SUPPLEMENTAL MATERIALS

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Impact of Nitrogen Removal in Wastewater Treatment on NDMA Formation at Downstream Drinking Water Treatment Plants

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Table S1. System information for the 31 systems included in the high DFR system set

PWSID	Name	Plant Size	HUC 2[1]	Source Water	Disinfectant[2]
AL0000933	ALBERTVILLE UTILITIES BOARD	L	06	Lake Guntersville	CL
AL0001084	DECATUR (MUNICIPAL UTILITIES BOARD OF)	XL	06	Tennessee River	CL
GA1210001	ATLANTA	XL	03W	Chattahoochee River	CL
GA2150000	COLUMBUS	XL	03W	Chattahoochee River	CL
IA8222001[3]	**IOWA-AMERICAN WTR CO-DAVENPORT**	**XL**	**07**	**Mississippi River**	**CA**
IL0894070	AURORA	XL	07	Fox River	CA
IL0894380	ELGIN	XL	07	Fox River	CA
IL1610450	**MOLINE**	**L**	**07**	**Mississippi River**	**CA**
IL1610650	**ROCK ISLAND**	**L**	**07**	**Mississippi River**	**CA**
IN5202020	FORT WAYNE - 3 RIVERS FILTRATION PLANT	XL	04	St. Joseph River	CA
IN5282002	EVANSVILLE WATER UTILITY	XL	05	Ohio River	CA
KY0110097	DANVILLE CITY WATER WORKS	VL	05	Herrington Lake	CL
KY0370143	FRANKFORT PLANT BOARD	VL	05	Kentucky River	CA
KY0730533	PADUCAH WATER WORKS	VL	05	Ohio River	CL
NC0229025	DAVIDSON WATER INC	XL	03N	Yadkin River	CL

NC0343045	HARNETT CO DEPT OF PUBLIC UTIL	XL	03N	Cape Fear River	CA
NC0392020	CARY, TOWN OF	XL	03N	Jordan Lake	CA
NJ1111001	TRENTON WATER WORKS	XL	02	Delaware River	CL
NJ1225001	MIDDLESEX WATER COMPANY	XL	02	Delaware River	CL
NY0100205	GUILDERLAND TOWN WD	L	02	Watervliet Reservoir	CL
PA1090026	LOWER BUCKS CO JOINT MUN AUTH	XL	02	Delaware River	CL
PA1460048	NORTH WALES WATER AUTHORITY	VL	02	Delaware River	CL
PA5020043	WEST VIEW BORO MUNI AUTH	XL	05	Ohio River	CA/CL
PA5020056	WILKINSBURG-PENN JT WATER AUTH	XL	05	Allegheny River	CA/CL
SC0720003	BJW&SA (0720003)	VL	03N	Savannah River	CA
TN0000107	TENN-AMERICAN WATER COMPANY	XL	06	Tennessee River	CL
TN0000116	CLARKSVILLE WATER DEPARTMENT	XL	05	Cumberland River	CL
TN0000286	HARPETH VALLEY U D	VL	05	Cumberland River	CA
TN0000366	KNOXVILLE UTILITIES BOARD-KUB	XL	06	Tennessee River	CL
TX0140005	CITY OF TEMPLE	VL	12	Leon River	CL
TX0700001	CITY OF ENNIS	L	12	Lake Bardwell	CA

[1]2-digit hydrologic unit code

[2]Secondary disinfectant listed for UCMR 2 samples included in this study: CL = free chlorine, CA = chloramine, CL/CA = both free chlorine and chloramine were listed (in separate samples)

[3]Plants in bold had NDMA measurements consistently over 10 ng/L

Table S2. Contributing WWTP count for each high DFR DWTP by analysis distance

PWSID	Unconfined	50km	100km	150km
AL0000933	2	2	2	2
AL0001084	164	11	22	28
GA1210001	11	4	6	11
GA2150000	29	5	11	16
IA8222001	767	23	54	108
IL0894070	45	15	36	45
IL0894380	37	22	34	37
IL1610450	766	22	53	104
IL1610650	766	22	53	107
IN5202020	18	7	18	18
IN5282002	1322	8	32	59
KY0110097	5	5	5	5
KY0370143	30	3	18	24
KY0730533	2032	9	30	73
NC0229025	13	5	13	13
NC0343045	25	7	20	25
NC0392020	2	2	2	2
NJ1111001	96	6	41	62
NJ1225001	24	24	24	24
NY0100205	4	4	4	4

