December 1, 2023

Delivered via Electronic Mail

Environmental Management Commission
Attn: A. Frank McFadden, Chair
1400 Coliseum Boulevard
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Delivered via Electronic Mail

Hon. Lance R. LeFleur, Director
Alabama Department of Environmental Management
1400 Coliseum Boulevard
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Re: Water Quality Criteria for the Protection of Human Health; Amendments to ADEM Admin. Code r. 335-6-10-.07 and ADEM Admin Code chap. 335-6-10 – Appendix A

Dear Messrs. McFadden and LeFleur:

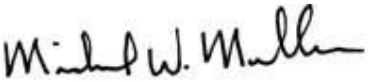
On February 20, 1991, the Environmental Management Commission adopted a rule establishing a methodology to calculate water quality criteria for toxic pollutants to protect human health. ADEM Admin. Code r. 335-6-10-.07(1)(d). Since then, there have been several amendments, the most notable of which were an August 29, 1994 amendment which revised a previously adopted fish consumption rate and a May 27, 2008 amendment which revised a previously adopted cancer risk level.

During the last twenty-three years, the science and data on which the methodology is based have matured significantly. This maturation demands that the methodology be reviewed and revised to ensure that it is adequately protective of human health and based on sound scientific rationale.

Enclosed are recommendations for revisions in the methodology, *e.g.*, revisions to cancer potency factors, reference doses, human body weight, relative source contributions, bioconcentration and bioaccumulation factors, fish consumption rate, and water consumption rate. Also enclosed are calculated water quality criteria for priority toxic pollutants based on these recommended revisions. We are providing this information to you because the Department may request that the Commission undertake rulemaking in the future to revise the methodology for calculating criteria for toxic pollutants.

We have also been informed that the Department may soon commence "stakeholder" meetings on revisions to the methodology to calculate criteria for toxic pollutants. We request to be invited to attend all such meetings as we believe it is most productive for all stakeholders to hear from each other and better understand each other's perspectives on proposed methodology revisions.

Sincerely,



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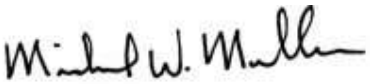

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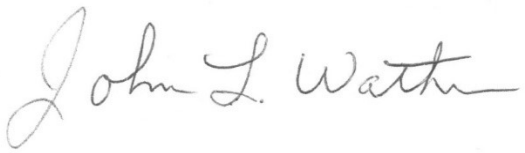

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Enclosures (3):

Rationale for Recommended Revisions to ADEM Water Quality Criteria for Priority Toxic Pollutants to Protect Human Health

Comparison of Current ADEM Water Quality Criteria for Priority Toxic Pollutants at Fish Consumption Rate of 30 g/day and Recommended Water Quality Criteria for Priority Toxic Pollutants at Fish Consumption Rate of Recommended and 45 g/day

Existing ADEM and EPA Recommended Chemical-specific Inputs for Human Health Ambient Water Quality Criteria

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Existing ADEM and EPA Recommended Chemical-specific Inputs for Human Health Ambient Water Quality Criteria for Priority Toxic Pollutants

