Appendix A

Expanded Discussion of Specific Statistical Topics Related to Sampling

Appendix A

Expanded Discussion of Statistical Topics Related to Sampling

A.1 Effect of Finite Population and Unequal Weighting on Variance

Given large populations, the variances associated with sample estimates of population parameters depend only on the sample size, not the population size. This situation begins to change when the population is small, numbering a few hundred, which is the case for the HWC risk analysis.

By way of example, the variance of an estimated population mean can be written as

$$\sum_h \frac{N_h^2}{N^2} var\{\bar{y}_h\} \tag{A-1}$$

where the *h*-subscript denotes strata, and

N_h = number of facilities in the *h*-th stratum

N = $\sum_h N_h$

$\bar{y}_h$ = sample estimate of the stratum mean

$var\{\bar{y}_h\}$ = variance of the stratum mean.

Given an equal probability, single stage, without replacement selection of the sample facilities from each stratum,

$$var\{\bar{y}_h\} = \left(\frac{N_h - n_h}{N_h - 1}\right)\left(\frac{\sigma_h^2}{n_h}\right) \tag{A-2}$$

where

n_h = size of the sample selected from the *h*-th stratum.

In this expression σ_h^2 is the population variance of the variable values $y_{h,i}$, $i = 1, 2, \ldots, N_h$ (i.e., the variable values associated with all of the facilities in the *h*-th stratum).

The influence of the sampling rates is now clear. For the certainty stratum (facility stratum 1 in Table A-1) and the lightweight aggregate kiln stratum (stratum 3), $n_h = N_h$ with the result that $var\{\bar{y}_h\} = 0$. On the other hand, if the number of facilities in a stratum were large,

$$\frac{N_h - n_h}{N_h - 1} \rightarrow 1 \qquad \text{(A-3)}$$

and the only influence on the stratum-level variances is the division of the population variance, σ_h^2, by the sample size, n_h.

Table A-1. Frame and Sample Sizes

Facility Stratum	Number Facilities on Frame	Facility Sample Size	Actual Waste Heat Boilers
1. Certainty	10	10	1
2. Cement Kilns	13	10	0
3. Lightweight Aggregate Kilns	3	3	0
4. Commercial Incinerators	16	11	4
5. Large On-Site Incinerators	36	13	2
6. Small On-Site Incinerators	81	21	6
Total	159	68	13
7. Additional Waste Heat Boilers, First Time	19	2	0 (classification error)
8. Additional Waste Heat Boilers, Second Time	16	3	3
9. Additional Large On-Site Incinerators	30	3	0
Total	--	76	16

Inefficient sampling refers to the point that the selection frequencies afforded the supplemental samples (in particular, but not exclusively) have essentially nothing to do with the relative importance of any of the facilities in determining the value of the population parameters. Denote the selection probability associated with the *g*-th facility in the **population** by π_g. Then, in general, an efficient sampling design seeks to ensure that the selection probabilities are proportional to the values y_g. It can be shown that, if the selection probabilities could be made equal to $n\, y_g / T_y$, where T_y is the total of the response variable *y* in the population, then the variance of the estimated population total or corresponding population mean is zero.

Of course such equalities cannot be achieved in practice. If nothing is known about the relative importance of each facility in determining the values of the population parameters of interest, the "best no information" response is to make the π_g all equal. However, for the supplemental samples in particular, the π_g-values were assigned simply to increase the number of sample facilities of specified types, which limits the efficiency of the sample.

The point made here is that these two effects (i.e., the finite population effect and the unequal weighting effect) act on the variances in the opposite direction, tending to be somewhat compensatory.

A.2 SUDAAN's Handling of Clustered Data

The observations obtained in any clustered design or experiment are not independent. In the notation introduced in Section A.1, we denote sample facilities with the subscript $i = 1, 2, ..., n_h$ and sectors associated with the *i*-th facility using the subscript $j = 1, 2, ..., m_{h,i}$. Additionally, we present the variance of an estimated stratum mean as

$$var\{\bar{y}_h\} = \left(\frac{N_h - n_h}{N_h - 1}\right)\left(\frac{\sigma_h^2}{n_h}\right), \qquad \text{(A-4)}$$

noting that this would be the variance if we had an equal probability, one stage, without replacement sample. In reality, we have a clustered sample. That is, the sector-level response variables are "clustered" around the sample facilities. Under this circumstance, the quantity in the second set of parentheses above becomes

$$\frac{\sigma_h^2}{n_h \bar{m}_h}\left[1 + \left(\bar{m}_h - 1\right)\rho_h\right] \qquad \text{(A-5)}$$

where

$\bar{m}_h$ = per facility average number of sectors

ρ_h = correlation between sectors associated with the same facility.

Note: The correlation is, in general, different for different response variables.

SUDAAN accounts for the "clustering effect" on the variance (as well as the finite population effect and the unequal weighting effect). Most commercially available statistical software assumes independent observations and, as a result, does not properly compute the variances. If the correlations are positive (as would be expected), then these packages will underestimate the true variances. The failure to properly account for correlated data is usually encountered if sample data sets are analyzed using SAS or SPSS, for example.

Appendix B

Facility-Specific Input Data

Table of Contents

List of Figures

Number		Page
B-1	Sample runstream files for ISCST3	B-3

List of Tables

Number		Page
B-1	Stack Parameters Used in Air Modeling	B-9
B-2	Building Profile Inputs for Site 200	B-12
B-3	Building Profile Inputs for Site 313	B-12
B-4	Building Profile Inputs for Site 342	B-12
B-5	Building Profile Inputs for Site 705	B-13
B-6	PCRAMMET Inputs for Air Models	B-14
B-7	Scavenging Rate Coefficients for Divalent and Elemental Mercury	B-20
B-8	Dry Deposition Velocity for Divalent Mercury Vapor at all Modeled Sites	B-23
B-9	Waterbody Data for Commercial Incinerators	B-25
B-10	Waterbody Characteristics for Cement Kilns	B-31
B-11	Waterbody Characteristics for Lightweight Aggregate Kilns	B-37
B-12	Waterbody Characteristics for On-Site Incinerators	B-39
B-13	Waterbody Characteristics for On-Site Small Incinerators	B-46
B-14	Meteorological Data for Commercial Incinerators	B-56
B-15	Meteorological Data for Cement Kilns	B-57
B-16	Meteorological Data for Lightweight Aggregate Kilns	B-58
B-17	Meteorological Data for On-Site Incinerators—Small	B-59
B-18	Meteorological Data for On-Site Incinerators—Large	B-61

ISCST3 Input File for Air Concentration of Particles Facility A45

```
CO STARTING
      TITLEONE  ISCST3, AIR CONCENTRATION OF PARTICLES
      TITLETWO  5 YR MET DATA
      MODELOPT  DFAULT  RURAL  CONC WETDPLT  DRYDPLT
      AVERTIME  ANNUAL
      SAVEFILE  A45AP.SAV
      POLLUTID  UNIT
      RUNORNOT  RUN
      ERRORFIL  ERRORS.OUT
CO FINISHED

SO STARTING
      LOCATION  stack1  POINT  0.0   0.0
** Point Source       EMIS STACKHT TEMP  VEL  DIAM
** Parameters:         ----  ----  ----  ----  ---
      SRCPARAM  stack1    1.   30.5   306.3  13.8  0.8
      PARTDIAM  stack1     7.4   1.8   0.7
      MASSFRAX  stack1   0.04   0.12   0.84
      PARTDENS  stack1       1.     1.     1.
      PARTSLIQ  stack1   4.7e-4   8.0e-5  4.0e-5
      PARTSICE  stack1   4.7e-4   8.0e-5  4.0e-5
SO SRCGROUP GROUP1 STACK1
SO FINISHED

RE STARTING
RE gridpolr  1 STA
RE GRIDPOLR  1 ORIG 0.0 0.0
RE GRIDPOLR  1 DIST 100. 150. 200. 300. 400. 500. 700. 1000. 1500. 2000.
RE GRIDPOLR  1 DIST 3000. 4000. 5000. 6000 7000 8000 9000 10000.
RE GRIDPOLR  1 DIST 12000. 14000. 16000 18000 20000.
RE GRIDPOLR  1 GDIR 32 11.25 11.25
RE GRIDPOLR  1 END
RE FINISHED

ME STARTING

ME INPUTFIL  HOU5YR.met
ME ANEMHGHT  10.0  METERS

ME SURFDATA  72243  1986

ME UAIRDATA  12912  1986

ME FINISHED


TG STARTING
TG FINISHED

OU STARTING
       rectable allave first
       MAXTABLE  ALLAVE  10
       plotfile ANNUAL group1 A45AP.PL1
OU FINISHED
```

Figure B-1. Sample runstream files for ISCST3.

