Supporting Information for

Disinfection By-Products in Drinking Water from the Tap: Variability in Household Calculated Additive Toxicity (CAT)

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Abbreviations

AWWA	American Water Works Association
BAA	Bromoacetic Acid
BAN	Bromoacetonitrile
BCAA	Bromochloroacetic Acid
BCAN	Bromochloroacetonitrile
BCIM	Bromochloroiodomethane
BDCAA	Bromodichloroacetic Acid
BDCM	Bromodichloromethane
CAA	Chloroacetic Acid
CAT	Calculated Additive Toxicity
CDBAA	Chlorodibromoacetic Acid
CDIM	Chlorodiiodomethane
CHO	Chinese Hamster Ovary
CI	Confidence Interval
CIAA	Chloroiodoacetic Acid
CL	Chlorination
cld	Compact Letter Display
CLM	Chloramination
CV	Coefficient of Variation
DBAA	Dibromoacetic Acid
DBAN	Dibromoacetonitrile
DBP	Disinfection By-Product
DCAA	Dichloroacetic Acid
df	Degrees of Freedom
EB	East Bay
EC	Effect Concentration
ECD	Electron Capture Detector
EPA	U.S. Environmental Protection Agency
GC	Gas Chromatography
GW	Groundwater
HAN	Haloacetonitrile
HK	Haloketones
HLB	Hydrophilic Lipophilic Balanced
IAA	Iodoacetic Acid
IAN	Iodoacetonitrile
IDSE	Initial Distribution System Evaluation
IQR	Interquartile Range
IR	Irvine
LA	Los Angeles
LC	Lethal Concentration
LLE	Liquid–Liquid Extraction
LOD	Limit of Detection
LOQ	Limit of Quantification
LRAA	Locational Running Annual Average
LSW	Large Surface Water
MC	Merced
MCL	Maximum Contaminant Level
MD	Madera
MS	Mass Spectrometry
MTBE	Methyl Tert–Butyl Ether
MW	Molecular Weight
MW	Mixed Water
MWD	Metropolitan Water District
ND	Not Detected
NOM	Natural Organic Matter
OS	Oxidative Stress
PDMS	Polydimethylsiloxane
Q1	First Quartile
Q2	Second Quartile
Q3	Third Quartile
QC	Quality Control
S	Summer
SM	San Mateo
SSW	Small Surface Water
TBAA	Tribromoacetic Acid
TBM	Tribromomethane
TCAA	Trichloroacetic Acid
TCM	Trichloromethane
TFSPME	Thin–Filmed Solid–Phase Microextraction
THM	Trihalomethane
W	Winter
WHO	World Health Organization
WV	Weaverville
YT	Yurok Tribe

Table S1: Targeted Disinfection By-Product Compounds

Class	Compound	Abv.	CAS no.	SMILES	Vendor	Purity
THM_4	Trichloromethane	TCM	67–66–3	C(Cl)(Cl)Cl	EPA 551A Mix, Sigma[a]	–
	Bromodichloromethane	BDCM	75–27–4	C(Cl)(Cl)Br	EPA 551A Mix, Sigma[a]	–
	Dibromochloromethane	DBCM	124–48–1	C(Cl)(Br)Br	EPA 551A Mix, Sigma[a]	–
	Tribromomethane	TBM	75–25–2	C(Br)(Br)Br	EPA 551A Mix, Sigma[a]	–
THM_{UR}	Bromochloroiodomethane	BCIM	34970–00–8	C(Cl)(Br)I	TRC[b]	97.0%
	Chlorodiiodomethane	CDIM	638–73–3	C(Cl)(I)I	TRC[b]	95.0%
HAA_5	Chloroacetic Acid	CAA	79–11–8	C(C(=O)O)Cl	EPA 552.2 Mix, Sigma[a]	–
	Dichloroacetic Acid	DCAA	79–43–6	C(C(=O)O)(Cl)Cl	EPA 552.2 Mix, Sigma[a]	–
	Trichloroacetic Acid	TCAA	76–03–9	C(=O)(C(Cl)(Cl)Cl)O	EPA 552.2 Mix, Sigma[a]	–
	Bromoacetic Acid	BAA	79–08–3	C(C(=O)O)Br	EPA 552.2 Mix, Sigma[a]	–
	Dibromoacetic Acid	DBAA	631–64–1	C(C(=O)O)(Br)Br	EPA 552.2 Mix, Sigma[a]	–
HAA_{UR}	Bromochloroacetic Acid	BCAA	5589–96–8	C(C(=O)O)(Cl)Br	EPA 552.2 Mix, Sigma[a]	–
	Bromodichloroacetic Acid	BDCAA	71133–14–7	C(=O)(C(Cl)(Cl)Br)O	EPA 552.2 Mix, Sigma[a]	–
	Chlorodibromoacetic Acid	CDBAA	5278–95–5	C(=O)(C(Cl)(Br)Br)O	EPA 552.2 Mix, Sigma[a]	–
	Tribromoacetic Acid	TBAA	75–96–7	C(=O)(C(Br)(Br)Br)O	EPA 552.2 Mix, Sigma[a]	–
	Iodoacetic Acid	IAA	64–69–7	C(C(=O)O)I	TRC[b]	98.0%
	Chloroiodoacetic Acid	CIAA	53715–09–6	C(C(=O)O)(Cl)I	TRC[b]	95.0%
HAN	Bromoacetonitrile	BAN	590–17–0	C(C#N)Br	TRC[b]	98.0%
	Bromochloroacetonitrile	BCAN	83463–62–1	C(#N)C(Cl)Br	TRC[b]	90.0%
	Dibromoacetonitrile	DBAN	3252–43–5	C(#N)C(Br)Br	TRC[b]	96.3%
	Iodoacetonitrile	IAN	624–75–9	C(C#N)I	TRC[b]	–

[a] *purchased from Sigma–Aldrich*
[b] *purchased from Toronto Research Chemicals*

Section S1: Additional Information for Studied Public Water Systems

Table S2: Overview of Public Water Systems

SOURCE WATER TYPE	REGION	WATER SYSTEM	POPULATION SERVED	DISINFECTION TYPE	CONSUMER CONFIDENCE REPORTS
Large Surface Water	San Mateo	California Water Services, San Mateo	101,004	Chloramination	2020
	East Bay	East Bay Municipal Utility District	1,379,000	Chloramination	2020
Small Surface Water	Weaverville	Weaverville C. S. D.	3,554	Chlorination	2020
	Yurok	Yurok Tribal Environmental Program	< 1,000	Chlorination	2020
Mixed Water	Los Angeles	LA City Department of Water and Power	4,072,307	Chloramination	2020
	Irvine	Irvine Ranch Water District	450,526	Chloramination	2020
Groundwater	Madera	City of Madera	66,082	Chlorination	2020
	Merced	City of Merced	86,750	Chlorination	2020

Figure S1: Map of Studied Public Water Systems

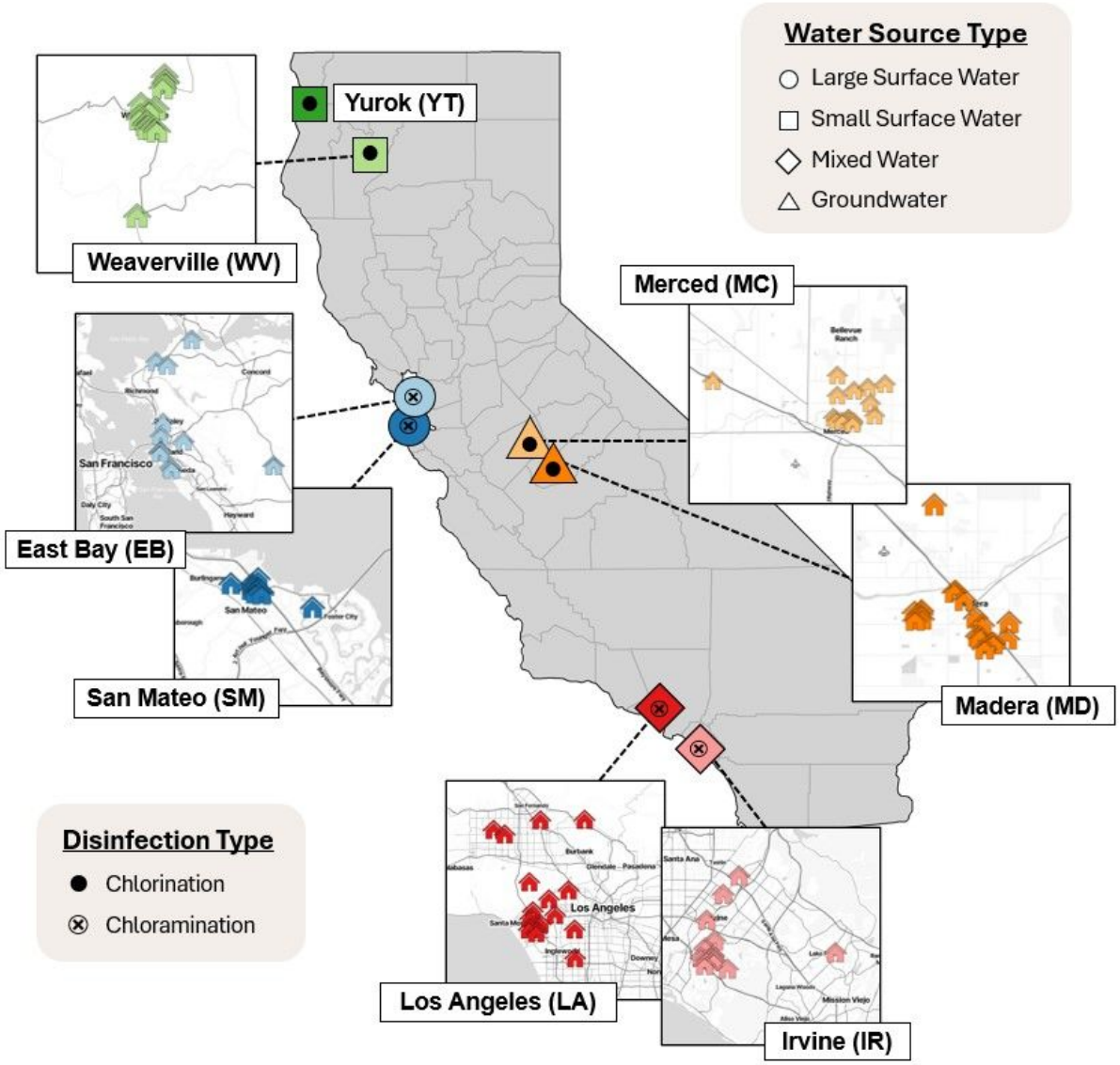
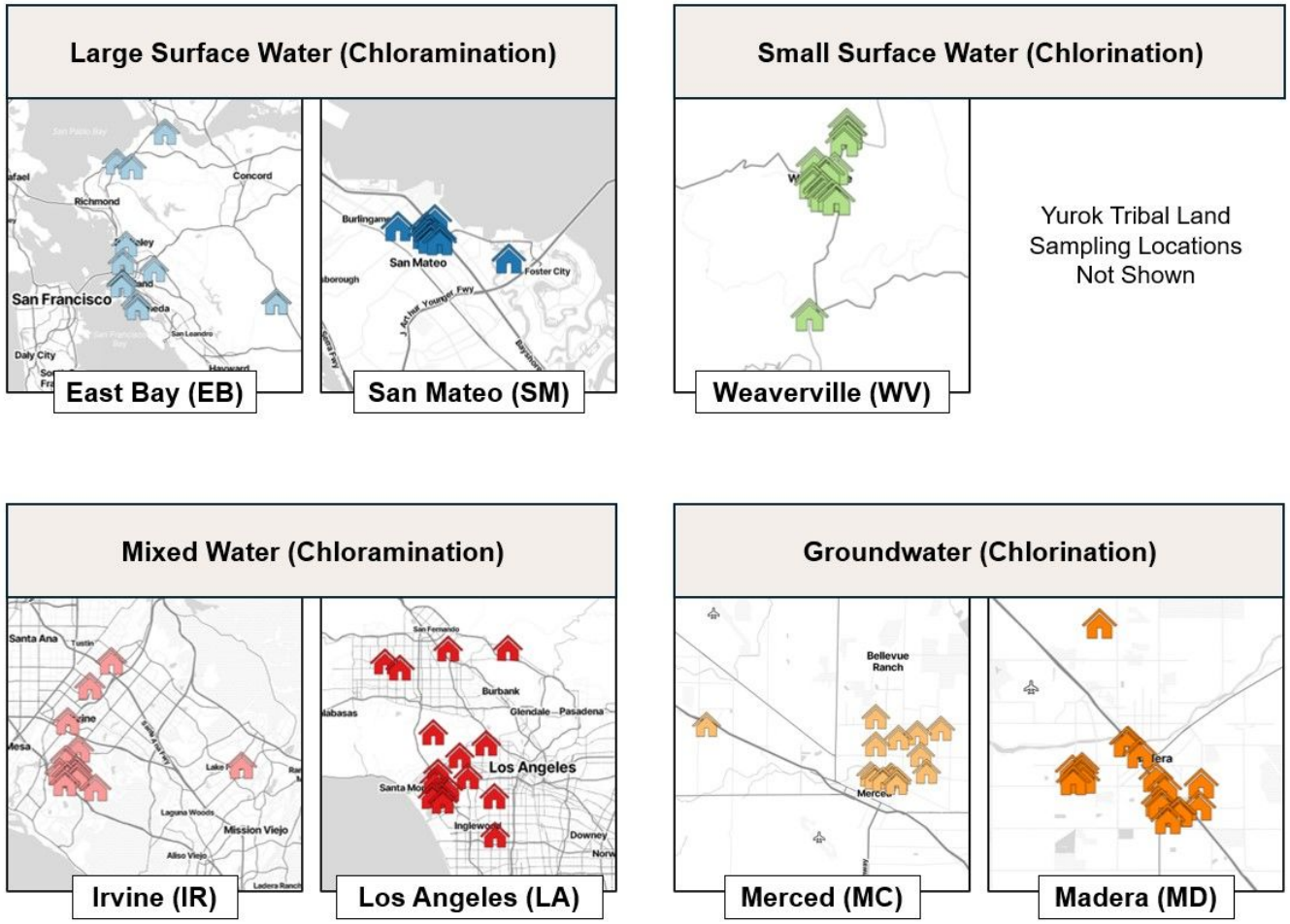


Figure S2: Household Sampling Locations



Section S2: Additional Information for Analytical Methods

Section S2.1: Methodological Limitations

1) Lack of use of dechlorinating agent during sample preparation:

EPA approved methods all require the use of preservatives or dechlorinating agents such as ammonium chloride or sodium thiosulfate to prevent further reactions between disinfectants and precursors.[1] In this study, household tap water samples were collected by participants, transported to the UC Davis Department of Civil and Environmental Engineering, immediately cooled on ice and shipped the same day, and were analyzed using numerous methods for targeted and nontargeted chemical analysis. Use of a dechlorinating agent risked reactions that might compromise nontarget compound detection or identification, a central project goal. To assess the validity of the methods used in this study, measured regulated concentrations in each region were statistically compared with concentrations reported in water utility consumer confidence reports (CCR). A Student's t-Test revealed that measured regulated concentrations were comparable to values reported in water utility consumer confidence reports (CCR) with no statistical difference for either THM_4 ($P = 0.10$, $df = 7$) or HAA_5 ($P = 0.19$, $df = 6$). Comparable values between reported and measured regulated compound concentrations support the validity of the methods used in this study despite deviations from established methods.