Chemical Name	CAS	Cancer Slope Factor, CSF (per mg/kg-day)		Reference Dose, RfD (mg/kg-d)		Relative Source Contribution, RSC		Bioaccumulation Factor, BAF (L/kg tissue)						Bioconcentration Factor, BCF (L/kg tissue)	
								Trophic Level 2		Trophic Level 3		Trophic Level 4			
		ADEM	EPA	ADEM	EPA	ADEM	EPA	ADEM	EPA	ADEM	EPA	ADEM	EPA	ADEM	EPA
1,1,1-Trichloroethane	71-55-6			ND	2	ND	0.20	ND	6.9	ND	9	ND	10	ND	
1,1,2,2-Tetrachloroethane	79-34-5	0.2	0.2					ND	5.7	ND	7.4	ND	8.4	5	
1,1,2-Trichloroethane	79-00-5	0.057	0.057					ND	6	ND	7.8	ND	8.9	4.5	
1,1-Dichloroethylene	75-35-4			0.05	0.05	0.2	0.20	ND	2	ND	2.4	ND	2.6	5.6	
1,2,4-Trichlorobenzene	120-82-1	0.01	0.029					ND	2800	ND	1500	ND	430	114	
1,2-Dichlorobenzene	95-50-1			0.09	0.3	0.2	0.20	ND	52	ND	71	ND	82	55.6	
1,2-Dichloroethane	107-06-2	0.091	0.0033					ND	1.6	ND	1.8	ND	1.9	1.2	
1,2-Dichloropropane	78-87-5	0.067	0.036					ND	2.9	ND	3.5	ND	3.9	4.1	
1,2-Diphenylhydrazine	122-66-7	0.8	0.8					ND	18	ND	24	ND	27	24.9	
1,2-Trans-Dichloroethylene	156-60-5			0.02	0.02	0.2	0.20	ND	3.3	ND	4.2	ND	4.7	1.58	
1,3-Dichlorobenzene	541-73-1			0.0134	0.002	1.0	0.20	ND	31	ND	120	ND	190	55.6	
1,3-Dichloropropene	542-75-6	0.1	0.122					ND	2.3	ND	2.7	ND	3	1.9	
1,4-Dichlorobenzene	106-46-7			0.0134	0.07	0.2	0.20	ND	28	ND	66	ND	84	55.6	
Dioxin	1746-01-6	17500	156000					ND	ND	ND	ND	ND	ND	5000	5000
2,4,6-Trichlorophenol	88-06-2	0.011	0.011					ND	94	ND	130	ND	150	150	
2,4-Dichlorophenol	120-83-2			0.003	0.003	1.0	0.20	ND	31	ND	42	ND	48	40.7	
2,4-Dimethylphenol	105-67-9			0.02	0.02	1.0	0.20	ND	4.8	ND	6.2	ND	7	93.8	
2,4-Dinitrophenol	51-28-5			0.002	0.002	1.0	0.20	ND	4.4	ND	4.4	ND	4.4	1.5	
2,4-Dinitrotoluene	121-14-2	0.31	0.667					ND	2.8	ND	3.5	ND	3.9	3.8	
2-Chloronaphthalene	91-58-7			0.08	0.08	1.0	0.80	ND	150	ND	210	ND	240	202	
2-Chlorophenol	95-57-8			0.005	0.005	1.0	0.20	ND	3.8	ND	4.8	ND	5.4	134	
2-Methyl-4,6-Dinitrophenol	534-52-1			0.00039	0.0003	1.0	0.20	ND	6.8	ND	8.9	ND	10	5.5	
3,3'-Dichlorobenzidine	91-94-1	0.45	0.45					ND	44	ND	60	ND	69	312	
3-Methyl-4-Chlorophenol	59-50-7			ND	0.1	ND	0.20	ND	25	ND	34	ND	39	ND	
4,4'-DDD	72-54-8	0.24	0.24					ND	33000	ND	140000	ND	240000	53600	
4,4'-DDE	72-55-9	0.34	0.167					ND	270000	ND	1100000	ND	3100000	53600	
4,4'-DDT	50-29-3	0.24	0.34					ND	35000	ND	240000	ND	1100000	53600	
Acenaphthene	83-32-9			0.06	0.06	1.0	0.20	ND	510	ND	510	ND	510	242	
Acrolein	107-02-8			0.0005	0.0005	1.0	0.20	ND	1	ND	1	ND	1	215	
Acrylonitrile	107-13-1	0.54	0.54					ND	1	ND	1	ND	1	30	
Aldrin	309-00-2	17	17					ND	18000	ND	310000	ND	650000	4670	
alpha-BHC	319-84-6	6.3	6.3					ND	1700	ND	1400	ND	1500	130	
alpha-Endosulfan	959-98-8			0.006	0.006	1.0	0.20	ND	130	ND	180	ND	200	270	
Anthracene	120-12-7			0.3	0.3	1.0	0.20	ND	610	ND	610	ND	610	30	
Antimony	7440-36-0			0.0004	0.0004	0.4	0.40	ND	ND	ND	ND	ND	ND	1	1
Arsenic	7440-38-2	1.75	1.75					ND	ND	ND	ND	ND	ND	44	44
Asbestos	1332-21-4														
Benzene	71-43-2	0.029	0.015 – 0.055					ND	3.6	ND	4.5	ND	5	5.2	
Benzidine	92-87-5	230	230					ND	1.4	ND	1.6	ND	1.7	87.5	
Benzo(a)anthracene	56-55-3	7.3	0.73					ND	3,900	ND	3,900	ND	3,900	30	
Benzo(a)pyrene	50-32-8	7.3	7.3					ND	3,900	ND	3,900	ND	3,900	30	
Benzo(b)fluoranthene	205-99-2	7.3	0.73					ND	3,900	ND	3,900	ND	3,900	30	
Benzo(k)fluoranthene	207-08-9	7.3	0.073					ND	3,900	ND	3,900	ND	3,900	30	
beta-BHC	319-85-7	1.8	1.8					ND	110	ND	160	ND	180	130	
beta-Endosulfan	33213-65-9			0.006	0.006	1.0	0.20	ND	80	ND	110	ND	130	270	
Bis(2-Chloro-1-Methylethyl) Ether	108-60-1			0.04	0.04	1.0	0.20	ND	6.7	ND	8.8	ND	10	2.47	
Bis(2-Chloroethyl) Ether	111-44-4	1.1	1.1					ND	1.4	ND	1.6	ND	1.7	6.9	
Bis(2-Ethylhexyl) Phthalate	117-81-7	0.014	0.014					ND	710	ND	710	ND	710	130	
Bromoform	75-25-2	0.0079	0.0045					ND	5.8	ND	7.5	ND	8.5	3.75	
Butylbenzyl Phthalate	85-68-7			0.2	1.3	1.0	0.20	ND	19,000	ND	19,000	ND	19,000	414	
Carbon Tetrachloride	56-23-5	0.13	0.07					ND	9.3	ND	12	ND	14	18.75	
Chlordane	57-74-9	0.35	0.35					ND	5300	ND	44000	ND	60000	14100	
Chlorobenzene	108-90-7			0.02	0.02	0.2	0.20	ND	14	ND	19	ND	22	10.3	
Chlorodibromomethane	124-48-1	0.084	0.040					ND	3.7	ND	4.8	ND	5.3	3.75	
Chloroform	67-66-3	0.0061	ND	ND	0.01	ND	0.20	ND	2.8	ND	3.4	ND	3.8	3.75	
Chrysene	218-01-9	7.3	0.0073					ND	3,900	ND	3,900	ND	3,900	30	
Copper	7440-50-8														
Cyanide	57-12-5			0.02	0.0006	0.2	0.20	ND	ND	ND	ND	ND	ND	1	1
Dibenzo(a,h)anthracene	53-70-3	7.3	7.3					ND	3,900	ND	3,900	ND	3,900	30	
Dichlorobromomethane	75-27-4	0.062	0.034					ND	3.4	ND	4.3	ND	4.8	3.75	
Dieldrin	60-57-1	16	16					ND	14000	ND	210000	ND	410000	4670	
Diethyl Phthalate	84-66-2			0.8	0.8	1.0	0.20	ND	920	ND	920	ND	920	73	
Dimethyl Phthalate	131-11-3			10	10	1.0	0.20	ND	4,000	ND	4,000	ND	4,000	36	
Di-n-Butyl Phthalate	84-74-2			0.1	0.1	1.0	0.20	ND	2,900	ND	2,900	ND	2,900	89	
Endosulfan Sulfate	1031-07-8			0.006	0.006	1.0	0.20	ND	88	ND	120	ND	140	270	
Endrin	72-20-8			0.0003	0.0003	0.2	0.80	ND	4600	ND	36000	ND	46000	3970	
		Cancer Slope Factor, CSF		Reference Dose, RfD		Relative Source		Bioaccumulation Factor, BAF						Bioconcentration Factor, BCF	