(continued)

Figure B-1. (continued)

ISCST3 Input File for Air Concentration of Vapors Facility A45

```
CO STARTING
      TITLEONE  ISCST3, AIR CONCENTRATION OF VAPORS
      TITLETWO  5 YEAR MET DATA
      MODELOPT  DFAULT  RURAL  CONC WETDPLT
      AVERTIME  ANNUAL
      SAVEFILE  A45AV.SAV
      POLLUTID  UNIT
      RUNORNOT  RUN
      ERRORFIL  ERRORS.OUT
CO FINISHED

SO STARTING
      LOCATION  stack1  POINT  0.0   0.0
** Point Source       EMIS STACKHT TEMP  VEL  DIAM
** Parameters:         ----  ----  ----  ----  ---
      SRCPARAM  stack1    1.   30.5   306.3  13.8  0.8
      gas-scav  stack1 liq 1.7E-4
      gas-scav  stack1 ice 1.7E-4
SO SRCGROUP GROUP1 STACK1
SO FINISHED

RE STARTING
RE gridpolr  1 STA
RE GRIDPOLR  1 ORIG 0.0 0.0
RE GRIDPOLR  1 DIST 100. 150. 200. 300. 400. 500. 700. 1000. 1500. 2000.
RE GRIDPOLR  1 DIST 3000. 4000. 5000. 6000 7000 8000 9000 10000.
RE GRIDPOLR  1 DIST 12000. 14000. 16000 18000 20000.
RE GRIDPOLR  1 GDIR 32 11.25 11.25
RE GRIDPOLR  1 END
RE FINISHED

ME STARTING

ME INPUTFIL  HOU5YR.met
ME ANEMHGHT  10.0  METERS

ME SURFDATA  72243  1986

ME UAIRDATA  12912  1986

ME FINISHED


TG STARTING
TG FINISHED

OU STARTING
       rectable allave first
       MAXTABLE  ALLAVE  10
       plotfile ANNUAL group1 A45AV.PL1
OU FINISHED
```

(continued)

Figure B-1. (continued)

ISCST3 Input File for Combined Deposition of Particles Facility A45

```
CO STARTING
      TITLEONE  ISCST3, COMBINED DEPOSITION PARTICLES
      TITLETWO  5 YEAR MET DATA
      MODELOPT  DFAULT  RURAL  DEPOS  WETDPLT DRYDPLT
      AVERTIME  ANNUAL
      SAVEFILE  A45CDP.SAV
      POLLUTID  UNIT
      RUNORNOT  RUN
      ERRORFIL  ERRORS.OUT
CO FINISHED

SO STARTING
      LOCATION  stack1  POINT  0.0   0.0
** Point Source       EMIS STACKHT TEMP  VEL  DIAM
** Parameters:         ----  ----  ----  ----  ---
      SRCPARAM  stack1    1.   30.5   306.3  13.8  0.8
      PARTDIAM  stack1     7.4   1.8   0.7
      MASSFRAX  stack1   0.04   0.12   0.84
      PARTDENS  stack1       1.     1.     1.
      PARTSLIQ  stack1   4.7e-4   8.0e-5  4.0e-5
      PARTSICE  stack1   4.7e-4   8.0e-5  4.0e-5
SO SRCGROUP GROUP1 STACK1
SO FINISHED

RE STARTING
RE gridpolr  1 STA
RE GRIDPOLR  1 ORIG 0.0 0.0
RE GRIDPOLR  1 DIST 100. 150. 200. 300. 400. 500. 700. 1000. 1500. 2000.
RE GRIDPOLR  1 DIST 3000. 4000. 5000. 6000 7000 8000 9000 10000.
RE GRIDPOLR  1 DIST 12000. 14000. 16000 18000 20000.
RE GRIDPOLR  1 GDIR 32 11.25 11.25
RE GRIDPOLR  1 END
RE FINISHED

ME STARTING

ME INPUTFIL  HOU5YR.met
ME ANEMHGHT  10.0  METERS

ME SURFDATA  72243  1986

ME UAIRDATA  12912  1986

ME FINISHED


TG STARTING
TG FINISHED

OU STARTING
      rectable allave first
      MAXTABLE  ALLAVE  10
      plotfile ANNUAL group1 A45CDP.PL1
OU FINISHED
```

(continued)

Figure B-1. (continued)

ISCST3 Input File for Dry Deposition of Particles Facility A45

```
CO STARTING
      TITLEONE  ISCST3, DRY DEPOSITION OF PARTICLES
      TITLETWO  5 YEAR MET DATA
      MODELOPT  DFAULT  RURAL  DDEP  WETDPLT DRYDPLT
      AVERTIME  ANNUAL
      SAVEFILE  A45DDP.SAV
      POLLUTID  UNIT
      RUNORNOT  RUN
      ERRORFIL  ERRORS.OUT
CO FINISHED

SO STARTING
      LOCATION  stack1  POINT  0.0   0.0
** Point Source       EMIS STACKHT TEMP  VEL  DIAM
** Parameters:         ----  ----  ----  ----  ---
      SRCPARAM  stack1    1.   30.5   306.3  13.8  0.8
      PARTDIAM  stack1     7.4   1.8   0.7
      MASSFRAX  stack1   0.04   0.12   0.84
      PARTDENS  stack1       1.     1.     1.
      PARTSLIQ  stack1   4.7e-4   8.0e-5  4.0e-5
      PARTSICE  stack1   4.7e-4   8.0e-5  4.0e-5
SO SRCGROUP GROUP1 STACK1
SO FINISHED

RE STARTING
RE gridpolr  1 STA
RE GRIDPOLR  1 ORIG 0.0 0.0
RE GRIDPOLR  1 DIST 100. 150. 200. 300. 400. 500. 700. 1000. 1500. 2000.
RE GRIDPOLR  1 DIST 3000. 4000. 5000. 6000 7000 8000 9000 10000.
RE GRIDPOLR  1 DIST 12000. 14000. 16000 18000 20000.
RE GRIDPOLR  1 GDIR 32 11.25 11.25
RE GRIDPOLR  1 END
RE FINISHED

ME STARTING

ME INPUTFIL  HOU5YR.met
ME ANEMHGHT  10.0  METERS

ME SURFDATA  72243  1986

ME UAIRDATA  12912  1986

ME FINISHED


TG STARTING
TG FINISHED

OU STARTING
       rectable allave first
       MAXTABLE  ALLAVE  10
       plotfile ANNUAL group1 A45DDP.PL1
OU FINISHED
```

(continued)

Figure B-1. (continued)

ISCST3 Input File for Wet Deposition of Particles Facility A45

```
CO STARTING
      TITLEONE  ISCST3, WET DEPOSITION OF PARTICLES
      TITLETWO  5 YEAR MET DATA
      MODELOPT  DFAULT  RURAL  WDEP  WETDPLT DRYDPLT
      AVERTIME  ANNUAL
      SAVEFILE  A45WDP.SAV
      POLLUTID  UNIT
      RUNORNOT  RUN
      ERRORFIL  ERRORS.OUT
CO FINISHED

SO STARTING
      LOCATION  stack1  POINT  0.0   0.0
** Point Source       EMIS STACKHT TEMP  VEL  DIAM
** Parameters:         ----  ----  ----  ----  ---
      SRCPARAM  stack1    1.   30.5   306.3  13.8  0.8
      PARTDIAM  stack1     7.4   1.8   0.7
      MASSFRAX  stack1   0.04   0.12   0.84
      PARTDENS  stack1       1.     1.     1.
      PARTSLIQ  stack1   4.7e-4   8.0e-5  4.0e-5
      PARTSICE  stack1   4.7e-4   8.0e-5  4.0e-5
SO SRCGROUP GROUP1 STACK1
SO FINISHED

RE STARTING
RE gridpolr  1 STA
RE GRIDPOLR  1 ORIG 0.0 0.0
RE GRIDPOLR  1 DIST 100. 150. 200. 300. 400. 500. 700. 1000. 1500. 2000.
RE GRIDPOLR  1 DIST 3000. 4000. 5000. 6000 7000 8000 9000 10000.
RE GRIDPOLR  1 DIST 12000. 14000. 16000 18000 20000.
RE GRIDPOLR  1 GDIR 32 11.25 11.25
RE GRIDPOLR  1 END
RE FINISHED

ME STARTING

ME INPUTFIL  HOU5YR.met
ME ANEMHGHT  10.0  METERS

ME SURFDATA  72243  1986

ME UAIRDATA  12912  1986

ME FINISHED


TG STARTING
TG FINISHED

OU STARTING
       rectable allave first
       MAXTABLE  ALLAVE  10
       plotfile ANNUAL group1 A45WDP.PL1
OU FINISHED
```

(continued)

Figure B-1. (continued)