PA1090026	105	15	45	70
PA1460048	94	16	54	65
PA5020043	310	65	161	252
PA5020056	159	25	85	116
SC0720003	46	1	3	7
TN0000107	132	2	13	38
TN0000116	62	5	14	20
TN0000286	54	5	12	22
TN0000366	60	11	20	39
TX0140005	16	4	7	10
TX0700001	2	2	2	2

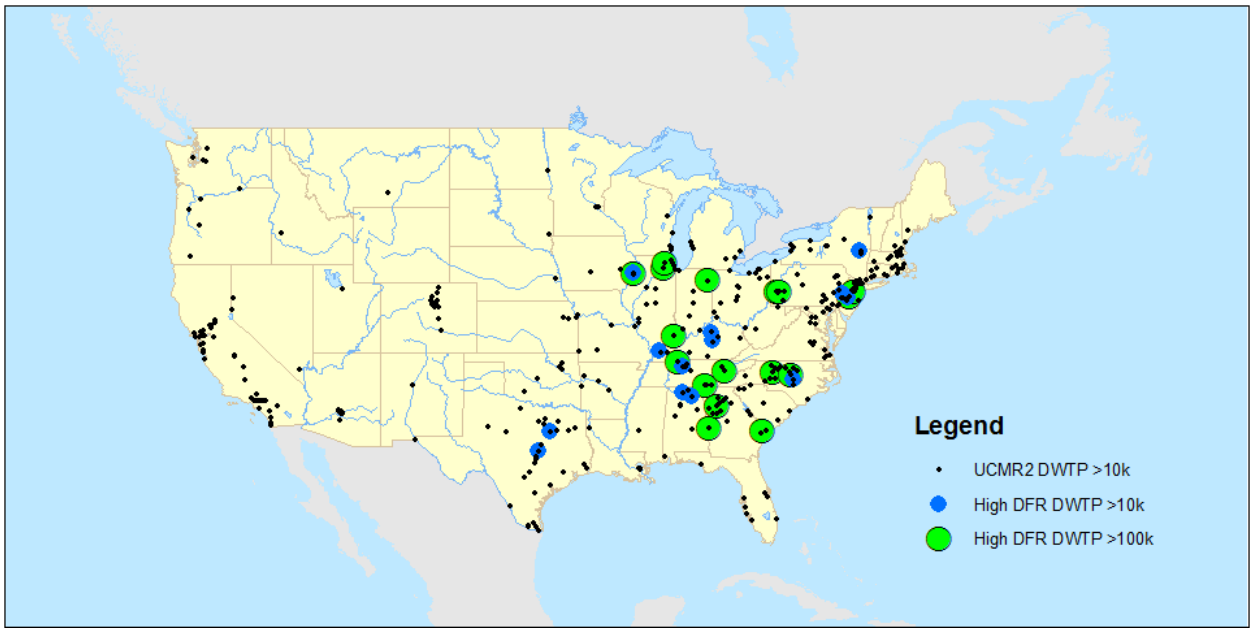

Figure S1. DWTP locations for plants serving >10k people in the UCMR2 (black dots), high DFR plants serving >10k people (small blue circles), and high DFR plants serving >100k (large green circles). Water features delineated in the USGS National Boundary Dataset. (Data from USGS 2014.)