Chemical Name	CAS	(per mg/kg-day)		(mg/kg-d)		Contribution, RSC		(L/kg tissue)						(L/kg tissue)	
								Trophic Level 2		Trophic Level 3		Trophic Level 4			
		ADEM	EPA	ADEM	EPA	ADEM	EPA	ADEM	EPA	ADEM	EPA	ADEM	EPA	ADEM	EPA
Endrin Aldehyde	7421-93-4			0.0003	0.0003	1.0	0.80	ND	440	ND	920	ND	850	3970	
Ethylbenzene	100-41-4			0.1	0.022	0.2	0.20	ND	100	ND	140	ND	160	37.5	
Fluoranthene	206-44-0			0.04	0.04	1.0	0.20	ND	1,500	ND	1,500	ND	1,500	1150	
Fluorene	86-73-7			0.04	0.04	1.0	0.20	ND	230	ND	450	ND	710	30	
gamma-BHC; Lindane	58-89-9			0.0003	0.0047	0.2	0.50	ND	1200	ND	2400	ND	2500	130	
Heptachlor	76-44-8	4.5	4.1					ND	12000	ND	180000	ND	330000	11200	
Heptachlor Epoxide	1024-57-3	9.1	5.5					ND	4000	ND	28000	ND	35000	11200	
Hexachlorobenzene	118-74-1	1.6	1.02					ND	18000	ND	46000	ND	90000	8690	
Hexachlorobutadiene	87-68-3	0.078	0.04					ND	23000	ND	2800	ND	1100	2.78	
Hexachlorocyclopentadiene	77-47-4			0.006	0.006	0.2	0.20	ND	620	ND	1500	ND	1300	4.34	
Hexachloroethane	67-72-1	0.014	0.04					ND	1200	ND	280	ND	600	86.9	
Indeno(1,2,3-cd)pyrene	193-39-5	7.3	0.73					ND	3,900	ND	3,900	ND	3,900	30	
Isophorone	78-59-1	0.00095	0.00095					ND	1.9	ND	2.2	ND	2.4	4.38	
Methyl Bromide	74-83-9			0.0014	0.02	1.0	0.20	ND	1.2	ND	1.3	ND	1.4	3.75	
Methylene Chloride	75-09-2	0.0075	0.002					ND	1.4	ND	1.5	ND	1.6	0.9	
Methylmercury	22967-92-6			ND	0.0001*	ND	0.000027**	ND	ND	ND	ND	ND	ND	ND	ND
N-Nitrosodi-n-Propylamine	621-64-7	7	7					ND	ND	ND	ND	ND	ND	1.13	1.13
N-Nitrosodimethylamine	62-75-9	51	51					ND	ND	ND	ND	ND	ND	0.026	0.026
N-Nitrosodiphenylamine	86-30-6	0.0049	0.0049					ND	ND	ND	ND	ND	ND	136	136
Nickel	7440-02-0			0.02	0.02	ND	ND	ND	ND	ND	ND	ND	ND	47	47
Nitrobenzene	98-95-3			0.0005	0.002	1.0	0.20	ND	2.3	ND	2.8	ND	3.1	2.89	
Pentachlorophenol (PCP)	87-86-5	0.12	0.4					ND	44	ND	290	ND	520	11	
Phenol	108-95-2			0.3	0.6	1.0	0.20	ND	1.5	ND	1.7	ND	1.9	1.4	
Polychlorinated Biphenyls (PCB	1336-36-3	2	2.0					ND	ND	ND	ND	ND	ND	31200	31200
Pyrene	129-00-0			0.03	0.03	1.0	0.20	ND	860	ND	860	ND	860	30	
Selenium	7782-49-2			0.005	0.005	1.0	ND	ND	ND	ND	ND	ND	ND	4.8	4.8
Tetrachloroethylene	127-18-4	0.039776	0.0021					ND	49	ND	66	ND	76	30.6	
Thallium	7440-28-0			0.000068	0.000068	0.2	0.20	ND	ND	ND	ND	ND	ND	116	116
Toluene	108-88-3			0.2	0.0097	0.2	0.20	ND	11	ND	15	ND	17	10.7	
Toxaphene	8001-35-2	1.1	1.1					ND	1700	ND	6600	ND	6300	13100	
Trichloroethylene	79-01-6	0.0126	0.05					ND	8.7	ND	12	ND	13	10.6	
Vinyl Chloride	75-01-4	1.4	1.5					ND	1.4	ND	1.6	ND	1.7	1..17	
Zinc	7440-66-6			0.3	0.3	1.0	ND	ND	ND	ND	ND	ND	ND	47	47

ND = No data.

* The units for the Methylmercury RfD are mg methylmercury/kg body weight-day.

**The RSC for Methylmercury is not a percentage but a value to be subtracted from the RfD.

Priority Toxic Pollutant	CAS Number	Current ADEM Human Health Water Quality Criteria[1] @ FCR=30 g/day		Recommended Human Health Water Quality Criteria[2] @ FCR=45 g/day[3]	
		Water + Organism (µg/L)	Organism Only (µg/L)	Water + Organism (µg/L)	Organism Only (µg/L)
1,1,1-Trichloroethane	71556	NA	NA	10000	80000
1,1,2,2-Tetrachloroethane	79345	0.163	2.33	0.1	1
1,1,2-Trichloroethane	79005	0.575	9.10	0.51	4.2
1,1-Dichloroethylene	75354	323	4167	300	8000
1,2,4-Trichlorobenzene	120821	25.8	40.9	0.035	0.036
1,2-Dichlorobenzene	95501	344	755	900	2000
1,2-Dichloroethane	107062	0.378	21.4	9.8	310
1,2-Dichloropropane	78875	0.492	8.49	0.87	15
1,2-Diphenylhydrazine	122667	0.0319	0.117	0.03	0.1
1,2-Trans-Dichloroethylene	156605	137	5907	100	2000
1,3-Dichlorobenzene	541731	256	562	4	7
1,3-Dichloropropene	542756	0.340	12.3	0.26	5.5
1,4-Dichlorobenzene	106467	51.1	112	200	400

Priority Toxic Pollutant	CAS Number	Current ADEM Human Health Water Quality Criteria @ 30 g/day		Recommended Human Health Water Quality Criteria @ 45 g/day	
		Water + Organism (µg/L)	Organism Only (µg/L)	Water + Organism (µg/L)	Organism Only (µg/L)
2,3,7,8-TCDD (Dioxin)[4]	1746016	0.000000026	0.000000027	TBD	TBD
2,4,6-Trichlorophenol	88062	0.979	1.41	0.92	1.3
2,4-Dichlorophenol	120832	65.2	172	10	30
2,4-Dimethylphenol	105679	291	498	100	1000
2,4-Dinitrophenol	51285	68.5	3111	10	200
2,4-Dinitrotoluene	121142	0.107	1.98	0.047	0.8
2-Chloronaphthalene	91587	695	924	500	600
2-Chlorophenol	95578	58.1	87.1	30	400
2-Methyl-4,6-Dinitrophenol	534521	12.6	165	2	10
3,3'-Dichlorobenzidine	91941	0.0137	0.0166	0.036	0.07
3-Methyl-4-Chlorophenol	59507	NA	NA	400	1000
4,4'-DDD	72548	0.0002	0.0002	0.000059	0.000059
4,4'-DDE	72559	0.0001	0.0001	0.0000083	0.0000083
4,4'-DDT	50293	0.0001	0.0001	0.00001	0.00001

Priority Toxic Pollutant	CAS Number	Current ADEM Human Health Water Quality Criteria @ 30 g/day		Recommended Human Health Water Quality Criteria @ 45 g/day	
		Water + Organism (µg/L)	Organism Only (µg/L)	Water + Organism (µg/L)	Organism Only (µg/L)
Acenaphthene	83329	454	579	40	40
Acrolein	107028	4	5	3	200
Acrylonitrile	107131	0.0447	0.1440	0.061	3.3
Aldrin	309002	0.00003	0.00003	3.6e-7	3.6e-7
alpha-BHC	319846	0.0019	0.0028	0.00018	0.00018
alpha-Endosulfan	959988	41.6	51.9	10	10
Anthracene	120127	7241	23333	200	200
Antimony	7440360	5.5	373	5.2	280
Arsenic[5]	7440382	0.1205	0.3030	0.01	0.023
Asbestos	1332214	7 million fibers/L	--	7 million fibers/L	--
Benzene	71432	1.12	15.5	0.56	7.5
Benzidine	92875	0.00007	0.0001	0.00014	0.005
Benzo(a) Anthracene	56553	0.0033	0.0107	0.00062	0.00062
Benzo(a) Pyrene	50328	0.0033	0.0107	0.000062	0.000062