ISCST3 Input File for Wet Deposition of Vapors Facility A45

```
CO STARTING
      TITLEONE  ISCST3, WET DEPOSITION OF VAPORS
      TITLETWO  5 YEAR MET DATA
      MODELOPT  DFAULT  RURAL WDEP WETDPLT
      AVERTIME  ANNUAL
      SAVEFILE  A45WDV.SAV
      POLLUTID  UNIT
      RUNORNOT  RUN
      ERRORFIL  ERRORS.OUT
CO FINISHED

SO STARTING
      LOCATION  stack1  POINT  0.0   0.0
** Point Source       EMIS STACKHT TEMP  VEL  DIAM
** Parameters:         ----  ----  ----  ----  ---
      SRCPARAM  stack1    1.   30.5   306.3  13.8  0.8
      gas-scav  stack1 liq 1.7e-4
      gas-scav  stack1 ice 1.7e-4
SO SRCGROUP GROUP1 STACK1
SO FINISHED

RE STARTING
RE gridpolr  1 STA
RE GRIDPOLR  1 ORIG 0.0 0.0
RE GRIDPOLR  1 DIST 100. 150. 200. 300. 400. 500. 700. 1000. 1500. 2000.
RE GRIDPOLR  1 DIST 3000. 4000. 5000. 6000 7000 8000 9000 10000.
RE GRIDPOLR  1 DIST 12000. 14000. 16000 18000 20000.
RE GRIDPOLR  1 GDIR 32 11.25 11.25
RE GRIDPOLR  1 END
RE FINISHED

ME STARTING

ME INPUTFIL  HOU5YR.met
ME ANEMHGHT  10.0  METERS

ME SURFDATA  72243  1986

ME UAIRDATA  12912  1986

ME FINISHED


TG STARTING
TG FINISHED

OU STARTING
       rectable allave first
       MAXTABLE  ALLAVE  10
       plotfile ANNUAL group1 A45WDV.PL1
OU FINISHED
```

(continued)

Table B-1. Stack Parameters Used in Air Modeling

Stack Parameters							
Site ID	**Stack ID**	**Type**	**Volumetric Flow Rate (ACFM)**	**Temperature (K)**	**Exit Velocity (m/s)**	**Stack Diameter (m)**	**Stack Height (m)**
214	214	CINC	34,220	317.1	6.1	1.8	30.5
221	221	CINC	90,160	315.2	16.7	1.8	30.5
209	209	CINC	23,914	339.7	17.4	0.9	19.8
CAL	210	CINC	76,722	345.4	7.7	2.4	30.5
CAL	211	CINC	43,844	341.7	11.3	1.5	30.5
CAL	212	CINC	43,371	343.2	11.3	1.5	30.5
325	325	CINC	24,492	308.5	12.2	1.1	33.5
324	324	CINC	12,083	498.3	9	0.9	12.6
331	331	CINC	44,516	322.9	8	1.8	41.2
SAU	333	CINC	42,372	455.7	17.7	1.2	30.5
SAU	612	CINC	16,949	449.1	7.1	1.2	30.5
359	359	CINC	15,975	331.7	16.6	0.8	15.2
A15	A15	CINC	1,300	320.8	12.5	0.3	9.9
A18	A18	CINC	59,643	331.1	12.4	1.7	39.6
ELD	486	CINC	27,406	348.4	7.3	1.5	59.4
ELD	487	CINC	54,811	348.4	14.6	1.5	59.4
202	202	CK	293,485	406.2	14.3	3.5	71.3
204	204	CK	837,288	536.5	11.5	6.6	76.2
302	302	CK	51,958	452.7	2.5	3.5	76.2
304	304	CK	356,634	548.9	17.5	3.5	67.5
320	320	CK	417,755	451.2	4.7	7.3	89
321	321	CK	409,529	401.2	21.9	3.4	42.7
HAR	200	CK	155,101	492.2	10	3	53.3
HAR	201	CK	186,000	491.7	12	3	53.3
HAR	680	CK	150.377	450	15.6	2.4	45.7
HAR	681	CK	133,214	475.5	13.8	2.4	45.7
203	203	CK	273,493	470.1	14.6	3.4	61
HOL	205	CK	209,879	481.7	11.2	3.4	45.7
HOL	206	CK	426,641	484.7	15.4	4.1	48.8
BAT	207	CK	86,276	429.1	11.4	2.1	59.4
BAT	208	CK	285,101	424.4	12.8	3.7	59.4
WAM	305	CK	244,220	480.6	11	3.7	91.4
WAM	335	CK	116,814	464.8	6.2	3.4	39.6
TEX	318	CK	153,080	458.7	15.5	2.4	61
TEX	473	CK	159,575	459.2	16.1	2.4	61
FRE	322	CK	89,345	438	6.8	2.8	53.3

(continued)

Table B-1. (continued)

Stack Parameters							
Site ID	Stack ID	Type	Volumetric Flow Rate (ACFM)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)	Stack Height (m)
FRE	323	CK	133,349	474.9	5.9	3.7	76.2
CHA	401	CK	181,256	403	8.1	3.7	90.8
CHA	402	CK	221,800	414.5	10	3.7	90.8
FOR	403	CK	242,783	484.6	21.7	2.6	45.7
FOR	404	CK	270,379	526.9	13.2	3.5	45.7
FOR	228	CK	191,004	495.6	17.1	2.6	45.7
NOR	225	LWAK	38,214	423	13.2	1.3	27.4
COH	307	LWAK	49,271	331.9	19.9	1.2	36.6
COH	479	LWAK	41,301	332.4	11	1.5	22.9
BRO	310	LWAK	47,534	429.8	10.8	1.6	15.2
BRO	475	LWAK	62,993	453.6	14.3	1.6	15.2
CAS	311	LWAK	51,613	447.6	18.4	1.3	24.4
CAS	312	LWAK	46,637	450.8	16.6	1.3	24.4
CAS	336	LWAK	51,285	458.6	18.2	1.3	24.4
ARV	313	LWAK	35,950	445.3	12.8	1.3	24.4
ARV	314	LWAK	38,163	442.9	13.6	1.3	24.4
334	334	OINC-L	40,667	297.5	10.9	1.5	61
464	464	OINC-L	71,188	1118.5	5.5	2.8	30.5
504	504	OINC-L	32,733	350.1	6.1	1.8	27.4
806	806	OINC-L	30,572	341.3	8.2	1.5	18.9
915	915	OINC-L	97,802	345.4	25.3	1.5	60.3
MID	353	OINC-L	36,331	309.3	1.6	3.7	61
MID	354	OINC-L	35,243	333	25.3	0.9	61
HAN	477	OINC-L	41,776	356.5	16.9	1.2	31.4
HAN	478	OINC-L	37,561	359.1	20.5	1.1	33.5
HAN	805	OINC-L	24,524	360.4	13	1.1	22.9
MCI	705	OINC-L	36,489	345.6	11.7	1.4	38.1
MCI	490	OINC-L	27,406	348.6	20.3	0.9	38.1
711	711	OINC-L	59,659	353.6	24.9	1.2	45.4
KIN	809	OINC-L	39,468	351.3	2.5	3.1	61
KIN	810	OINC-L	28,223	370.8	14.8	1.1	15.2
A43	A43	OINC-L	55,858	1139.5	10.6	1.78	4.57
A50	A50	OINC-L	20,716	353	8.6	1.2	15.2
A62	A62	OINC-L	200,000	1033	30	2	32
B20	B20	OINC-L	64,620	310.8	35.9	1	22.9
453	453	OINC-S	4,680	544.9	9.9	0.5	9.1
468	468	OINC-S	5,273	357.8	4.8	0.8	22.6

(continued)

Table B-1. (continued)

Stack Parameters							
Site ID	**Stack ID**	**Type**	**Volumetric Flow Rate (ACFM)**	**Temperature (K)**	**Exit Velocity (m/s)**	**Stack Diameter (m)**	**Stack Height (m)**
708	708	OINC-S	5,411	346.3	12.6	0.5	4.6
824	824	OINC-S	1,088	292.8	15.8	0.2	14.6
342	342	OINC-S	5,713	319.1	11	0.6	17.1
701	701	OINC-S	10,926	298.2	8.1	0.9	30.5
704	704	OINC-S	5,697	564.2	18.4	0.4	11.3
725	725	OINC-S	1,830	346.7	11.8	0.3	41.8
906	906	OINC-S	2,804	298.2	2.1	0.9	23.2
A14	A14	OINC-S	70	338.6	0.1	0.6	12.2
A26	A26	OINC-S	18,307	338.6	13.3	0.9	9.1
A31	A31	OINC-S	10,619	533	3.8	1.3	19.8
A45	A45	OINC-S	14,700	306.3	13.8	0.8	30.5
A46	A46	OINC-S	13,000	310.8	13.5	0.76	30.5
A47	A47	OINC-S	917	356	23.7	0.15	5.49
A55	A55	OINC-S	2,521	353.6	7.2	0.46	7.62
B18	B18	OINC-S	15,150	305.2	11.2	0.9	36.6
B23	B23	OINC-S	3,188	338.6	5.3	0.6	30.5
B31	B31	OINC-S	15,831	1195.2	8.3	1.1	27.4
B32	B32	OINC-S	10,250	327.4	17.1	0.6	65
B37	B37	OINC-S	1,830	346.7	0.8	1.2	30.5
B44	B44	OINC-S	18,676	349.7	6	1.4	27.4
TOO	493	OINC-S	11,313	407.4	29.5	0.5	9.1
TOO	494	OINC-S	11,659	382.8	30.4	0.5	9.1
601	601	CINC	103,658	348.5	18.6	1.83	60.96
600	600	OINC-L	35,464	337.4	9.2	1.52	36.57
340	340	OINC-S	16,198	344.3	11.6	0.91	9.14
904	904	OINC-S	10,619	549	18.7	0.58	55.17
STG	706	OINC-L	34,762	361.3	18.4	1.07	42.67
STG	480	OINC-L	46,743	358.5	18.9	1.22	42.67
463	463	OINC-L	24,241	355.6	17.4	0.91	9.1
483	483	OINC-L	55,858	1592	10.6	1.78	4.57

