be a cause for considering potential regulation.

Figure 8: Frequency of occurrence for VOCs by population served.

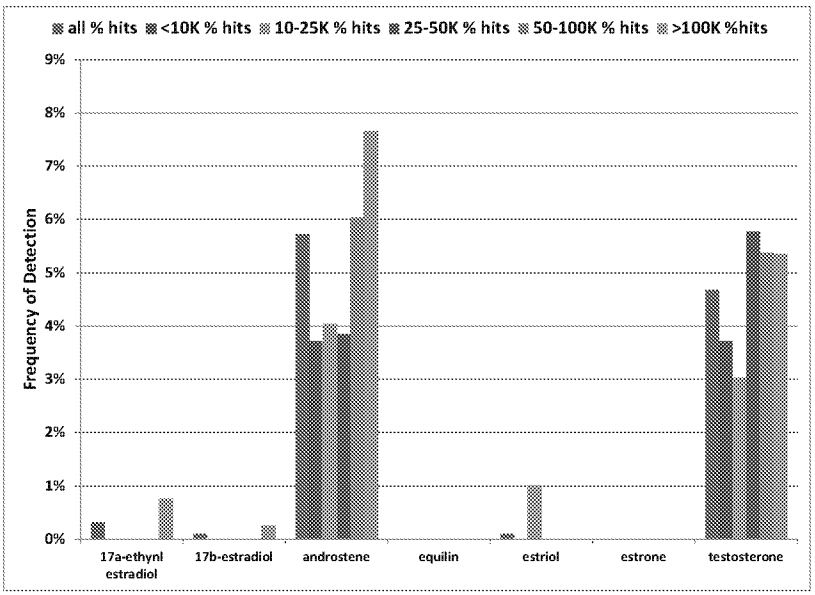



VOCs show the same pattern as PFCs, a much greater likelihood of detection in 100K+ systems.



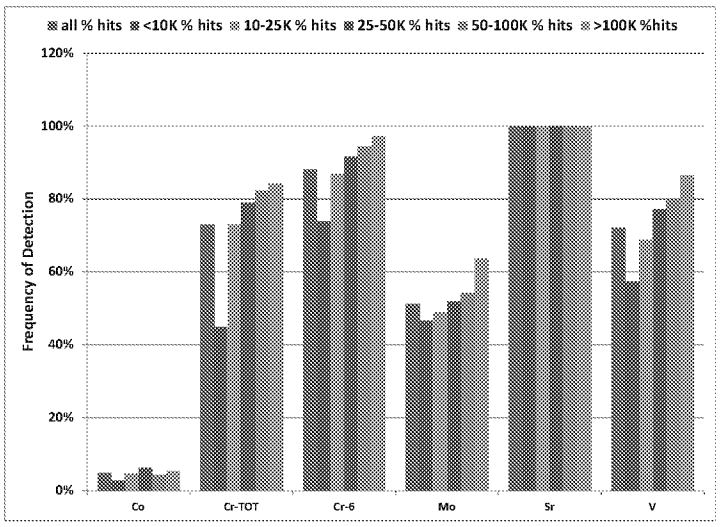
ED_002479_00000019-00076

Figure 9: Frequency of occurrence for hormones by population served.




Even though the frequency of occurrence is relatively high (~5% of systems with detects for testosterone and androstenedione), there is no clear trend with population size. This is most likely due to the fact that detection levels overall are very close to the minimum reporting levels, as one would expect the hormones to show a major anthropogenic impact (e.g. more population = more hormone detections). When detected, hormones are almost always a single detection and not repeated on additional sampling events, making it more likely that at least some of the detects may be artifacts of some sort.

Figure 10: Frequency of occurrence for metals by population served




For the metals the difference across system size is less marked than for some of the anthropogenic contaminants, but there are still trends suggesting greater occurrence in larger systems, and thus also larger population impacts.



ED_002479_00000019-00077

Message

**From**: Huff, Lisa [Huff.Lisa@epa.gov]
**Sent**: 7/7/2016 3:29:00 PM
**To**: Carroll, Gregory [Carroll.Gregory@epa.gov]
**Subject**: FW: Letter to EPA RA RE: PFCs

FYI – I talked to Betsy about an hour ago and told he Ex. 5 - Deliberative Process
Ex. 5 - Deliberative Process

She did comment Ex. 5 - Deliberative Process
Ex. 5 - Deliberative Process

*Lisa Foersom Huff*

Associate Branch Chief
Targeting and Analysis Branch
Standards and Risk Management Division
Office of Groundwater and Drinking Water
U.S. EPA
EPA East Bldg. Rm. 2331 C
202-566-0787

---

**From:** Behl, Betsy
**Sent:** Thursday, July 07, 2016 8:44 AM
**To:** Strong, Jamie <Strong.Jamie@epa.gov>; Allenbach, Becky <Allenbach.Becky@epa.gov>
**Cc:** Donohue, Joyce <Donohue.Joyce@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>; Harper, Ashley <harper.ashley@epa.gov>; Huff, Lisa <Huff.Lisa@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>
**Subject:** RE: Letter to EPA RA RE: PFCs

Becky, I am still looking onto the paragraph we spoke about yesterday. I will add to these comments shortly

---

**From:** Strong, Jamie
**Sent:** Thursday, July 07, 2016 8:35 AM
**To:** Allenbach, Becky <Allenbach.Becky@epa.gov>
**Cc:** Behl, Betsy <Behl.Betsy@epa.gov>; Donohue, Joyce <Donohue.Joyce@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>; Harper, Ashley <harper.ashley@epa.gov>; Huff, Lisa <Huff.Lisa@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>
**Subject:** Re: Letter to EPA RA RE: PFCs

Becky,
We only had one comment (consulted with OGWDW) and a question. Thanks for allowing us to review. Let me know if you need anything else.

Jamie

---

**From:** Allenbach, Becky
**Sent:** Wednesday, July 6, 2016 6:02 PM

**To:** Behl, Betsy
**Cc:** Strong, Jamie
**Subject:** RE: Letter to EPA RA RE: PFCs

Thanks Betsy!!

Becky B. Allenbach, Chief
Grants and Drinking Water Protection Branch
EPA Region 4 - Atlanta
(404)562-9687
allenbach.becky@epa.gov

---

**From:** Behl, Betsy
**Sent:** Wednesday, July 06, 2016 6:02 PM
**To:** Allenbach, Becky <Allenbach.Becky@epa.gov>
**Cc:** Strong, Jamie <Strong.Jamie@epa.gov>
**Subject:** RE: Letter to EPA RA RE: PFCs

Thanks for the reminder Becky. We will try to get back to you this week

---

**From:** Allenbach, Becky
**Sent:** Wednesday, July 06, 2016 5:28 PM
**To:** Behl, Betsy <Behl.Betsy@epa.gov>
**Subject:** RE: Letter to EPA RA RE: PFCs
**Importance:** High

Hi Betsy:

Wondering if you have had time to review our document sent on June 30?