Priority Toxic Pollutant	CAS Number	Current ADEM Human Health Water Quality Criteria @ 30 g/day		Recommended Human Health Water Quality Criteria @ 45 g/day	
		Water + Organism (µg/L)	Organism Only (µg/L)	Water + Organism (µg/L)	Organism Only (µg/L)
Benzo(b) Fluoranthene	205992	0.0033	0.0107	0.00062	0.00062
Benzo(k) Fluoranthene	207089	0.0033	0.0107	0.0062	0.0062
beta-BHC (beta-HCH)	319857	0.0066	0.0100	0.0049	0.0067
beta-Endosulfan	33213659	41.6	51.9	10	20
Bis(2-Chloro-1-Methylethyl) Ether	108601	1350	37787	200	2000
Bis(2-Chloroethyl) Ether	111444	0.0288	0.307	0.029	1
Bis(2-Ethylhexyl) Phthalate	117817	0.847	1.28	0.17	0.18
Bromoform	75252	4.19	78.8	6.5	55
Butylbenzyl Phthalate	85687	971	1127	0.05	0.05
Carbon Tetrachloride	56235	0.210	0.957	0.4	2
Chlordane	57749	0.0005	0.0005	0.00015	0.00015
Chlorobenzene	108907	121	906	100	400
Chlorodibromomethane	124481	0.3945	7.41	0.77	9.8
Chloroform	67663	5.43	102	60	1000

Priority Toxic Pollutant	CAS Number	Current ADEM Human Health Water Quality Criteria @ 30 g/day		Recommended Human Health Water Quality Criteria @ 45 g/day	
		Water + Organism (µg/L)	Organism Only (µg/L)	Water + Organism (µg/L)	Organism Only (µg/L)
Chrysene	218019	0.0033	0.0107	0.062	0.062
Copper	7440508	1300	--	1300	--
Cyanide	57125	138	9333	4	200
Dibenzo(a,h) Anthracene	53703	0.0033	0.0107	0.000062	0.000062
Dichlorobromomethane	75274	0.534	10.0	0.91	13
Dieldrin	60571	0.00003	0.00003	5.9e-7	5.9e-7
Diethyl Phthalate	84662	13365	25571	300	300
Dimethyl Phthalate	131113	227273	648148	900	900
Di-n-Butyl-Phthalate	84742	1499	2622	10	10
Endosulfan Sulfate	1031078	41.6	51.9	10	20
Endrin	72208	0.035	0.035	0.02	0.02
Endrin Aldehyde	7421934	0.173	0.176	0.5	0.6
Ethylbenzene	100414	448	1244	43	60
Fluoranthene	206440	76.7	81.2	9	9

Priority Toxic Pollutant	CAS Number	Current ADEM Human Health Water Quality Criteria @ 30 g/day		Recommended Human Health Water Quality Criteria @ 45 g/day	
		Water + Organism (µg/L)	Organism Only (µg/L)	Water + Organism (µg/L)	Organism Only (µg/L)
Fluorene	86737	966	3111	30	30
Gamma-BHC (HCH); Lindane	58899	0.712	1.077	2	2.1
Heptachlor	76448	0.00005	0.00005	0.0000028	0.0000028
Heptachlor Epoxide	1024573	0.00002	0.00002	0.000015	0.000015
Hexachlorobenzene	118741	0.0002	0.0002	0.000037	0.000037
Hexachlorobutadiene	87683	0.431	10.8	0.005	0.005
Hexachlorocyclopentadiene	77474	39.4	645	2	2
Hexachloroethane	67721	1.09	1.92	0.06	0.06
Indeno(1,2,3-cd) Pyrene	193395	0.0033	0.0107	0.00062	0.00062
Isophorone	78591	34.6	561	34	870
Methyl Bromide	74839	46.4	871	100	6000
Methylene Chloride	75092	4.60	346	20	600
Methylmercury	22967926	NA	NA	N/A	0.1 *mg/kg*
N-Nitrosodi-n-Propylamine	621647	0.0049	0.295	0.0047	0.22

Priority Toxic Pollutant	CAS Number	Current ADEM Human Health Water Quality Criteria @ 30 g/day		Recommended Human Health Water Quality Criteria @ 45 g/day	
		Water + Organism (µg/L)	Organism Only (µg/L)	Water + Organism (µg/L)	Organism Only (µg/L)
N-Nitrosodimethylamine	62759	0.0007	1.76	0.00065	1.3
N-Nitrosodiphenylamine	86306	2.35	3.50	1.9	2.7
Nickel	7440020	411	993	71	150
Nitrobenzene	98953	16.8	404	10	300
Pentachlorophenol (PCP)	87865	0.250	1.77	0.01	0.02
Phenol	108952	10284	500000	4000	100000
Polychlorinated Biphenyls (PCBs)	1336363	0.00004	0.00004	0.000028	0.000028
Pyrene	129000	724	2333	10	10
Selenium	7782492	163	2431	31	370
Tetrachloroethylene	127184	0.603	1.92	7.3	14
Thallium	7440280	0.174	0.274	0.14	0.21
Toluene	108883	1206	8723	51	250
Toxaphene	8001352	0.0002	0.0002	0.00033	0.00034
Trichloroethylene	79016	2.40	17.5	0.6	3

Priority Toxic Pollutant	CAS Number	Current ADEM Human Health Water Quality Criteria @ 30 g/day		Recommended Human Health Water Quality Criteria @ 45 g/day	
		Water + Organism (µg/L)	Organism Only (µg/L)	Water + Organism (µg/L)	Organism Only (µg/L)
Vinyl Chloride	75014	0.0246	1.42	0.022	0.76
Zinc	7440666	6158	14894	1100	2300

[1] Electronic mail from Azure Jones, ADEM Records Custodian to David A. Ludder (Aug. 3, 2016) (criteria effective Nov. 25, 2008). ADEM's current criteria are based on a human body weight of 70 kg, water consumption rate of 2.0 L/day, a fish consumption rate of 30 g/day, chemical-specific cancer potency factors, chemical-specific reference doses, chemical-specific relative source contribution factors, and chemical specific bioconcentration factors. ADEM Admin. Code r. 335-6-10-.07(1)(d) and ADEM Admin. Code chap. 335-6-10 Appendix A. Except for Arsenic, ADEM's current criteria for carcinogens are based on a cancer risk level of 1 in 1,000,000 (1×10^{-6}). ADEM Admin. Code r. 335-6-10-.07(1)(d).

[2] Recommended criteria were calculated using EPA's Tribal/State Human Health Criteria Calculator at https://www.epa.gov/wqs-tech/water-quality-standards-tools-tribes#tab4. With few exceptions, the recommended criteria incorporate EPA's recommended values for human body weight (80 kg), water consumption rate (2.4 L/day), chemical-specific cancer potency factors, chemical-specific reference doses, chemical-specific relative source contribution factors, and chemical-specific bioaccumulation factors and bioconcentration factors. Recommended criteria for carcinogens are based on a cancer risk level of 1 in 1,000,000 (1×10^{-6}).

[3] Dep't of Fisheries and Allied Aquacultures, Auburn Univ., *Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers* (1994), available at https://www.adem.alabama.gov/programs/water/wqsurvey/2004AlabamaAnglers.pdf.

