June 29, 2015

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NJDEP - OFFICE OF
LEGAL AFFAIRS

Office of Legal Affairs
Attention: Rulemaking Petitions
New Jersey Department of Environmental Protection
Mail Code 401-04L
401 East State Street, 4th Floor
P.O. Box 402
Trenton, New Jersey 08625-0402

Mark Pedersen, Assistant Commissioner
New Jersey Department of Environmental Protection
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Re: March 25, 2015 Public Petition Pursuant to N.J.A.C. 7:1D-1.1 to Amend the Practical Quantitation Limit and Groundwater Quality Standard for the Contaminant bis (2-chloroethyl) ether, (aka BCEE), N.J.A.C. 7:9C, Appendix, Table 1

NJDEP Response Letters Dated April 8, 2015 and May 22, 2015
NJDEP File No. R15-009

Greetings:

Please accept this letter for rulemaking on behalf of myself pursuant to N.J.S.A. 52:14B-1 *et seq*. This letter provides supplemental information to the original Petition, dated March 25, 2015 regarding the above request. The following information is being provided to NJDEP for additional consideration:

- Although specifically referenced and cited in the March 25, 2015 Petition (page 21 of 79), Petitioner specifically emphasizes the potential applicability of the method detection limit (MDL) for USEPA Method 611 from USEPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. Petitioner believes the current MDL which can be obtained using Method 611 is 0.3 ppb. Additional information regarding the USEPA's approval of the use of Method 611 in detecting BCEE is provided in Exhibit 1.
- As provided in Exhibit 2, Petitioner believes additional laboratory analyses, using USEPA Method 525.2 for the detection of BCEE is another viable option, and its use would result in a significantly lower MDL than that currently in force in Table 1 of N.J.A.C. 7:9C. In this case Petitioner requests NJDEP confer with applicable internal experts and outside vendors to determine the applicable MDL for BCEE using Method 525.2.

- As provided in Exhibit 3, in the attached May 2014 document, USEPA has reevaluated the 2002 ambient water quality criteria for BCEE of 0.030 ppb and revised such downward to 0.024 ppb. As stated in the subject document, *"EPA periodically revises water quality criteria to ensure that they reflect the latest scientific knowledge."*

Both USEPA Methods 611 and 525.2 are widely available, commonly used and well established.

Said information is provided to the NJDEP for additional consideration, in no way should this supplemental information be construed to alter any of the original information, assertions, and requests in the March 25, 2015 Petition.

All previously cited laws, rules, and regulations as described in the March 25, 2015 Petition, are incorporated herein.

The petitioner awaits your timely response and thanks you in advance for your assistance.

Exhibit 1

Supplemental Information on USEPA Method 611

AUTHENTICATED U.S. GOVERNMENT INFORMATION GPO

FEDERAL REGISTER

Vol. 80 Thursday,
No. 33 February 19, 2015

Part II

Environmental Protection Agency

40 CFR Part 136
Clean Water Act Methods Update Rule for the Analysis of Effluent; Proposed Rule

[70] Techniques and Methods Book 5–B1, Determination of Elements in Natural-Water, Biota, Sediment and Soil Samples Using Collision/Reaction Cell Inductively Coupled Plasma-Mass Spectrometry, Chapter 1, Section B, Methods of the National Water Quality Laboratory, Book 5, Laboratory Analysis, 2006. USGS.

[71] Water-Resources Investigations Report 01–4132, Methods of Analysis by the U.S. Geological Survey National Water Quality Laboratory—Determination of Organic Plus Inorganic Mercury in Filtered and Unfiltered Natural Water with Cold Vapor-Atomic Fluorescence Spectrometry, 2001. USGS.

[72] USGS Techniques and Methods 5–B8, Chapter 8, Section B, Methods of the National Water Quality Laboratory Book 5, Laboratory Analysis, 2011 USGS.

[73] NECi Method N07–0003, Revision 9.0, March 2014, Method for Nitrate Reductase Nitrate-Nitrogen Analysis, The Nitrate Elimination Co., Inc.

[74] Timberline Instruments, LLC Method Ammonia-001, Timberline Instruments, LLC.

[75] Hach Company Method 10206, Hach Company.

[76] Hach Company Method 10242, Hach Company.

[77] National Council for Air and Stream Improvement (NCASI) Method TNTP–W10900, Total (Kjeldahl) Nitrogen and Total Phosphorus in Pulp and Paper Biologically Treated Effluent by Alkaline Persulfate Digestion. June 2011.

TABLE IC—LIST OF APPROVED TEST PROCEDURES FOR NON-PESTICIDE ORGANIC COMPOUNDS

Parameter[1]	Method	EPA[2 7]	Standard methods	ASTM	Other
1. Acenaphthene	GC	610			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
	HPLC	610	6440 B–2005	D4657–92 (98)	
2. Acenaphthylene	GC	610			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
	HPLC	610	6440 B–2005	D4657–92 (98)	
3. Acrolein	GC	603			
	GC/MS	624.1[4],1624B			
4. Acrylonitrile	GC	603			
	GC/MS	624.1[4],1624B			
5. Anthracene	GC	610			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
	HPLC	610	6440B–2005	D4657–92 (98)	
6. Benzene	GC	602	6200 C–2011		
	GC/MS	624.1, 1624B	6200 B–2011		
7. Benzidine	Spectro-photometric.				See footnote[3], p.1.
	GC/MS	625.1[5], 1625B	6410 B–2000		
	HPLC	605			
8. Benzo(a)anthracene	GC	610			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
	HPLC	610	6440 B–2005	D4657–92 (98)	
9. Benzo(a)pyrene	GC	610			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
	HPLC	610	6440 B–2005	D4657–92 (98)	
10. Benzo(b)fluoranthene	GC	610			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
	HPLC	610	6440 B–2005	D4657–92 (98)	
11. Benzo(g,h,i)perylene	GC	610			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
	HPLC	610	6440 B–2005	D4657–92 (98)	
12. Benzo(k)fluoranthene	GC	610			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
	HPLC	610	6440 B–2005	D4657–92 (98)	
13. Benzyl chloride	GC				See footnote[3], p. 130.
	GC/MS				See footnote[6], p. S102.
14. Butyl benzyl phthalate	GC	606			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
15. bis(2-Chloroethoxy) methane	GC	611			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
16. bis(2-Chloroethyl) ether	GC	611			
	GC/MS	625.1, 1625B	6410 B–2000		See footnote[9], p. 27.
17. bis(2-Ethylhexyl) phthalate	GC	606			

Reagent water—Water demonstrated to be free from the analytes of interest and potentially interfering substances at the MDLs for the analytes in this method.

Regulatory compliance limit—A limit on the concentration or amount of a pollutant or contaminant specified in a nationwide standard, in a permit, or otherwise established by a regulatory/control authority.