2) Extended reaction times during sample processing:

Household tap water samples were held at 4°C up to 14 days prior to extraction and thus also had extended reaction times. THM concentrations have been found to increase with residence time, forming as end products while other DBPs are intermediates.[2] Measured THM_4 concentrations averaged +9.6 μg/L more than reported values, which may be due to lack of use of a dechlorinating agent and extended reaction times. As mentioned in the previous section, a Student's t-Test revealed that measured regulated concentrations were comparable to values reported in water utility consumer confidence reports (CCR) with no statistical difference for either THM_4 ($P = 0.10$, $df = 7$) or HAA_5 ($P = 0.19$, $df = 6$). Comparable values between reported and measured regulated concentrations supports the validity of the methods used in this study despite extended reaction times.

3) Instances of chloroform extrapolation:

Chloroform was detected in every region, but, 64% of summer detects and 41% of winter detects saturated the GC–MS detector and were beyond the linear range of the calibration curve. Due to limited sample volume, we were unable to dilute and rerun samples. While extrapolated chloroform concentrations are reported, it should be noted that these values have a high degree of uncertainty. However, chloroform is one of the least potent DBPs for all five biological endpoints and did not have a significant impact on calculated additive toxicity.

4) Inclusion of a limited set of unregulated DBPs:

DBPs examined in this study include all currently regulated organohalogen DBPs (THM4 and HAA5). However, a limited set of 12 unregulated DBPs were selected including four HANs, six additional HAAs, and two additional THMs. The DBPs included in this study account for ~21% of the DBPs in the CHO database[3] and ~38% in the database for the other endpoints.[4] While it was not feasible to include all known unregulated DBP compounds with toxicological data,

potent drivers of toxicity were selected for this study including haloacetonitriles (particularly DBAN), bromo-DBPs, and iodo-DBPs.

Section S2.2: Materials and Reagents

All materials and reagents were purchased at the highest purity available. Standards were purchased from Accustandard Inc., New Haven, CT; Sigma-Aldrich, St. Louis, MO; and Toronto Research Chemicals Inc., Toronto, Ontario. All compounds and solvents used for extraction including sodium bicarbonate, sodium sulfate, acetone, hexane, methanol, methyl tert-butyl ether (MTBE), and sulfuric acid were purchased from Thermo Fisher Scientific, Waltham, MA or Sigma-Aldrich, St. Louis, MO. Carrier gas tanks for gas chromatography (GC) instruments including nitrogen, helium, and argon (5% methane) were purchased from Airgas, Radnor, PA.

Section S2.3: Extraction Methods

Haloacetic Acids (HAAs)

HAA extraction methods were derived from EPA Method 552.3, however a dechlorinating agent was not used.[5] All HAAs were extracted using a liquid-liquid extraction (LLE) with 40 mL of sample, 4 mL of methyl tert-butyl ether (MTBE), and 18 g of sodium sulfate. Samples were acidified with sulfuric acid to ensure pH < 0.5 and derivatized by sample methylation with acidified methanol using methods outlined in EPA Method 552.3.[5] Extracts were then analyzed using GC–ECD (Agilent 6890) and methods outlined in Section S2.4. Results were analyzed using Agilent ChemStation Software and Microsoft Excel. Chloroacetic acid (CAA) coeluted with an unidentified compound in samples from some regions. Duplicates of all winter and summer samples were analyzed using GC–ECD and methods outlined in Section S2.4. However, an Agilent J&W DB-5MS GC column was used and the method was modified to a shorter run time to exclusively analyze CAA. HAAs were analyzed separately from THMs and HANs because HAA analysis methods using GC–ECD or GC–MS require an additional derivatization process.

Trihalomethanes (THMs) and Haloacetonitriles (HANs)

All remaining compounds including THMs and HANs were extracted using thin-film solid-phase microextraction (TF–SPME) with polydimethylsiloxane/ hydrophilic lipophilic balanced (PDMS/HLB) fibers. Preconditioned fibers were immersed in 10 mL of sample in 12 mL amber vials which were then placed in a tube rotator for 30 minutes at 30 rpm. The fibers were allowed to dry fully before being placed in thermal desorption tubes and analyzed using GC–MS (Agilent 6890) paired with an automated thermal desorption system (Markes International ULTRA–xr) and methods outlined in Section S2.5. Results were analyzed using Agilent MassHunter Quantitative Analysis Software.

Section S2.4: Overview of GC–ECD Methods

6890 GC METHOD

OVEN
Initial temp: 40 'C (On) Maximum temp: 325 'C
Initial time: 10.00 min Equilibration time: 3.00 min
Ramps:

#	Rate	Final temp	Final time
1	2.50	65	0.00
2	10.00	85	0.00
3	20.00	205	7.00
4	0.0(Off)		

Post temp: 100 'C
Post time: 0.00 min
Run time: 35.00 min

FRONT INLET (SPLIT/SPLITLESS) BACK INLET (VOLATILES)
Mode: Splitless Mode: Split
Initial temp: 210 'C (On) Initial temp: 50 'C (Off)
Pressure: 9.17 psi (On) Pressure: 0.00 psi (Off)
Purge flow: 30.0 mL/min Total flow: 45.0 mL/min
Purge time: 0.75 min Gas saver: Off
Total flow: 33.6 mL/min Gas type: Helium
Gas saver: Off
Gas type: Helium

COLUMN 1 COLUMN 2
Capillary Column (not installed)
Model Number: Agilent 222–0732LTM
DB–1701 (G3900–63003)
Max temperature: 300 'C
Nominal length: 30.0 m
Nominal diameter: 250.00 um
Nominal film thickness: 0.25 um
Mode: constant pressure
Pressure: 9.17 psi
Nominal initial flow: 0.7 mL/min
Average velocity: 20 cm/sec
Inlet: Front Inlet
Outlet: Back Detector
Outlet pressure: ambient

FRONT DETECTOR (FID) BACK DETECTOR (μECD)
Temperature: 250 'C (Off) Temperature: 250 'C (On)
Hydrogen flow: 40.0 mL/min (Off) Mode: Constant column+makeup flow
Air flow: 450.0 mL/min (Off) Combined flow: 20.0 mL/min
Mode: Constant makeup flow Makeup flow: On
Makeup flow: 45.0 mL/min (Off) Makeup Gas Type: Argon methane 5%
Makeup Gas Type: Nitrogen Electrometer: On
Flame: Off
Electrometer: Off
Lit offset: 2.0

SIGNAL 1 SIGNAL 2
Data rate: 20 Hz Data rate: 20 Hz

Type: back detector
Save Data: On
Zero: 0.0 (Off)
Range: 0
Fast Peaks: Off
Attenuation: 0

Type: front detector
Save Data: Off
Zero: 0.0 (Off)
Range: 0
Fast Peaks: Off
Attenuation: 0

COLUMN COMP 1
Derive from back detector

COLUMN COMP 2
Derive from back detector

AUX PRESSURE 3
Description:
Gas Type: Helium
Initial pressure: 0.00 psi (Off)

AUX PRESSURE 4
Description:
Gas Type: Helium
Initial pressure: 0.00 psi (Off)

AUX PRESSURE 5
Description:
Gas Type: Helium
Initial pressure: 0.00 psi (Off)

POST RUN
Post Time: 0.00 min

TIME TABLE

Time	Specifier	Parameter & Setpoint

GC Injector

Front Injector:

Sample Washes	2
Sample Pumps	3
Injection Volume	1.00 microliters
Syringe Size	5.0 microliters
PreInj Solvent A Washes	2
PreInj Solvent B Washes	2
PostInj Solvent A Washes	2
PostInj Solvent B Washes	2
Viscosity Delay	0 seconds
Plunger Speed	Fast
PreInjection Dwell	0.00 minutes
PostInjection Dwell	0.00 minutes

Back Injector:
No parameters specified

Section S2.5: Overview of GC–MS Methods

6890 GC METHOD

OVEN
Equilibration time: 0.50 min
Maximum temp: 260 C
Initial temp: 45 C (On)
Initial time: 3.00 min
Ramps:
Rate Final temp Final time
1 10.00 250 5.00
2 0 (Off)
Post temp: 0 C
Post time: 0.00 min
Run time: 28.50 min

FRONT INLET (SPLIT/SPLITLESS)
Mode: Splitless
Initial temp: 250 C (Off)
Pressure: 7.3 psi (Off)
Purge flow: 50.0 mL/min
Purge time: 2.00 min
Total flow: 53.7 mL/min
Gas saver: On
Saver flow: 20.0 mL/min
Saver time: 2.00 min
Gas type: Helium

BACK INLET (SPLIT/SPLITLESS)
Mode: Split
Initial temp: 140 C (On)
Pressure: 0.0 psi (Off)
Total flow: 45.0 mL/min
Gas saver: Off
Gas type: Helium

COLUMN 1
Capillary Column
Max temperature: 320 C
Nominal length: 30.0 m
Nominal diameter: 250.00 um
Nominal film thickness: 0.25 um
Mode: constant flow
Initial flow: 1.0 mL/min
Nominal init pressure: 7.3 psi
Average velocity: 36 cm/sec
Inlet: Front Inlet
Outlet: MSD
Outlet pressure: vacuum

MS ACQUISITION PARAMETERS

COLUMN 2
(not installed)

FRONT DETECTOR (NO DET)

BACK DETECTOR (NO DET)

SIGNAL 1
Save Data: Off

SIGNAL 2
Save Data: Off

THERMAL AUX 2
Use: MSD Transfer Line Heater
Initial temp: 280 C (On)

POST RUN
Post Time: 0.00 min

INJECTOR 1
Solvent Wash Mode: A, B
Waste Bottle Use: A Only
Sample Volume (uL): 2.000
Syringe size (uL): 5.0
Pre washes from bottle A: 2
Pre washes from bottle B: 2
Post washes from bottle A: 2
Post washes from bottle B: 2
Viscosity delay (seconds): 0
Pre injection dwell (min): 0.00
Post injection dwell (min): 0.00
Sample skim depth (mm): 0.0 (Off)
Plunger Speed: Fast
Solvent saver: Off

ALS ERRORS:
On missing vial: pause

TIME TABLE
Time(min) Parameter & Setpoint

Column 1 Inventory Number :
Column 2 Inventory Number :

General Information

Tune File : atune.u
Acquistion Mode : Scan

MS Information

Solvent Delay : 0.00 min

EMV Mode : Relative
Relative Voltage : 0
Resulting EM Voltage : 1812

[Scan Parameters]

Low Mass : 35.0
High Mass : 300.0
Threshold : 0
Sample # : 2 A/D Samples 4
Plot 2 low mass : 33.0
Plot 2 high mass : 300.0

[MSZones]

MS Source : 230 C maximum 250 C
MS Quad : 150 C maximum 200 C

END OF MS ACQUISITION PARAMETERS

TUNE PARAMETERS for SN: US02080150

Trace Ion Detection is OFF.

EMISSION : 34.610
ENERGY : 69.922
REPELLER : 29.955
IONFOCUS : 90.157
ENTRANCE_LE : 0.000
EMVOLTS : 1811.765
Actual EMV : 1811.77
GAIN FACTOR : 2.07
AMUGAIN : 2275.000
AMUOFFSET : 126.000
FILAMENT : 1.000
DCPOLARITY : 0.000
ENTLENSOFFS : 25.098
MASSGAIN : 251.000
MASSOFFSET : –10.000

END OF TUNE PARAMETERS

END OF INSTRUMENT CONTROL PARAMETERS

Section S2.6: Limits of Detection and Quality Controls

The limits of detection (LOD) and limits of quantification (LOQ) for all compounds are summarized in Table S5. The LOQ for all compounds ranged from 0.01–1 µg/L however most were at 0.1 µg/L. Values between the LOD and LOQ were included in variability and toxicity analysis for compounds that had high detection frequencies (>60%) within a given distribution system. Although these values have a higher uncertainty, they were included because they provide the best available point estimate of potential exposure and toxicity. The relative standard deviation (RSD) between QC recoveries (GC–ECD) and QC peak response (GC–MS) are presented in Table S5. Accuracies for all points used in the calibration curve from the LOQ to the maximum calibration point are also reported in Table S5. Retention times for GC–ECD and GC–MS are presented in Tables S3 and S4, respectively.