Becky B. Allenbach, Chief
Grants and Drinking Water Protection Branch
EPA Region 4 - Atlanta
(404)562-9687
allenbach.becky@epa.gov

---

**From:** Behl, Betsy
**Sent:** Thursday, June 30, 2016 10:29 AM
**To:** Allenbach, Becky <Allenbach.Becky@epa.gov>; Grevatt, Peter <Grevatt.Peter@epa.gov>; Giattina, James <Giattina.Jim@epa.gov>; Bush, William <Bush.William@epa.gov>; Ghosh, Mita <Ghosh.Mita@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>; Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>; Thomas, Lee <Thomas.Lee@epa.gov>; Campbell-Dunbar, Shawneille <Campbell-Dunbar.Shawneille@epa.gov>
**Cc:** Carroll, Gregory <Carroll.Gregory@epa.gov>; Thomas, Lee <Thomas.Lee@epa.gov>; Campbell-Dunbar, Shawneille <Campbell-Dunbar.Shawneille@epa.gov>; Humphris, Allison <Humphris.Allison@epa.gov>; Hall, Renea <Hall.Renea@epa.gov>; Lopez-Carbo, Maria <Lopez-Carbo.Maria@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>; Harris, Adrienne <Harris.Adrienne@epa.gov>; Osegueda, Carlos <Osegueda.Carlos@epa.gov>; Strong, Jamie <Strong.Jamie@epa.gov>; Flaherty, Colleen <Flaherty.Colleen@epa.gov>
**Subject:** RE: Letter to EPA RA RE: PFCs

Becky, we will provide comments to you on this. Thanks
Betsy

**From:** Allenbach, Becky
**Sent:** Thursday, June 30, 2016 10:24 AM
**To:** Grevatt, Peter <Grevatt.Peter@epa.gov>; Giattina, James <Giattina.Jim@epa.gov>; Bush, William <Bush.William@epa.gov>; Ghosh, Mita <Ghosh.Mita@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>; Thomas, Lee <Thomas.Lee@epa.gov>; Campbell-Dunbar, Shawneille <Campbell-Dunbar.Shawneille@epa.gov>
**Cc:** Carroll, Gregory <Carroll.Gregory@epa.gov>; Thomas, Lee <Thomas.Lee@epa.gov>; Campbell-Dunbar, Shawneille <Campbell-Dunbar.Shawneille@epa.gov>; Humphris, Allison <Humphris.Allison@epa.gov>; Hall, Renea <Hall.Renea@epa.gov>; Lopez-Carbo, Maria <Lopez-Carbo.Maria@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>; Harris, Adrienne <Harris.Adrienne@epa.gov>; Osegueda, Carlos <Osegueda.Carlos@epa.gov>
**Subject:** RE: Letter to EPA RA RE: PFCs

Peter, my staff is one step ahead of me as usual. They have put together this response for your review and edit. If you have more definitive information that we can share at this time that would be great. Alabama has been proactive in testing for the shorter chain compounds and their concerns are of course, very valid.

Becky

Becky B. Allenbach, Chief
Grants and Drinking Water Protection Branch
EPA Region 4 - Atlanta
(404)562-9687
allenbach.becky@epa.gov

---

**From:** Grevatt, Peter
**Sent:** Thursday, June 30, 2016 7:32 AM
**To:** Allenbach, Becky <Allenbach.Becky@epa.gov>; Giattina, James <Giattina.Jim@epa.gov>; Bush, William <Bush.William@epa.gov>; Ghosh, Mita <Ghosh.Mita@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>
**Cc:** Carroll, Gregory <Carroll.Gregory@epa.gov>; Thomas, Lee <Thomas.Lee@epa.gov>; Campbell-Dunbar, Shawneille <Campbell-Dunbar.Shawneille@epa.gov>; Humphris, Allison <Humphris.Allison@epa.gov>; Hall, Renea <Hall.Renea@epa.gov>; Lopez-Carbo, Maria <Lopez-Carbo.Maria@epa.gov>; Wadlington, Christina <Wadlington.Christina@epa.gov>; Harris, Adrienne <Harris.Adrienne@epa.gov>; Osegueda, Carlos <Osegueda.Carlos@epa.gov>
**Subject:** RE: Letter to EPA RA RE: PFCs

Thanks Becky. Please let us know how we can be most helpful. Will you be sending us a draft response to review?

---

**From:** Allenbach, Becky
**Sent:** Wednesday, June 29, 2016 11:31 AM
**To:** Giattina, James <Giattina.Jim@epa.gov>; Bush, William <Bush.William@epa.gov>; Ghosh, Mita <Ghosh.Mita@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>; Grevatt, Peter <Grevatt.Peter@epa.gov>
**Cc:** Carroll, Gregory <Carroll.Gregory@epa.gov>; Thomas, Lee <Thomas.Lee@epa.gov>; Campbell-Dunbar, Shawneille <Campbell-Dunbar.Shawneille@epa.gov>; Humphris, Allison <Humphris.Allison@epa.gov>; Hall, Renea <Hall.Renea@epa.gov>; Lopez-Carbo, Maria <Lopez-Carbo.Maria@epa.gov>
**Subject:** Fwd: Letter to EPA RA RE: PFCs

Eric/Betsy:

Please see the letter below that we received from Alabama. We will need your assistance in preparing a response. We know that an additional study is currently going on in the Dalton, GA area.

Regards,

Becky

Sent from my iPhone

Begin forwarded message:

> **From:** "Dean, Glenda" <GLD@adem.alabama.gov>
> **Date:** June 29, 2016 at 10:14:55 AM EDT
> **To:** "'Allenbach, Becky'" <Allenbach.Becky@epa.gov>
> **Subject: Letter to EPA RA RE: PFCs**
>
> FYI.
>
> Glenda L. Dean, Chief
> Water Division
> Alabama Department of Environmental Management
> Post Office Box 301463
> Montgomery, Alabama 36130-1463
> (334) 271-7823
> www.adem.alabama.gov
> gld@adem.state.al.us

Message

**From**: Huff, Lisa [Huff.Lisa@epa.gov]
**Sent**: 12/15/2016 4:59:31 PM
**To**: Wadlington, Christina [Wadlington.Christina@epa.gov]
**CC**: Burneson, Eric [Burneson.Eric@epa.gov]; Carroll, Gregory [Carroll.Gregory@epa.gov]; Oshida, Phil [Oshida.Phil@epa.gov]
**Subject**: RE: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Christina,

I looked at the first 2 paragraphs you had provided and I checked in with Greg Carroll who had the following suggestions on the paragraph regarding UCMR3. Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

Thanks,

*Lisa Foersom Huff*

Associate Branch Chief
Targeting and Analysis Branch
Standards and Risk Management Division
Office of Groundwater and Drinking Water
U.S. EPA
EPA East Bldg. Rm. 2331 C
202-566-0787

**From:** Burneson, Eric
**Sent:** Thursday, December 15, 2016 9:25 AM
**To:** Wadlington, Christina <Wadlington.Christina@epa.gov>; Huff, Lisa <Huff.Lisa@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>; Albert, Ryan <Albert.Ryan@epa.gov>
**Cc:** Carroll, Gregory <Carroll.Gregory@epa.gov>; Oshida, Phil <Oshida.Phil@epa.gov>
**Subject:** RE: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Lisa Huff can you take the lead reviewing/updating the first two paragraphs?