Relative standard deviation (RSD)—The standard deviation times 100 divided by the mean. Also termed "coefficient of variation."

RF—Response factor. See Section 7.6.2.

RPD—Relative percent difference.

RSD—See relative standard deviation.

Safety Data Sheet (SDS)—Written information on a chemical's toxicity, health hazards, physical properties, fire, and reactivity, including storage, spill, and handling precautions that meet the requirements of OSHA, 29 CFR 1910.1200(g) and appendix D to § 1910.1200. United Nations Globally Harmonized System of Classification and Labelling of Chemicals (GHS), third revised edition, United Nations, 2009.

Should—This action, activity, or procedural step is suggested but not required.

SPE—Solid-phase extraction; a sample extraction or extract cleanup technique in which an analyte is selectively removed from a sample or extract by passage over or through a material capable of reversibly adsorbing the analyte.

Stock solution—A solution containing an analyte that is prepared using a reference material traceable to EPA, the National Institute of Science and Technology (NIST), or a source that will attest to the purity and authenticity of the reference material.

Surrogate—A compound unlikely to be found in a sample, which is spiked into the sample in a known amount before extraction, and which is quantified with the same procedures used to quantify other sample components. The purpose of the surrogate is to monitor method performance with each sample.

* * * * *

Method 611—Haloethers

1. Scope and Application

1.1 This method covers the determination of certain haloethers. The following parameters can be determined by this method:

Parameter	STORET No.	CAS No.
Bis(2-chloroethyl) ether	34273	111–44–4
Bis(2-chloroethoxy) methane	34278	111–91–1
2, 2′-oxybis (1-chloropropane)	34283	108–60–1
4-Bromophenyl phenyl ether	34636	101–55–3
4-Chlorophenyl phenyl either	34641	7005–72–3

* * * * *

Method 624.1—Purgeables by GC/MS

1. Scope and Application

1.1 This method is for determination of purgeable organic pollutants in industrial discharges and other environmental samples by gas chromatography combined with mass spectrometry (GC/MS), as provided under 40 CFR 136.1. This revision is based on previous protocols (References 1–3), on the revision promulgated October 26, 1984 (49 FR 43234), and on an interlaboratory method validation study (Reference 4). Although this method was validated through an interlaboratory study conducted more than 29 years ago, the fundamental chemistry principles used in this method remain sound and continue to apply.

1.2 The analytes that may be qualitatively and quantitatively determined using this method and their CAS Registry numbers are listed in Table 1. The method may be extended to determine the analytes listed in Table 2; however, poor purging efficiency or gas chromatography of some of these analytes may make quantitative determination difficult. For example, an elevated temperature may be required to purge some analytes from water. If an elevated temperature is used, calibration and all quality control (QC) tests must be performed at the elevated temperature. EPA encourages the use of this method to determine additional compounds amenable to purge-and-trap GC/MS.

1.3 The large number of analytes in Tables 1 and 2 of this method makes testing difficult if all analytes are determined simultaneously. Therefore, it is necessary to determine and perform QC tests for "analytes of interest" only. Analytes of interest are those required to be determined by a regulatory/control authority or in a permit, or by a client. If a list of analytes is not specified, the analytes in Table 1 must be determined, at a minimum, and QC testing must be performed for these analytes. The analytes in Table 1 and some of the analytes in Table 2 have been identified as Toxic Pollutants (40 CFR 401.15), expanded to a list of Priority Pollutants (40 CFR part 423, appendix A).

1.4 Method detection limits (MDLs; Reference 5) for the analytes in Table 1 are listed in that table. These MDLs were determined in reagent water (Reference 6). Advances in analytical technology, particularly the use of capillary (open-tubular) columns, allowed laboratories to routinely achieve MDLs for the analytes in this method that are 2–10 times lower than those in the version promulgated in 1984 (40 FR 43234). The MDL for a specific wastewater may differ from those listed, depending on the nature of interferences in the sample matrix.

1.4.1 EPA has promulgated this method at 40 CFR part 136 for use in wastewater compliance monitoring under the National Pollutant Discharge Elimination System (NPDES). The data reporting practices described in Section 13.2 are focused on such monitoring needs and may not be relevant to other uses of the method.

1.4.2 This method includes "reporting limits" based on EPA's "minimum level" (ML) concept (see the glossary in Section 20). Table 1 contains MDL values and ML values for many of the analytes. The MDL for an analyte in a specific wastewater may differ from that listed in Table 1, depending upon the nature of interferences in the sample matrix.

1.5 This method is performance-based. It may be modified to improve performance (*e.g.*, to overcome interferences or improve the accuracy of results) provided all performance requirements are met.

1.5.1 Examples of allowed method modifications are described at 40 CFR 136.6. Other examples of allowed modifications specific to this method are described in Section 8.1.2.

1.5.2 Any modification beyond those expressly allowed at 40 CFR 136.6 or in Section 8.1.2 of this method shall be considered a major modification that is subject to application and approval of an alternate test procedure under 40 CFR 136.4 and 136.5.

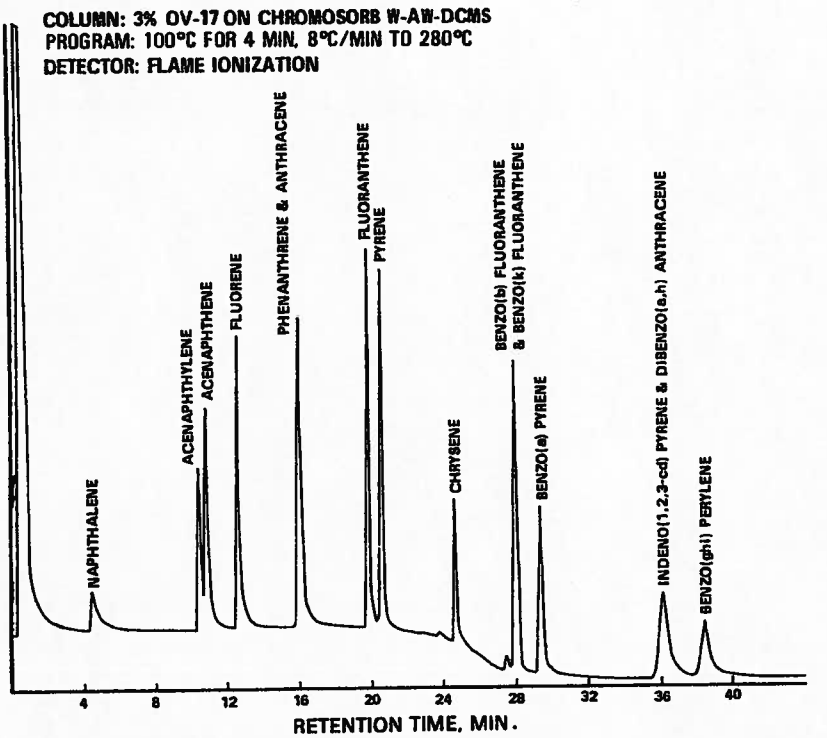


Figure 3. Gas chromatogram of polynuclear aromatic hydrocarbons.