Table S3: GC–ECD Retention Times (RTs)

Class	Compound	Abv.	CAS no.	RT – Winter (min)	RT – Summer (min)
HAA_5	Chloroacetic Acid	CAA	79–11–8	5.37	5.37
	Dichloroacetic Acid	DCAA	79–43–6	20.75	20.82
	Trichloroacetic Acid	TCAA	76–03–9	23.29	23.33
	Bromoacetic Acid	BAA	79–08–3	19.97	20.05
	Dibromoacetic Acid	DBAA	631–64–1	26.29	26.32
HAA_{UR}	Bromochloroacetic Acid	BCAA	5589–96–8	24.36	24.40
	Bromodichloroacetic Acid	BDCAA	71133–14–7	25.95	25.99
	Chlorodibromoacetic Acid	CDBAA	5278–95–5	27.72	27.75
	Tribromoacetic Acid	TBAA	75–96–7	29.13	29.17
	Iodoacetic Acid	IAA	64–69–7	29.83	29.87
	Chloroiodoacetic Acid	CIAA	53715–09–6	27.07	27.11

Note: Reported average RTs had RSD ranging from 0.003% – 0.18% across both seasons

Table S4: GC–MS Retention Times (RTs), Quantifiers, and Qualifiers

Class	Compound	Abv.	CAS no.	RT – Winter (min)	RT – Summer (min)	Quantifier (m/z)	Qualifiers (m/z)
THM_4	Trichloromethane	TCM	67–66–3	8.15	8.15	83	85, 47, 87
	Bromodichloromethane	BDCM	75–27–4	10.41	10.50	83	85, 129, 87
	Dibromochloromethane	DBCM	124–48–1	12.79	12.85	129	127, 131, 48
	Tribromomethane	TBM	75–25–2	15.08	15.18	173	171, 175, 91
THM_{UR}	Bromochloroiodomethane	BCIM	34970–00–8	15.78	15.84	127	129, 131, 175
	Chlorodiiodomethane	CDIM	638–73–3	18.66	18.64	175	127, 177, 302
HAN	Bromoacetonitrile	BAN	590–17–0	11.60	11.77	119	121, 40, 79
	Bromochloroacetonitrile	BCAN	83463–62–1	12.81	12.86	74	76, 155, 153
	Dibromoacetonitrile	DBAN	3252–43–5	15.24	15.32	120	118, 199, 79
	Iodoacetonitrile	IAN	624–75–9	14.87	14.90	167	127

Table S5: LODs, LOQs, Cal Curve Accuracies, and Quality Control RSDs

			Winter				Summer			
Class	Compound	Abv.	LOD (ppb)	LOQ (ppb)	Cal Accuracy (%)	QC RSD (%)	LOD (ppb)	LOQ (ppb)	Cal Accuracy (%)	QC RSD (%)
THM_4	Trichloromethane	TCM	0.025	0.25	109 ± 20	N/A[a]	0.1	0.25	101 ± 34	12.8
	Bromodichloromethane	BDCM	0.025	0.1	114 ± 28	18.7	0.05	0.1	110 ± 26	30.5
	Dibromochloromethane	DBCM	0.01	0.1	103 ± 13	17.2	0.05	0.1	103 ± 13	22.6
	Tribromomethane	TBM	0.01	0.5	111 ± 27	23.0	0.05	0.1	103 ± 31	6.1
THM_{UR}	Bromochloroiodomethane	BCIM	0.05	0.1	110 ± 33	17.2	0.01	0.025	99 ± 36	11.4
	Chlorodiiodomethane	CDIM	0.1	0.25	93 ± 27	20.0	0.1	0.25	90 ± 16	18.5
HAA_5	Chloroacetic Acid	CAA	0.5	1	114 ± 17	62.1	0.5	1	117 ± 20	30.7
	Dichloroacetic Acid	DCAA	0.1	0.25	106 ± 11	21.8	0.1	1	111 ± 15	11.1
	Trichloroacetic Acid	TCAA	0.1	0.25	92 ± 13	15.5	0.05	0.1	100 ± 12	8.1
	Bromoacetic Acid	BAA	0.25	0.25	100 ± 8	16.6	0.1	0.25	111 ± 15	6.6
	Dibromoacetic Acid	DBAA	0.025	0.1	80 ± 19	19.5	0.01	0.1	99 ± 8	6.8
HAA_{UR}	Bromochloroacetic Acid	BCAA	0.25	0.25	97 ± 14	20.9	0.25	0.5	114 ± 16	10.4
	Bromodichloroacetic Acid	BDCAA	0.25	1	89 ± 24	11.6	0.05	0.1	81 ± 19	3.9
	Chlorodibromoacetic Acid	CDBAA	0.1	0.25	86 ± 19	44.4	0.1	0.25	85 ± 18	8.9
	Tribromoacetic Acid	TBAA	0.5	1	92 ± 16	36.8	0.5	1	95 ± 16	13.2
	Iodoacetic Acid	IAA	0.5	1	101 ± 14	24.3	0.05	0.1	92 ± 13	6.4
	Chloroiodoacetic Acid	CIAA	0.05	0.1	98 ± 16	39.4	0.05	0.1	101 ± 14	6.1
HAN	Bromoacetonitrile	BAN	0.5	1	110 ± 39	25.0	0.1	0.5	107 ± 28	14.5
	Bromochloroacetonitrile	BCAN	0.025	0.1	102 ± 20	24.4	0.025	0.1	101 ± 20	40.7
	Dibromoacetonitrile	DBAN	0.05	1	107 ± 26	20.0	0.025	0.1	98 ± 39	42.5
	Iodoacetonitrile	IAN	0.5	1	105 ± 24	20.4	0.5	1	95 ± 33	19.8

[a] *Compounds were under solvent peak for winter sampling but later verified during summer sampling*

Section S2.7: Compound Toxicity Potencies

Table S6: Compound Toxicity Potencies and Molecular Weights (MW). *The colors signify effect concentrations from least potent (yellow) to most potent (red orange)*

Class	Compound	Abv.	MW (g/mol)	ARE-bla $EC_{IR1.5}$ (mol//L)	AREc32 $EC_{IR1.5}$ (mol//L)	P53-bla $EC_{IR1.5}$ (mol//L)	Microtox EC_{50} (mol//L)	CHO LC_{50} (mol/L)
THM_4	Trichloromethane	TCM	119.37	4.00E-02[a]	1.40E-02	3.00E-02[a]	6.80E-03	9.62E-03
	Bromodichloromethane	BDCM	163.83	4.00E-02[a]	6.10E-03	1.00E-02[a]	1.80E-03	1.15E-02
	Dibromochloromethane	DBCM	208.28	1.60E-02	1.90E-03	1.00E-02[a]	1.00E-03	5.36E-03
	Tribromomethane	TBM	252.73	4.00E-02[a]	1.40E-03	6.00E-03[a]	2.30E-04	3.96E-03
THM_{UR}	Bromochloroiodomethane	BCIM	255.28	2.80E-03	1.20E-04	2.90E-03	9.70E-05	2.42E-03
	Chlorodiiodomethane	CDIM	302.28	2.80E-04	2.70E-05	2.60E-04	7.10E-05	2.41E-03
HAA_5	Chloroacetic Acid	CAA	94.50	2.50E-04	2.70E-04	1.70E-04	3.80E-03	8.10E-04
	Dichloroacetic Acid	DCAA	128.94	1.60E-02	6.00E-03	3.00E-02[a]	3.70E-03	7.30E-03
	Trichloroacetic Acid	TCAA	163.38	2.00E-02[a]	2.00E-02[a]	2.00E-02[a]	1.30E-02	2.40E-03
	Bromoacetic Acid	BAA	138.95	1.10E-05	5.20E-06	9.50E-06	3.80E-05	9.60E-06
	Dibromoacetic Acid	DBAA	217.84	2.50E-04	1.20E-04	2.60E-04	8.50E-04	5.90E-04
HAA_{UR}	Bromochloroacetic Acid	BCAA	173.39	4.60E-04	1.40E-04	2.30E-04	1.20E-03	7.78E-04
	Bromodichloroacetic Acid	BDCAA	207.83	4.00E-03	2.00E-03	3.00E-03[a]	6.10E-04	6.85E-04
	Chlorodibromoacetic Acid	CDBAA	252.29	2.20E-03	4.90E-03	2.00E-03[a]	4.20E-04	2.02E-04
	Tribromoacetic Acid	TBAA	296.74	6.70E-04	4.40E-04	5.00E-04[a]	1.30E-04	8.50E-05
	Iodoacetic Acid	IAA	185.95	5.10E-06	3.60E-06	4.70E-06	1.70E-05	2.95E-06
	Chloroiodoacetic Acid	CIAA	220.39	1.00E-04	2.20E-05	1.10E-04	3.10E-05	3.04E-04
HAN	Bromoacetonitrile	BAN	119.95	n.t.[b]	n.t.[b]	n.t.[b]	n.t.[b]	3.21E-06
	Bromochloroacetonitrile	BCAN	154.39	1.10E-05	2.20E-06	1.30E-05	1.30E-05	8.46E-06
	Dibromoacetonitrile	DBAN	198.84	7.00E-06	1.50E-07	1.30E-05	8.50E-06	2.85E-06
	Iodoacetonitrile	IAN	166.95	n.t.[b]	n.t.[b]	n.t.[b]	n.t.[b]	3.30E-06

[a] *no effect observed at highest concentration tested*

[b] *compound not tested or included in Stalter et al.*[4] *study*

Section S3: Additional Information for Results

Table S7: Overview of Detection Frequencies. *The colors signify low detection frequency (yellow) to high detection frequency (red orange)*

		Winter Detection Frequency (%)								Summer Detection Frequency (%)							
Class	Abv.	EB	SM	WV	YT	IR	LA	MC	MD	EB	SM	WV	YT	IR	LA	MC	MD
THM_4	TCM	100	100	100	100	100	100	100	13	100	100	100	100	100	100	93	13
	BDCM	100	100	100	100	100	100	100	13	100	100	100	100	100	100	100	13
	DBCM	0	100	0	100	93	100	100	81	93	0	40	100	100	100	100	80
	TBM	0	100	0	0	93	100	100	94	13	0	0	0	93	100	100	80
THM_{UR}	BCIM	0	100	0	0	87	100	0	0	0	0	0	0	93	100	0	0
	CDIM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
HAA_5	CAA	100	100	100	100	60	100	0	0	20	0	0	0	73	100	0	0
	DCAA	100	100	100	100	87	100	87	0	100	100	100	100	100	100	73	0
	TCAA	100	100	100	100	87	100	0	0	100	100	100	100	100	100	13	0
	BAA	0	0	0	0	53	100	0	0	13	0	7	0	13	100	0	0
	DBAA	47	100	29	100	87	100	100	81	100	100	100	100	100	100	100	80
HAA_{UR}	BCAA	100	100	57	100	87	100	7	0	100	100	53	100	93	100	33	0
	BDCAA	100	93	100	100	87	100	53	0	100	100	100	100	93	100	0	0
	CDBAA	0	53	0	29	87	93	0	13	20	0	20	0	93	100	13	20
	TBAA	0	0	0	0	33	0	0	0	0	0	27	0	0	21	0	7
	IAA	0	7	0	0	0	0	0	13	100	100	93	87	93	7	87	0
	CIAA	0	100	0	0	20	0	0	0	0	0	0	0	0	0	0	0
HAN	BAN	0	0	0	0	0	0	0	0	0	40	0	0	60	100	7	0
	BCAN	0	100	0	100	87	100	80	19	20	0	100	100	93	100	100	40
	DBAN	0	0	0	0	87	100	7	69	20	7	27	0	93	100	100	73
	IAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Section S3.1: Water Utility Reported vs. Measured Regulated THM_4 and HAA_5
The water utility reported and measured regional averages for THM_4 and HAA_5 are presented in Table S8. Measured THM_4 concentrations averaged +9.6 µg/L more than reported values which may be due to lack of use of a dechlorinating agent and extended reaction times. THM concentrations have been found to increase with residence time, forming as end products while other DBPs are intermediates.[2] Measured HAA_5 concentrations averaged -4.4 µg/L less than reported values. Overall, measured regulated concentrations were comparable to values reported in water utility consumer confidence reports (CCR) with no statistical difference for both THM_4 ($P = 0.10$, $df = 7$) and HAA_5 ($P = 0.19$, $df = 6$).

Table S8: Water Utility Reported vs. Measured Regulated THM_4 and HAA_5. *The bolded value represents the reported or measured locational running annual average (LRAA) or running annual average (RAA) followed by the range throughout the distribution system in parentheses. ND indicates concentrations not detected and NR indicates concentrations not reported.*

	Water Utility Reported (µg/L) *Average (Range)*			Measured (µg/L) *Average (Range)*		
Region	Year Reported	THM_4	HAA_5	Year Sampled	THM_4	HAA_5
EB	2020	**49** (24-57)	**43** (15-51)	2020	**87** (24-150)	**42** (20-56)
SM	2020	**30** (14-41)	**26** (9.0-35)	2020	**39** (3-62)	**21** (13-28)
WV	2020	**15** (NR)	**14** (NR)	2020	**30** (15-62)	**19** (8-34)
YT	2020	**44** (NR)	**38** (NR)	2020	**62** (42-93)	**20** (12-41)
IR	2021	**45** (6.7-56)	**22** (1.9-22)	2020	**36** (3-63)	**8.5** (ND-9.5)
LA	2020	**27** (7-29)	**11** (3-12)	2020	**30** (7-49)	**11** (5-13)
MC	2021	**0.6** (ND-2.4)	NR	2020	**2.2** (0.6-10.7)	**0.2** (0.01-0.5)
MD	2021	**0.3** (ND-0.6)	**0** (ND-0)	2020	**1.7** (ND-5.3)	**0.1** (ND-0.5)

Section S3.2: Trends in DBP Concentrations by Source Water Type

East Bay, San Mateo, Weaverville, and Yurok – Surface Water Source

East Bay (EB) and San Mateo (SM) rely on large surface water systems including the Hetch Hetchy Regional Water System and Mokelumne River Watershed, respectively. Weaverville (WV) and Yurok Tribal Land (YT) also rely on surface water sources, but these are primarily local rivers or creeks. Regulated DBP concentrations were highest in these regions. Unregulated DBPs only accounted for ~3% of total measured concentrations and consisted primarily of BCAA, BDCAA, BCAN, and IAA.

Irvine and Los Angeles – Mixed Water Source

Irvine (IR) and Los Angeles (LA) had relatively low regulated compound concentrations but had the highest unregulated compound concentrations and the most diverse speciation with a total of 19 DBPs detected. Household level unregulated compound concentrations accounted for ~16% of total measured DBP concentrations and comprised primarily bromo-HAAs, HANs, and BCIM. The diversity of DBPs detected in these samples may be attributed to the complex nature of Irvine and Los Angeles' water supplies including surface water with historically elevated salinity levels, brackish groundwater, and indirect potable reuse of recycled water.