Christina the third paragraph summarizes some of ORD's activity on PFAS. I think Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

**From:** Wadlington, Christina
**Sent:** Thursday, December 15, 2016 9:13 AM
**To:** Huff, Lisa <Huff.Lisa@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>; Albert, Ryan <Albert.Ryan@epa.gov>

**Cc:** Burneson, Eric <Burneson.Eric@epa.gov>
**Subject:** FW: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process Request assistance in reviewing/completing the below.

**

Ex. 5 - Deliberative Process

---

**From:** Fuld, John
**Sent:** Thursday, December 15, 2016 8:13 AM
**To:** Wadlington, Christina <Wadlington.Christina@epa.gov>
**Subject:** MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

# Office of Water
# Media Inquiry


**Travis Loop**
Communications Director-Water
loop.travis@epa.gov

**John W. Fuld, Ph.D.**
Media Relations Mgr.-Water
fuld.john@epa.gov


**DATE:** December 15, 2016
**OUTLET: The Decatur Daily**
**REPORTER: Evan Belanger**
**TOPIC: RE: Drinking Water**
**DEADLINE: Monday, 19 Dec. 9 am**

## PERTINENT INFORMATION:

I am aware the EPA is still investigating other C8 chemicals, otherwise known as PFAS, and that health advisories could be issued in the future for other C8 chemicals in drinking water, in addition to the current advisory regarding PFOS and PFOA.

I am uncertain whether the EPA is also studying possible health effects for C6 and C4 chemicals, which have replaced C8 chemicals in manufacturing processes, including manufacturing in Decatur, AL.

## QUESTION:

1. Does the EPA feel C6 are safe in drinking water?
2. Has the EPA set a limit for C6 in drinking water. If so, what is it?
3. Does the EPA feel C4 is safe in drinking water?
4. Has the EPA set a limit for C4 in drinking water? If so, what is it?
5. Is the EPA studying the potential health impacts of C4 in drinking water, and is the agency's recommendation regarding C4 in drinking water subject to change?
6. Is the EPA studying the potential health impacts of C6 in drinking water, and is the agency's recommendation regarding C6 in drinking water subject to change?
7. Does EPA believe C4 can be removed from wastewater through standard treatment processes such as those used at the Decatur Utilities municipal sewer plant?
8. Does EPA believe C6 can be removed from wastewater through standard treatment processes such as those that used at the Decatur Utilities municipal power plant

**John W. Fuld, Ph.D.**
Media Relations Manager-Water
Environmental Protection Agency
1200 Constitution Ave
Washington DC 20460
Office: 202-564-8847
Cell: 202-815-6408
Fuld.john@epa.gov

Message

**From**: Huff, Lisa [Huff.Lisa@epa.gov]
**Sent**: 12/15/2016 3:36:27 PM
**To**: Carroll, Gregory [Carroll.Gregory@epa.gov]
**Subject**: FW: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Greg,
Per Eric's request I looked at the first 2 paragraphs below and don't know that I have much to add unless you feel it's appropriate or we have elsewhere publicly said more about the UCMR3 results noted in paragraph 2 (and pasted here)

Ex. 5 - Deliberative Process

Christina is right that only PFOA and PFOS are on CCL4 – none of the other PFAS were listed.

Let me know if you think/want to add a sentence to the above Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

I see the prepub is up for UCMR4 – Congratulations! Ex. 5 - Deliberative Process

*Lisa Foersom Huff*

Associate Branch Chief
Targeting and Analysis Branch
Standards and Risk Management Division
Office of Groundwater and Drinking Water
U.S. EPA
EPA East Bldg. Rm. 2331 C
202-566-0787

**From:** Burneson, Eric
**Sent:** Thursday, December 15, 2016 9:25 AM
**To:** Wadlington, Christina <Wadlington.Christina@epa.gov>; Huff, Lisa <Huff.Lisa@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>; Albert, Ryan <Albert.Ryan@epa.gov>
**Cc:** Carroll, Gregory <Carroll.Gregory@epa.gov>; Oshida, Phil <Oshida.Phil@epa.gov>
**Subject:** RE: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Lisa Huff can you take the lead reviewing/updating the first two paragraphs?

Christina the third paragraph summarizes some of ORD's activity on PFAS. I think Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

**From:** Wadlington, Christina
**Sent:** Thursday, December 15, 2016 9:13 AM
**To:** Huff, Lisa <Huff.Lisa@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>; Albert, Ryan <Albert.Ryan@epa.gov>
**Cc:** Burneson, Eric <Burneson.Eric@epa.gov>
**Subject:** FW: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process Request assistance in reviewing/completing the below.

**

Ex. 5 - Deliberative Process

**From:** Fuld, John
**Sent:** Thursday, December 15, 2016 8:13 AM
**To:** Wadlington, Christina <Wadlington.Christina@epa.gov>
**Subject:** MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

**Office of Water**
**Media Inquiry**

**Travis Loop**
Communications Director-Water
loop.travis@epa.gov

**John W. Fuld, Ph.D.**
Media Relations Mgr.-Water
fuld.john@epa.gov

**DATE:** December 15, 2016
**OUTLET: The Decatur Daily**
**REPORTER: Evan Belanger**
**TOPIC: RE: Drinking Water**
**DEADLINE: Monday, 19 Dec. 9 am**

## PERTINENT INFORMATION:

I am aware the EPA is still investigating other C8 chemicals, otherwise known as PFAS, and that health advisories could be issued in the future for other C8 chemicals in drinking water, in addition to the current advisory regarding PFOS and PFOA.

I am uncertain whether the EPA is also studying possible health effects for C6 and C4 chemicals, which have replaced C8 chemicals in manufacturing processes, including manufacturing in Decatur, AL.