METHOD 611—HALOETHERS

1. Scope and Application

1.1 This method covers the determination of certain haloethers. The following parameters can be determined by this method:

Parameter	STORET No.	CAS No.
Bis(2-chloroethyl) ether	34273	111-44-4
Bis(2-chloroethoxy) methane	34278	111-91-1
Bis(2-chloroisopropyl) ether	34283	108-60-1
4-Bromophenyl phenyl ether	34636	101-55-3
4-Chlorophenyl phenyl either	34641	7005-72-3

1.2 This is a gas chromatographic (GC) method applicable to the determination of the compounds listed above in municipal and industrial discharges as provided under 40 CFR 136.1. When this method is used to analyze unfamiliar samples for any or all of the compounds above, compound identifications should be supported by at least one additional qualitative technique. This method describes analytical conditions for a second gas chromatographic column that can be used to confirm measurements made with the primary column. Method 625 provides gas chromatograph/mass spectrometer (GC/MS) conditions appropriate for the qualitative and quantitative confirmation of results for all of the parameters listed above, using the extract produced by this method.

1.3 The method detection limit (MDL, defined in Section 14.1)[1] for each parameter is listed in Table 1. The MDL for a specific wastewater may differ from those listed, depending upon the nature of interferences in the sample matrix.

1.4 The sample extraction and concentration steps in this method are essentially the same as in Methods 606, 608, 609, and 612. Thus, a single sample may be extracted to measure the parameters included in the scope of each of these methods. When cleanup is required, the concentration levels must be high enough to permit selecting aliquots, as necessary, to apply appropriate cleanup procedures. The analyst is allowed the latitude, under Section 12, to select

Florisil Columns," *Journal of the Association of Official Analytical Chemists, 51,* 29 (1968).

8. Provost, L.P., and Elder, R.S. "Interpretation of Percent Recovery Data," *American Laboratory, 15,* 58–63 (1983). (The value 2.44 used in the equation in Section 8.3.3 is two times the value 1.22 derived in this report.)

9. ASTM Annual Book of Standards, Part 31, D3370–76. "Standard Practices for Sampling Water," American Society for Testing and Materials, Philadelphia.

10. "Methods 330.4 (Titrimetric, DPD–FAS) and 330.5 (Spectrophotometric, DPD) for Chlorine, Total Residual," Methods for Chemical Analysis of Water and Wastes, EPA–600/4–79–020, U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268, March 1979.

11. Burke, J.A. "Gas Chromatography for Pesticide Residue Analysis; Some Practical Aspects," *Journal of the Association of Official Analytical Chemists, 48,* 1037 (1965).

12. "EPA Method Study 21, Method 611, Haloethers," EPA 600/4–84–052, National Technical Information Service, PB84–205939, Springfield, Virginia 22161, June 1984.

TABLE 1—CHROMATOGRAPHIC CONDITIONS AND METHODS DETECTION LIMITS

Parameters	Retention time (min)		Method detection limit (μ/L)
	Column 1	Column 2	
Bis(2-chloroisopropyl) ether	8.4	9.7	0.8
Bis(2-chloroethyl) ether	9.3	9.1	0.3
Bis(2-chloroethoxy) methane	13.1	10.0	0.5
4-Chlorophenyl ether	19.4	15.0	3.9
4-Bromophenyl phenyl ether	21.2	16.2	2.3

AColumn 1 conditions: Supelcoport (100/120 mesh) coated with 3% SP–1000 packed in a 1.8 m long x 2 mm ID glass column with helium carrier gas at 40 mL/min. flow rate. Column temperature held at 60 °C for 2 min. after injection then programmed at 8 °C/min. to 230 °C and held for 4 min. Under these conditions the retention time for Aldrin is 22.6 min.

AColumn 2 conditions: Tenax–GC (60/80 mesh) packed in a 1.8 m long x 2mm ID glass column with helium carrier gas at 40 mL/min. flow rate. Column temperature held at 150 °C for 4 min. after injection then programmed at 16 °C/min. to 310 °C. Under these conditions the retention time for Aldrin is 18.4 min.

TABLE 2—QC ACCEPTANCE CRITERIA—METHOD 611

Parameter	Test conc. (μg/L)	Limit for s (μg/L)	Range for $\bar{X}$ (μg/L)	Range for P, P_s percent
Bis (2-chloroethyl)ether	100	26.3	26.3–136.8	11–152
Bis (2-chloroethoxy)methane	100	25.7	27.3–115.0	12–128
Bis (2-chloroisopropyl)ether	100	32.7	26.4–147.0	9–165
4-Bromophenyl phenyl ether	100	39.3	7.6 –167.5	D–189
4-Chlorophenyl phenyl ether	100	30.7	15.4–152.5	D–170

s=Standard deviation of four recovery measurements, in μg/L (Section 8.2.4).
X=Average recovery for four recovery measurements, in μg/L (Section 8.2.4).
P, P_s=Percent recovery measured (Section 8.3.2, Section 8.4.2).
D=Detected; result must be greater than zero.

NOTE: These criteria are based directly upon the method performance data in Table 3. Where necessary, the limits for recovery have been broadened to assure applicability of the limits to concentrations below those used to develop Table 3.

TABLE 3—METHOD ACCURACY AND PRECISION AS FUNCTIONS OF CONCENTRATION—METHOD 611

Parameter	Accuracy, as recovery, X′ (μg/L)	Single analyst precision, s_r' (μg/L)	Overall precision, S′ (μg/L)
Bis(2-chloroethyl) ether	0.81C+0.54	$0.19\bar{X}+0.28$	$0.35\bar{X}+0.36$
Bis(2-chloroethoxy) methane	0.71C+0.13	$0.20\bar{X}+0.15$	$0.33\bar{X}+0.11$
Bis(2-chloroisopropyl) ether	0.85C+1.67	$0.20\bar{X}+1.05$	$0.36\bar{X}+0.79$
4–Bromophenyl phenyl ether	0.85C+2.55	$0.25\bar{X}+0.21$	$0.47\bar{X}+0.37$
4–Chlorophenyl phenyl ether	0.82C+1.97	$0.18\bar{X}+2.13$	$0.41\bar{X}+0.55$

X′ = Expected recovery for one or more measurements of a sample containing a concentration of C, in μg/L.
s_r' = Expected single analyst standard deviation of measurements at an average concentration found of $\bar{X}$, in μg/L.
S′ = Expected interlaboratory standard deviation of measurements at an average concentration found of $\bar{X}$, in μg/L.
C =True value for the concentration, in μg/L.
$\bar{X}$ = Average recovery found for measurements of samples containing a concentration of C, in μg/L.