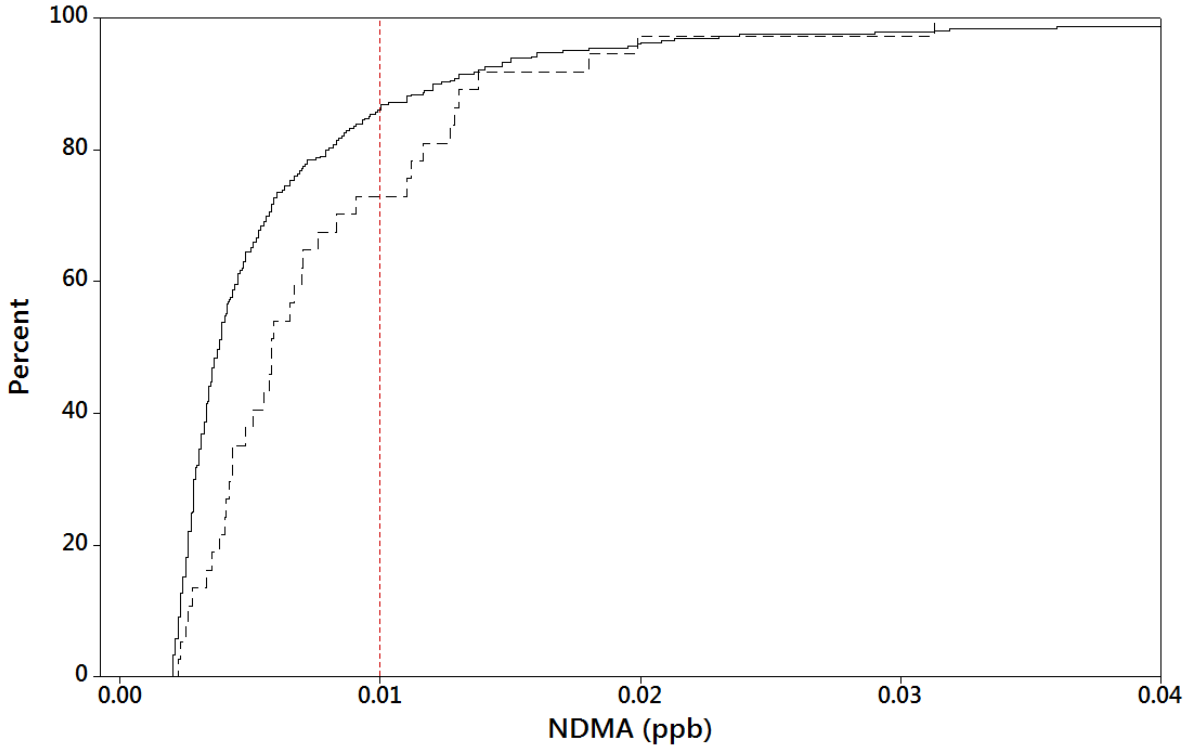

Figure S2. Empirical CDF of NDMA detections at the maximum residence time for chloraminating plants for the UCMR2 (solid) and high DFR subset (dashed). The vertical dashed line marks the California notification level of 10 ng/L