Table B-2. Building Profile Inputs for Site 200

Site 200, 2 Buildings, 2 Stacks (All Dimensions in Meters)							
Building Number	Tier Height	Corner 1 Coord.	Corner 2 Coord.	Corner 3 Coord.	Corner 4 Coord.	Stack Ht.	Stack Coord.
1	32.6	(51,-119)	(92,-119)	(92,-132)	(51,-132)	49.7 53.3	(0,0) (248,-237)
2	27.4	(52,-180)	(129,-180)	(129,-213)	(52,-213)	49.7 53.3	(0,0) (248,-237)

Table B-3. Building Profile Inputs for Site 313

Site 313, 3 Buildings, 3 Stacks (All Dimensions in Meters)							
Building Number	Tier Height	Corner 1 Coord.	Corner 2 Coord.	Corner 3 Coord.	Corner 4 Coord.	Stack Ht.	Stack Coord.
1	15.2	(-8,-3)	(-17,-3)	(-17,-12)	(-8,-12)	24.4 24.4 24.4	(0,0) (-8,24) (-21,-40)
2	15.2	(-18,15)	(-28,15)	(-28,24)	(-18,24)	24.4 24.4 24.4	(0,0) (-8,24) (-21,-40)
3	15.2	(-31,31)	(-40,31)	(-40,39)	(-31,39)	24.4 24.4 24.4	(0,0) (-8,24) (-21,-40)

Table B-4. Building Profile Inputs for Site 342

Site 342, 3 Buildings, 1 Stack (All Dimensions in Meters)							
Building Number	Tier Height	Corner 1 Coord.	Corner 2 Coord.	Corner 3 Coord.	Corner 4 Coord.	Stack Height	Stack Coord.
1	8.5	(6,24)	(6,33)	(21,33)	(21,24)	17.07	(4,23)
2	5.5	(0,0)	(0,31)	(37,31)	(37,0)	17.07	(4,23)
3	10.2	(27,36)	(27,82)	(51,82)	(51,36)	17.07	(4,23)

Table B-5. Building Profile Inputs for Site 705

Site 705, 2 Buildings, 1 Stack (All Dimensions in Meters)							
Building Number	Tier Height	Corner 1 Coord.	Corner 2 Coord.	Corner 3 Coord.	Corner 4 Coord.	Stack Height	Stack Coord.
1	11.9	(-4,-6)	(-4,-68)	(4,-68)	(4,-6)	38.1	(0,0)
1	21.9	(-4,-16)	(-4,-23)	(4,-23)	(4,-16)	38.1	(0,0)
1	34.1	(-4,-32)	(-4,-48)	(4,-48)	(4,-32)	38.1	(0,0)
2	10.9	(38,-7)	(38,-26)	(53,-27)	(53,-7)	38.1	(0,0)
2	7.6	(38,-26)	(38,-38)	(53,-38)	(53,-26)	38.1	(0,0)
2	6.1	(27,-21)	(27,-38)	(37,-38)	(37,-21)	38.1	(0,0)
2	8.3	(36,-11)	(36,-26)	(38,-26)	(38,-11)	38.1	(0,0)

Table B-6. PCRAMMET Inputs for Air Models

Site	Location	Type	Land Use Data Used In Modeling	Land Use Data at Site (according to GIS Info.)	Upper Air Station	Surface Met Station	Landuse at Met Station Used in Modeling	Actual Landuse at Met Station (according to GIS Info.)	Roughness Height at Met. Station (m)	Roughness Height at Site (m)	Min. Monin Obukhov Length	Noontime Albedo	Bowen Ratio	Anthropogenic Heat Flux	Fraction of Net Radiation	Anemometer Height (ft)
209 Laidlaw Envir.	Roebuck, SC	CINC	20% Urban 25% Agricultural 55% Mixed For.	20% Urban 25% Agricultural 55% Mixed For.	Greensboro	Greenville	25% Urban 50% Agricultural 25% Mixed For.	25% Urban 50% Agricultural 25% Mixed For.	0.6	0.8	2	0.2	1	0	0.15	20
210, 211, 212 LWD, Inc.	Calvert City, KY	CINC	85% Agricultural 10% Deciduous For. 5% Water	15% Urban 60% Agricultural 20% Deciduous For. 5% Water	Peoria	Evansville	5% Urban 90% Agricultural 5% Deciduous For.	40% Urban 35% Agricultural 5% Deciduous For. 20% Conif. For.	0.16	0.15	2	0.3	0.8	0	0.15	20
214 Rollins Environmental	Baton Rouge, LA	CINC	60% Urban 10% Agricultural 5% Forested 25% Swamp	25% Urban 25% Agricultural 35% % Deciduous For. 10% Water 5% Swamp	Lake Charles	Baton Rouge	20% Agricultural 65% Mixed For. 15% Water	60% Urban 15% Agricultural 20% Deciduous For. 5% Barren	0.5 (Based on 1/20 th anemometer height)	0.5 (Based on 1/20 th anemometer height)	50	0.16	0.9	0	0.22	32.8
221 Rollins Environmental	Deer Park, TX	CINC	70% Urban 30% Water	30% Urban 35% Agricultural 5% Deciduous For. 5% Mixed For. 15% Water 5% Swamp 5% Barren	Lake Charles	Houston	45% Urban 40% Agricultural 5% Conif. For. 10% Mixed For.	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	0.5 (Based on 1/20 th anemometer height)	0.5 (Based on 1/20 th anemometer height)	50	0.21	0.5	0	0.27	32.8
324 Allied Corp.	Birmingham, AL	CINC	35% Urban 60% Mixed For. 5% Agricultural	70% Urban 5% Agricultural 25% Mixed For.	Jackson	Birmingham	10% Urban 80% Mixed For. 5% Agricultural 5% Conifuerous	70% Urban 30% Mixed For.	1.05	1.01	2	0.2	0.4	0	0.15	20
325 Aptus	Coffeyville, KS	CINC	95% Agricultural 5% Deciduous For.	5% Urban 90% agricultural 5% Deciduous For.	Topeka	Wichita	10% Urban 80% Agricultural 5% Range 5%Deciduous For.	30% Urban 65% Agricultural 5% Water	0.2	0.11	2	0.3	0.8	0	0.15	20
331 Ross Incineration	Grafton, OH	CINC	5% Urban 95% Agricultural	10% Urban 85% Agricultural 5% Deciduous For.	Flint	Cleveland	75% Urban 10% Agricultural 5% Deciduous For. 10% Water	90% Urban 10% Agricultural	0.8	0.12	25	0.21	1.36	0	0.27	20
333/612 Trade Waste Incin.	Sauget, IL	CINC	75% Urban 15% Agricultural 10% Water	75% Urban 15% Agricultural 10% Water	Monett	St. Louis	90% Urban 5% Agricultural 5% Deciduous For.	90% Urban 5% Agricultural 5% Deciduous For.	0.9	0.8	25	0.2	1.5	0	0.22	20
359 Atochem	Carrolton, KY	CINC	30% Agricultural 70% Deciduous For.	15% Urban 40% Agricultural 35% Conif. For. 10% Water	Dayton	Louisville	60% Urban 30% Agricultural 10% Deciduous For.	90% Urban 5% Agricultural 5% Conif. For.	0.71	0.65	25	0.2	1.3	0	0.22	20
601 Laidlaw Envir. Svc. Inc.	Clive, UT	CINC	15% Range 85% Barren	15% Range 85% Barren	Salt Lake City	Salt Lake City	55% Urban 10% Agricultural 20% Range 5% Swamp 10% Barren	55% Urban 10% Agricultural 20% Range 5% Swamp 10% Barren	0.6	0.2	25	0.2	1.6	0	0.22	20
A15 BDT Inc.	Clarence, NY	CINC	20% Urban 40% Agricultural 30% Deciduous For. 10% Barren	20% Urban 40% Agricultural 30% Deciduous For. 10% Barren	Buffalo	Buffalo	80% Urban 10% Agricultural 10% Deciduous For.	80% Urban 10% Agricultural 10% Deciduous For.	0.62	0.29	25	0.2	1.2	0	0.22	20
A18 Chemical Waste Man.	Port Arthur, TX	CINC	35% Agricultural 65% Swamp	35% Agricultural 65% Swamp	Lake Charles	Port Arthur	35% Urban 50% Agricultural 5%Swamp 10% Barren	35% Urban 50% Agricultural 5%Swamp 10% Barren	0.37	0.32	2	0.26	0.34	0	0.15	20
A29 (486/487) Ensco	El Dorado, AR	CINC	20% Urban 5% Agricultural 75% Mixed Forest	20% Urban 5% Agricultural 75% Mixed Forest	Monett	Shreveport	55% Urban 5% Deciduous For. 5% Conif. For. 15% Mixed For. 10% Water 10% Barren	55% Urban 5% Deciduous For. 5% Conif. For. 15% Mixed For. 10% Water 10% Barren	0.9	1	25	0.2	0.8	0	0.22	20