Exhibit 2

Supplemental Information on USEPA Method 525.2

McCAMPBELL ANALYTICAL INC.

1534 Willow Pass Road • Pittsburg • CA 94565-1701
Toll Free Telephone: 877-252-9262 • Fax: 925-252-9269
Web: www.mccampbell.com • E-mail: main@mccampbell.com

COMPARISON OF TARGET LISTS AVAILABLE FROM MAI FOR SEMVOLATILES BY GC-MS

SVOC Compound	CAS Number	EPA 525.2	EPA 625 / CTR	EPA 8270C	Appendix IX 8270 or 8250 Compounds
Acenaphthene	83-32-9	●	●	●	●
Acenaphthylene	208-96-8	●	●	●	●
Acetochlor	34256-82-1	●[2]		●[2]	
Acetophenone	98-86-2			●	●
2-Acetylaminofluorene (2-AAF)	53-96-3			●	●
1-Acetyl-2-thiourea	591-08-2			●	
Alachlor	15972-60-8	●			
Aldrin	309-00-2	●	●	●	●
Ametryn	834-12-8	●			
2-Aminoanthraquinone	117-79-3			●	
4-Aminoazobenzene	60-09-3			●	
4-Aminobiphenyl	92-67-1			●	●
3-Amino-9-ethylcarbazole	132-32-1			●	
Anilazine (Triazine)	101-05-3			●	
Aniline	62-53-3			●	●
o-Anisidine	90-04-0			●	
Anthracene	120-12-7	●	●	●	●
Aramite	140-57-8			●	●
Atraton	1610-17-9	●			
Atrazine	1912-24-9	●			
Azinphos methyl	86-50-0			●	
Barban (Barbamate)	101-27-9			●	
Benzidine	92-87-5		●	●	
Benzoic acid	65-85-0			●	
Benzo(a)anthracene	56-55-3	●	●	●	●
Benzo(b)fluoranthene	205-99-2	●	●	●	●
Benzo(k)fluoranthene	207-08-9	●	●	●	●
Benzo(g,h,i)perylene	191-24-2	●	●	●	●
Benzo(a)pyrene	50-32-8	●	●	●	●
p-Benzoquinone	106-51-4			●	
Benzyl alcohol	100-51-6			●	●
α-BHC	319-84-6	●	●	●	●
β-BHC	319-85-7	●	●	●	●
δ-BHC	319-86-8	●	●	●	●
γ-BHC (Lindane)	58-89-9	(●)	●	●	●
1,1'-Biphenyl	92-52-4			●[2]	
Bis(2-Chloroethoxy)methane	111-91-1		●	●	●
Bis(2-Chloroethyl)ether	111-44-4	●	●	●	●
Bis(2-Chloroisopropyl)ether	108-60-1		●	●	●
Bis(2-Ethylhexyl)adipate	103-23-1	●	●[2]	●[2]	
Bis(2-Ethylhexyl)phthalate	117-81-7	●	●	●	●
Bromacil	314-40-9	●			
4-Bromophenyl phenyl ether	101-55-3		●	●	●
Bromoxynil (Brominal)	1689-84-5			●	
Butachlor	23184-66-9	●			
Butylate	2008-41-5	●			
Butyl benzylphthalate	85-68-7	●	●	●	●
Caffeine	58-08-2			●	

McCAMPBELL ANALYTICAL INC.
1534 Willow Pass Road • Pittsburg • CA 94565-1701
Toll Free Telephone: 877-252-9262 • Fax: 925-252-9269
Web: www.mccampbell.com • E-mail: main@mccampbell.com

SVOC Compound	CAS Number	EPA 525.2	EPA 625 / CTR	EPA 8270C	Appendix IX 8270 or 8250 Compounds
Triadimefon	43121-43-3	◌			
1,2,4-Trichlorobenzene	120-82-1	·	●	●	●
2,4,5-Trichlorobiphenyl	15862-07-4	◌			
2,4,5-Trichlorophenol	95-95-4			●	●
2,4,6-Trichlorophenol	88-06-2		●	●	●
Tricyclazole	41814-78-2	◌			
O,O,O-Triethyl phosphorothioate	126-68-1			◌	●
Trifluralin	1582-09-8	◌		◌	
2,4,5-Trimethylaniline	137-17-7			◌	
Trimethyl phosphate	512-56-1			◌	
1,3,5-Trinitrobenzene	99-35-4			◌	●
Tris (2,3-dibromopropyl) phosphate	126-72-7			◌	
Tri-p-tolyl phosphate	78-32-0			◌	
Vernolate	1929-77-7	◌			

● (Black print) = Basic Target Analyte, i.e. its name and result will appear on our routine reports.

(●) (Black print) = Basic Target Analyte only if requested. There may be an additional charge.

$●^{Z}$ = Compound added to formal method target list. For example Thiobencatb is not listed in EPA method 525.2.

$●^{X}$ = Analyte not recommended for analysis by this method when needing to meet required drinking water or effluent detection limits.

* ◌ (Gray print) = Formal method compound that MAI can analyze by special request. There is an extra set-up charge.

METHOD 525.2

DETERMINATION OF ORGANIC COMPOUNDS IN DRINKING WATER BY LIQUID-SOLID EXTRACTION AND CAPILLARY COLUMN GAS CHROMATOGRAPHY/MASS SPECTROMETRY

Revision 2.0

J.W. Eichelberger, T.D. Behymer, W.L. Budde - Method 525,
Revision 1.0, 2.0, 2.1 (1988)

J.W. Eichelberger, T.D. Behymer, and W.L. Budde - Method 525.1
Revision 2.2 (July 1991)

J.W. Eichelberger, J.W. Munch, and J.A. Shoemaker
Method 525.2 Revision 1.0 (February, 1994)

J.W. Munch - Method 525.2, Revision 2.0 (1995)

NATIONAL EXPOSURE RESEARCH LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
CINCINNATI, OHIO 45268

Exhibit 3

Draft Update of Human Health Ambient Water Quality Criteria

Bis (2-Chloroethyl) Ether (111-44-4)