## QUESTION:

1. Does the EPA feel C6 are safe in drinking water?
2. Has the EPA set a limit for C6 in drinking water. If so, what is it?
3. Does the EPA feel C4 is safe in drinking water?
4. Has the EPA set a limit for C4 in drinking water? If so, what is it?
5. Is the EPA studying the potential health impacts of C4 in drinking water, and is the agency's recommendation regarding C4 in drinking water subject to change?
6. Is the EPA studying the potential health impacts of C6 in drinking water, and is the agency's recommendation regarding C6 in drinking water subject to change?
7. Does EPA believe C4 can be removed from wastewater through standard treatment processes such as those used at the Decatur Utilities municipal sewer plant?
8. Does EPA believe C6 can be removed from wastewater through standard treatment processes such as those that used at the Decatur Utilities municipal power plant

**John W. Fuld, Ph.D.**
Media Relations Manager-Water
Environmental Protection Agency
1200 Constitution Ave
Washington DC 20460
Office: 202-564-8847
Cell: 202-815-6408
Fuld.john@epa.gov

Message

**From**: Wadlington, Christina [Wadlington.Christina@epa.gov]
**Sent**: 4/4/2016 3:00:50 PM
**To**: Carroll, Gregory [Carroll.Gregory@epa.gov]
**CC**: Hautman, Dan [Hautman.Dan@epa.gov]; Burneson, Eric [Burneson.Eric@epa.gov]
**Subject**: PFOA UCMR Media Response

Greg,

Can I release this publically to a media outlet that has an inquiry about PFOA/PFOS? I took it from the DRAFT UCMR fact sheet.

**Ex. 5 - Deliberative Process**

Christina Wadlington
Communications Director
Office of Ground Water and Drinking Water
U.S. Environmental Protection Agency
Tel: 202.566.1859
Email: wadlington.christina@epa.gov

Message

**From**: Carroll, Gregory [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=B97C09639E7F415EABCF369552152FA5-GCARRO02]
**Sent**: 12/15/2016 4:52:46 PM
**To**: Huff, Lisa [Huff.Lisa@epa.gov]
**Subject**: RE: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

I like the shorter, simpler approach, but I'm flexible on this point.

---

**From:** Huff, Lisa
**Sent:** Thursday, December 15, 2016 11:10 AM
**To:** Carroll, Gregory <Carroll.Gregory@epa.gov>
**Subject:** RE: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Thanks Greg – so do you think it's best Ex. 5 - Deliberative Process

*Lisa Foersom Huff*

Associate Branch Chief
Targeting and Analysis Branch
Standards and Risk Management Division
Office of Groundwater and Drinking Water
U.S. EPA
EPA East Bldg. Rm. 2331 C
202-566-0787

---

**From:** Carroll, Gregory
**Sent:** Thursday, December 15, 2016 10:56 AM
**To:** Huff, Lisa <Huff.Lisa@epa.gov>
**Subject:** RE: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

See below for my suggestions. Let me know if you want me to send them to Christina.

Ex. 5 - Deliberative Process

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**From:** Huff, Lisa
**Sent:** Thursday, December 15, 2016 10:36 AM
**To:** Carroll, Gregory <Carroll.Gregory@epa.gov>
**Subject:** FW: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Greg,
Per Eric's request I looked at the first 2 paragraphs below and don't know that I have much to add unless you feel it's appropriate or we have elsewhere publicly said more about the UCMR3 results noted in paragraph 2 (and pasted here)

Ex. 5 - Deliberative Process

Christina is right that only PFOA and PFOS are on CCL4 – none of the other PFAS were listed.

Ex. 5 - Deliberative Process

I see the prepub is up for UCMR4 – Congratulations! - Ex. 5 - Deliberative Process

*Lisa Foersom Huff*

Associate Branch Chief
Targeting and Analysis Branch
Standards and Risk Management Division
Office of Groundwater and Drinking Water
U.S. EPA
EPA East Bldg. Rm. 2331 C
202-566-0787

---

**From:** Burneson, Eric
**Sent:** Thursday, December 15, 2016 9:25 AM
**To:** Wadlington, Christina <Wadlington.Christina@epa.gov>; Huff, Lisa <Huff.Lisa@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>; Albert, Ryan <Albert.Ryan@epa.gov>
**Cc:** Carroll, Gregory <Carroll.Gregory@epa.gov>; Oshida, Phil <Oshida.Phil@epa.gov>
**Subject:** RE: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Lisa Huff can you take the lead reviewing/updating the first two paragraphs?

Christina the third paragraph summarizes some of ORD's activity on PFAS. I think Ex. 5 - Deliberative Process

Ex. 5 - Deliberative Process

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**From:** Wadlington, Christina
**Sent:** Thursday, December 15, 2016 9:13 AM
**To:** Huff, Lisa <Huff.Lisa@epa.gov>; Christ, Lisa <Christ.Lisa@epa.gov>; Rodgers-Jenkins, Crystal <Rodgers-Jenkins.Crystal@epa.gov>; Albert, Ryan <Albert.Ryan@epa.gov>
**Cc:** Burneson, Eric <Burneson.Eric@epa.gov>
**Subject:** FW: MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

Are we doing anything else the PFAS (other than PFOA and PFOS)? I noticed we included others on UCMR3 but not in CCL4? Request assistance in reviewing/completing the below.

**

Ex. 5 - Deliberative Process

# Ex. 5 - Deliberative Process

**From:** Fuld, John
**Sent:** Thursday, December 15, 2016 8:13 AM
**To:** Wadlington, Christina <Wadlington.Christina@epa.gov>
**Subject:** MEDIA INQUIRY The Decatur Daily RE: Drinking Water DL: 12-19 9 am

# Office of Water
# Media Inquiry


**Travis Loop**
Communications Director-Water
loop.travis@epa.gov

**John W. Fuld, Ph.D.**
Media Relations Mgr.-Water
fuld.john@epa.gov


**DATE:** December 15, 2016
**OUTLET: The Decatur Daily**
**REPORTER: Evan Belanger**
**TOPIC: RE: Drinking Water**
**DEADLINE: Monday, 19 Dec. 9 am**

## PERTINENT INFORMATION:

I am aware the EPA is still investigating other C8 chemicals, otherwise known as PFAS, and that health advisories could be issued in the future for other C8 chemicals in drinking water, in addition to the current advisory regarding PFOS and PFOA.

I am uncertain whether the EPA is also studying possible health effects for C6 and C4 chemicals, which have replaced C8 chemicals in manufacturing processes, including manufacturing in Decatur, AL.

## QUESTION:

1. Does the EPA feel C6 are safe in drinking water?
2. Has the EPA set a limit for C6 in drinking water. If so, what is it?
3. Does the EPA feel C4 is safe in drinking water?
4. Has the EPA set a limit for C4 in drinking water? If so, what is it?
5. Is the EPA studying the potential health impacts of C4 in drinking water, and is the agency's recommendation regarding C4 in drinking water subject to change?
6. Is the EPA studying the potential health impacts of C6 in drinking water, and is the agency's recommendation regarding C6 in drinking water subject to change?
7. Does EPA believe C4 can be removed from wastewater through standard treatment processes such as those used at the Decatur Utilities municipal sewer plant?
8. Does EPA believe C6 can be removed from wastewater through standard treatment processes such as those that used at the Decatur Utilities municipal power plant

**John W. Fuld, Ph.D.**
Media Relations Manager-Water
Environmental Protection Agency
1200 Constitution Ave
Washington DC 20460
Office: 202-564-8847
Cell: 202-815-6408
Fuld.john@epa.gov

Message

**From**: Carroll, Gregory [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=B97C09639E7F415EABCF369552152FA5-GCARRO02]
**Sent**: 7/13/2016 2:25:14 PM
**To**: Bradford, Charlotte [Bradford.Charlotte@epa.gov]; Schuck, Tracey [Schuck.Tracey@epa.gov]
**Subject**: FW: Internal EPA Prep Meeting - Briefing Call on PFOA/PFOS Bill with Cong. Boyle's Staff

Forwarding in case Eric doesn't have a chance to look at this before our 11:30 meeting. Can one of you make sure he has a copy? Thanks.