Both Los Angeles and Irvine rely on water imported by the Metropolitan Water District of Southern California (MWD) which consists of surface water from Northern California via the State Water Project and the Colorado River via the Colorado River Aqueduct. The Colorado River is known to have historical elevated salinity levels.[6] Both regions also use groundwater that is impacted by seawater intrusion. Higher bromide and iodide levels in high salinity source waters and brackish groundwater may result in the increased formation of bromo- and iodo-DBPs.[7] Irvine and Los Angeles had the highest reported bromide levels in their 2020 consumer confidence reports which ranged from 30–200 µg/L and ND–190 µg/L, respectively. To combat seawater intrusion and recharge aquifers both regions also inject highly treated wastewater or recycled water into their groundwater supplies, a process referred to as indirect potable reuse. However, DBPs are emerging as a concern for both direct and indirect potable reuse applications due to the increased amount of organic material, dissolved organic nitrogen, ammonia, bromide, and iodide present in recycled waters.[8,9] Elevated unregulated DBPs, particularly N-DBPs, have also been observed in treated drinking water from wastewater-influenced sources.[10]

Both Irvine and Los Angeles also use ammonia to form chloramines as a secondary disinfectant. While chloramination typically results in reduced overall DBP formation,[11] increases in HANs and iodo-THMs have been observed.[12,13] BCIM was consistently present in both regions and seasons at concentrations ranging from 0.02–1.4 µg/L with a few non–detects. HAN concentrations were highest in Irvine and Los Angeles at concentrations ranging from 0.6–7.4 µg/L with a few non–detects.

Although we cannot identify which water source(s) or disinfection processes are contributing specifically to observed DBP speciation in Irvine and Los Angeles household samples, the elevated unregulated concentrations and diverse speciation is noteworthy. Disinfection by-product formation potential experiments on each individual water source or water quality measurements (i.e. bromide, iodide, nitrogen, organic carbon) may help identify which sources are contributing DBP precursors of concern.

Merced and Madera – Groundwater Source

Merced (MC) and Madera (MD) both rely on groundwater from the San Joaquin Basin and use chlorination disinfection processes. Merced and Madera overall had the lowest total DBP concentrations ranging from ND–11.3 µg/L. THM_4, DBAA, BCAN, and DBAN were the primary DBPs detected in both regions with more brominated compounds formed compared with their chlorinated analogs. This shift in speciation could be due to high bromide levels (>50 µg/L) in the source water.[14] While bromide levels in Madera are not reported, Merced reported bromide levels ranging from 24–170 µg/L in their 2020 consumer confidence report.

Section S3.3: Comparisons of CAT across Endpoints and System Variables (Figures S3-S8) Figure S3 shows the compact letter displays (*cld*) of the Tukey HSD comparisons of calculated additive toxicity (CAT) across the five biological endpoints (ARE-bla, AREc32, CHO, Microtox, p53-bla) and system variables (season, region, disinfection type, source water type). Figures S3-S8 show the boxplots of CAT for each biological endpoint and system variable.

Figure S3: Tukey HSD Test Comparisons of CAT across Biological Endpoints

			Biological Endpoints					
			ARE-bla	AREc32	P53-bla	Microtox	CHO	*df*
System Variables	All Samples		a	b	a	a	a	1185
	Season	Winter	a	b	a	a	a	590
		Summer	a	b	a	a	a	590
	Disinfection Type	Chlorination	a	b	a	a	a	590
		Chloramination	a	b	a	a	a	590
	Source Type	Large Surface Water	a	a	a	a	a	295
		Small Surface Water	a	c	ab	a	b	285
		Mixed Water	a	b	a	a	a	290
		Groundwater	a	b	a	a	a	300
	Region	EB	ab	b	ab	a	b	145
		SM	a	a	a	a	a	145
		WV	a	b	a	a	ab	140
		YT	a	c	ab	a	b	140
		IR	a	b	a	a	a	145
		LA	a	b	a	a	a	140
		MC	a	b	a	a	a	145
		MD	a	b	a	a	a	150

Figure S4: CAT Across All Endpoints and Samples

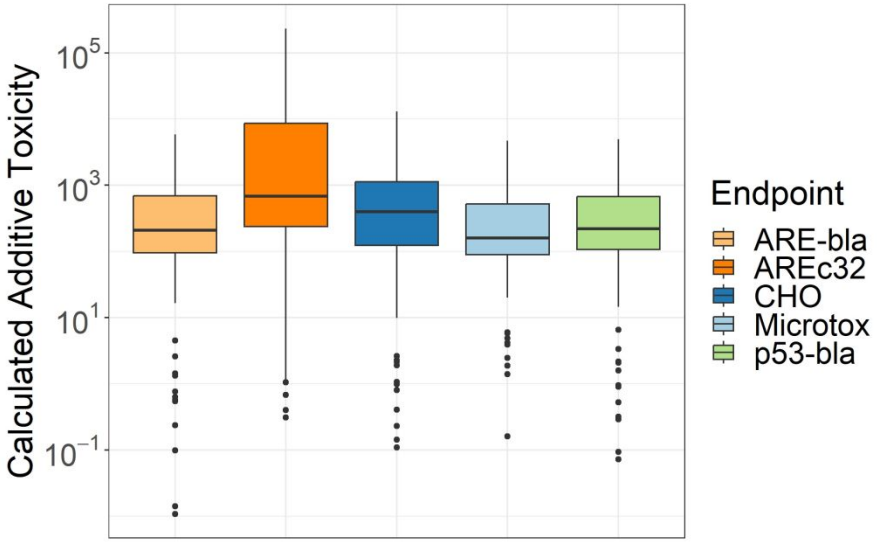


Figure S5: CAT Across All Endpoints and Seasons

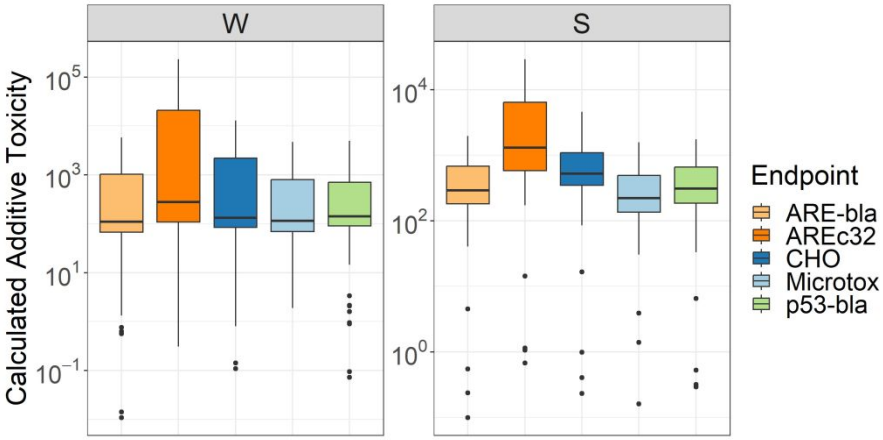


Figure S6: CAT Across All Endpoints and Disinfection Types

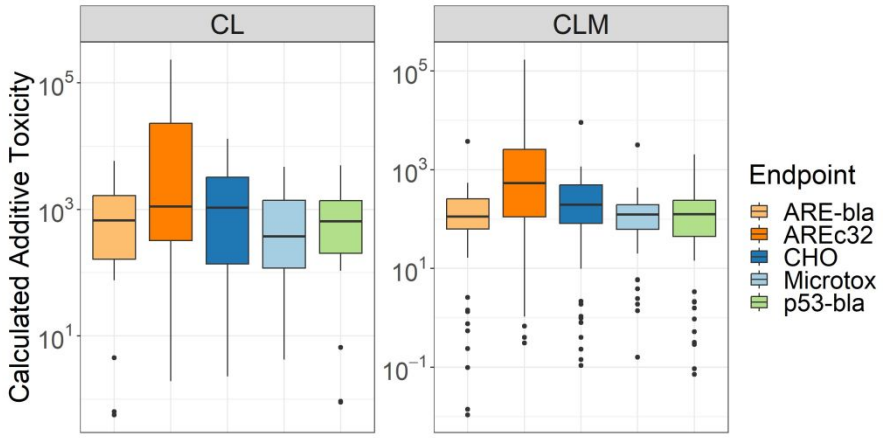


Figure S7: CAT Across All Endpoints and Source Water Types

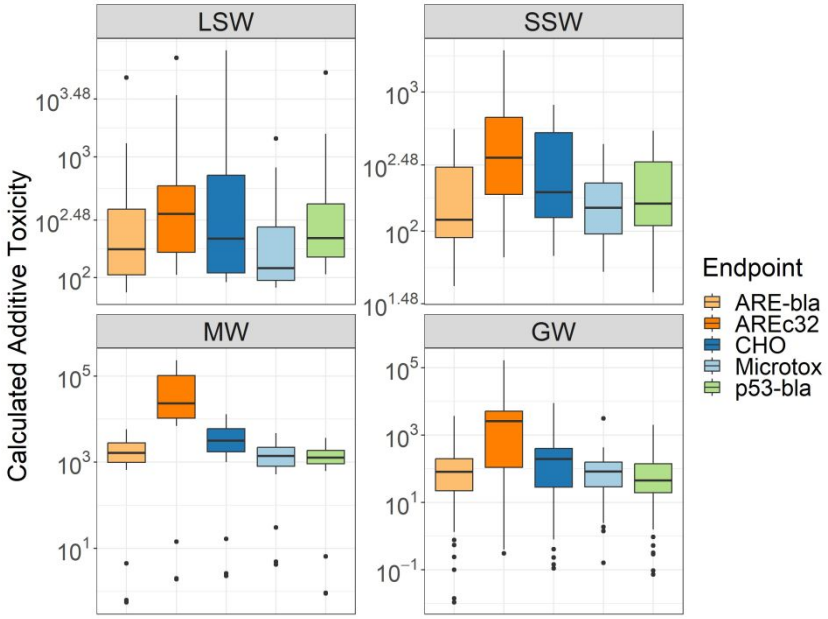
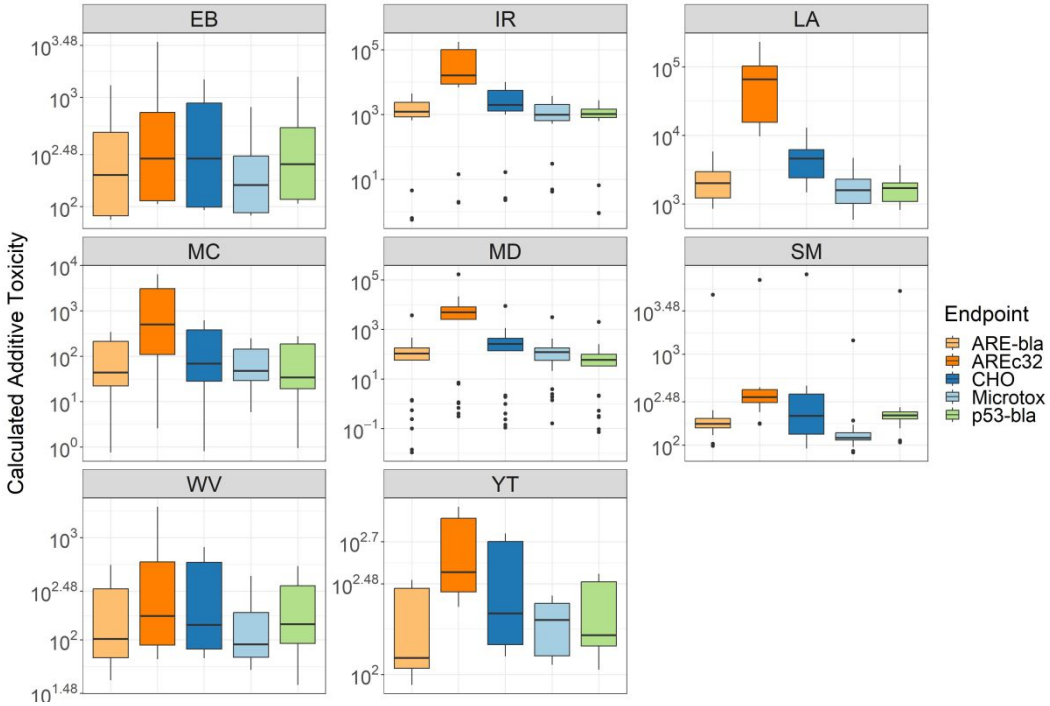


Figure S8: CAT Across All Endpoints and Regions

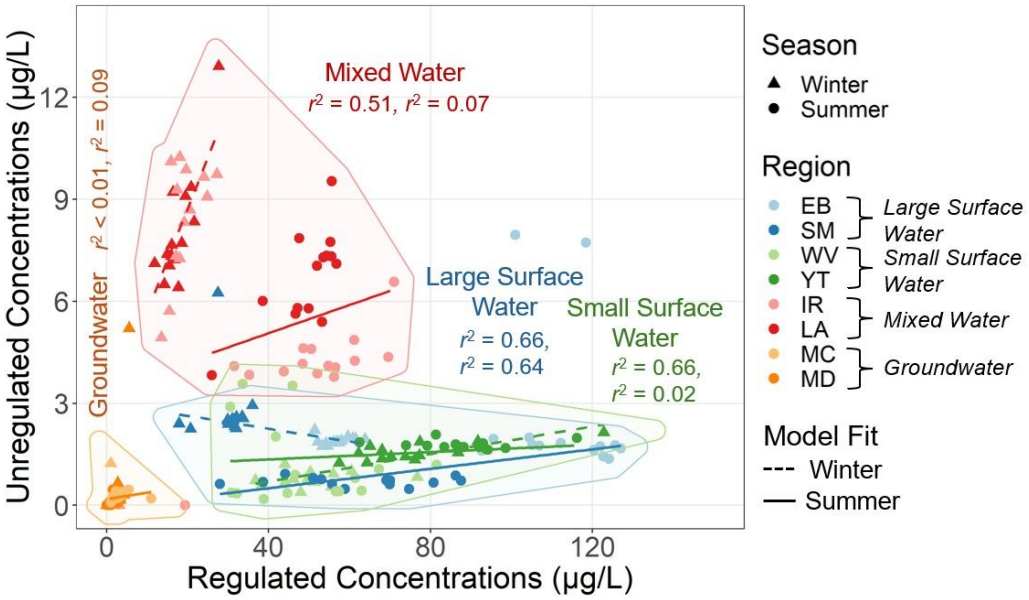


Section S3.4: Regulated vs. Unregulated Concentrations Predictive Models
This section provides predictive models for regulated vs. unregulated concentrations grouped by season, region, disinfection type, and source water type variables. The model strength coefficients of determinations (r^2) are summarized in Table S9. Coefficients of determination values of $r^2 > 0.7$ indicates a strong model (green), $0.3 < r^2 < 0.7$ indicates a fair model (yellow), and $r^2 < 0.3$ indicates a poor model (orange). Plots of each model are shown in Section S3.5.