[4] ADEM's current criteria for 2,3,7,8-TCDD (Dioxin) are based on a Food and Drug Administration cancer potency value of 17,500 per mg/kg-day. EPA's recommended criteria for 2,3,7,8-TCDD (Dioxin) are based on EPA's recommended cancer potency value of 156,000 per mg/kg-day and a bioconcentration factor of 5,000 L/kg tissue. Final recommended criteria for 2,3,7,8-TCDD (Dioxin) are to be determined ("TBD") after updating the bioconcentration/bioaccumulation factor.

[5] ADEM's current criteria for Arsenic are based on a cancer risk level of 1 in 100,000 (1×10^{-5}). The recommended criteria are based on a cancer risk level of 1 in 1,000,000 (1×10^{-6}).

Rationale for Recommended Revisions to ADEM Water Quality Criteria for Priority Toxic Pollutants to Protect Human Health

In ADEM Admin. Code r. 335-6-10-.07(1)(d), the Environmental Management Commission established a methodology for ADEM to calculate criteria for toxic pollutants in surface waters to protect human health. The rule provides the following:

For pollutants classified by the U.S. Environmental Protection Agency as non-carcinogens, the criteria shall be calculated using the following equations, except where numeric values are given in ADEM Admin. Code chap. 335-6-10 – Table 1.

(i) Consumption of water and fish:
conc. (mg/l) = (HBW × RfD × RSC)/[(FCR × BCF) + WCR]

(ii) Consumption of fish only:
conc. (mg/l) = (HBW × RfD × RSC)/(FCR × BCF)

For pollutants classified by the U.S. Environmental Protection Agency as carcinogens, the criteria shall be calculated using the following equations, except where numeric values are given in ADEM Admin. Code chap. 336-6-10 – Table 1.

(i) Consumption of water and fish:
conc. (mg/l) = (HBW × RL)/(CPF × [(FCR × BCF) + WCR])

(ii) Consumption of fish only:
conc. (mg/l) = (HBW × RL)/(CPF × FCR × BCF)

Where:

HBW = human body weight, set at 70 kg
RL = risk level, set at 1×10^{-6} (except for arsenic which is set at 1×10^{-5})
CPF = cancer potency factor, in (kg-day)/mg
RfD = reference dose, in mg/(kg-day)
RSC = relative source contribution
FCR = fish consumption rate, set at 0.030 kg/day

BCF = bioconcentration factor, in l/kg
WCR = water consumption rate, set at 2 l/day

Since this methodology was first adopted by the Commission in 1991, the science and data underlying the methodology have matured significantly. That science and data are discussed below along with recommended amendments to the ADEM administrative code.

Human Body Weight (HBW)

In November 1980, EPA recommended a national default human body weight of 70 kg for the calculation of human health water quality criteria. *See Notice of Water Quality Criteria Documents*, 45 Fed. Reg. 79318, 79324 (Nov. 28, 1980). This body weight was reaffirmed by EPA in 1992, and again in 2000. *Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants; States' compliance* - Final Rule, 57 Fed. Reg. 60848, 60863 (Dec. 22, 1992); *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (EPA-822-B-00-004, Oct. 2000), at 4-19.

On February 20, 1991, the Environmental Management Commission adopted a human body weight of 70 kg to calculate water quality criteria for the protection of human health. ADEM Admin. Code r. 335-6-10-.07(1)(d).

In September, 2011, EPA identified a recommended adult human body weight of 80 kg for human exposure calculations based on data derived from the National Health and Nutrition Examination Survey (NHANES) 1999-2006. *Exposure Factors Handbook: 2011 Edition* (EPA-600-R-09-052F, Sep 2011), at Table 8-1. In 2015, EPA published revised national recommended water quality criteria for the protection of human health based on the 80 kg human body weight value. *See Human Health Ambient Water Quality Criteria: 2015 Update* (EPA 820-F-15-001 June 2015).

In *Water Quality Standards Handbook* (EPA 823-B-17-001 2017), Chap. 3, at § 3.3.2, EPA explained:

> The EPA's 2015 updated recommended exposure assumption for body weight is 80 kg, which represents the mean weight for adults 21 years of age and older based on data derived from the Center for Disease Control and Prevention's National Health and Nutrition

> Examination Survey (NHANES) 1999-2006 data. This recommendation is found in Table 8.1 in the *2011 Exposure Factors Handbook*. This updated body weight assumption replaced the EPA's previously recommended weight for adults of 70 kg that was described in the *2000 Human Health Methodology*, which was approximated from the mean body weight of adults from the NHANES III database (1988-1994) and a 1989 study by the National Cancer Institute (see the 2000 Human Health Methodology for additional information).

Based on the data from Table 8.1 in the *Exposure Factors Handbook: 2011 Edition*, it is recommended that ADEM Admin. Code r. 335-6-10-.07(1)(d) be amended to revise the value for human body weight (HBW) from 70 kg to 80 kg.

Fish Consumption Rate (FCR)

> As described in EPA's human health criteria methodology (USEPA 2000), the level of fish consumption in highly exposed populations varies by geographical location. Therefore, EPA suggests a four preference hierarchy for states and authorized tribes that encourages use of the best local, state, or regional data available to derive fish consumption rates. EPA recommends that states and authorized tribes consider developing criteria to protect highly exposed population groups and use local or regional data in place of a default value as more representative of their target population group(s). The preferred hierarchy is: (1) use of local data; (2) use of data reflecting similar geography/population groups; (3) use of data from national surveys; and (4) use of EPA's default consumption rates.

Human Health Ambient Water Quality Criteria: 2015 Update (EPA 820-F-15-001 June 2015).

On August 29, 1994, the Environmental Management Commission amended ADEM Admin. Code r. 335-6-10-.07(1)(d) to revise the fish consumption rate for calculation of water quality criteria for the protection of human health from 6.5 grams per day (0.0065 kg/day) to 30 grams per day (0.030 kg/day) based on local data reported in Department of Fisheries and Allied Aquacultures, Auburn

University, *Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers* (1994).

Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers explains that surveys of anglers were conducted at "[t]wenty-three (23) locations distributed across Alabama . . . (Figure 1). These locations included twenty-nine (29) primary sampling sites: twenty–three (23) tailwater sites and 6 reservoir sites, representing 11 river drainages in Alabama (Tables 1 and 5)." *Id.* at 3. "Anglers were intercepted and interviewed at access points at the completion of their fishing trips." *Id.* at 4.

> Two methods were used to estimate C_{daily}: (1) Anglers with harvested fish were asked if they planned to consume their fish that day (Question 3). If the answer was 'yes', then C_{daily} was calculated for that interview using the quantity of fish that would be eaten at the next meal as specified by the interviewee. This method [was] termed the 'Harvest Method'. * * * (2) For all anglers who indicated that they consumed fish from the study site, the number of 4-oz servings typically eaten at a meal was determined by equating the entire surface (palm side) of the flat, open hand to a single 4-oz serving. * * * This gave the angler a visual frame of reference for the serving size being addressed. This method [was] termed the '4-oz Serving Method'."

Id. at 4.