---

**From:** Carroll, Gregory
**Sent:** Wednesday, July 13, 2016 9:11 AM
**To:** Burneson, Eric <Burneson.Eric@epa.gov>
**Subject:** FW: Internal EPA Prep Meeting - Briefing Call on PFOA/PFOS Bill with Cong. Boyle's Staff

Eric:

I'll follow your lead (speaking up when called on), but here are a number of background points to consider:

**Deliberative Process / Ex. 5**

# Deliberative Process / Ex. 5

I realize that some of these points will not be persuasive with Congress but am offering them for background.

Greg

---

**From:** Davis, CatherineM
**Sent:** Tuesday, July 12, 2016 10:11 AM
**To:** Burneson, Eric <Burneson.Eric@epa.gov>
**Cc:** Carroll, Gregory <Carroll.Gregory@epa.gov>
**Subject:** Re: Internal EPA Prep Meeting - Briefing Call on PFOA/PFOS Bill with Cong. Boyle's Staff

Thanks, I included a call-in number, so we should be good.

Cathy Davis
US Environmental Protection Agency
Office of Congressional and
Intergovernmental Relations
(202) 564-2703 (desk)
(202) 573-1704 (cell)

On Jul 12, 2016, at 10:05 AM, Burneson, Eric <Burneson.Eric@epa.gov> wrote:

> Yes we can meet in my office 2331A. Greg is in Cincinnati so we will call him.
>
> ---
>
> **From:** Davis, CatherineM
> **Sent:** Tuesday, July 12, 2016 9:49 AM
> **To:** Burneson, Eric <Burneson.Eric@epa.gov>
> **Subject:** Re: Internal EPA Prep Meeting - Briefing Call on PFOA/PFOS Bill with Cong. Boyle's Staff
>
> Hi Eric,
>
> Can we meet in your office for the prep meeting and the briefing call? Or is there a conference room near you that I could reserve?
>
> Thanks!
>
> Cathy Davis
> Office of Congressional and Intergovernmental Relations
> Office: 202-564-2703
> Mobile: 202-573-1704
> Email: davis.catherinem@epa.gov
>
> Send mail to:

US Environmental Protection Agency
1200 Pennsylvania Ave, NW
MC: 1305A
Washington, DC 20460

---

**From:** Davis, CatherineM
**Sent:** Tuesday, July 12, 2016 9:42:29 AM
**To:** Burneson, Eric; Carroll, Gregory
**Cc:** Christ, Lisa; Harris, Adrienne; Kaiser, Sven-Erik; Klasen, Matthew; Peck, Gregory; Orvin, Chris; Wehling, Carrie; Messier, Dawn; Greene, Ashley
**Subject:** Internal EPA Prep Meeting - Briefing Call on PFOA/PFOS Bill with Cong. Boyle's Staff
**When:** Wednesday, July 13, 2016 11:30 AM-12:00 PM.
**Where:** Call-in # Personal Matters / Ex. 6 Extension Personal Matters / Ex. 6 Participant Code Personal Matters / Ex. 6

Message

**From**: Carroll, Gregory [/O=EXCHANGELABS/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=B97C09639E7F415EABCF369552152FA5-GCARRO02]
**Sent**: 4/4/2016 4:04:50 PM
**To**: Wadlington, Christina [Wadlington.Christina@epa.gov]; Burneson, Eric [Burneson.Eric@epa.gov]
**CC**: Hautman, Dan [Hautman.Dan@epa.gov]
**Subject**: RE: PFOA UCMR Media Response

Christina -- I believe that this information is accurate, but see a suggested minor clarification in the third paragraph (I

**Deliberative Process / Ex. 5**

I'm comfortable with this being used but suggest that you wait for Eric to weigh in given the sensitivity around this subject.

---

**From:** Wadlington, Christina
**Sent:** Monday, April 04, 2016 11:01 AM
**To:** Carroll, Gregory <Carroll.Gregory@epa.gov>
**Cc:** Hautman, Dan <Hautman.Dan@epa.gov>; Burneson, Eric <Burneson.Eric@epa.gov>
**Subject:** PFOA UCMR Media Response

Greg,

Can I release this publically to a media outlet that has an inquiry about PFOA/PFOS? I took it from the DRAFT UCMR fact sheet.

**Deliberative Process / Ex. 5**

Christina Wadlington
Communications Director
Office of Ground Water and Drinking Water
U.S. Environmental Protection Agency
Tel: 202.566.1859
Email: wadlington.christina@epa.gov

Message

**From**: Gray, Fredianne [Gray.Fredianne@epa.gov]
**Sent**: 8/10/2016 4:30:18 PM
**To**: Frebis, Chris [Frebis.Chris@epa.gov]; Hautman, Dan [Hautman.Dan@epa.gov]
**Subject**: State access to UCMR 3 data

Hello Chris and Dan!

I have been away for 2 weeks so sorry to have missed the UCMR meeting. I'll catch up and read the minutes and look at the completeness tables. Thank you!

Washington Department of Health would like to look at the UCMR 3 data for perfluorinated chemicals. The request came from someone other than the Washington UCMR 4 contact (who is not the UCMR 3 contact). If the UCMR 4 contact can access CDX, does that also give them access to the UCMR 3 data? If not, can they get access or is it too late?

Thank you so much!
Fredianne

Message

**From**: Wright, Sarah | APHL [sarah.wright@aphl.org]
**Sent**: 8/4/2016 2:05:51 PM
**To**: Shoemaker, Jody [shoemaker.jody@epa.gov]; Strong, Jamie [Strong.Jamie@epa.gov]; Hautman, Dan [Hautman.Dan@epa.gov]
**CC**: Donohue, Joyce [Donohue.Joyce@epa.gov]
**Subject**: RE: UCMR4 and PFAS

Hello everyone – An update on this end. CDC will likely not speak on the biomonitoring method Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

Thanks again for your involvement with this webinar.
Sarah

---

**From:** Wright, Sarah | APHL
**Sent:** Monday, July 25, 2016 2:47 PM
**To:** 'Shoemaker, Jody' <shoemaker.jody@epa.gov>; Strong, Jamie <Strong.Jamie@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Thank you both – I'll send out a tentative hold for that date and time. However, I just talked with CDC and they need a bit of time to determine if they want to pr Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

---

**From:** Shoemaker, Jody [mailto:shoemaker.jody@epa.gov]
**Sent:** Monday, July 25, 2016 2:43 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>; Strong, Jamie <Strong.Jamie@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Sept 14 1-2 pm works for me.