Table S9: Regulated vs. Unregulated Concentrations Model Strengths

Group	Variable	R^2	*P*	*df*	Group	Variable	R^2	*P*	*df*
All	~	< 0.01	0.146	236	~Source-Season	LSW-W	0.66	< 0.001	26
~Season	W	0.01	0.278	236		LSW-S	0.64	< 0.001	26
	S	0.13	< 0.001	236		SSW-W	0.66	< 0.001	26
~Disinfection	CL	0.42	< 0.001	117		SSW-S	0.02	0.436	28
	CLM	0.09	< 0.001	117		MW-W	0.51	< 0.001	26
~Source	LSW	0.10	0.015	54		MW-S	0.07	0.188	26
	SSW	0.12	0.007	56		GW-W	< 0.01	0.742	21
	MW	0.23	< 0.001	54		GW-S	0.09	0.126	24
	GW	0.02	0.305	47	~Region-Season	EB-W	0.01	0.673	13
~Region	EB	0.36	< 0.001	25		EB-S	0.24	0.104	10
	SM	0.59	< 0.001	27		SM-W	0.31	0.038	12
	WV	0.04	0.305	27		SM-S	< 0.01	0.975	13
	YT	0.39	< 0.001	27		WV-W	0.07	0.366	12
	IR	0.47	< 0.001	25		WV-S	0.07	0.332	13
	LA	0.03	0.401	27		YT-W	0.57	0.002	12
	MC	0.01	0.603	26		YT-S	< 0.01	~1.00	13
	MD	0.13	0.115	19		IR-W	0.31	0.046	11
~Disinfection-Season	CL-W	0.34	< 0.001	49		IR-S	0.31	0.040	12
	CL-S	0.48	< 0.001	54		LA-W	0.71	< 0.001	13
	CLM-W	0.33	< 0.001	55		LA-S	0.52	0.003	12
	CLM-S	< 0.01	0.897	53		MC-W	0.10	0.283	11
						MC-S	0.02	0.603	13
						MD-W	< 0.01	0.928	8
						MD-S	0.02	0.671	9

Figure S9: Regulated vs. Unregulated Concentrations by Source and Season



Section S3.5: Regulated vs. Unregulated Concentrations Figures (S10-S17)