May 2014

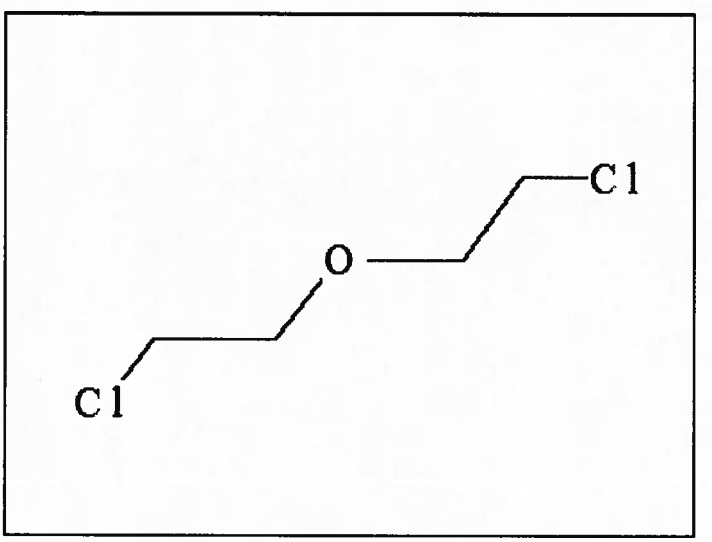
United States Environmental Protection Agency

Office of Water
Office Science and Technology

EPA 820-D-14-018
May 2014

Draft Update of Human Health Ambient Water Quality Criteria:

Bis(2-Chloroethyl) Ether
111-44-4



EPA 820-D-14-018
May 2014

Update of Human Health Ambient Water Quality Criteria:

Bis(2-Chloroethyl) Ether 111-44-4

Draft

Office of Science and Technology
Office of Water
U.S. Environmental Protection Agency
Washington, DC 20460

Table of Contents

Introduction: Plan and Scope of Update

Human health ambient water quality criteria (AWQC) are numeric values for pollutant concentrations in ambient waters that the U.S. Environmental Protection Agency (EPA) considers to be protective of human health. EPA periodically revises water quality criteria to ensure that they reflect the latest scientific knowledge. The current revisions of the criteria for bis(2-chloroethyl) ether, contained in this document, incorporate updated information regarding body weight, drinking water intake, fish consumption rate, and bioaccumulation. Updated body weight and drinking water intake data are identified in EPA's 'Exposure Factors Handbook: 2011 Edition' (USEPA, 2011). The bioaccumulation factor data is updated using EPA's Estimation Program Interface (EPI) Suite modeling program (USEPA, 2012a). The overall fish consumption rate and trophic level breakdowns are updated using EPA's 'Estimated Fish Consumption Rates for the U.S. Population and Selected Subpopulations (NHANES 2003-2010)' (USEPA, 2014). Unless otherwise specified, all sources of information used in this update are from peer reviewed sources.

Note that the term "water quality criteria" can carry one of two possible meanings, depending on the section of the Clean Water Act (CWA) associated with the particular criteria at issue. "Water quality criteria" may refer to national water quality criteria recommendations issued under CWA § 304. "Water quality criteria" may also refer to water quality criteria components of water quality standards adopted by states, territories, or authorized tribes under CWA § 303.

National ambient water quality criteria recommendations for human health are issued by the EPA under CWA §304. They are based on the latest scientific information on the relationship between the effects of a constituent concentration and human health. Protective assumptions are made regarding the potential human exposure intakes. These criteria do not reflect consideration of non-human health endpoints or economic impacts. Nor do they reflect

the technological feasibility of meeting the chemical concentrations in ambient water. National ambient water quality criteria recommendations for human health are not automatically incorporated into water quality standards adopted by states, territories, or authorized tribes. Rather, they provide scientific information to states, territories and authorized tribes to assist them in adopting ambient water quality criteria for human health in water quality standards that meet CWA requirements. National ambient water quality criteria recommendations for human health are not regulations themselves and they do not impose legally binding requirements on EPA, states, territories, authorized tribes, or the public. States, territories, and authorized tribes have the discretion to adopt, where appropriate, other scientifically defensible water quality criteria that differ from EPA's national ambient recommended criteria for human health.

Ambient water quality criteria components of water quality standards are generally adopted by the states, territories, and authorized tribes themselves, under §303(c)(2). (In certain circumstances EPA also may promulgate this type of criterion itself, pursuant to §303(c)(4)). State ambient water quality criteria for human health represent a quality of water that sufficiently protects human health to support a designated use of the state, territory, or authorized tribe. Such criteria may be expressed in terms of constituent concentrations, levels, or narrative statements. Once ambient water quality criteria for human health are adopted by a state, territory, or authorized tribe into their water quality standards, they provide a basis for controlling discharges or releases of pollutants, for developing permit limits, assessing waters, and developing total maximum daily loads (TMDLs) for waters that do not meet the water quality standard. Ambient water quality criteria for human health have a regulatory impact once they have been adopted into water quality standards by the state, territory, or authorized tribe under § 303(c)(2) (or alternatively issued by EPA pursuant to § 303(c)(4)).

The water quality criteria at issue in this document are national ambient water quality criteria recommendations for human health issued under CWA § 304. Unless expressly indicated otherwise, all references to "criteria," "water quality criteria," "ambient water quality criteria (AWQC) recommendations," or similar variants thereof, are references to national ambient water quality criteria recommendations for human health.

Problem Formulation

Problem formulation provides a strategic framework for water quality criteria development by focusing on the most relevant endpoints and increasing the transparency of the effects assessment process. The structure of this criteria document is consistent with U.S. EPA's 'Framework for Human Health Risk Assessment to Inform Decision Making' (USEPA, 2012b).

In the development of AWQC, EPA currently follows the deterministic assessment methodology outlined in EPA's 'Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000)' (USEPA, 2000), hereafter known as the 2000 Methodology. For the development of criteria for carcinogens that express a non-threshold,

linear dose response, the 2000 Methodology takes into consideration exposure factors (body weight, drinking water intake, fish consumption, and bioaccumulation), the increased cancer risk due to exposure to the pollutant, and a 10^{-6} (or 1 in 1,000,000) risk level for the general population. The 10^{-6} risk level utilized in the derivation of the AWQC represents the water concentration that would be expected to increase an individual's lifetime cancer risk from exposure to the particular pollutant by no more than one chance in one million, regardless of the additional lifetime cancer risk due to exposure, if any, to that particular substance from other sources. States and authorized tribes may consider adjusting exposure assumptions and related model inputs according to guidance in the 2000 Methodology, to assure that subpopulations are adequately protected if data are available.

Criteria Formulas- Analysis Plan

The following formulas are used to develop EPA's CWA Section 304(a) human health ambient water quality criteria. EPA develops criteria for ambient waters typically considering two routes of exposure. The first formula can be used to derive a human health criterion that assumes exposure through both the consumption of water and the consumption of aquatic organisms. The second formula can be used to derive a criterion that assumes exposure through the consumption of aquatic organisms, but not water. The use of one criterion over the other depends on the designated use of the water bodies in question (i.e. drinking water source and/or fishable waters).