Jody

Dr. Jody Shoemaker
EPA/National Exposure Research Laboratory
26 W. Martin Luther King Drive
MS 587
Cincinnati, OH 45268
513-569-7298 (office)
shoemaker.jody@epa.gov

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Friday, July 22, 2016 12:56 PM
**To:** Strong, Jamie <Strong.Jamie@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

It looks like Tuesday, September 13 is not so conducive for people's schedules. How about Wednesday, September 14 from 1-2 pm ET?

---

**From:** Wright, Sarah | APHL
**Sent:** Wednesday, July 20, 2016 1:25 PM
**To:** 'Strong, Jamie' <Strong.Jamie@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Great, thank you both for your quick responses. It would be great to have Jody discuss the method and Jamie, you would discuss the EPA health advisories? We'd definitely like to cover both.

Would Tuesday, September 13 from 2-3 pm ET work for you both?

I will also be asking for a speaker from CDC. If amenable to you all, I'd like to set up a call for us all to discuss webinar content specifics in the next few weeks.

Thanks again,
Sarah

---

**From:** Strong, Jamie [mailto:Strong.Jamie@epa.gov]
**Sent:** Wednesday, July 20, 2016 1:10 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>; Wright, Sarah | APHL <sarah.wright@aphl.org>
**Cc:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Either Joyce or I can participate in September or October

---

**From:** Hautman, Dan
**Sent:** Wednesday, July 20, 2016 1:04 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>
**Cc:** Strong, Jamie <Strong.Jamie@epa.gov>; Shoemaker, Jody <shoemaker.jody@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Sarah - Jody Shoemaker (ORD NERL) responded to me indicating she can present on the analytical method (EPA 537).

Jody – note the timing is flexible but early September is being targeted.

---

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Wednesday, July 20, 2016 12:49 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Strong, Jamie <Strong.Jamie@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Thanks Dan – Jamie, the timing is flexible; we would like to provide a good webinar for our labs sooner rather than later. Ideally I'd like to do it in early September.

---

**From:** Hautman, Dan [mailto:Hautman.Dan@epa.gov]
**Sent:** Wednesday, July 20, 2016 12:47 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>
**Cc:** Strong, Jamie <Strong.Jamie@epa.gov>
**Subject:** FW: UCMR4 and PFAS

Sarah – see Jamie's request regarding timing for the webinar.

---

**From:** Strong, Jamie
**Sent:** Wednesday, July 20, 2016 10:50 AM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** RE: UCMR4 and PFAS

when is this webinar?

---

**From:** Hautman, Dan
**Sent:** Thursday, July 14, 2016 6:21 PM
**To:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Strong, Jamie <Strong.Jamie@epa.gov>
**Cc:** Grimmett, Paul <Grimmett.Paul@epa.gov>; Wright, Sarah | APHL <sarah.wright@aphl.org>
**Subject:** FW: UCMR4 and PFAS

See below APHL request for speakers for a future Webinar:

Jody – Can you cover the methods, perhaps reusing the presentation you'll give at the Small System Workshop on 537? Or would you want Paul to cover it?

Jamie – Any possibility of providing a speaker for this APHL Webinar on PFC HAs.

---

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Thursday, July 14, 2016 5:23 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Thanks Dan for the good information – if it was the State Hygienic Laboratory at the University of Wisconsin, then yes that is the one we consider to be the PHL. Glad that we have a few PHLs participating – since it won't hurt, I'll put something about this in our next Environmental Laboratory newsletter. I think New Mexico is interested in participating. Do you all have a blurb or anything that advertises it? If not, I can develop something from the website.

As far as the webinar goes, ideally we'd like to address the following topics, listed in order of priority, as much as possible:
1.) provide overall review the Unregulated Contaminant Monitoring Rule (UCMR) 3 method, including sampling and other relevant considerations. This does not need to be in much detail, but rather a summary that can orient a laboratory just starting to adopt this method.
2.) discuss issues with the method and its capability to detect the lower EPA-recommended values.
3.) describe the health issues and data that supported the new EPA health advisories.
4.) summarize the publically-available EPA data to demonstrate how big of an issue it is nationwide.

The method is the priority, but it would be great to get some bigger picture information as well. If need be, we could have two EPA speakers.

What do you think?
Thanks,
Sarah

---

**From:** Hautman, Dan [mailto:Hautman.Dan@epa.gov]
**Sent:** Thursday, July 14, 2016 1:13 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>
**Subject:** RE: UCMR4 and PFAS

Sarah,
Thus far, 34 laboratories have registered with EPA to support UCMR4 testing. This includes the following:
Utah Public Health Laboratory
Arkansas Dept of Health
University of Wisconsin – Madison *(not sure if you consider this a public health lab)*

In the past we've found that 90% of the analytical support work is conducted at about 10 laboratories. With 34 labs engaged, we likely will not have a lab capacity issue. It wouldn't hurt to conduct state PHL outreach, but many may find it impractical to support a short term (3 year) program where occurrence may be low and immediate follow-up action by the state may not be warranted.

I can pull someone in that can address the analytical method (analytical chemist) but that same individual would not be an expert on the health advisories (toxicologist). Where do you see the priority?

Dan

---

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Wednesday, July 13, 2016 8:27 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** UCMR4 and PFAS

Hi Dan - hope you are well. A few questions - have you all had many applicants for UCMR4 testing, particularly public health labs? Would it be helpful if we conducted some outreach for this?

We'd like to do a webinar on the drinking water and biomonitoring methods for PFC/PFAS. Is there an EPA representative who is familiar with the drinking water method who might be available to speak on this and the new health advisories? Our timeline is flexible, but it does seem like lab capacity is an issue for many state environmental agencies.

Thanks!
Sarah

Sent from my Windows Phone

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This email has been scanned for spam and viruses by Proofpoint Essentials. Click here to report this email as spam.

Message

**From**: Burneson, Eric [Burneson.Eric@epa.gov]
**Sent**: 4/19/2016 1:50:41 PM
**To**: Hautman, Dan [Hautman.Dan@epa.gov]; Huff, Lisa [Huff.Lisa@epa.gov]; Wadlington, Christina [Wadlington.Christina@epa.gov]
**CC**: Grevatt, Peter [Grevatt.Peter@epa.gov]; Greene, Ashley [Greene.Ashley@epa.gov]
**Subject**: FW: PFCs rollout materials
**Attachments**: FactSheet_UCMR_PFCs.docx; Copy of PFOS PFOA Sum_Jan 2016.xlsx

Attached are the last versions of the UCMR Fact sheet and spreadsheet that I had from 2 weeks ago. Does anyone have a more recent version that can be used to create the "wrap" described below

-----Original Message-----
From: Grevatt, Peter
Sent: Tuesday, April 19, 2016 8:43 AM
To: Burneson, Eric <Burneson.Eric@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
Cc: Greene, Ashley <Greene.Ashley@epa.gov>
Subject: FW: PFCs rollout materials

The UCMR wrap referenced below came up in discussion last week. It is basically a short summary to use to help interpret the latest UCMR highlighted spreadsheet on PFAS results. Sorry to jam you on this, but it would be very helpful if you could draw from the fact sheet we previously prepared for intro and then very briefly summarize the key points shown in the fact sheet by COB. Note that I head to Dallas at about 2:00 today, but could review when I arrive.