Figure S10: Regulated vs. Unregulated Concentrations

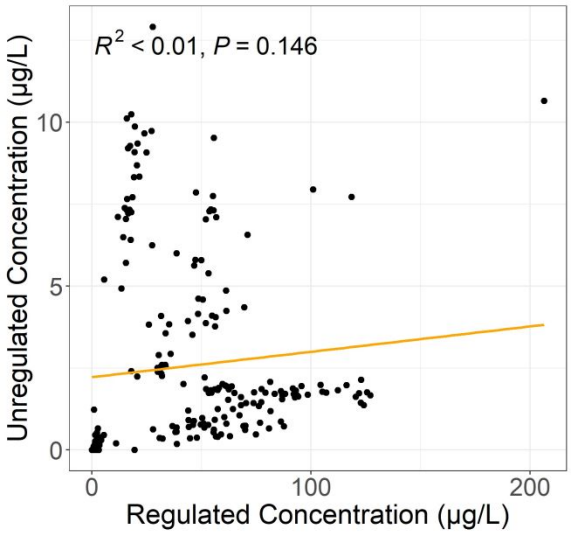


Figure S11: Regulated vs. Unregulated Concentrations by Season

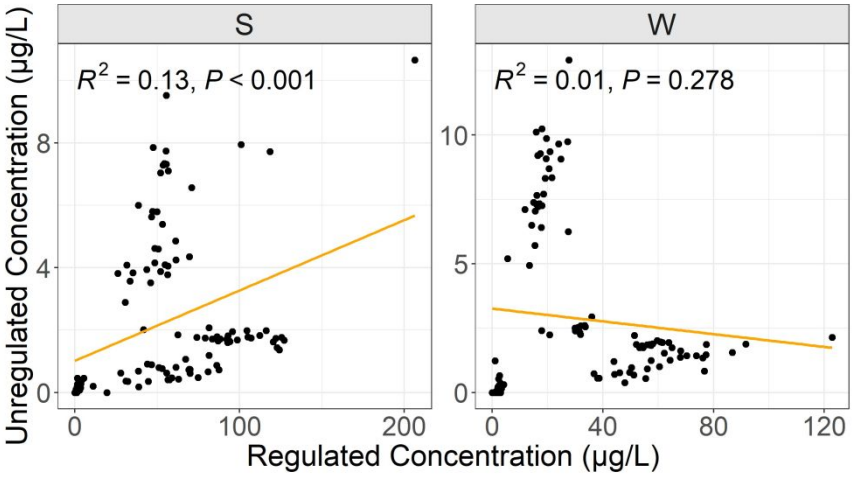


Figure S12: Regulated vs. Unregulated Concentrations by Disinfection Type

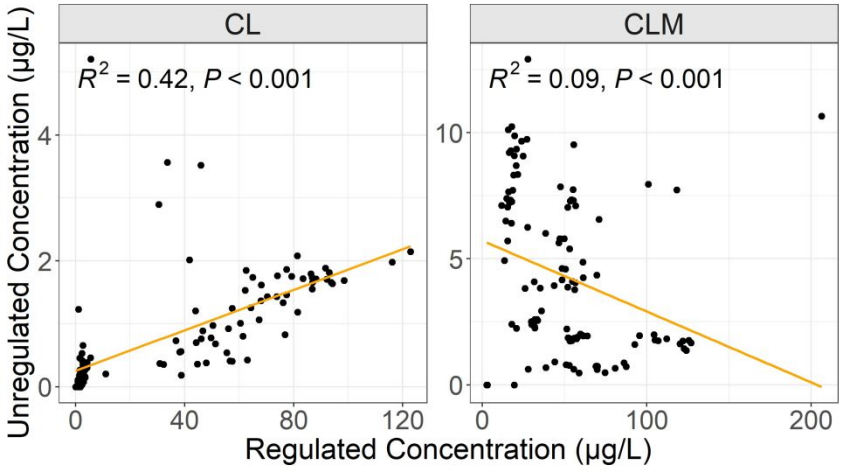


Figure S13: Regulated vs. Unregulated Concentrations by Source Type

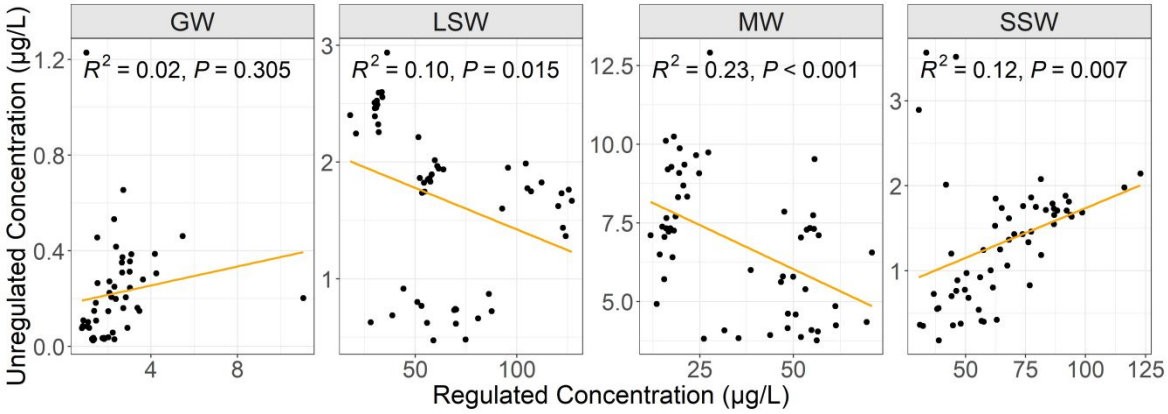


Figure S14: Regulated vs. Unregulated Concentrations by Region

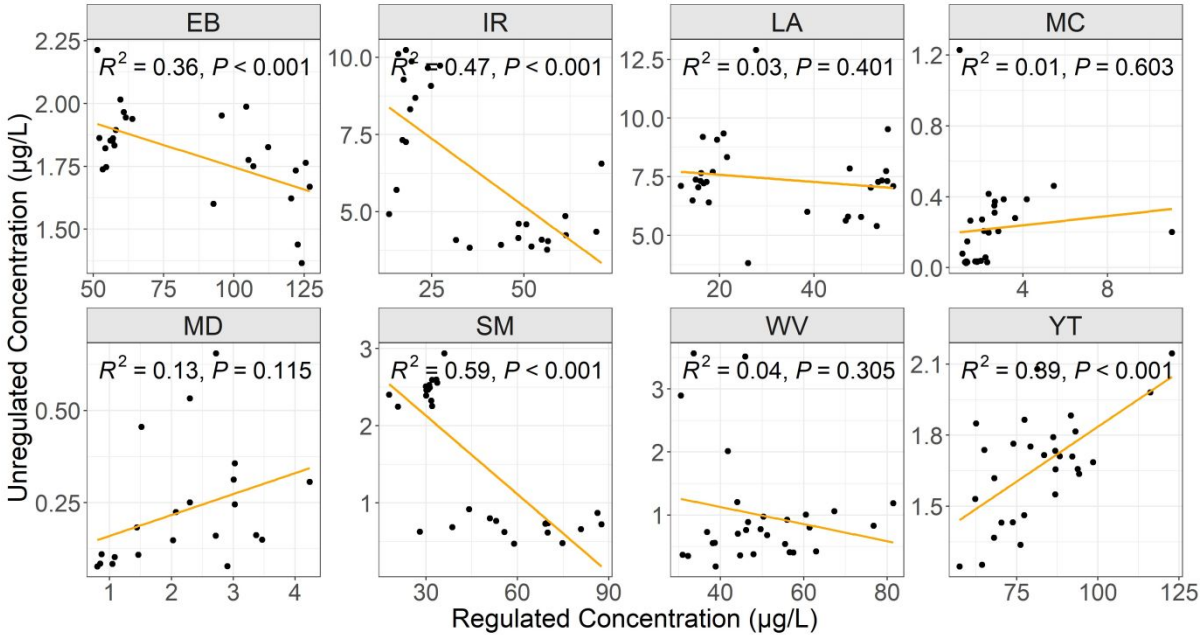


Figure S15: Regulated vs. Unregulated Concentrations by Disinfection and Season

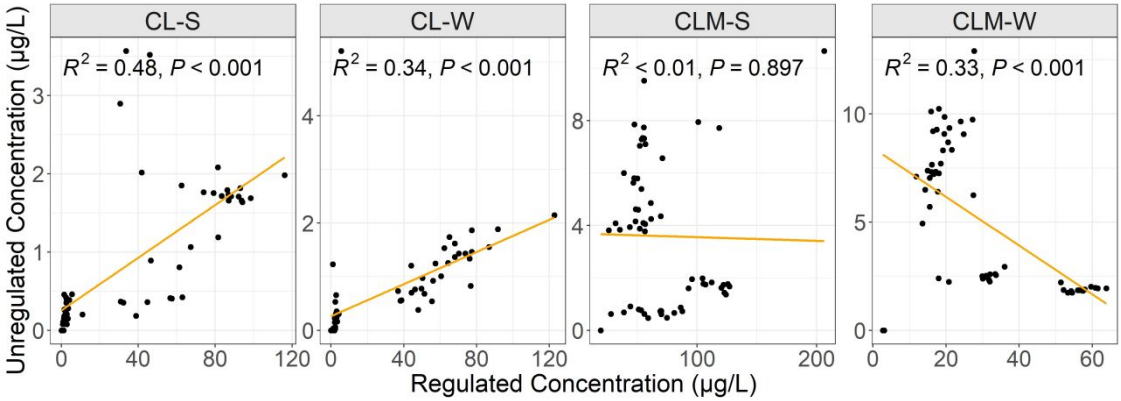


Figure S16: Regulated vs. Unregulated Concentrations by Source and Season

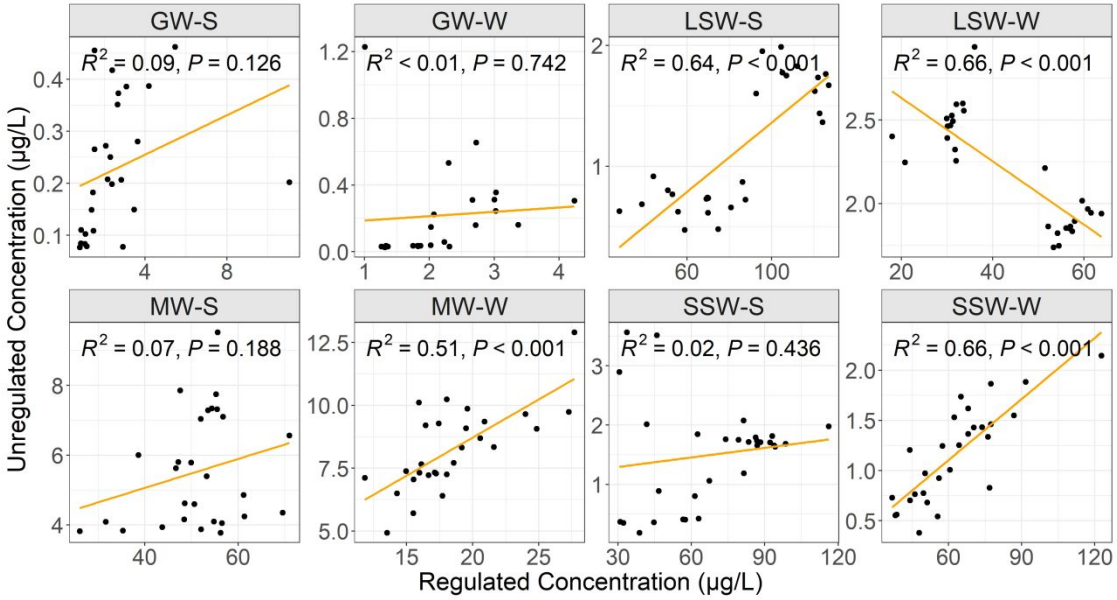
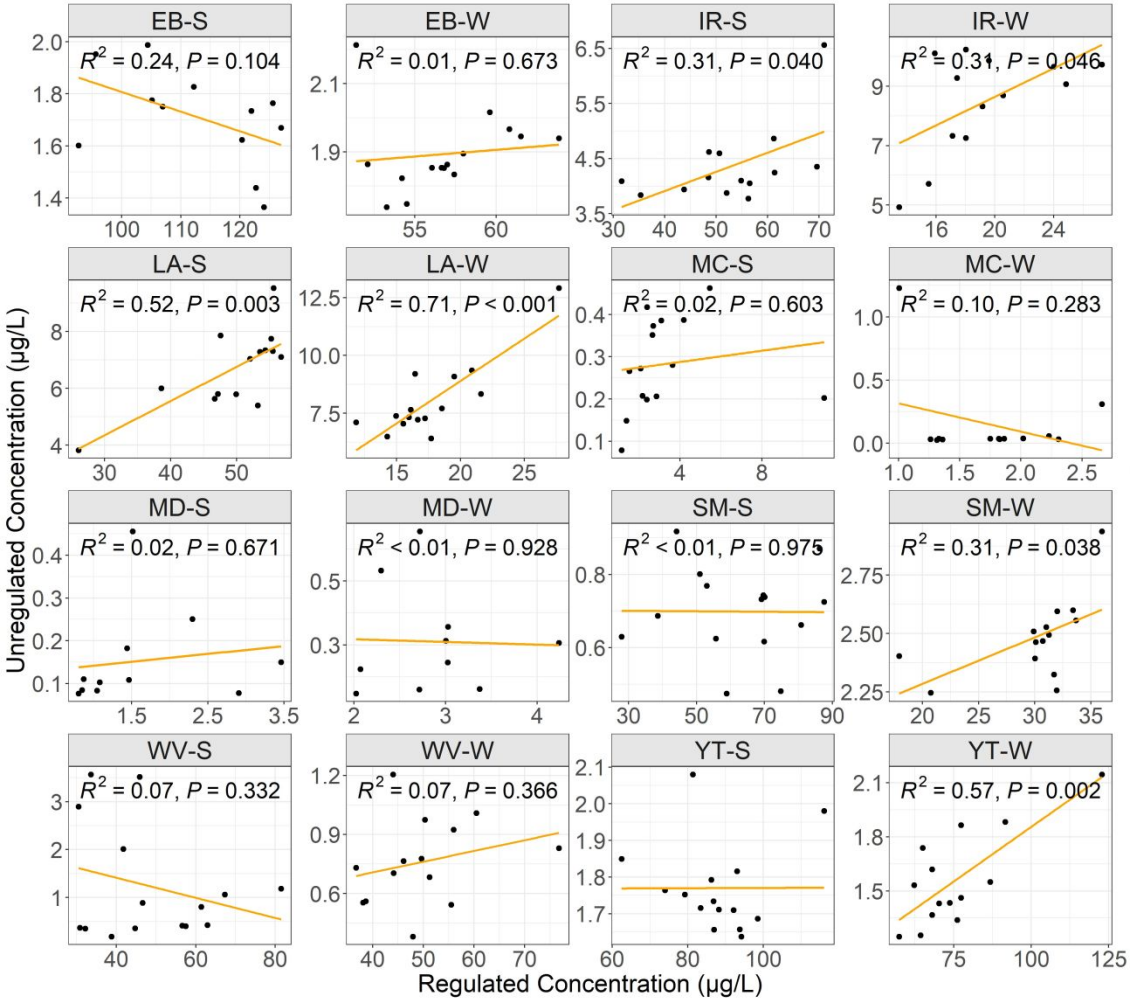


Figure S17: Regulated vs. Unregulated Concentrations by Region and Season



Section S3.6: Regulated vs. Unregulated CAT Predictive Models

This section provides predictive models for regulated vs. unregulated AREc32 oxidative stress and CHO cytotoxicity grouped by season, region, disinfection type, and source water type variables. Model strength coefficients of determinations (r^2) for AREc32 oxidative stress are summarized in Table S10. Model strength coefficients of determinations (r^2) for CHO cytotoxicity are summarized in Table S11. Coefficients of determination values of $r^2 > 0.7$ indicates a strong model (green), $0.3 < r^2 < 0.7$ indicates a fair model (yellow), and $r^2 < 0.3$ indicates a poor model (orange). There was no statistically significant difference ($P = 0.12$, $df = 43$) in AREc32 and CHO coefficients of determinations as summarized in Figure S18. Linear models for the AREc32 endpoint by system variable are shown in Section S3.7. Linear models for the CHO endpoint by system variable are shown in Section S3.8.

Removed Outliers

The following households were removed from the linear models due to zero CAT values for either regulated or unregulated DBPs: IR11-W, IR14-W, MC4-W, MC10-W, MD2-W, MD3-W, MD8-W, MD12-W, MD14-W, IR11-S, MD2-S, MD10-S, MD13-S, and MD16-S. Other households were removed due to spikes in potent unregulated DBPs including MD11-W and SM15-W. This was driven by a high detect of DBAN and IAA, respectively. While it's important to highlight that slight changes in potent concentrations can have a drastic impact on CAT, these households were removed from the linear models due to their major influence. EB5-S, EB8-S, and EB13-S were also removed due to high regulated CAT which was driven by elevated BAA concentrations. These three households were also in the upper part of the distribution system, separated from the other households.

Figure S18: Regulated vs. Unregulated CAT Models for AREc32 and CHO Endpoints

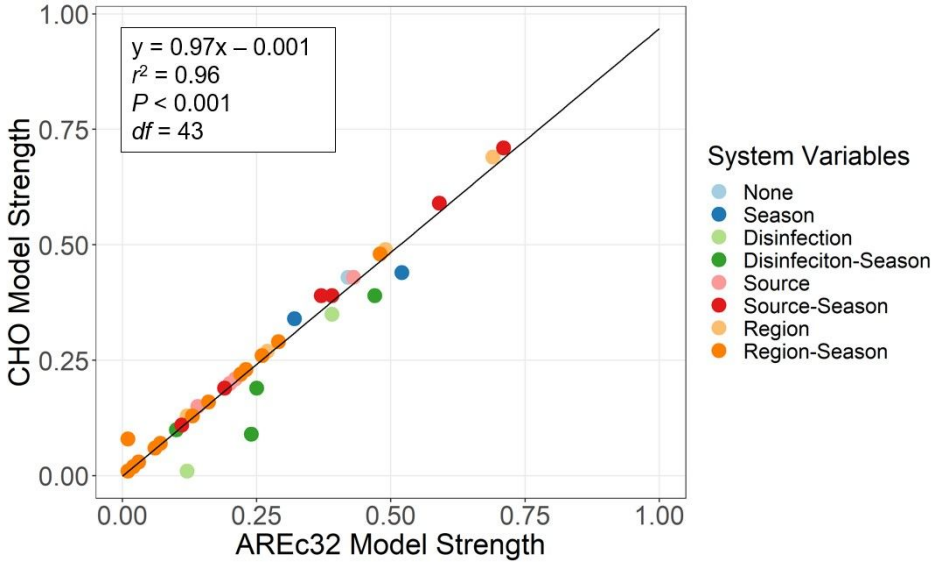


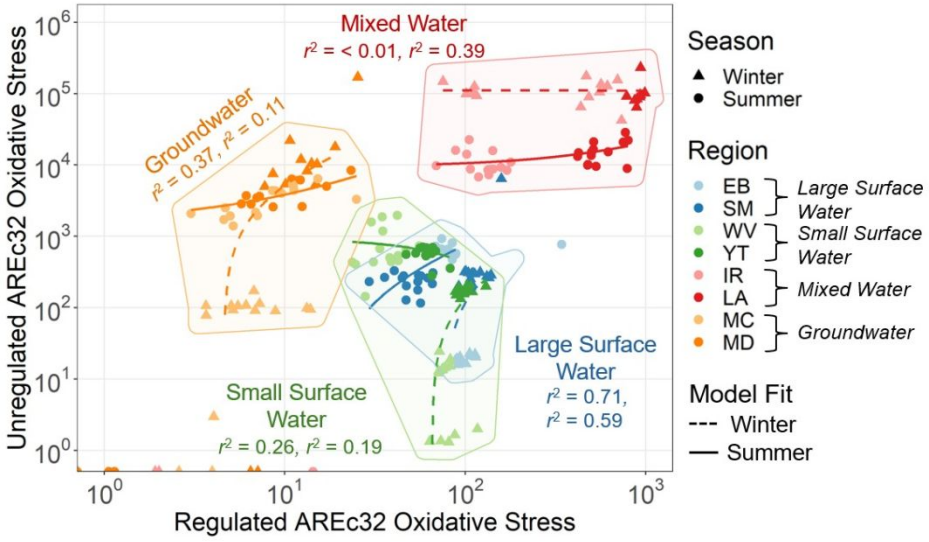
Table S10: Regulated vs. Unregulated AREc32 Oxidative Stress Model Strengths

Group	Variable	r^2	*P*	*df*	Group	Variable	r^2	*P*	*df*
All	~	0.42	< 0.001	236	~Source-Season	LSW-W	0.71	< 0.001	26
~Season	W	0.52	< 0.001	236		LSW-S	0.59	< 0.001	27
	S	0.32	< 0.001	236		SSW-W	0.26	0.006	26
~Disinfection	CL	0.12	< 0.001	116		SSW-S	0.19	0.016	28
	CLM	0.39	< 0.001	117		MW-W	< 0.01	0.931	26
~Source	LSW	0.43	< 0.001	55		MW-S	0.39	< 0.001	26
	SSW	0.20	< 0.001	56		GW-W	0.37	0.003	21
	MW	0.21	< 0.001	54		GW-S	0.11	0.094	24
	GW	0.14	0.010	47	~Region-Season	EB-W	0.29	0.037	13
~Region	EB	0.69	< 0.001	26		EB-S	0.13	0.248	11
	SM	0.13	0.059	27		SM-W	0.16	0.158	12
	WV	0.27	0.004	27		SM-S	0.01	0.714	13
	YT	0.13	0.057	27		WV-W	0.06	0.405	12
	IR	0.22	0.014	25		WV-S	< 0.01	0.817	13
	LA	0.49	< 0.001	27		YT-W	0.26	0.060	12
	MC	0.12	0.081	26		YT-S	0.22	0.075	13
	MD	0.23	0.027	19		IR-W	< 0.01	0.833	11
~Disinfection-Season	CL-W	0.10	0.016	49		IR-S	0.03	0.573	12
	CL-S	0.24	< 0.001	54		LA-W	0.02	0.581	13
	CLM-W	0.47	< 0.001	55		LA-S	0.23	0.080	12
	CLM-S	0.25	< 0.001	54		MC-W	< 0.01	0.887	11
						MC-S	0.03	0.567	13
						MD-W	0.07	0.448	8
						MD-S	0.48	0.019	9

Table S11: Regulated vs. Unregulated CHO Cytotoxicity Model Strengths

Group	Variable	R^2	*P*	*df*	Group	Variable	R^2	*P*	*df*
All	~	0.43	< 0.001	236	~Source-Season	LSW-W	0.71	< 0.001	26
~Season	W	0.44	<0.001	236		LSW-S	0.59	< 0.001	27
	S	0.34	<0.001	236		SSW-W	0.26	0.006	26
~Disinfection	CL	< 0.01	0.289	116		SSW-S	0.19	0.016	28
	CLM	0.35	< 0.001	117		MW-W	< 0.01	0.931	26
~Source	LSW	0.43	< 0.001	55		MW-S	0.39	< 0.001	26
	SSW	0.20	< 0.001	56		GW-W	0.39	0.002	21
	MW	0.21	< 0.001	54		GW-S	0.11	0.094	24
	GW	0.15	0.006	47	~Region-Season	EB-W	0.29	0.037	13
~Region	EB	0.69	< 0.001	26		EB-S	0.13	0.248	11
	SM	0.13	0.059	27		SM-W	0.16	0.158	12
	WV	0.27	0.004	27		SM-S	0.01	0.714	13
	YT	0.13	0.057	27		WV-W	0.06	0.405	12
	IR	0.22	0.014	25		WV-S	< 0.01	0.817	13
	LA	0.49	< 0.001	27		YT-W	0.26	0.060	12
	MC	0.13	0.057	26		YT-S	0.22	0.075	13
	MD	0.23	0.027	19		IR-W	< 0.01	0.833	11
~Disinfection-Season	CL-W	0.10	0.014	49		IR-S	0.03	0.573	12
	CL-S	0.09	0.020	54		LA-W	0.02	0.581	13
	CLM-W	0.39	< 0.001	55		LA-S	0.23	0.080	12
	CLM-S	0.19	< 0.001	54		MC-W	0.08	0.362	11
						MC-S	0.03	0.567	13
						MD-W	0.07	0.448	8
						MD-S	0.48	0.019	9

Figure S19: Regulated vs. Unregulated AREc32 Oxidative Stress by Source and Season



Section S3.7: Regulated vs. Unregulated AREc32 Oxidative Stress (Figures S20-S27)

Figure S20: Regulated vs. Unregulated AREc32 Oxidative Stress

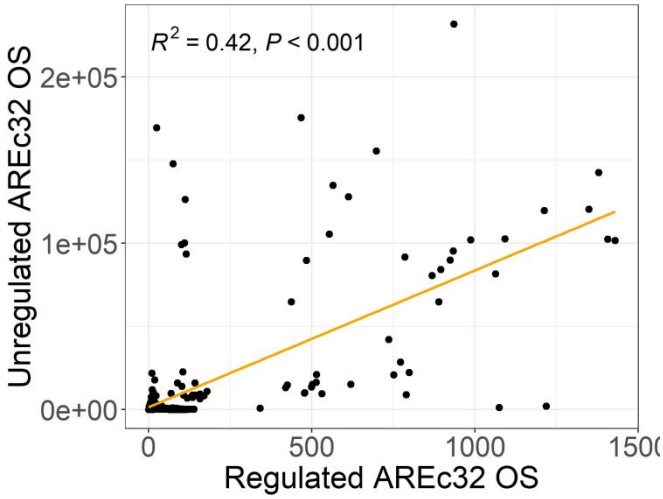


Figure S21: Regulated vs. Unregulated AREc32 Oxidative Stress by Season

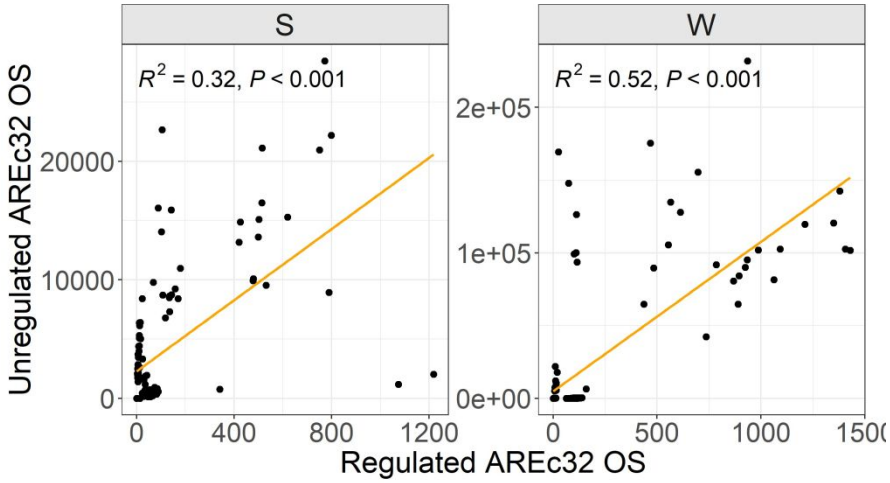


Figure S22: Regulated vs. Unregulated AREc32 Oxidative Stress by Disinfection Type