Estimated daily per capita freshwater fish consumption (C_{daily}) was calculated using the Harvest Method based on "the number of meals eaten in the past month of fish caught at that landing or study site only (site meals), and the number of meals eaten in the past month of fish caught from the sample site plus all other lakes and rivers in Alabama (all meals), not including farm ponds." *Id.* at 9. Estimated daily per capita freshwater fish consumption (C_{daily}) was calculated using the 4-oz Serving Method based on "sample site meals, and also [on] all meals comprised of fish caught from Alabama lakes and rivers." *Id.* at 10.

The authors of *Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers* concluded:

> Annual estimates of mean daily per capita consumption (C_{annual}) for anglers from the current ADEM study were 43 g/d for the Harvest Method and 46 g/d for the 4-oz Serving Method, respectively. These two estimates of C_{annual} corroborated one another.
>
> If estimates of C_{annual} are based only on the meals of fish caught at the study sites (primarily river tailwater areas just below dams), then estimates of C_{annual} dropped to 33 g/d using the Harvest Method, and to 30 g/d using the 4-oz Serving Method. Again, the estimates from the two methods corroborated one another.

Id. at 24. *See also* *Exposure Factors Handbook: 2011 Edition* (EPA/600/R-09/052F, Sep. 2011) at § 10.5.7 (summarizing the methods and findings of *Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers*) and Merideth, Earl K., *Evaluation of Two On-site Methods for Determining Daily Per Capita Freshwater Fish Consumption of Alabama Anglers* (Auburn Univ. 1996), available at https://www.proquest.com/openview/2f800005a7fba0ee6640337d5af758c8/1?pq-origsite=gscholar&cbl=18750&diss=y (same).

The authors further explained:

> There was no significant difference ($p > .05$) between the estimates of C_{annual} derived from the Harvest Method and the 4-oz Serving Method. This was the case whether C_{annual} was based only on study site meals, or on all meals (Table 4). There was a significant difference ($p < .05$) between estimates of C_{annual} based on site meals vs. all meals, as might be expected, whether C_{annual} was estimated using the Harvest Method or the 4-oz Serving Method (Table 4). Meals eaten with fish harvested from the sample sites represented 60% of all meals eaten with fish caught from rivers and reservoirs in Alabama.
>
> These results imply that the Harvest Method and the 4-oz Serving Method provided estimates of C_{annual} that corroborated one another. The significant difference between C_{annual} based on site meals vs. all meals indicates that the values based only on study site meals could underestimate the true per capita consumption rate of all freshwater fish by anglers.

Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers, at 15. Notably, the authors offered no justification for basing a regulatory fish consumption rate on study site meals only.

The exclusion of fish consumption from "other lakes and rivers" is impermissible. "States must adopt those water quality criteria that protect the designated use. Such criteria must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use." 40 C.F.R. § 131.11(a)(1). "EPA is to review and to approve or disapprove State-adopted water quality standards" and determine "[w]hether the State has adopted criteria that protect the designated water uses based on sound scientific rationale consistent with § 131.11[.]" 40 C.F.R. § 131.15(a)(2). "EPA has consistently implemented the Clean Water Act to ensure that the *total rate of consumption* of freshwater and estuarine fish and shellfish (including estuarine species harvested in near coastal waters) reflects consumption rates demonstrated by the population of concern. In other words, EPA expects that the standards will be set to enable residents to safely consume from local waters the amount of fish they would normally consume *from all fresh and estuarine waters* (including estuarine species harvested in near coastal waters)." *Human Health Ambient Water Quality Criteria and Fish Consumption Rates: Frequently Asked Questions* (EPA, Jan. 18, 2013) at 2 (emphasis added). "Because the overall goal of the criteria is to allow for a consumer to safely consume from local waters the amount of fish they would normally consume from all fresh and estuarine waters, the FCR [should reflect consumption of fish and shellfish from all] local, commercial, aquaculture, interstate, and international sources." *Id.*, at 2.

Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers makes clear that the true mean per capita consumption rate of all freshwater fish by anglers is 43.1 grams per day to 45.8 grams per day. Moreover, the analysis in *Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers* omits any consideration of estuarine fish and

shellfish consumption,[1] and fish and shellfish consumption from commercial, aquaculture, interstate, and international sources.

Because ADEM calculates water quality criteria for the protection of human health based on a fish consumption rate (30 g/day) that represents only fish consumed by anglers at twenty-three (23) tailwater sites and six (6) reservoir sites and disregards fish consumption from "other lakes and rivers," fish and shellfish consumption from estuarine waters, and fish and shellfish from commercial, aquaculture, interstate, and international sources, the 30 g/day fish consumption rate adopted by the Commission is not based on sound scientific rationale and does not contain sufficient parameters to protect the designated uses of Alabama waters.

The best local data available – published in *Estimation of Daily Per Capita Freshwater Fish Consumption of Alabama Anglers* – supports a total fish consumption rate of 45 g/day from surveyed sites and other lakes and rivers. Accordingly, it is recommended that ADEM Admin. Code r. 335-6-10-.07(1)(d) be amended to revise the value for fish consumption rate (FCR) from 0.030 kg/day to 0.045 kg/day.

Bioaccumulation Factors (BAFs)

Human exposure to toxic pollutants in water is primarily through consumption of contaminated water and contaminated aquatic organisms (fish and shellfish). Aquatic organisms become contaminated when they ingest toxic pollutants from contaminated food and sediments, and contact toxic pollutants in contaminated water.

ADEM Admin. Code r. 335-6-10-.07(1)(d) and chap. 335-6-10 – Appendix A, require that ADEM calculate water quality criteria for the protection of human heath using bioconcentration factors (BCFs) for toxic pollutants. "The term "bioconcentration" refers to the uptake and retention of a chemical by an

[1] The 90th percentile shellfish consumption rates for the Gulf of Mexico, Coastal, and South regions of the United States are 20.1, 15.7, and 20.0 grams per day, respectively. *Estimated Fish Consumption Rates for the U.S. Population and Selected Subpopulations* (NHANES 2003-2010) (EPA-820-R-14-002, April 2014), at Table 12b.

aquatic organism from water only." *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (EPA-822-B-00-004, Oct. 2000), at 5-2. For some chemicals (particularly those that are highly persistent and hydrophobic), the assessment of bioconcentration of chemicals from the water column alone would underestimate the extent of accumulation in aquatic organisms. *Id.*

In *Water Quality Standards Handbook* (EPA 823-B-17-001 2017), Chap. 3, at § 3.3.2, EPA explained why BAFs are preferable to BCFs as follows:

> Bioaccumulation refers to the uptake and retention of a chemical by an aquatic organism from all surrounding media (e.g., water, food, sediment) whereas bioconcentration refers to the uptake and retention of a chemical by an aquatic organism from water only. For some chemicals, particularly those that are persistent and hydrophobic, the magnitude of bioaccumulation by aquatic organisms can be substantially greater than the magnitude of bioconcentration. Thus, an assessment of bioconcentration alone may underestimate the extent of accumulation in aquatic biota for these chemicals.
>
> The magnitude of bioaccumulation by aquatic organisms varies widely depending on the chemical, but can be extremely high for some persistent and hydrophobic chemicals. For such bioaccumulative chemicals, concentrations in aquatic organisms may pose unacceptable human health risks from fish and shellfish consumption even when concentrations in water are too low to cause unacceptable health risks from drinking water consumption alone. These chemicals may also biomagnify in aquatic food webs, a process whereby chemical concentrations increase in aquatic organisms of each successive trophic level due to increasing dietary exposures (e.g., increasing concentrations from algae, to zooplankton, to forage fish, to predatory fish).
>
> The EPA's *2000 Human Health Methodology* recommends the use of bioaccumulation factors (BAFs), where available, to reflect the uptake of a contaminant from all sources (e.g., ingestion, sediment) by fish and shellfish, rather than only from the water column as reflected by the use of bioconcentration factors (BCFs) in the 1980

> Human Health Methodology. Criteria developed using BAFs better represent exposures to pollutants that affect human health than do criteria developed using BCFs. The EPA's *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (2000); *Technical Support Document Volume 2: Development of National Bioaccumulation Factors* (2003) contains procedures for calculating BAFs. The EPA also recommends that states and authorized tribes calculate site-specific BAFs, where possible, for use in developing their state and authorized tribal human health water quality criteria. The EPA's *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (2000); *Technical Support Document Volume 3: Development of Site Specific Bioaccumulation Factors* (2009) contains procedures for calculating site-specific BAFs. The EPA applied the methodologies above in its 2015 human health criteria updates.

See Human Health Ambient Water Quality Criteria: 2015 Update (EPA 820-F-15-001 June 2015).

EPA has developed BAFs for many toxic pollutants. *See, e.g., Chemical-specific Inputs for EPA's 2015 Final Updated Human Health Ambient Water Quality Criteria; Fact Sheet – Methodology for Deriving Ambient Water Quality Criteria, for the Protection of Human Health (2000), Technical Support Document, Volume 2: Development of National Bioaccumulation Factors* (EPA-822-F-03-014, Dec. 2003); *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000), Technical Support Document, Volume 2: Development of National Bioaccumulation Factors* (EPA-822-R-03-030, Dec. 2003); *Development of National Bioaccumulation Factors: Supplemental Information for EPA's 2015 Human Health Criteria Update* (EPA 822-R-16-001, Jan. 2016).

Since BAFs provide a more accurate representation of fish and shellfish uptake of toxic pollutants than do BCFs, it is recommended that BAFs be used, where available, in calculating water quality criteria for toxic pollutants to protect human health. Accordingly, it is recommended that ADEM Admin. Code r. 335-6-10-.07(1)(d) and ADEM Admin. Code chap. 335-6-10 – Appendix A be amended to specify BAFs in lieu of BCFs, where available.

Bioconcentration Factors (BCFs)

EPA has yet to publish recommended BAFs for some toxic pollutants and continues to apply BCFs to those pollutants. One such toxic pollutant is 2,3,7,8-TCDD (Dioxin). In 1984, EPA published *Ambient Water Quality Criteria for 2,3,7,8-Tetrachlorodibenzo-p-dioxin* (EPA 440/5-84-007, Feb. 1984) in which EPA stated, "Until further information is available, the U.S. EPA's best current estimate for the BCF of 2,3,7,8-TCDD in aquatic organisms is 5000 [L/kg tissue]." *Id.*, at C-14. The Environmental Management Commission adopted the 5,000 L/kg tissue bioconcentration factor for 2,3,7,8-TCDD (Dioxin) on February 20, 1991. ADEM Admin. Code chap. 335-6-10 – Appendix A.

2,3,7,8-TCDD (Dioxin) is highly lipophilic and highly hydrophobic ($K_{ow} \approx 6.61$). For chemicals that are highly persistent and hydrophobic like 2,3,7,8-TCDD (Dioxin), the assessment of bioconcentration of toxic pollutants from the water column alone would underestimate the extent of accumulation in aquatic organisms. Ingestion of food contaminated with 2,3,7,8-TCDD (Dioxin) is the predominant mode of bioaccumulation in fish. Thus, the 5,000 L/kg tissue BCF used in ADEM Admin. Code chap. 335-6-10 – Appendix A, is a grossly inaccurate measure of the uptake of 2,3,7,8-TCDD (Dioxin) in fish. More information on this topic will be submitted at a later date along with a recommendation for revision of the bioconcentration factor (BCF) for 2,3,7,8-TCDD (Dioxin).

Water Consumption Rate

In November 1980, EPA recommended a national default water consumption rate (WCR) of 2.0 liters per day for calculation of water quality criteria for the protection of human health. *Notice of Water Quality Criteria Documents*, 45 Fed. Reg. 79318, 79324 (Nov. 28, 1980).

On February 20, 1991, the Environmental Management Commission adopted a methodology for the calculation of water quality criteria for the protection of human health based on a water consumption rate (WCR) of 2.0 L/day. Today's criteria continue to be based on this rate. ADEM Admin. Code r. 335-6-10-.07(1)(d).

In 1992 and 2000, EPA reaffirmed the 2.0 L/day water consumption rate (WCR). *Water Quality Standards: Establishment of Numeric Criteria for*

Priority Toxic Pollutants; States' compliance - Final Rule, 57 Fed. Reg. 60848, 60863 (Dec. 22, 1992); *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (EPA-822-B-00-004, Oct. 2000), at 4-22 to 4-23.

In September, 2011, EPA identified a recommended adult drinking water consumption rate of 2.4 liters per day for human exposure calculations based on the National Health and Nutrition Examination Survey (NHANES) data from 2003 to 2006. *Exposure Factors Handbook: 2011 Edition* (EPA-600-R-09-052F, Sep 2011), at Table 3-23. In 2015, EPA published revised national recommended water quality criteria for the protection of human health based on the 2.4 L/day water consumption rate value. *See Human Health Ambient Water Quality Criteria: 2015 Update* (EPA 820-F-15-001 June 2015).

In *Water Quality Standards Handbook* (EPA 823-B-17-001 2017), Chap. 3, at § 3.3.2, EPA describes the derivation of the water consumption rate as follows:

> Based on NHANES 2003-2006 data, the EPA's 2015 updated recommended exposure assumption for drinking water intake is 2.4 liters/day (L/d), rounded from 2.414 L/d for per capita estimate of combined direct and indirect "community water" ingestion at the 90th percentile for adults 21 years of age and older. For this estimate, direct water is defined as water ingested directly as a beverage (from community water sources); indirect water is defined as water added in the preparation of food or beverages but not water intrinsic to purchased foods. Community water includes direct and indirect use of tap water and excludes bottled water and other sources such as water from wells and springs. This recommended value is found in Chapter 3 (Table 3-23) of the *2011 Exposure Factors Handbook*.

Accordingly, it is recommended that ADEM Admin. Code r. 335-6-10-.07(1)(d) be revised to specify a water consumption rate (WCR) of 2.4 L/day.