-----Original Message-----
From: Grevatt, Peter
Sent: Tuesday, April 19, 2016 8:40 AM
To: Beauvais, Joel <Beauvais.Joel@epa.gov>; Loop, Travis <Loop.Travis@epa.gov>
Cc: Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>; Burneson, Eric <burneson.eric@epa.gov>; Greene, Ashley <greene.ashley@epa.gov>
Subject: RE: PFCs rollout materials

UCMR 'wrap' explaining the spreadsheet will be done later today. I'll be in the room on Thursday, but the 11:30 prep today is scheduled for a time that I can't attend. It would be very helpful if this could be moved to a time after my NAS panel and before I head to the airport so I could make sure I am clear on the latest materials and game plan.

-----Original Message-----
From: Beauvais, Joel
Sent: Tuesday, April 19, 2016 7:33 AM
To: Loop, Travis <Loop.Travis@epa.gov>
Cc: Southerland, Elizabeth <Southerland.Elizabeth@epa.gov>; Behl, Betsy <Behl.Betsy@epa.gov>; Grevatt, Peter <Grevatt.Peter@epa.gov>; Campbell, Ann <Campbell.Ann@epa.gov>
Subject: PFCs rollout materials

Travis and company - When can I get a look at the PFCs rollout materials for the Thursday mtg with the Administrator? I am out of pocket after 5 today and traveling to R6 tomorrow ...

Peter, we were going to work up a "wrap" explaining the UCMR spreadsheet to have in our back pockets - which we will need to discuss at the Thursday mtg. Do we have that ready?

Finally, I will be participating I. The Thursday mtg by phone so need to know, Peter, if you will be in the room with the Administrator to lead the meeting for us with Travis?

Message

**From**: Wright, Sarah | APHL [sarah.wright@aphl.org]
**Sent**: 8/23/2016 10:56:19 PM
**To**: Shoemaker, Jody [shoemaker.jody@epa.gov]; Strong, Jamie [Strong.Jamie@epa.gov]; Hautman, Dan [Hautman.Dan@epa.gov]
**CC**: Donohue, Joyce [Donohue.Joyce@epa.gov]
**Subject**: RE: UCMR4 and PFAS

Hi All – Thanks for your patience. After several rounds of recruitment, we have a finalized webinar panel. In addition to Jody and Jamie or Joyce, we will have Carin Huset from the Minnesota Public Health Laboratory as the third speaker. She will provide an example from the state public health laboratory perspective on how to approach a PFC community issue by providing a case study of how they analyzed the drinking water and used biomonitoring to assess, and ultimately, reduce exposure levels.

Martina McGarvey, Director of the Pennsylvania Environmental Laboratory, will moderate.

I'd like to change the date to give us all more time to get this together. Would sometime at the end of September/early October work for you all? And would it work to get together for a phone call with everyone sometime in the next two weeks to discuss each webinar part? If yes, I can send out doodle polls to determine everyone's availability.

Thanks,
Sarah

---

**From:** Wright, Sarah | APHL
**Sent:** Thursday, August 4, 2016 10:06 AM
**To:** 'Shoemaker, Jody' <shoemaker.jody@epa.gov>; 'Strong, Jamie' <Strong.Jamie@epa.gov>; 'Hautman, Dan' <Hautman.Dan@epa.gov>
**Cc:** 'Donohue, Joyce' <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Hello everyone – An update on this end. CDC will likely not speak on the biomonitoring method Deliberative Process / Ex. 5

Deliberative Process / Ex. 5

Thanks again for your involvement with this webinar.
Sarah

---

**From:** Wright, Sarah | APHL
**Sent:** Monday, July 25, 2016 2:47 PM
**To:** 'Shoemaker, Jody' <shoemaker.jody@epa.gov>; Strong, Jamie <Strong.Jamie@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Thank you both – I'll send out a tentative hold for that date and time. However, I just talked with CDC and they need a bit of time to determine if they want to present on the biomonitoring method due to some internal decisions they need

to make. I'll hopefully know by the middle of next week at the latest to see if they have a speaker and if that date will work for them. Thanks again, Sarah

---

**From:** Shoemaker, Jody [mailto:shoemaker.jody@epa.gov]
**Sent:** Monday, July 25, 2016 2:43 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>; Strong, Jamie <Strong.Jamie@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Sept 14 1-2 pm works for me.

Jody

Dr. Jody Shoemaker
EPA/National Exposure Research Laboratory
26 W. Martin Luther King Drive
MS 587
Cincinnati, OH 45268
513-569-7298 (office)
shoemaker.jody@epa.gov

---

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Friday, July 22, 2016 12:56 PM
**To:** Strong, Jamie <Strong.Jamie@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

It looks like Tuesday, September 13 is not so conducive for people's schedules. How about Wednesday, September 14 from 1-2 pm ET?

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**From:** Wright, Sarah | APHL
**Sent:** Wednesday, July 20, 2016 1:25 PM
**To:** 'Strong, Jamie' <Strong.Jamie@epa.gov>; Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Great, thank you both for your quick responses. It would be great to have Jody discuss the method and Jamie, you would discuss the EPA health advisories? We'd definitely like to cover both.

Would Tuesday, September 13 from 2-3 pm ET work for you both?

I will also be asking for a speaker from CDC. If amenable to you all, I'd like to set up a call for us all to discuss webinar content specifics in the next few weeks.

Thanks again,
Sarah

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**From:** Strong, Jamie [mailto:Strong.Jamie@epa.gov]
**Sent:** Wednesday, July 20, 2016 1:10 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>; Wright, Sarah | APHL <sarah.wright@aphl.org>

**Cc:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Donohue, Joyce <Donohue.Joyce@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Either Joyce or I can participate in September or October

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**From:** Hautman, Dan
**Sent:** Wednesday, July 20, 2016 1:04 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>
**Cc:** Strong, Jamie <Strong.Jamie@epa.gov>; Shoemaker, Jody <shoemaker.jody@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Sarah - Jody Shoemaker (ORD NERL) responded to me indicating she can present on the analytical method (EPA 537).

Jody – note the timing is flexible but early September is being targeted.

---

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Wednesday, July 20, 2016 12:49 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Cc:** Strong, Jamie <Strong.Jamie@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Thanks Dan – Jamie, the timing is flexible; we would like to provide a good webinar for our labs sooner rather than later. Ideally I'd like to do it in early September.

---

**From:** Hautman, Dan [mailto:Hautman.Dan@epa.gov]
**Sent:** Wednesday, July 20, 2016 12:47 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>
**Cc:** Strong, Jamie <Strong.Jamie@epa.gov>
**Subject:** FW: UCMR4 and PFAS

Sarah – see Jamie's request regarding timing for the webinar.