EPA recommends inclusion of the drinking water exposure pathway for ambient surface waters where drinking water is a designated use for the following reasons: (1) Drinking water is a designated use for surface waters under the CWA, and therefore, criteria are needed to assure that this designated use can be protected and maintained. (2) Although rare, there are some public water supplies that provide drinking water from surface water sources without treatment. (3) Even among the majority of water supplies that do treat surface waters, existing treatments may not necessarily be effective for reducing levels of particular contaminants. (4) In consideration of the Agency's goals of pollution prevention, ambient waters should not be contaminated to a level where the burden of achieving health objectives is shifted away from those responsible for pollutant discharges and placed on downstream users to bear the costs of upgraded or supplemental water treatment (USEPA, 2000).

EPA recommends the organism only criterion in those cases where the designated uses of a water body include only supporting fishable uses under Section 101(a) of the CWA, and thus, fish or shellfish for human consumption, but not as a drinking water supply source (e.g., non-potable estuarine waters) (USEPA, 2000).

The formulas for deriving the criteria values are as follows (USEPA, 2000):

For consumption of water and organisms:

$$AWQC\ (\mu g/L) = \frac{[10^{-6}{}^{*} / CSF\ (kg{\cdot}d/mg)] \times BW\ (kg) \times 1000\ (\mu g/mg)^{\dagger}}{DI\ (L/d) + \sum_{i=2}^{4} (FCR_i\ (kg/d) \times BAF_i\ (L/kg))} \quad \text{(Eq. 1)}$$

For consumption of organisms only:

$$AWQC\ (\mu g/L) = \frac{[10^{-6}{}^{*} / CSF\ (kg{\cdot}d/mg)] \times BW\ (kg) \times 1000\ (\mu g/mg)^{\dagger}}{\sum_{i=2}^{4} (FCR_i\ (kg/d) \times BAF_i\ (L/kg))} \quad \text{(Eq. 2)}$$

Where:
AWQC = ambient water quality criteria (at the 10^{-6} risk level)
CSF = cancer slope factor
BW = body weight
DI = drinking water intake
$\sum_{i=2}^{4}$ = summation of values for aquatic trophic levels (TL) where the letter "i" stands for the trophic levels to be considered, starting with TL 2 and proceeding to TL 4
FCR_i = fish consumption rate for aquatic trophic levels 2, 3, and 4
BAF_i = bioaccumulation factor for aquatic trophic levels 2, 3, and 4

The following sections identify each of the components of the formulas for the human health ambient water quality criteria and provide reference sources, previously used values when available, and the values to be used in the updated criteria.

Exposure Factors:

Body Weight

The updated recommended body weight (BW) is 80 kg which represents the mean weight for adults 21 years of age and older. This recommendation is found in EPA's 'Exposure Factors Handbook: 2011 Edition' in Chapter 8. It was based on data derived from the National Health and Nutrition Examination Survey (NHANES) 1999–2006 (USEPA, 2011). This body weight replaces the recommended standard weight for adults of 70 kg that was described in the 2000 Methodology which was approximated from the mean body weight of adults from the National Health and Nutrition Examination Survey (NHANES) III database (1988-1994) and a 1989 study by the National Cancer Institute (USEPA, 2000).

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* 10^{-6} or 1 in 1,000,000 risk level for the general population
† 1000 µg/mg is used to convert the units of mass into micrograms from milligrams.

Drinking Water Intake

The updated drinking water intake (DI) is 3 L/day, rounded from 3.091 L/day for consumer-only estimates of direct and indirect water ingestion based on NHANES 2003-2006 data for all sources of water at the 90th percentile for adults (≥21 years of age) (USEPA, 2011). Direct water is defined as water ingested directly as a beverage (from all sources); indirect water is defined as water added in the preparation of food or beverages, not including indirect consumption of bottled water. This recommended value is found in EPA's 'Exposure Factors Handbook: 2011 Edition' in Table 3-36. It replaces the drinking water intake standard of 2 L/day described in the 2000 Methodology which represented the 86th percentile for adults 20 years and older in the US Department of Agriculture's 1994-96 Continuing Survey of Food Intake by Individuals (CSFII) analysis or the 88th percentile of adults in the National Cancer Institute study of the 1977-78 Nationwide Food Consumption Survey (USEPA, 2000).

Fish Consumption Rate

The updated fish consumption rate (FCR) for the general adult population is 22 grams/day (0.022 kg/day) (USEPA, 2014: *see Table 9a*). It represents the 90th percentile per capita consumption rate of freshwater and estuarine fish for the U.S. adult population 21 years of age and older based on the Centers for Disease Control and Prevention (CDC) National Health and Nutrition Examination Surveys (NHANES) conducted from 2003-2010. It replaces the FCR default of 17.5 grams/day, which represented an estimate of the 90th percentile per capita consumption rate of freshwater and estuarine fish for the U.S. adult population based on the U.S. Department of Agriculture's (USDA's) Continuing Survey of Food Intake by Individuals (CSFII) 1994-96 data (USEPA, 2002a).

As recommended in the 2000 Methodology, this update to the criteria distinguishes a trophic level (TL) breakdown of the fish consumption rate to provide a better representation of dietary exposure to fish at multiple trophic levels. An organism's trophic position in the aquatic food web can have an important effect on the magnitude of bioaccumulation of certain chemicals. The trophic levels are numbered 2, 3, and 4 and account for different categories of fish and shellfish species based on their position in the aquatic food web. TL2 accounts for benthic filter feeders, TL3 accounts for forage fish, and TL4 accounts for predatory fish.

In order to derive the trophic level breakdown of the 22 grams/day freshwater and estuarine FCR, the trophic level specific freshwater and estuarine FCR data sets for adults 21 years of age and older were identified (USEPA, 2014: *see Tables 16a, 17a, and 18a*). In each trophic level specific data set, the ratio of that trophic level's 90th percentile FCR compared to the summation of all three trophic level specific 90th percentile FCRs was applied to the 22 grams/day FCR used in this update. The trophic level ratios were calculated as follows: TL ratio = 90th percentile FCR for the TL divided by the sum of the 90th percentile FCRs for all TLs. TL2 = 7.6/21.3 = 0.3568 (35.68%), TL3 = 8.6/21.3 = 0.4038 (40.38%), and TL4 = 5.1/21.3 = 0.2394 (23.94%). Applying these ratios to the updated FCR of 22 grams/day result in trophic level breakdowns of TL2 = 8 grams/day (0.008 kg/day); TL3 = 9 grams/day (0.009 kg/day); and TL4 = 5

grams/day (0.005 kg/day). These resulting trophic level FCRs are well within the confidence intervals for each of the trophic level specific distributions' 90th percentiles and add to the total of 22 grams/day (USEPA, 2014).