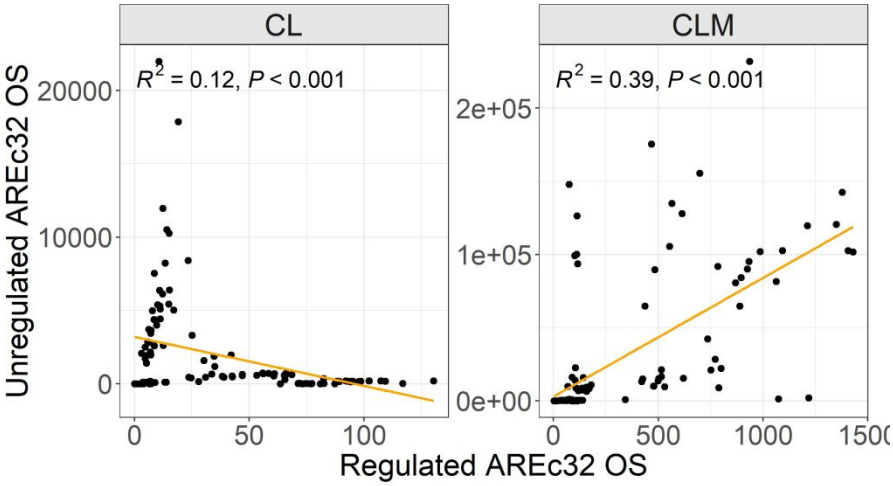


Figure S23: Regulated vs. Unregulated AREc32 Oxidative Stress by Source Type

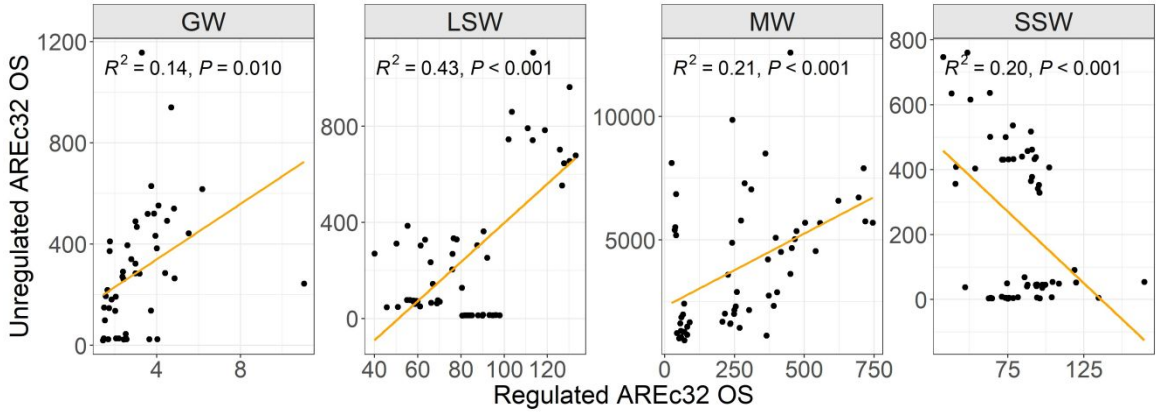


Figure S24: Regulated vs. Unregulated AREc32 Oxidative Stress by Region

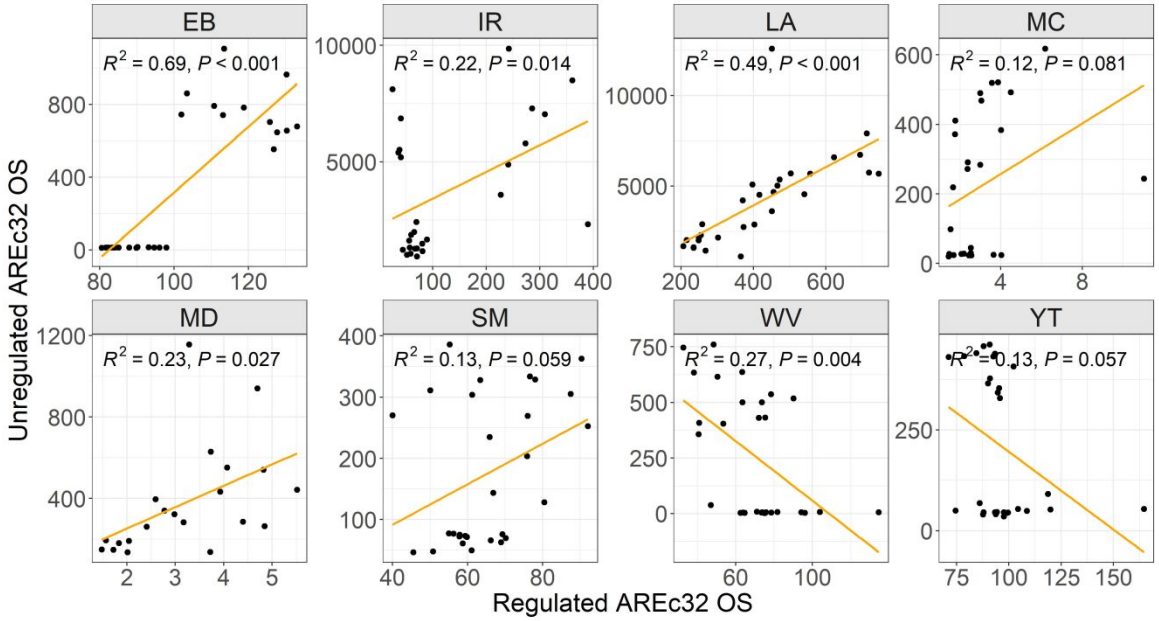


Figure S25: Regulated vs. Unregulated AREc32 Oxidative Stress by Disinfection and Season

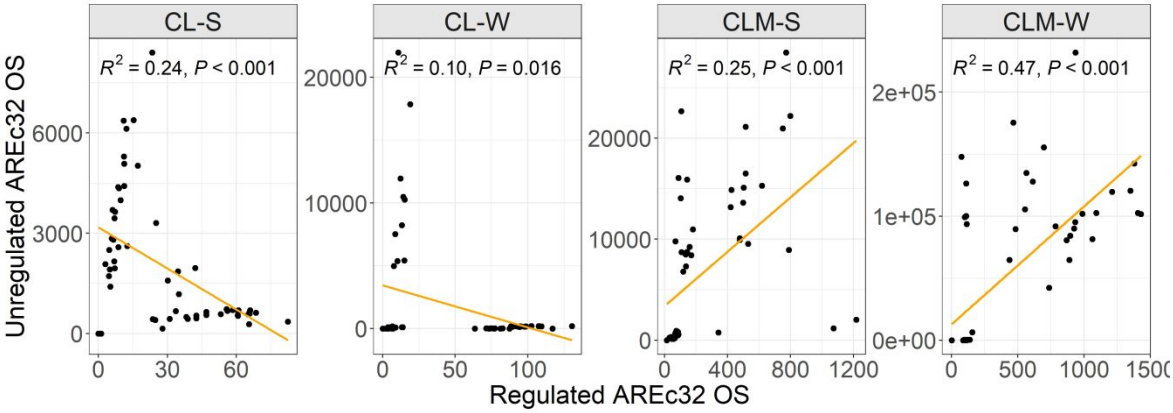


Figure S26: Regulated vs. Unregulated AREc32 Oxidative Stress by Source and Season

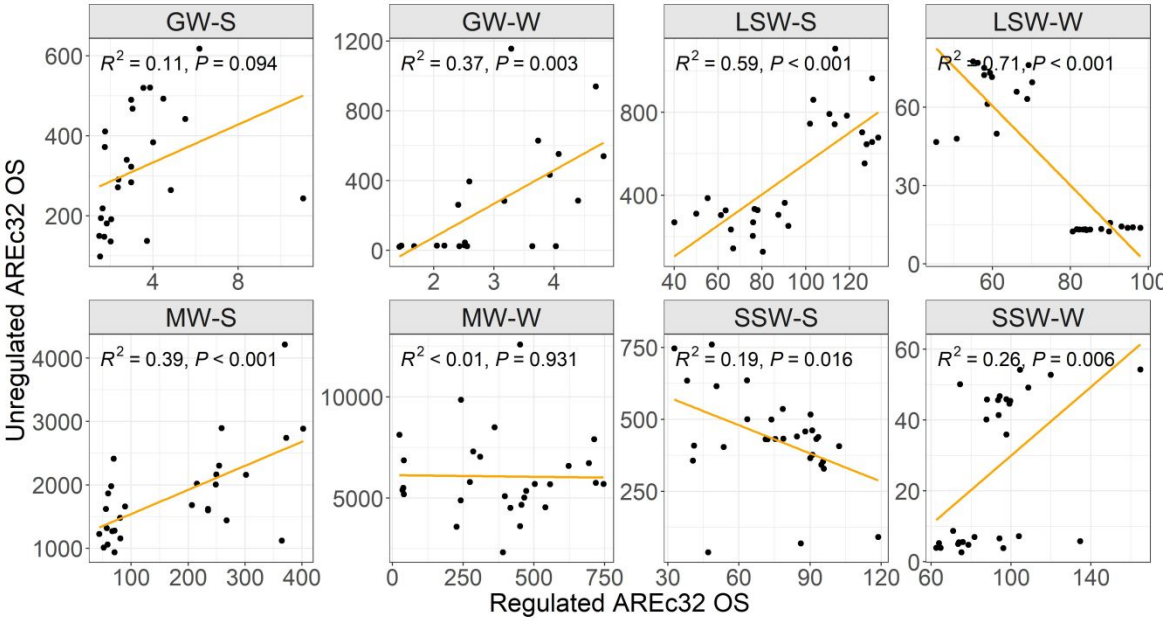
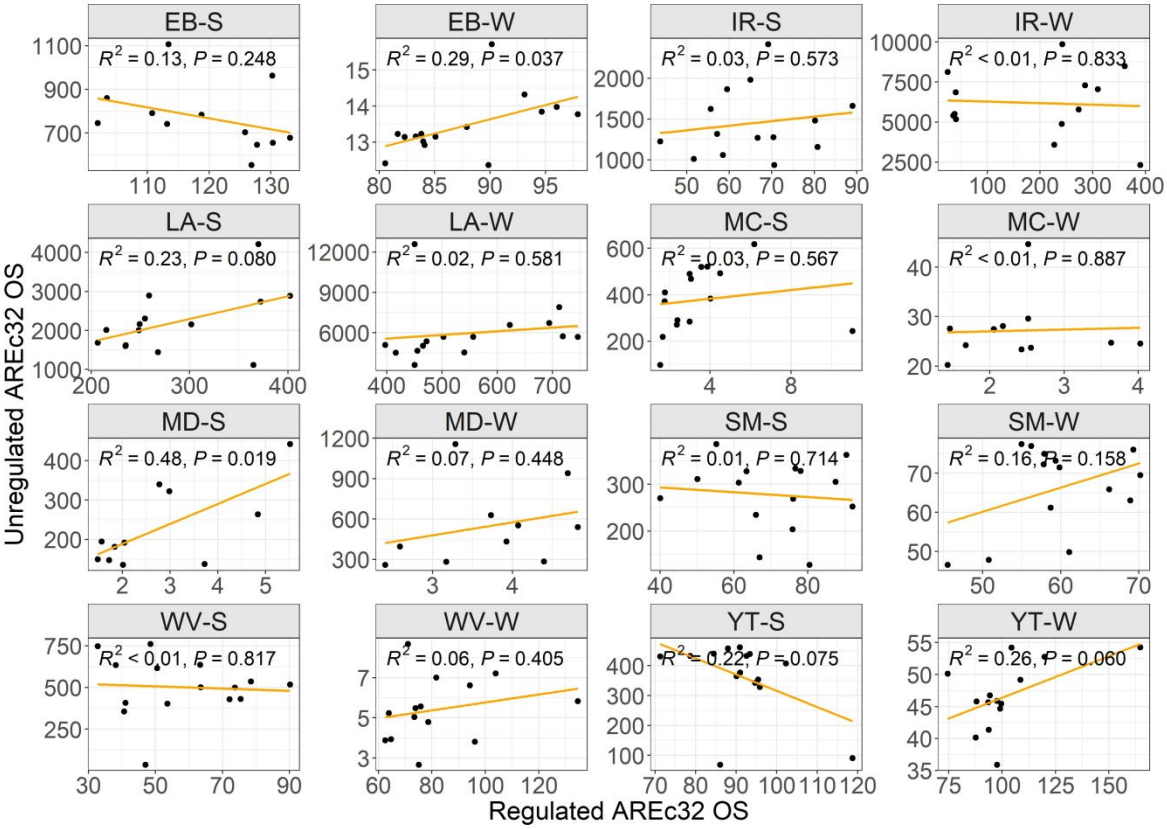


Figure S27: Regulated vs. Unregulated AREc32 Oxidative Stress by Region and Season



Section S3.8: Regulated vs. Unregulated CHO Cytotoxicity (Figures S28-S35)