(continued)

Table B-6. (continued)

Site	Location	Type	Land Use Data Used In Modeling	Land Use Data at Site (according to GIS Info.)	Upper Air Station	Surface Met Station	Landuse at Met Station Used in Modeling	Actual Landuse at Met Station (according to GIS Info.)	Roughness Height at Met. Station (m)	Roughness Height at Site (m)	Min. Monin Obukhov Length	Noontime Albedo	Bowen Ratio	Anthropogenic Heat Flux	Fraction of Net Radiation	Anemometer Height (ft)
200, 201, 680, 681 Giant Cement	Harleysville, SC	CK	15% Agricultural 20% Conif. For. 65% Mixed For.	5% Urban 20% Agricultural 20% Conif. For. 50% Mixed For. 5% Barren	Charleston	Charleston	5% Urban 55% Mixed For. 25% Agricultural 15% Conif. For.	55% Urban 25% Conif. For. 5% Mixed For. 5% Water 5%Swamp 5% Barren	0.87	0.99	2	0.2	0.3	0	0.15	20
202 Heartland Cement	Independence, KS	CK	95% Agricultural 5% Deciduous For.	10% Urban 80% Agricultural 10% Deciduous For.	Dodge City	Wichita	10% Urban 80% Agricultural 5% Range 5%Deciduous For.	30% Urban 65% Agricultural 5% Water	0.2	0.11	2	0.27	0.85	0	0.15	20
203 Holnam, Inc.	Artesia, MS	CK	80% Agricultural 5% Deciduous For. 15% Mixed For.	80% Agricultural 5% Deciduous For. 15% Mixed For.	Jackson	Meridian	10% Agricultural 10% Conif. For. 80% Mixed For.	20% Urban 15% Agricultural 60% Mixed For. 5% Barren	1.02	0.27	2	0.2	0.3	0	0.15	20
204 Holnam, Inc.	Clarksville, MO	CK	75% Agricultural 20% Decid. For. 5% Water	5% Urban 45% Agricultural 30% Deciduous For. 15% Water 5% Barren	Peoria	Springfield, IL	90% Agriultural 10% Urban	20% Urban 65% Agricultural 15% Decid. For.	0.08	0.2	2	0.3	0.8	0	0.15	20
205, 206 Holnam	Holly Hill, SC	CK	50% Agricultural 50% Forested	5% Urban 20% Agricultural 5% Deciduous For. 15% Conif. For. 55% Mixed For.	Charleston	Charleston	5% Urban 55% Mixed For. 25% Agricultural 15% Conif. For.	55% Urban 25% Conif. For. 5% Mixed For. 5% Water 5%Swamp 5% Barren	0.3 (Based on 1/20th Anemometer Height)		50	0.12	0.9	0	0.15	20
207, 208 Keystone Cement	Bath, PA	CK	50% Agricultural 50% Forested	5% Urban 95% Agricultural	Albany	Allentown	20% Urban 55% Agricultural 20% Deciduous For. 5% Water	55% Urban 40% Agricultural 5% Barren	0.31 (Based on 1/20th Anemometer Height)	0.31 (Based on 1/20th Anemometer Height)	2	0.28	0.5	0	0.15	20
302 Lafarge	Paulding, OH	CK	95% Agricultural 5% Deciduous For.	5% Urban 90 Agricultural 5% Deciduous For.	Wright-Patterson	Fort Wayne	100% Agricultural	20% Urban 70% Agricultural 5% Deciduous For. 5% Barren	0.07	0.11	2	0.28	0.75	0	0.15	20
304 Lone Star	Greencastle, IN	CK	15% Urban 85% Agricultural	10% Urban 70% Agricultural 20% Deciduous For.	Wright-Patterson	Indianapolis	5% Urban 90% Agricultural 5% Deciduous For.	60% Urban 40% Agricultural	0.2	0.2	2	0.2	0.5	0	0.15	20
305, 335 Medusa Cement	Wampum, PA	CK	25% Urban 20% Agricultural 50% Deciduous For. 5% Barren	25% Urban 20% Agricultural 50% Deciduous For. 5% Barren	Pittsburgh	Pittsburgh	40% Urban 15% Agricultural 25%Decid. For. 5% Conif. For. 10% Mixed For. 5% Water	40% Urban 15% Agricultural 25%Decid. For. 5% Conif. For. 10% Mixed For. 5% Water	0.8	0.7	2	0.2	1.1	0	0.15	20
318, 473 Texas Indust.	Midlothian, TX	CK	60% Agricultural 40% Deciduous For.	5% Urban 90% Agricultural 5% Rangeland	Oklahoma City	Fort Worth	25% Agricultural 75% Deciduous For.	30% Urban 55% Agricultural 10% Range 5% Deciduous For.	0.69	0.4	2	0.2	0.8	0	0.15	20
320 Lafarge	Alpena, MI	CK	25% Agricultural 50% Forested 25% Water	20% Urban 5% Agricultural 30% Mixed For. 40% Water 5% Barren	Saulte St. Marie	Alpena	25% Agricultural 50% Forested 25% Water		0.34 (Based on 1/20 th Anemometer Height)	0.34 (Based on 1/20 th Anemometer Height)	50	0.18	0.9	0	0.15	22
321 Medusa Cement	Demopolis, AL	CK	5% Urban 35%Agricultural 50% Decid For. 10% Water	10% Urban 30% Agricultural 10% Deciduous For. 40% Mixed For. 10% Water	Jackson	Montgomery	80% Agriculture 20% Mixed For.	10% Urban 75% Agricultural 5% Deciduous For. 10% Mixed For.	0.3	0.5	2	0.4	0.4	0	0.15	20

(continued)

Table B-6. (continued)

Site	Location	Type	Land Use Data Used In Modeling	Land Use Data at Site (according to GIS Info.)	Upper Air Station	Surface Met Station	Landuse at Met Station Used in Modeling	Actual Landuse at Met Station (according to GIS Info.)	Roughness Height at Met. Station (m)	Roughness Height at Site (m)	Min. Monin Obukhov Length	Noontime Albedo	Bowen Ratio	Anthropogenic Heat Flux	Fraction of Net Radiation	Anemometer Height (ft)
322, 323 Lafarge	Fredonia, KS	CK	95% Agricultural 5% Deciduous For.	5% Urban 85% Agricultural 5% Rangeland 5% Deciduous For.	Topeka	Wichita	10% Urban 80% Agricultural 5% Range 5%Deciduous For.	30% Urban 65% Agricultural 5% Water	0.2	0.11	2	0.3	0.9	0	0.15	20
401, 402 Ash Grove Cement	Chanute, KS	CK	15% Urban 80% Agricultural 5% Deciduous For.	15% Urban 80% Agricultural 5% Deciduous For.	Monett	Springfield, MO	100% Agricultural	20% Urban 75% Agricultural 5% Deciduous For.	0.25	0.25	2	0.2	0.5	0	0.15	20
403, 404, 228 Ash Grove Cement	Foreman, AR	CK	10% Agricultural 5% Decid Forest 5% Conif Forest 80% Mixed Forest	5% Urban 65% Agricultural 20% Deciduous For. 10% Mixed For.	Monett	Shreveport	5% Urban 15% Agricultural 20% Deciduous For. 15% Conif. For. 45% Mixed For.	55% Urban 5% Deciduous For. 5% Conif. For. 15% Mixed For. 10% Water 10% Barren	0.93	1	2	0.2	0.34	0	0.15	20
225 Solite	Norwood, NC	LWAK	25% Urban 10% Agricultural 20% Deciduous For. 10% Conif. For. 30% Mixed For. 5% Water	60% Agricultural 5% Deciduous For. 5% Conif. For. 30% Mixed For.	Greensboro	Greenville	5% Agricultual 80% Deciduous For. 15% Conif. For.	25% Urban 50% Agricultural 25% Mixed For.	0.92	0.9	2	0.22	0.86	0	0.15	20
307, 479 Thermalkem	Cohoes, NY	LWAK	50% Urban 50% Agricultural	65% Urban 15% Agricultural 10% Deciduous For. 5% Conif. For. 5% Water	Albany	Albany	40% Urban 20% Agricultural 30% Decid For. 10% Water	60% Urban 15% Agricultural 20% Deciduous For. 5% Water	0.5 (Based on 1/20th Anemometer Height)	0.5 (Based on 1/20th Anemometer Height)	2	0.28	0.5	0	0.15	32.8
310, 475 Solite	Brooks, KY	LWAK	15% Urban 70% Agricultural 15% Deciduous For.	20% Urban 35% Agricultural 30% Deciduous For. 5% Conif. For. 5% Mixed For. 5% Barren	Flint	Louisville	60% Urban 30% Agricultural 10% Deciduous For.	90% Urban 5% Agricultural 5% Conif. For.	0.71	0.33	2	0.23	1.27	0	0.22	20
311, 312, 336 Solite	Cascade, VA	LWAK	50% Forest 50% Agricultural	10% Urban 35% Agricultural 5% Deciduous For. 5% Conif. For. 45% Mixed For.	Greensboro	Greensboro, NC	50% Forest 50% Agricultural		0.5 (Based on 1/20th Anemometer Height)	0.5 (Based on 1/20th Anemometer Height)	2	0.28	0.5	0	0.15	32.8
313, 314 Solite	Arvonia, VA	LWAK	10% Agricultural 15% Mixed For. 70% Deciduous For. 5% Conif. For.	5% Urban 20% Agricultural 45% Deciduous For. 15% Conif. For. 5% Mixed For. 5% Water 5% Barren	Greensboro	Richmond	10% Urban 10% Agricultural 5% Conif. For. 70% Mixed For. 5% Water	40% Urban 15% Agricultural 10% Conif. For. 25% Mixed For. 10% Barren	0.94	0.87	2	0.21	0.89	0	0.15	20
334 3M	Cottage Grove, MN	OINC-L	15% Forested 85% Ag/Range Land	5% Urban 70% Agricultural 5% Deciduous For. 20% Water	St. Cloud	Rochester, MN	15% Forested 85% Ag/Range Land		0.2	0.2	2	0.28	0.5	0	0.15	29.9
353, 354 Dow Chemical	Midland, MI	OINC-L	35% Agricultural 60% Decid. For. 5% Mixed For.	50% Urban 20% Agricultural 20% Mixed For. 5% Water 5% Barren	Flint	Flint	20% Urban 70% Agricultural 10% Deciduous For.	55% Urban 40% Agricultural 5% Deciduous For.	0.34	0.62	25	0.26	0.933	0	0.22	20
463 Miles, Inc.	Kansas City, MO	OINC-L	70% Urban 15% Agricultural 10% Deciduous For 5% Water	70% Urban 15% Agricultural 10% Deciduous For 5% Water	Topeka	Kansas City	30% Urban 65% Agricultural 5% Water	30% Urban 65% Agricultural 5% Water	0.3	0.8	2	0.3	1	0	0.15	20
464 B.P. Chem	Lima, OH	OINC-L	55% Urban 40% Agricultural 5% Deciduous For.	55% Urban 40% Agricultural 5% Deciduous For.	Dayton	Dayton	25% Urban 65% Agricultural 10% Deciduous For.	25% Urban 65% Agricultural 10% Deciduous For.	0.4	0.6	2	0.3	1	0	0.15	20