---

**From:** Strong, Jamie
**Sent:** Wednesday, July 20, 2016 10:50 AM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** RE: UCMR4 and PFAS

when is this webinar?

---

**From:** Hautman, Dan
**Sent:** Thursday, July 14, 2016 6:21 PM
**To:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Strong, Jamie <Strong.Jamie@epa.gov>
**Cc:** Grimmett, Paul <Grimmett.Paul@epa.gov>; Wright, Sarah | APHL <sarah.wright@aphl.org>
**Subject:** FW: UCMR4 and PFAS

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Jamie – Any possibility of providing a speaker for this APHL Webinar on PFC HAs.

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Thursday, July 14, 2016 5:23 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** RE: UCMR4 and PFAS

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The method is the priority, but it would be great to get some bigger picture information as well. If need be, we could have two EPA speakers.

What do you think?
Thanks,
Sarah

**From:** Hautman, Dan [mailto:Hautman.Dan@epa.gov]
**Sent:** Thursday, July 14, 2016 1:13 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>
**Subject:** RE: UCMR4 and PFAS

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I can pull someone in that can address the analytical method (analytical chemist) but that same individual would not be an expert on the health advisories (toxicologist). Where do you see the priority?

Dan

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Wednesday, July 13, 2016 8:27 PM

**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** UCMR4 and PFAS

Hi Dan - hope you are well. A few questions - have you all had many applicants for UCMR4 testing, particularly public health labs? Would it be helpful if we conducted some outreach for this?

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Thanks!
Sarah

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Message

**From**: Shoemaker, Jody [shoemaker.jody@epa.gov]
**Sent**: 7/20/2016 4:58:59 PM
**To**: Hautman, Dan [Hautman.Dan@epa.gov]
**Subject**: RE: UCMR4 and PFAS

You can put me down as the webinar speaker for Method 537. Not sure it will be a very exciting talk given that I would be just regurgitating what is everyone could just read. Usually I give talks on the development of the method, not the final procedure.

Jody

Dr. Jody Shoemaker
EPA/National Exposure Research Laboratory
26 W. Martin Luther King Drive
MS 587
Cincinnati, OH 45268
513-569-7298 (office)
shoemaker.jody@epa.gov

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**From:** Hautman, Dan
**Sent:** Wednesday, July 20, 2016 12:57 PM
**To:** Shoemaker, Jody <shoemaker.jody@epa.gov>
**Subject:** RE: UCMR4 and PFAS

Only the method. I would expect OST (Jamie) to cover the health advisories.

---

**From:** Shoemaker, Jody
**Sent:** Friday, July 15, 2016 8:41 AM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** RE: UCMR4 and PFAS

This is just a summary of the analytical procedure for PFAAs? I am definitely not comfortable talking about the health advisories.

Jody

Dr. Jody Shoemaker
EPA/National Exposure Research Laboratory
26 W. Martin Luther King Drive
MS 587
Cincinnati, OH 45268
513-569-7298 (office)
shoemaker.jody@epa.gov

---

**From:** Hautman, Dan
**Sent:** Thursday, July 14, 2016 6:21 PM
**To:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Strong, Jamie <Strong.Jamie@epa.gov>
**Cc:** Grimmett, Paul <Grimmett.Paul@epa.gov>; Wright, Sarah | APHL <sarah.wright@aphl.org>
**Subject:** FW: UCMR4 and PFAS

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**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Thursday, July 14, 2016 5:23 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** RE: UCMR4 and PFAS

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The method is the priority, but it would be great to get some bigger picture information as well. If need be, we could have two EPA speakers.

What do you think?
Thanks,
Sarah

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**From:** Hautman, Dan [mailto:Hautman.Dan@epa.gov]
**Sent:** Thursday, July 14, 2016 1:13 PM
**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>
**Subject:** RE: UCMR4 and PFAS

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I can pull someone in that can address the analytical method (analytical chemist) but that same individual would not be an expert on the health advisories (toxicologist). Where do you see the priority?

Dan

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**To:** Hautman, Dan <Hautman.Dan@epa.gov>
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Thanks!
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Sent from my Windows Phone

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Message

**From**: Wright, Sarah | APHL [sarah.wright@aphl.org]
**Sent**: 7/20/2016 4:48:52 PM
**To**: Hautman, Dan [Hautman.Dan@epa.gov]
**CC**: Strong, Jamie [Strong.Jamie@epa.gov]
**Subject**: RE: UCMR4 and PFAS

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**To:** Wright, Sarah | APHL <sarah.wright@aphl.org>
**Cc:** Strong, Jamie <Strong.Jamie@epa.gov>
**Subject:** FW: UCMR4 and PFAS

Sarah – see Jamie's request regarding timing for the webinar.

---

**From:** Strong, Jamie
**Sent:** Wednesday, July 20, 2016 10:50 AM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** RE: UCMR4 and PFAS

when is this webinar?

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**From:** Hautman, Dan
**Sent:** Thursday, July 14, 2016 6:21 PM
**To:** Shoemaker, Jody <shoemaker.jody@epa.gov>; Strong, Jamie <Strong.Jamie@epa.gov>
**Cc:** Grimmett, Paul <Grimmett.Paul@epa.gov>; Wright, Sarah | APHL <sarah.wright@aphl.org>
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**Sent:** Thursday, July 14, 2016 5:23 PM
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**Subject:** RE: UCMR4 and PFAS

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Sarah

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**Sent:** Wednesday, July 13, 2016 8:27 PM
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Message

**From**: Shoemaker, Jody [shoemaker.jody@epa.gov]
**Sent**: 7/15/2016 12:40:54 PM
**To**: Hautman, Dan [Hautman.Dan@epa.gov]
**Subject**: RE: UCMR4 and PFAS

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Sent from my Windows Phone

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Message

**From**: Karapondo, Michella [Karapondo.Michella@epa.gov]
**Sent**: 7/14/2016 1:37:28 PM
**To**: Hautman, Dan [Hautman.Dan@epa.gov]
**Subject**: RE: UCMR4 and PFAS

34 registered.

Utah Public Health Laboratory
Arkansas Dept of Health
I am not sure if University of Wisconsin – Madison counts

---

**From:** Hautman, Dan
**Sent:** Thursday, July 14, 2016 7:34 AM
**To:** Karapondo, Michella <Karapondo.Michella@epa.gov>
**Subject:** FW: UCMR4 and PFAS

Michella,
Can you tell me how many labs have registered for UCMR4 and how many are state labs? I'll respond to Sarah.

---

**From:** Wright, Sarah | APHL [mailto:sarah.wright@aphl.org]
**Sent:** Wednesday, July 13, 2016 8:27 PM
**To:** Hautman, Dan <Hautman.Dan@epa.gov>
**Subject:** UCMR4 and PFAS

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