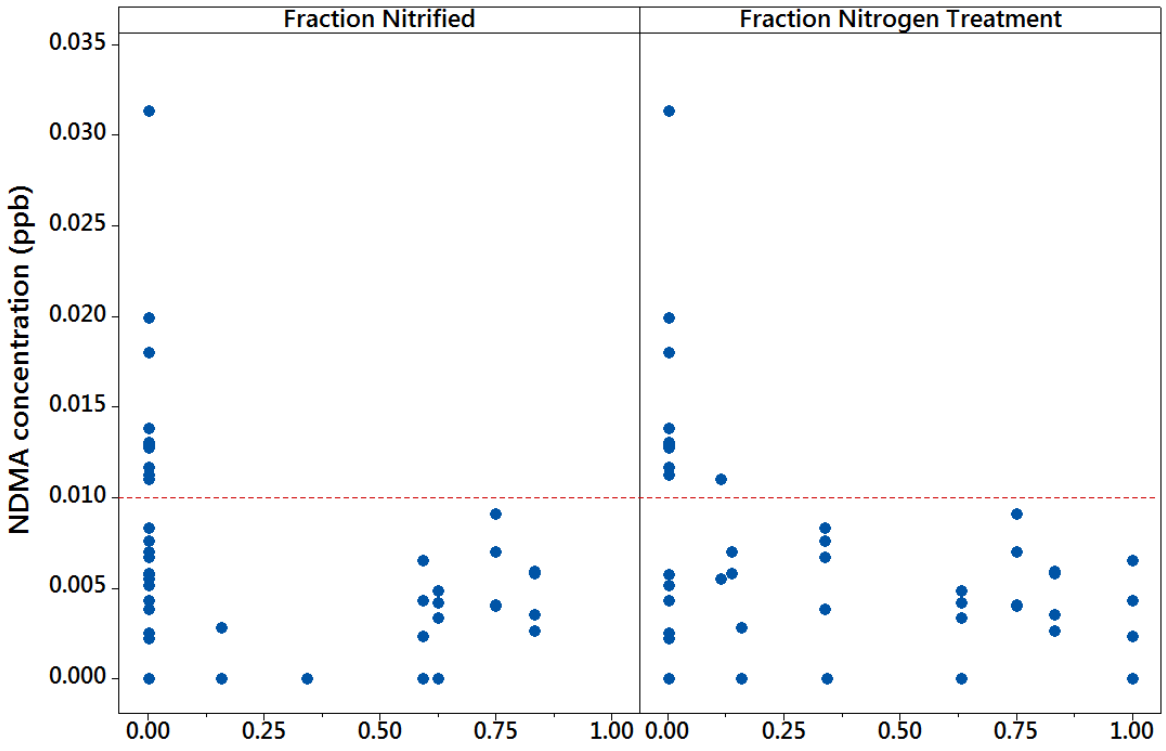

Figure S3. NDMA concentrations for chloraminating drinking water plants with upstream wastewater treatment facilities within 50 km, based on fraction of wastewater flows that are treated by nitrification (left) or include any nitrogen treatment (right). The horizontal red dashed line represents the California notification level of 10 ng/L.