(continued)

Table B-6. (continued)

Site	Location	Type	Land Use Data Used In Modeling	Land Use Data at Site (according to GIS Info.)	Upper Air Station	Surface Met Station	Landuse at Met Station Used in Modeling	Actual Landuse at Met Station (according to GIS Info.)	Roughness Height at Met. Station (m)	Roughness Height at Site (m)	Min. Monin Obukhov Length	Noontime Albedo	Bowen Ratio	Anthropogenic Heat Flux	Fraction of Net Radiation	Anemometer Height (ft)
477, 478, 805 American Cyanamid	Hannibal, MO	OINC-L	5% Urban 80% Agricultural 10% Deciduous For. 5% Water	70% Agricultural 20% Deciduous For. 10% Water	Monett	St. Louis	80% Urban 10% Agricultural 10% Deciduous	90% Urban 5% Agricultural 5% Deciduous For.	0.89	0.2	50	0.21	1.43	0	0.27	20
504 Chevron Chem.	Philadelphia, PA	OINC-L	60% Urban 20% Swamp 20% Water	70% Urban 15% Water 10% Swamp 5% Barren	Dulles	Philadelphia	50% Urban 30% Swamp 20% Water	60% Urban 20% Water 15% Swamp 5% Barren	0.51	0.63	25	0.2	1	0	0.22	20
600 Dow Chem.	Freeport, TX	OINC-L	25% Urban 5% Agricultural 20% Rangeland 15% Conif. For. 5% Mixed For. 5% Water 25% Swamp	25% Urban 5% Agricultural 20% Rangeland 15% Conif. For. 5% Mixed For. 5% Water 25% Swamp	Lake Charles	Corpus Christi	15% Urban 85% Agricultural	15% Urban 85% Agricultural	0.2	0.6	2	0.3	0.9	0	0.15	20
705, 490 Ciba-Geigy Corp.	McIntosh, AL	OINC-L	5% Urban 5% Conif. For. 80% Mixed For. 10% Water	5% Urban 5% Conif. For. 80% Mixed For. 10% Water	Lake Charles	Mobile	15% Urban 35% Agricultural 10% Deciduous For. 40% Mixed For.	15% Urban 35% Agricultural 10% Deciduous For. 40% Mixed For.	0.7	1	2	0.2	0.4	0	0.15	20
706/480 Ciba-Geigy	St. Gabriel, LA	OINC-L	10% Urban 50% Agricultural 30% Deciduous For. 10% Water	10% Urban 50% Agricultural 30% Deciduous For. 10% Water	Lake Charles	Baton Rouge	60% Urban 15% Agricultural 20% Deciduous For. 5% Barren	60% Urban 15% Agricultural 20% Deciduous For. 5% Barren	0.4	0.8	25	0.2	0.7	0	0.22	20
711 Chevron Chemical	Belle Chase, LA	OINC-L	5% Urban 20% Water 35% Mixed For. 10% Agricultural 30% Swamp	10% Urban 10% Agricultural 40% Deciduous For. 20% Water 15% Swamp 5% Barren	Lake Charles	New Orleans	70% Urban 10% Agricultural 20% Mixed For.	65% Urban 5% Agricultural 10% Water 15% Mixed For. 5% Swamp	0.93	0.49	50	0.2	0.6	0	0.22	20
806 Amoco Oil	Whiting, IN	OINC-L	6% Urban 27% Agricultural 18% Range 25% Forested 6% Water 9% Barren Land 9% Shrubland	90% Urban 5% Deciduous For. 5% Water	Peoria	Chicago	100% Urban	85% Urban 5% Agricultural 10% Deciduous For.	1	0.4	100	0.21	1.6	27.8	0.27	20
809, 810 Tennessee Eastman	Kingsport, TN	OINC-L	10% Urban 25% Agricultural 60% Deciduous For. 5% Water	50% Urban 10% Agricultural 30% Deciduous For. 5% Water 5% Barren	Huntington	Bristol	55% Agricultural 40% Deciduous For. 5% Water	5% Urban 70% Agricultural 20% Deciduous For. 5% Water	0.4	0.66	2	0.25	0.79	0	0.15	20
915 Eastman Kodak	Rochester, NY	OINC-L	35% Urban 20% Agricultural 15% Deciduous For. 30% Water	95% Urban 5% Mixed For.	Buffalo	Rochester	15% Urban 75% Agricultural 10% Deciduous For.	70% Urban 20% Agricultural 5% Deciduous For. 5% Mixed For.	0.29	0.5	2	0.3	0.9	0	0.15	20
A32 (483) Hoechst Celanese	Seabrook, TX	OINC-L	15% Urban 35% Agricultural 10% Deciduous For. 35% Water 5% Barren	15% Urban 35% Agricultural 10% Deciduous For. 35% Water 5% Barren	Lake Charles	Houston	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	0.7	0.3	2	0.2	0.5	0	0.15	20
A43 Occidental	Niagara Falls, NY	OINC-L	80% Urban 15% Water 5% Barren	80% Urban 15% Water 5% Barren	Buffalo	Buffalo	80% Urban 10% Agricultural 10% Deciduous For.	80% Urban 10% Agricultural 10% Deciduous For.	0.9	0.8	25	0.2	1.4	0	0.22	20
A50 Quantum Chemical	La Porte, TX	OINC-L	20% Urban 45% Agricultural 5% Decidous For. 20% Water 10% Swamp	20% Urban 45% Agricultural 5% Decidous For. 20% Water 10% Swamp	Lake Charles	Houston	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	0.7	0.3	2	0.2	0.5	0	0.15	20

(continued)

Table B-6. (continued)