Figure S28: Regulated vs. Unregulated CHO Cytotoxicity

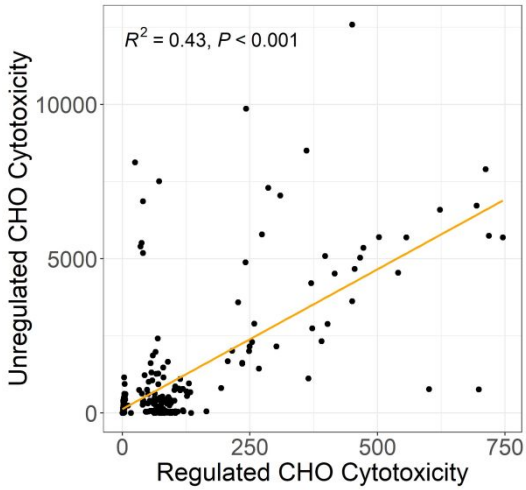


Figure S29: Regulated vs. Unregulated CHO Cytotoxicity by Season

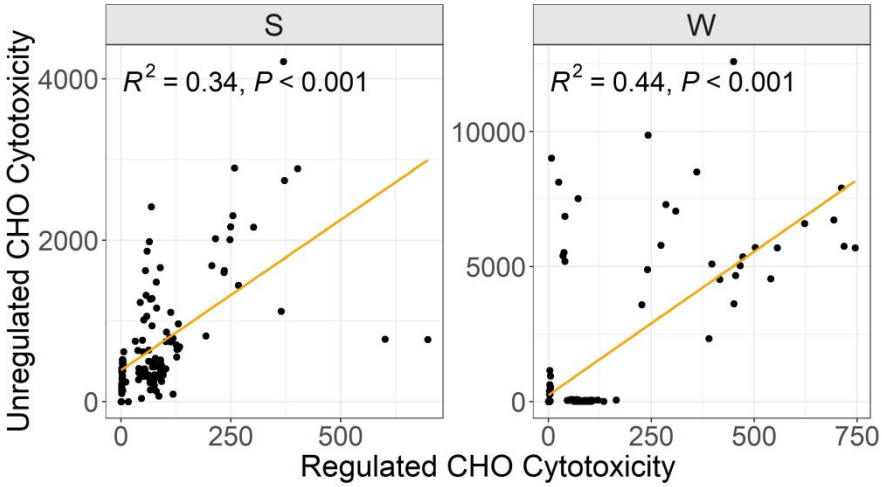


Figure S30: Regulated vs. Unregulated CHO Cytotoxicity by Disinfection Type

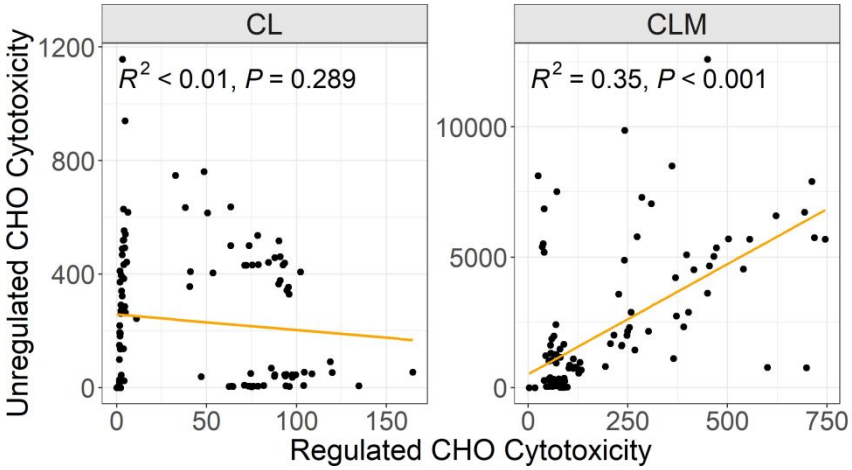


Figure S31: Regulated vs. Unregulated CHO Cytotoxicity by Source Type

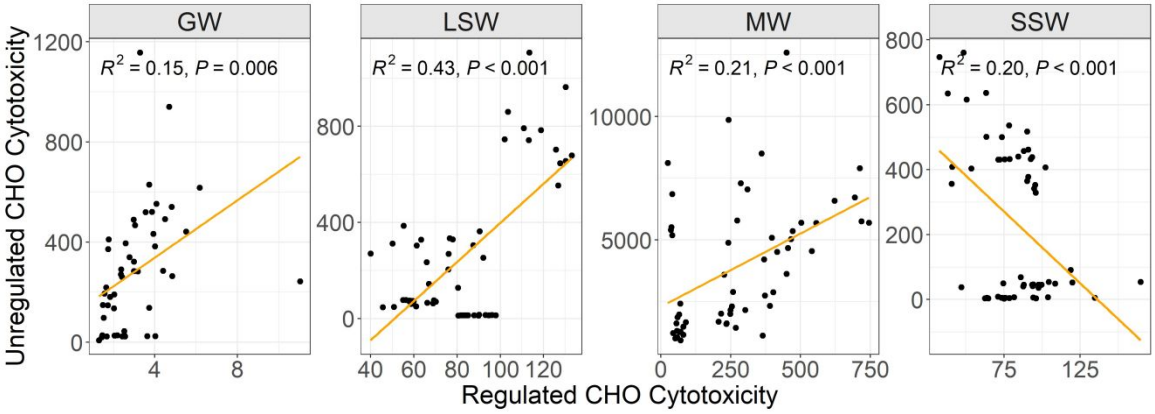


Figure S32: Regulated vs. Unregulated CHO Cytotoxicity by Region

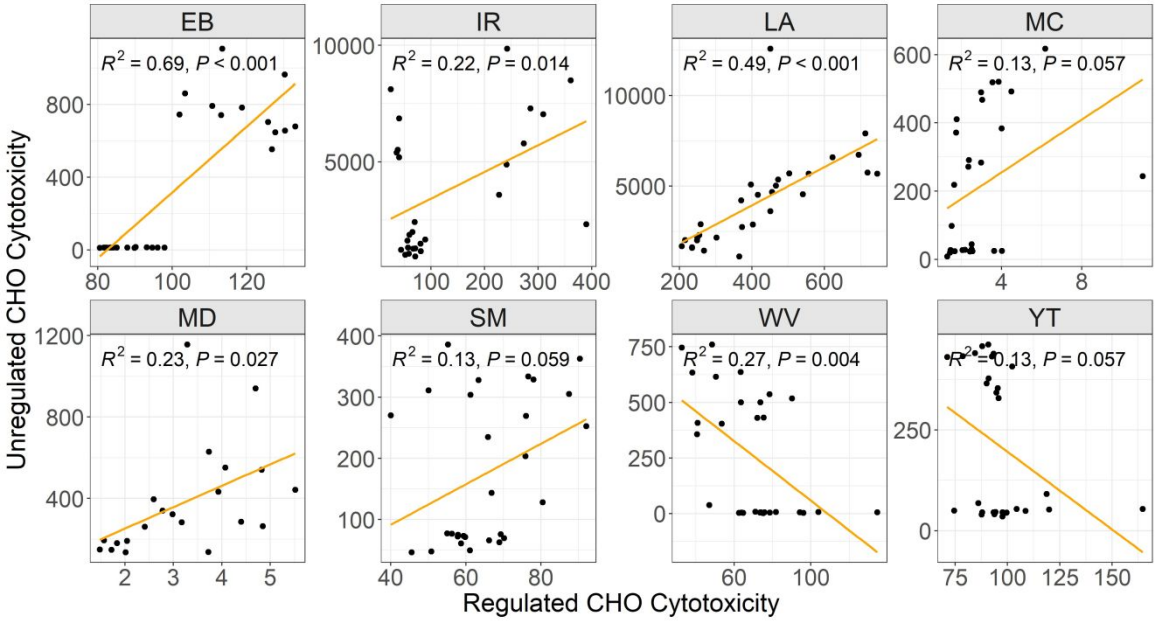


Figure S33: Regulated vs. Unregulated CHO Cytotoxicity by Disinfection and Season

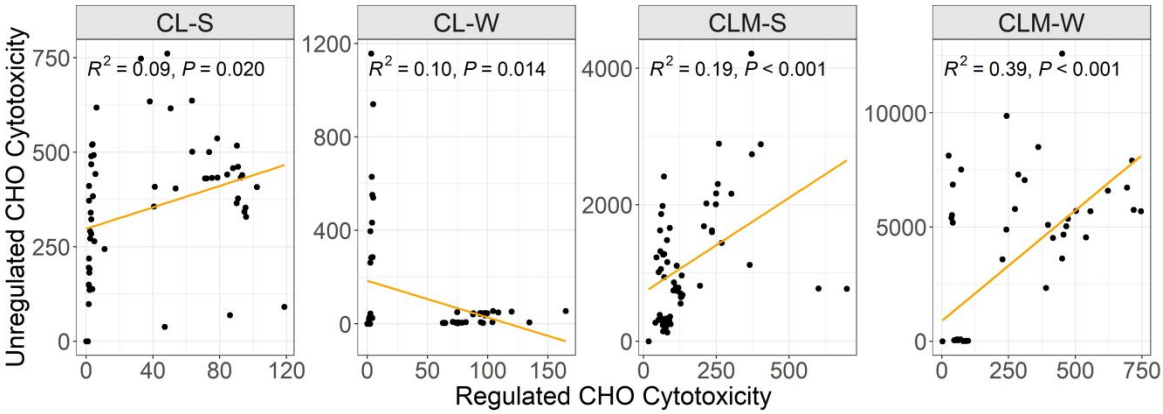


Figure S34: Regulated vs. Unregulated CHO Cytotoxicity by Source and Season

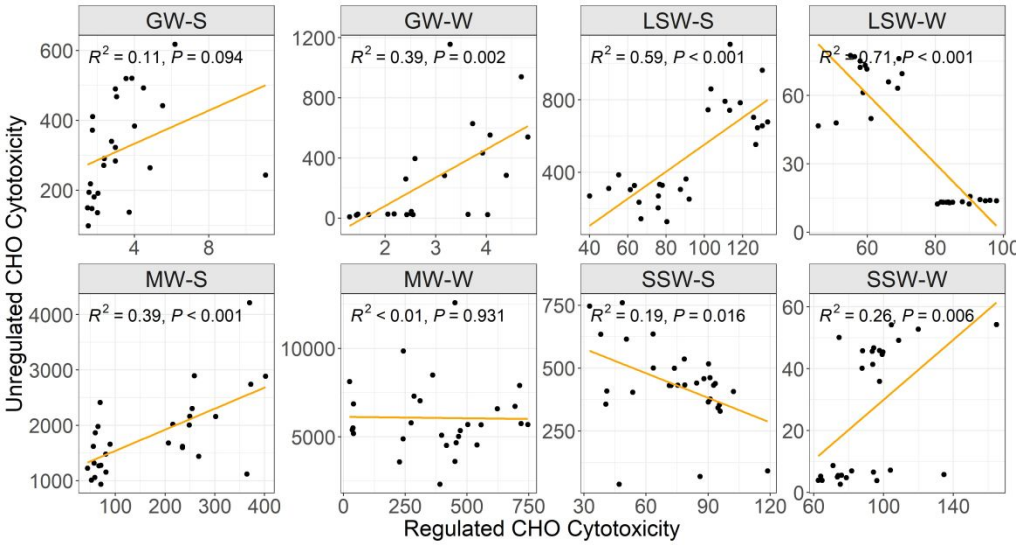
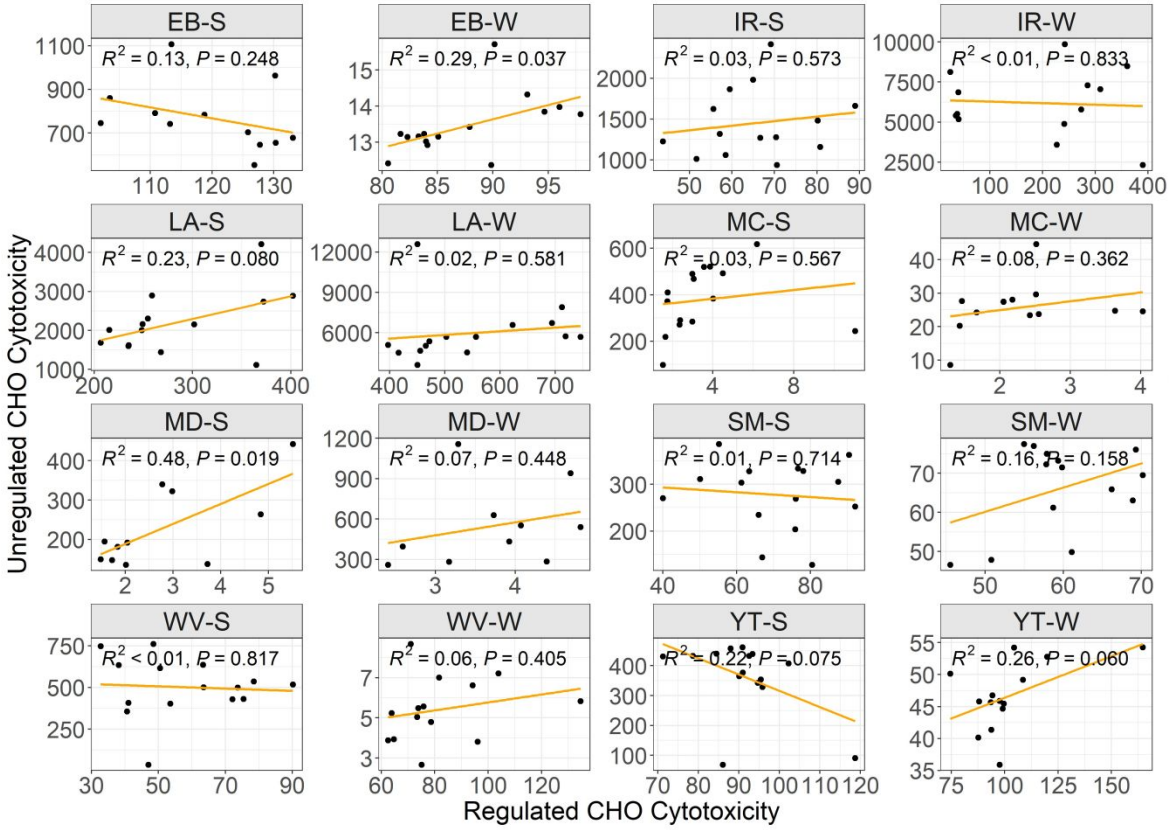


Figure S35: Regulated vs. Unregulated CHO Cytotoxicity by Region and Season



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