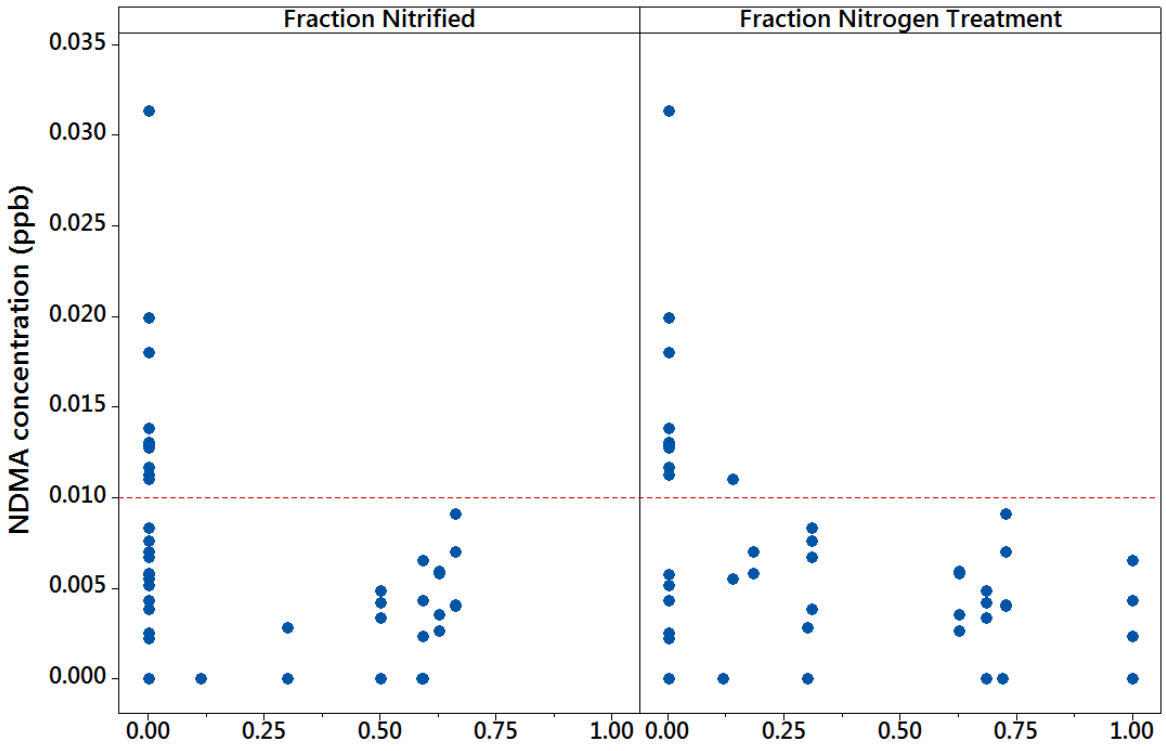

Figure S4. NDMA concentrations for chloraminating drinking water plants with upstream wastewater treatment facilities within 100 km, based on fraction of wastewater flows that are treated by nitrification (left) or include any nitrogen treatment (right). The horizontal red dashed line represents the California notification level of 10 ng/L.

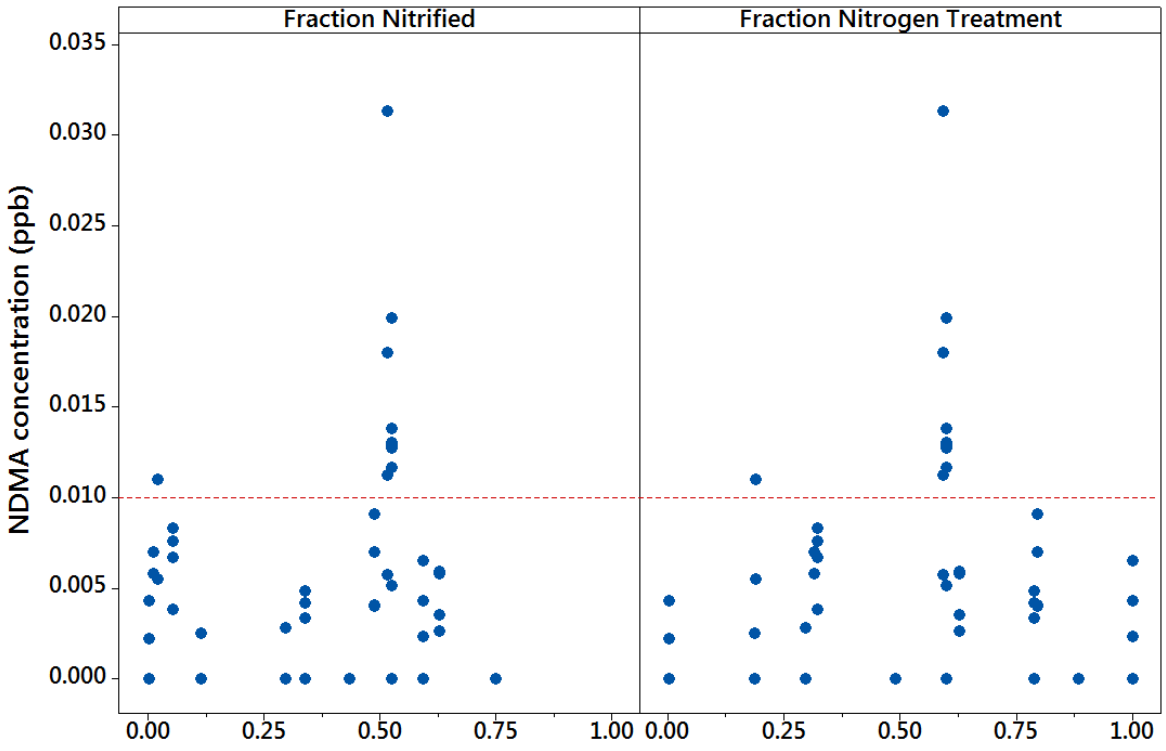

Figure S5. NDMA concentrations for chloraminating drinking water plants with upstream wastewater treatment facilities, based on fraction of wastewater flows that are treated by nitrification (left) or include any nitrogen treatment (right). The horizontal red dashed line represents the California notification level of 10 ng/L.

References

USGS (2014) United States Geological Survey, “The National Boundary Dataset Downloadable Data Collection.” Accessed March 2018. https://data.usgs.gov/datacatalog/data/USGS:6dcde538-1684-48a0-a8d6-cb671ca0a43e