Bioaccumulation Factor

Several attributes of the bioaccumulation process are important to understand when deriving national BAFs for use in setting national 304(a) criteria. First, the term "bioaccumulation" refers to the uptake and retention of a chemical by an aquatic organism from all surrounding media (e.g., water, food, sediment). The term "bioconcentration" refers to the uptake and retention of a chemical by an aquatic organism from water only. For some chemicals (particularly those that are highly 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. Accordingly, EPA's guidelines presented in the 2000 Methodology emphasize the measurement or estimation of chemical bioaccumulation by aquatic organisms (USEPA, 2000).

The bioaccumulation factors (BAF) have been estimated using EPA's Estimation Program Interface (EPI) Suite (USEPA, 2012a). The BCFBAF™ program within EPI Suite estimates fish bioaccumulation factors using octanol-water partition coefficients (K_{OW}) and biotransformation data from a model designed by Arnot and Gobas (2003). The model includes mechanistic processes for bioaccumulation such as chemical uptake from the water at the gill surface and from the diet, chemical elimination at the gill surface, fecal egestion, growth dilution and metabolic biotransformation. Other processes included in the calculations are bioavailability in the water column (only the freely dissolved fraction can bioconcentrate) and absorption efficiencies at the gill and in the gastrointestinal tract. The model requires the octanol-water partition coefficient (K_{OW}) of the chemical and the normalized whole-body metabolic biotransformation rate constant as input parameters to predict BAF values. Model predictions may be highly uncertain for chemicals that have estimated log K_{OW} values > 9. The model is not recommended at this time for chemicals that appreciably ionize, for pigments and dyes, or for perfluorinated substances (USEPA, 2012a).

For bis(2-chloroethyl) ether, BAFs have been estimated using the EPI Suite model (USEPA, 2012a) as described above for trophic levels 2, 3, and 4. The estimated lower (TL2), mid (TL3), and upper (TL4) trophic level BAFs for bis(2-chloroethyl) ether (log K_{OW} = 1.29) are 2.028 L/kg, 2.156 L/kg, and 2.639 L/kg wet-weight, respectively. These estimated BAFs replace the bioconcentration factor (BCF) of 6.9 L/kg used in the 2002 criteria derivations, which was calculated from a measured steady-state bioconcentration from a study of bluegills and represented all trophic levels (USEPA, 1980).

Hazard Identification and Dose Response: Cancer Slope Factor

Bis(2-chloroethyl) ether is characterized as a class B2 probable human carcinogen following the 1986 EPA Guidelines for Carcinogen Risk Assessment (USEPA, 1986a; USEPA, 1986b; USEPA, 1994).

The cancer slope factor (CSF) is an upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime oral exposure to an agent. The CSF for bis(2-chloroethyl) ether is 1.1 per mg/kg·day (USEPA, 1994).

The principle study by Innes et al. (1969) chosen to calculate the cancer slope factor for bis(2-chloroethyl) ether was based on development of hepatomas in mice orally exposed to bis(2-chloroethyl) ether (USEPA, 1994).

Criteria Derivation- Analysis

Table 1 summarizes model inputs used to derive the 2014 updated human health ambient water quality criteria for bis(2-chloroethyl) ether. Criteria calculations are presented below. These updated bis(2-chloroethyl) ether criteria recommendations are based on the 2000 Methodology and updated exposure assumptions as described above (Exposure Factors).

Table 1. Summary of input parameters for 2014 human health ambient water quality criteria for bis(2-chloroethyl) ether

Component		Value	Source	Input Characterization
CSF		1.1 per mg/kg·day	USEPA, 1994	an upper bound, approximating a 95% confidence limit, on the increased cancer risk from a lifetime exposure to an agent by ingestion
BW		80 kg	USEPA, 2011	mean weight for adults (≥21 years of age)
DI		3 L/day	USEPA, 2011	90th percentile for adults (≥21 years of age)
FCR	TL2	0.008 kg/day	USEPA, 2014	90th percentile consumption rate for the U.S. adult population (≥21 years of age)
	TL3	0.009 kg/day		
	TL4	0.005 kg/day		
BAF	TL2	2.028 L/kg	USEPA, 2012a	EPI Suite K_{OW} model estimated steady-state BAF values for non-ionic organic chemicals in 3 general trophic levels of fish in temperate environments (10°C)
	TL3	2.156 L/kg		
	TL4	2.639 L/kg		

For consumption of water and organisms:

$$AWQC\ (\mu g/L) = \frac{[10^{-6} / CSF\ (kg{\cdot}d/mg)] \times BW\ (kg) \times 1000\ (\mu g/mg)}{DI\ (L/d) + \sum_{i=2}^{4} (FCR_i\ (kg/d) \times BAF_i\ (L/kg))}$$

$$= \frac{10^{-6} / 1.1 \text{ kg·d/mg} \times 80 \text{ kg} \times 1000 \text{ µg/mg}}{3 \text{ L/d} + ((0.008 \text{ kg/d} \times 2.028 \text{ L/kg}) + (0.009 \text{ kg/d} \times 2.156 \text{ L/kg}) + (0.005 \text{ kg/d} \times 2.639 \text{ L/kg}))}$$

= 0.0238 µg/L (rounded to 0.024 µg/L because of significant figures, see 2000 Methodology)

For consumption of organisms only:

$$\text{AWQC (µg/L)} = \frac{[10^{-6} / \text{CSF (kg·d/mg)}] \times \text{BW (kg)} \times 1000 \text{ (µg/mg)}}{\sum_{i=2}^{4} (\text{FCR}_i \text{ (kg/d)} \times \text{BAF}_i \text{ (L/kg)})}$$

$$= \frac{10^{-6} / 1.1 \text{ kg·d/mg} \times 80 \text{ kg} \times 1000 \text{ µg/mg}}{(0.008 \text{ kg/d} \times 2.028 \text{ L/kg}) + (0.009 \text{ kg/d} \times 2.156 \text{ L/kg}) + (0.005 \text{ kg/d} \times 2.639 \text{ L/kg})}$$

= 1.490 µg/L (rounded to 1.5 µg/L because of significant figures, see 2000 Methodology)

The updated magnitude of the human health ambient water quality criteria for bis(2-chloroethyl) ether at the 10^{-6} risk level are **0.024 µg/L** (water and organism) and **1.5 µg/L** (organism only) (Table 2). These updated criteria replace the previously published values (USEPA, 2002b).