Site	Location	Type	Land Use Data Used In Modeling	Land Use Data at Site (according to GIS Info.)	Upper Air Station	Surface Met Station	Landuse at Met Station Used in Modeling	Actual Landuse at Met Station (according to GIS Info.)	Roughness Height at Met. Station (m)	Roughness Height at Site (m)	Min. Monin Obukhov Length	Noontime Albedo	Bowen Ratio	Anthropogenic Heat Flux	Fraction of Net Radiation	Anemometer Height (ft)
A62 Texaco Chemical	Conroe, TX	OINC-L	5% Urban 25% Conif. For. 70% Mixed For.	20% Urban 70% Conif. For. 5% Mixed For. 5% Barren	Lake Charles	Houston	45% Urban 40% Agricultural 5% Conif. For. 10% Mixed For.	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	0.65	1.15	2	0.2	0.5	0	0.15	20
B20 GSX Chemical	Cleveland, OH	OINC-L	60% Urban 40% Water	60% Urban 40% Water	Flint	Cleveland	90% Urban 10% Agricultural	90% Urban 10% Agricultural	0.41	0.4	25	0.2	1.2	14.1	0.22	10.1
340 Miles, Inc.	New Martinsville, WV	OINC-S	10% Urban 15% Agricultural 70% Deciduous For. 5% Water	10% Urban 15% Agricultural 70% Deciduous For. 5% Water	Huntington	Huntington	20% Urban 15% Agricultural 60% Deciduous For. 5% Water	20% Urban 15% Agricultural 60% Deciduous For. 5% Water	0.8	0.7	2	0.2	1	0	0.15	20
342 Upjohn	Kalamazoo, MI	OINC-S	70% Urban 20% Agricultural 10% Deciduous For.	70% Urban 20% Agricultural 10% Deciduous For.	Flint	Lansing	50% Urban 45% Agricultural 5% Deciduous For.	50% Urban 45% Agricultural 5% Deciduous For.	0.39	0.25	2	0.3	1	0	0.15	20
453 Cargill Chem.	Forest Park, GA	OINC-S	6% Urban 27% Agricultural 18% Range 25% Forested 6% Water 9% Barren Land 9% Shrubland	75% Urban 5% Deciduous For. 15% Mixed For. 5% Barren	Waycross	Atlanta	10% Mixed For. 90% Urban	85% Urban 10% Mixed For. 5% Barren	1	0.4	50	0.21	0.71	9.3	0.27	20
468 Lonza Chem.	Conshohocken, PA	OINC-S	40% Urban 5% Water 25% Agricultural 30% Deciduous For.	75% Urban 5%Agricultural 10% Deciduous For. 5% Water 5% Barren	Dulles	Philadelphia	50% Urban 30% Swamp 20% Water	60% Urban 20% Water 15% Swamp 5% Barren	0.51	0.69	25	0.2	1	0	0.22	20
701 Eli Lily	Clinton, IN	OINC-S	80% Agricultural 20% Deciduous For.	80% Agricultural 15% Deciduous For. 5% Water	Peoria	Indianapolis	5% Urban 90% Agricultural 5% Deciduous For.	60% Urban 40% Agricultural	0.16	0.24	2	0.3	0.8	0	0.15	20
704 Ashland Chem.	Los Angeles, CA	OINC-S	100% Urban	100% Urban	Oakland	Los Angeles	70% Urban 25% Water 5% Barren	95% Urban 5% Barren	0.7	1	50	0.2	2.3	21	0.27	20
708 Burroughs Welcome	Greenville, NC	OINC-S	5% Urban 50% Agriucultural 35% Conif. For. 10% Mixed For.	15% Urban 50% Agriucultural 20% Conif. For. 15% Mixed For.	Greensboro	Raleigh-Durham	10% Water 10% Urban 15% Agricultural 65% Mixed For.	10% Urban 5% Agricultural 20% Deciduous For. 25% Conif. For. 40% Mixed For.	0.91	0.65	2	0.216	0.914	0	0.15	20
725 Zeneca	Bayonne, NJ	OINC-S	70% Urban 30% Water	60% Urban 35% Water 5% Barren	Atlantic City	Newark	80% Urban 10% Water 10% Deciduous	80% Urban 15% Water 5% Barren	0.89	0.7	25	0.2	1.4	0	0.22	20
824 Penwalt Corp.	Thorofare, NJ	OINC-S	30% Urban 15% Water 40% Agricultural 15% Deciduous For.	50% Urban 15% Agricultural 5% Mixed For. 20% Water 10% Barren	Dulles	Philadelphia	50% Urban 30% Swamp 20% Water	60% Urban 20% Water 15% Swamp 5% Barren	0.51	0.46	25	0.2	1	0	0.22	20
904 First Chem. Co.	Pascagoula, MS	OINC-S	30% Urban 20% Conif. For. 20% Water 30%	30% Urban 20% Conif. For. 20% Water 30%	Apalachicola	Mobile	15% Urban 35% Agricultural 10% Deciduous For. 40% Mixed For.	15% Urban 35% Agricultural 10% Deciduous For. 40% Mixed For.	0.7	0.6	2	0.2	0.4	0	0.15	20
906 Monsanto Agricultural	Muscatine, IA	OINC-S	100% Agricultural	5% Urban 75% Agricultural 10% Water 5% Deciduous For. 5% Barren	Peoria	Moline	100% Agricultural	40% Urban 35% Agricultural 20% Deciduous For. 5% Water	0.07	0.07	2	0.3	0.8	0	0.15	20
A14 BASF Corp.	Geismar, LA	OINC-S	15% Urban 30% Agricultural 40% Deciduous For. 15% Water	10% Urban 40% Agricultural 40% Deciduous For. 10% Water	Lake Charles	Baton Rouge	50% Urban 30% Agricultural 20% Decid. For.	60% Urban 15% Agricultural 20% Deciduous For. 5% Barren	0.7	0.53	2	0.2	0.6	0	0.15	20

(continued)

Table B-6. (continued)

Site	Location	Type	Land Use Data Used In Modeling	Land Use Data at Site (according to GIS Info.)	Upper Air Station	Surface Met Station	Landuse at Met Station Used in Modeling	Actual Landuse at Met Station (according to GIS Info.)	Roughness Height at Met. Station (m)	Roughness Height at Site (m)	Min. Monin Obukhov Length	Noontime Albedo	Bowen Ratio	Anthropogenic Heat Flux	Fraction of Net Radiation	Anemometer Height (ft)
A26 Eastman Chemical	Magness, AR	OINC-S	80% Agricultural 10% Deciduous For. 10% Mixed For.	70% Agricultural 25% Mixed Forest 5% Water	Monett	Springfield, MO	100% Agricultural	20% Urban 75% Agricultural 5% Deciduous For.	0.2	0.256	2	0.27	0.84	0	0.15	20
A31 Hercules, Inc.	Franklin, VA	OINC-S	10% Urban 35% Agricultural 15% Conif. For. 40% Mixed For	10% Urban 35% Agricultural 15% Conif. For. 40% Mixed For	Greensboro	Richmond	40% Urban 15% Agricultural 10% Conif. For. 25% Mixed For. 10% Barren	40% Urban 15% Agricultural 10% Conif. For. 25% Mixed For. 10% Barren	0.8	0.8	2	0.2	1.5	0	0.15	20
A45 Occidental Chemical	Deer Park, TX	OINC-S	70% Urban 30% Water	40% Urban 50% Agricultural 5% Mixed For. 5% Water	Victoria	Hobby Field	70% Urban 30% Water		0.5 (Based on 1/20 th anemometer height)	0.5 (Based on 1/20 th anemometer height)	50	0.21	0.5	0	0.27	32.8
A46 OSI Specialties	Sisterville, WV	OINC-S	5% Urban 10% Agricultural 85% Deciduous For.	5% Urban 10% Agricultural 75% Deciduous For. 5% Mixed For. 5% Water	Huntington	Huntington	15% Urban 10% Agricultural 70% Deciduous For. 5% Water	20% Urban 15% Agricultural 60% Deciduous For. 5% Water	0.79	0.82	2	0.22	0.95	0	0.15	20
A47 Phillips Research Center	Bartlesville, OK	OINC-S	5% Urban 90% Agricultural 5% Water	20% Urban 20% Agricultural 30% Range 30% Deciduous For.	Oklahoma City	Tulsa	25% Urban 65% Agricultural 10% Deciduous For.	50% Urban 35% Agricultural 10% Deciduous For. 5% Water	0.6	0.5	2	0.2	1.2	0	0.15	20
A55 Schenectady Int.	Rotterdam Jct., NY	OINC-S	15% Urban 15% Agricultural 5% Range 20% Deciduous For. 40% Mixed For. 5% Water	15% Urban 15% Agricultural 5% Range 20% Deciduous For. 40% Mixed For. 5% Water	Albany	Albany	60% Urban 15% Agricultural 20% Deciduous For. 5% Water	60% Urban 15% Agricultural 20% Deciduous For. 5% Water	0.8	0.8	25	0.2	1.3	0	0.22	20
B18 Georgia Gulf	Plaquemine, LA	OINC-S	20% Urban 50% Agricultural 15% Deciduous 15% Water	20% Urban 50% Agricultural 15% Deciduous 15% Water	Lake Charles	Baton Rouge	60% Urban 15% Agricultural 20% Deciduous For. 5% Barren	60% Urban 15% Agricultural 20% Deciduous For. 5% Barren	0.8	0.4	25	0.2	0.7	0	0.22	20
B23 Huntsman Corp.	Port Neches, TX	OINC-S	30% Urban 10% Agricultural 10% Water 50% Swamp	40% Urban 10% Agricultural 5% Deciduous For. 5% Water 35% Swamp 5% Barren	Lake Charles	Port Arthur	70% Agricultural 5% Deciduous For. 25% Mixed For.	35% Urban 50% Agricultural 5%Swamp 10% Barren	0.37	0.39	2	0.3	0.3	0	0.15	20
B31 Merck and Co.	West Point, PA	OINC-S	40% Urban 50% Agricultural 10% Deciduous For.	40% Urban 50% Agricultural 10% Deciduous For.	Dulles	Allentown	55% Urban 40% Agricultural 5% Barren	55% Urban 40% Agricultural 5% Barren	0.6	0.5	25	0.3	1.4	0	0.22	20
B32 Miles Corp.	Baytown, TX	OINC-S	45% Urban 25% Agricultural 15% Deciduous For. 10% Water 5% Swamp	45% Urban 25% Agricultural 15% Deciduous For. 10% Water 5% Swamp	Lake Charles	Houston	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	0.7	0.6	2	0.2	0.5	0	0.15	20
B37 Pine Bluff Arsenal	Pine Bluff, AR	OINC-S	50% Urban 25% Agricultural 15% Deciduous 10% Mixed For.	50% Urban 25% Agricultural 15% Deciduous 10% Mixed For.	Monett	Springfield, MO	20% Urban 75% Agricultural 5% Deciduous For.	20% Urban 75% Agricultural 5% Deciduous For.	0.3	0.8	2	0.3	0.9	0	0.15	20
B44 Shell Chemical	Deer Park, TX	OINC-S	40% Urban 50% Agricultural 5% Mixed For. 5% Water	40% Urban 50% Agricultural 5% Mixed For. 5% Water	Lake Charles	Houston	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	30% Urban 40% Agricultural 5% Deciduous For. 20% Conif. For. 5% Mixed For.	0.7	0.17	25	0.3	0.5	0	0.15	20
B53 (493,494) US Army Tooele Depot N.	Tooele, UT	OINC-S	25% Urban 40% Agricultural 20% Deciduous For. 15% Mixed For.	25% Urban 40% Agricultural 20% Range 15% Mixed For.	Salt Lake City	Salt Lake City	40% Urban 25% Range 35% Conif. For.	55% Urban 10% Agricultural 20% Range 5% Swamp 10% Barren	0.6	0.5	25	0.2	1.6	0	0.22	20