Reference Doses (RfDs) and Cancer Potency Factors (CPFs)

On February 20, 1991, the Environmental Management Commission adopted a methodology for calculating water quality criteria for the protection of human health based mostly on reference doses and cancer potency factors published by

EPA. ADEM Admin. Code r. 335-6-10-.07(1)(d)1.(iii) provides that "[t]he values used for the reference dose (RfD) shall be values available through the U.S. Environmental Protection Agency's Integrated Risk Information System (IRIS), . . ., except where other values are established pursuant to subparagraph (1)(g). The RfD . . . values for specific pollutants are provided in Appendix A." ADEM Admin. Code r. 335-6-10-.07(1)(d)2.(iii) provides that "[t]he values used for the cancer potency factor (CPF) shall be values available through the U.S. Environmental Protection Agency's Integrated Risk Information System (IRIS) . . ., except where other values are established pursuant to subparagraph (1)(g). The CPF . . . values for specific pollutants are provided in Appendix A."

After EPA's 2015 publication of revised recommended water quality criteria for 94 toxic pollutants, ADEM's adopted cancer potency factors for 27 carcinogens and reference doses for 16 non-carcinogens no longer conform to EPA's recommendations. Accordingly, it is recommended that the cancer potency factors (CPFs) and reference doses (RfDs) in ADEM Admin. Code chap. 335-6-10 – Appendix A, be revised to conform to the cancer potency factors (CPFs) and reference doses (RfDs) determined by EPA. *See Existing ADEM and EPA Recommended Chemical-specific Inputs for Human Health Ambient Water Quality Criteria for Priority Toxic Pollutants.*

The EPA's Integrated Risk Information System does not include a cancer potency factor (CPF) for 2,3,7,8-TCDD (Dioxin). In 1984, EPA published a cancer potency factor of 156,000 per mg/kg-day and expressly rejected the Food and Drug Administration's methodology for determining its cancer potency factor (CPF) of 17,500 per mg/kg-day. *Ambient Water Quality Criteria for 2,3,7,8-Tetrachlorodibenzo-p-dioxin* (EPA 440/5-84-007, Feb. 1984). On February 20, 1991, the Environmental Management Commission adopted a cancer potency factor (CPF) for 2,3,7,8-TCDD (Dioxin) of 17,500 per mg/kg-day allegedly based on the cancer potency factor (CPF) developed by the Food and Drug Administration. ADEM Admin. Code chap. 335-6-10 – Appendix A.

More information on this topic will be submitted at a later date with a recommendation to revise the cancer potency factor (CPF) for 2,3,7,8-TCDD (Dioxin).

Relative Source Contribution (RSC)

The RSC represents the appropriate portion of the reference dose (RfD) for non-carcinogenic toxic pollutants to be attributed to ambient water consumption and freshwater and estuarine fish and shellfish consumption from inland and nearshore waters when there are other potential exposure sources. This is usually expressed as a percentage of the RfD. The rationale for this approach is that the objective of the water quality criteria is to ensure that an individual's total exposure from all sources does not exceed the RfD for the toxic pollutant. Sources of exposure to toxic pollutants not reflected in water quality criteria include ocean fish consumption (not included in the fish consumption rate), non-fish food consumption (meats, poultry, fruits, vegetables, and grains), dermal exposure, and respiratory exposure. *Human Health Ambient Water Quality Criteria: 2015 Update* (EPA 820-F-15-001 June 2015); *Water Quality Standards Handbook* (EPA 823-B-17-001 2017), Chap. 3, at § 3.3.2. An RSC of 1.0 assumes that 100% of the RfD for a toxic pollutant is attributable to the presence of that toxic pollutant in water and fish and shellfish and 0% of the RfD for the toxic pollutant is attributable to other sources. Similarly, an RSC of 0.20 assumes that 20% of the RfD for a toxic pollutant is attributable to the presence of that toxic pollutant in water and fish and shellfish and 80% of the RfD for the toxic pollutant is attributable to other sources.

ADEM's current human health water quality criteria (last revised in 2008) include relative source contribution (RSC) factors less than 1.0 (i.e., the percentage of the RfD that is attributable to human exposure to contaminated water and fresh and estuarine fish and shellfish is less than 100%) for seven priority toxic pollutants. ADEM Admin. Code chap. 335-6-10 – Appendix A.

EPA recommends following the Exposure Decision Tree in Figure 4-1 of the *Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health* (EPA-822-B-00-004, Oct. 2000) to determine the appropriate RSC. A default RSC of 20 percent (0.20) is recommended and used by EPA in deriving recommended criteria for non-carcinogens and non-linear carcinogens where available data are insufficient to characterize the likelihood of exposure to relevant sources. The 20 percent (0.20) default RSC should only be replaced where sufficient data are available to develop a scientifically defensible alternative value. For example, in the 2015 updated criteria recommendations for the protection of human health, the EPA defined a RSC of 0.50 or 0.80 for several pollutants based on currently available data regarding human exposure

to specific pollutants. *Water Quality Standards Handbook* (EPA 823-B-17-001 2017), Chap. 3, at § 3.3.2; *Chemical-specific Inputs for EPA's 2015 Final Updated Human Health Ambient Water Quality Criteria*, EPA published revised ambient water quality criteria documents in 2015 that incorporate RSCs less than 1.0 for 38 priority toxic pollutants. *See Existing ADEM and EPA Recommended Chemical-specific Inputs for Human Health Ambient Water Quality Criteria for Priority Toxic Pollutants.* EPA published RSCs less than 1.0 for at least two other priority toxic pollutants prior to 2015. *Id.*

ADEM Admin. Code r. 335-6-10-.07(1)(d)1.(iii) provides that the values used for the relative source contribution (RSC) shall be values contained in ambient water quality criteria documents published by the U.S. Environmental Protection Agency, except where other values are established pursuant to subparagraph (1)(g). Accordingly, it is recommended that ADEM Admin. Code chap. 335-6-10 – Appendix A be amended to include the RSCs published by EPA in EPA's current ambient water quality criteria documents for priority toxic pollutants. *See Existing ADEM and EPA Chemical-specific Inputs for Human Health Ambient Water Quality Criteria for Priority Toxic Pollutants*.

Cancer Risk Level

On May 27, 2008, the Environmental Management Commission adopted an amendment to ADEM Admin. Code r. 335-6-10-.07(1)(d)2. which lowered the acceptable cancer risk level (RL) from exposure to toxic pollutants in water and fish from 1 in 100,000 (1×10^{-5}) to 1 in 1,000,000 (1×10^{-6}). However, the Commission made an exception for Arsenic. Rule 335-6-10-.07(1)(d)2. authorizes Arsenic concentrations in Alabama waters at a level that will produce a 1 in 100,000 (1×10^{-5}) risk of causing cancer.

It is recommended that the 1 in 100,000 (1×10^{-5}) cancer risk level (RL) presently allowed for Arsenic in surface waters in ADEM Admin. Code r. 335-6-10-.07(1)(d)2. be deleted so that concentrations of Arsenic in surface waters will not exceed a level that will create a cancer risk higher than 1 in 1,000,000.