Table 2. Summary of EPA's preciously recommended (2002) and updated (2014) human health ambient water quality criteria for bis(2-chloroethyl) ether

	2002 Human Health AWQC	2014 Human Health AWQC
Water and Organism	0.030 µg/L	**0.024 µg/L**
Organism Only	0.53 µg/L	**1.5 µg/L**

These AWQC are meant to be protective of human health for the general adult population from an increased cancer risk due to exposure to bis(2-chloroethyl) ether at a 10^{-6} or 1 in 1,000,000 risk level. The 10^{-6} risk level associated with the AWQC represents the concentration that would be expected to increase an individual's lifetime cancer risk from exposure to the particular pollutant by no more than one chance in one million, regardless of the additional lifetime cancer risk due to exposure, if any, to that particular substance from other sources.

Criteria Characterization

The updated 2014 human health AWQC for bis(2-chloroethyl) ether take into account current data on health effects and exposure input parameters, consistent with the 2000 Methodology. The updated 2014 human health AWQC for bis(2-chloroethyl) ether are within an order of magnitude of EPA's previously recommended 2002 criteria; i.e. the water-and-organism criterion decreased from 0.030 to 0.024 µg/L and the organism-only criterion increased from 0.53 to 1.5 µg/L (Table 2). The following paragraphs describe the individual influence of each of the revised model inputs and exposure assumptions on the overall change in value.

Body Weight

EPA's updated AWQC assume a higher body weight compared to the previously recommended 2002 criteria, reflecting a recent rise in average adult body weight among the U.S. population. The updated body weight assumption of 80 kg based on recent survey data from the 1999–2006 NHANES data is 10 kg greater than the previous recommendation of 70 kg. Assuming all other input parameters remain constant, a higher average body weight in the AWQC calculations (Eq. 1 and 2 above) results in higher AWQC. That is, as body weight increases, the level of a contaminant in water at or below which negative health effects are not anticipated from a lifetime of exposure also increases.

Drinking Water Intake

The updated drinking water intake assumption is 3 L/day, which is higher than the previously recommended rate of 2 L/day. Assuming all other input parameters remain constant, a higher drinking water intake assumption in the AWQC calculations (Eq. 1 and 2 above) results in lower AWQC. That is, as drinking water intake increases, and thus overall exposure increases, the level of a contaminant in water at or below which negative health effects are not anticipated from a lifetime of exposure decreases.

Fish Consumption Rate

The updated fish consumption rate is 22 g/day, divided into trophic level rates of 8 g/day, 9 g/day, and 5 g/day for trophic levels 2, 3, and 4, respectively, which is higher than the previously recommended rate of 17.5 g/day. Assuming all other input parameters remain constant, a higher fish consumption rate assumption in the AWQC calculations (Eq. 1 and 2 above) results in lower AWQC. That is, as fish consumption increase, and thus overall exposure increases, the level of a contaminant in water at or below which negative health effects are not anticipated from a lifetime of exposure decreases.

Bioaccumulation Factor

The updated AWQC rely on EPI Suite model-estimated BAFs rather than the previously recommended BCF of 6.9 L/kg. The lower (TL2), mid (TL3), and upper (TL4) trophic level BAFs assumed in the updated criteria equations (Eq. 1 and 2 above) are 2.028, 2.156, and 2.639 L/kg wet-weight, respectively. Assuming all other input parameters remain constant, the lower ratios of fish tissue concentrations to water concentrations of bis(2-chloroethyl) ether by aquatic organisms result in higher AWQC. That is, as bioaccumulation or bioconcentration of a contaminant in fish and shellfish decreases, and thus overall exposure decreases, the level of a contaminant in water at or below which negative health effects are not anticipated from a lifetime of exposure increases. The utilization of a bioaccumulation factor rather than a bioconcentration factor better represents the amount of a contaminant accumulating in an organism because it accounts not only for the organism's exposure to the pollutant in the water column, but also from the food chain and surrounding environment as well as

biotransformation of the pollutant in the organism due to metabolic processes. The utilization of the three trophic levels of fish and shellfish consumed, as opposed to representing all trophic levels of fish and shellfish consumed by a single value, allows for better exposure representation, especially when pollutants bioaccumulate in significantly different amounts for organisms in different trophic levels at different positions in the food chain.

Additional routes of exposure to a particular pollutant besides exposure from water intake and fish consumption are possible and may be considered when setting criteria for a state or tribe. Possible additional routes include, but are not limited to, dermal exposure, inhalation exposure, marine fish and shellfish consumption (when not included in the fish consumption rate), and non-fish dietary exposures (fruits, vegetables, grains, meats or poultry). If scientific evidence exists which indicate that one or more of these routes pose a significant risk of exposure, states and authorized tribes are encouraged to ensure that subpopulations are adequately protected.

States, territories, and authorized tribes have the flexibility to develop criteria, on a site-specific basis, that provide additional protection appropriate for highly exposed populations. EPA is aware that exposure patterns in general, and fish consumption in particular, vary substantially. EPA understands that highly exposed populations may be widely distributed geographically throughout a given state, territory, or authorized tribal area. EPA recommends that priority be given to identifying and adequately protecting the most highly exposed populations. Thus, if a state, territory, or authorized tribe determines that a highly exposed population is at greater risk and would not be adequately protected by criteria based on the general population, and by the national 304(a) criteria in particular, the state, territory, or authorized tribe may adopt more stringent criteria using alternative exposure assumptions (USEPA, 2000). Subpopulations that may be considered include, but are not limited to, recreational fishers, subsistence fishers, women of childbearing age, and children. When scientific data exist showing one of these subpopulations is at risk of greater exposure to the pollutant or are biologically more sensitive, then the relevant inputs should be considered in setting criteria. This could entail raising the fish consumption rate to a level more reflective of the subpopulation based on collected data or adjusting the body weight and drinking water intake.

Chemical Name / Synonyms

- Bis(2-chloroethyl) ether (CAS Number 111-44-4)
- BCEE
- Beta,beta'-dichloroethyl ether
- Bis(chloroethyl)ether
- Bis(beta-chloroethyl) ether
- Chlorex
- 1-chloro-2-(beta-chloroethoxy)ethane
- Chloroethyl ether

- Clorex
- DCEE
- 2,2'-dichloorethylether
- 2,2'-dichlor-diaethylaether
- 2,2'-dichlorethyl ether
- Beta,beta-dichlorodiethyl ether
- Dichloroether
- Dichloroethyl ether
- Di(2-chloroethyl) ether
- 2,2'-dichloroethyl ether
- Di(beta-chloroethyl)ether
- Sym-dichloroethyl ether
- Dichloroethyl oxide
- 2,2'-dicloroetiletere
- Dwuchlorodwuetylowy eter
- ENT 4,504
- Ethane, 1,1'-oxybis(2-chloro-
- Ether, bis(2-chloroethyl)
- Ether dichlore
- 1,1'-oxybis(2-chloro)ethane
- Oxyde de chlorethyle
- RCRA waste number U025
- UN 1916

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