Table B-7. Scavenging Rate Coefficients for Divalent and Elemental Mercury

Stack ID	Type of Combustor	Site Location	Annual Average Mixing Height (m)			Scavenging Rate Coefficient (h/mm-s)	
			Morning	Afternoon	Average	Divalent Mercury	Elemental Mercury
Commercial Incinerators							
209	CINC	Roebuck, SC	390	1550	970	4.6E-04	4.6E-06
210,211,212	CINC	Calvert City, KY	440	1430	935	4.8E-04	4.8E-06
214	CINC	Baton Rouge, LA	650	1200	925	4.8E-04	4.8E-06
221	CINC	Deer Park, TX	510	1220	865	5.1E-04	5.1E-06
324	CINC	Birmingham, AL	390	1500	945	4.7E-04	4.7E-06
325	CINC	Coffeyville, KS	420	1380	900	4.9E-04	4.9E-06
331	CINC	Grafton, OH	560	1290	925	4.8E-04	4.8E-06
333, 612	CINC	Sauget, IL	410	1430	920	4.8E-04	4.8E-06
359	CINC	Carrolton, KY	470	1400	935	4.8E-04	4.8E-06
601	CINC	Clive, UT	290	2300	1295	3.4E-04	3.4E-06
A15	CINC	Clarence, NY	630	1240	935	4.8E-04	4.8E-06
A18	CINC	Port Arthur, TX	490	1170	830	5.4E-04	5.4E-06
486, 487	CINC	El Dorado, AR	450	1480	965	4.6E-04	4.6E-06
Cement Kilns							
200,201,680,681	CK	Harleyville, SC	390	1400	895	5.0E-04	5.0E-06
202	CK	Independence, MO	450	1300	875	5.1E-04	5.1E-06
203	CK	Artesia, MS	390	1500	945	4.7E-04	4.7E-06
204	CK	Clarksville, MO	390	1300	845	5.3E-04	5.3E-06
205, 206	CK	Holly Hill, SC	390	1400	895	5.0E-04	5.0E-06
207, 208	CK	Bath, PA	650	1500	1075	4.1E-04	4.1E-06
228, 403, 404	CK	Foreman, AR	450	1450	950	4.7E-04	4.7E-06
302	CK	Paudling, OH	480	1300	890	5.0E-04	5.0E-06
304	CK	Greencastle, IN	440	1320	880	5.1E-04	5.1E-06
305,335	CK	Wampum, PA	550	1410	980	4.5E-04	4.5E-06
320	CK	Alpena, MI	520	1200	860	5.2E-04	5.2E-06
321	CK	Demopolis, AL	500	1410	955	4.7E-04	4.7E-06

(continued)

Table B-7. (continued)

Stack ID	Type of Combustor	Site Location	Annual Average Mixing Height (m)			Scavenging Rate Coefficient (h/mm-s)	
			Morning	Afternoon	Average	Divalent Mercury	Elemental Mercury
322, 323	CK	Fredonia, KS	410	1370	890	5.0E-04	5.0E-06
401, 402	CK	Chanute, KS	420	1380	900	4.9E-04	4.9E-06
318, 473	CK	Midlothian, TX	500	1500	1000	4.4E-04	4.4E-06
Light Weight Aggregate Kilns							
225	LWAK	Norwood, NC	400	1500	950	4.7E-04	4.7E-06
307, 479	LWAK	Cohoes, NY	700	1490	1095	4.1E-04	4.1E-06
310, 475	LWAK	Brooks, KY	460	1410	935	4.8E-04	4.8E-06
311, 312, 336	LWAK	Cascade, VA	490	1580	1035	4.3E-04	4.3E-06
313, 314	LWAK	Arvonia, VA	490	1490	990	4.5E-04	4.5E-06
Large Onsite Incinerators							
334	OINC-Large	Cottage Grove, MN	420	1210	815	5.5E-04	5.5E-06
463	OINC-Large	Kansas City, MO	410	1300	855	5.2E-04	5.2E-06
464	OINC-Large	Lima, OH	480	1300	890	5.0E-04	5.0E-06
483	OINC-Large	Seabrook, TX	510	1200	855	5.2E-04	5.2E-06
504	OINC-Large	Philadelphia, PA	690	1400	1045	4.3E-04	4.3E-06
600	OINC-Large	Freeport, TX	520	1190	855	5.2E-04	5.2E-06
711	OINC-Large	Belle Chasse, LA	800	1070	935	4.8E-04	4.8E-06
806	OINC-Large	Whiting, IN	470	1190	830	5.4E-04	5.4E-06
915	OINC-Large	Rochester, NY	650	1200	925	4.8E-04	4.8E-06
353, 354	OINC-Large	Midland, MI	510	1250	880	5.1E-04	5.1E-06
477, 478, 805	OINC-Large	Hannibal, MO	390	1300	845	5.3E-04	5.3E-06
705, 490	OINC-Large	McIntosh, AL	550	1300	925	4.8E-04	4.8E-06
706, 480	OINC-Large	St. Gabriel, LA	700	1100	900	4.9E-04	4.9E-06
809, 810	OINC-Large	Kingsport, TN	480	1620	1050	4.2E-04	4.2E-06
a43	OINC-Large	Niagara Falls, NY	610	1200	905	4.9E-04	4.9E-06
A50	OINC-Large	La Porte, TX	510	1220	865	5.1E-04	5.1E-06
A62	OINC-Large	Conroe, TX	530	1400	965	4.6E-04	4.6E-06
B20	OINC-Large	Cleveland, OH	550	1290	920	4.8E-04	4.8E-06

(continued)

Table B-7. (continued)

Stack ID	Type of Combustor	Site Location	Annual Average Mixing Height (m)			Scavenging Rate Coefficient (h/mm-s)	
			Morning	Afternoon	Average	Divalent Mercury	Elemental Mercury
Small Onsite Incinerators							
340	OINC-Small	New Martinsville, WV	510	1400	955	4.7E-04	4.7E-06
342	OINC-Small	Kalamazoo, MI	490	1220	855	5.2E-04	5.2E-06
453	OINC-Small	Forest Park, GA	390	1510	950	4.7E-04	4.7E-06
468	OINC-Small	Conshohocken, PA	650	1450	1050	4.2E-04	4.2E-06
701	OINC-Small	Clinton, IN	430	1370	900	4.9E-04	4.9E-06
704	OINC-Small	Los Angeles, CA	510	800	655	6.8E-04	6.8E-06
708	OINC-Small	Greenville, NC	550	1200	875	5.1E-04	5.1E-06
725	OINC-Small	Bayonne, NJ	800	1210	1005	4.4E-04	4.4E-06
824	OINC-Small	Thorofare, NJ	700	1350	1025	4.3E-04	4.3E-06
904	OINC-Small	Pascagoula, MS	750	1100	925	4.8E-04	4.8E-06
906	OINC-Small	Muscatine, IA	390	1190	790	5.6E-04	5.6E-06
493, 494	OINC-Small	Tooele, UT	290	2350	1320	3.4E-04	3.4E-06
A14	OINC-Small	Geismar, LA	610	1100	855	5.2E-04	5.2E-06
A26	OINC-Small	Magness, AR	450	1500	975	4.6E-04	4.6E-06
A31	OINC-Small	Franklin, VA	450	1610	1030	4.3E-04	4.3E-06
A45	OINC-Small	Deer Park, TX	510	1220	865	5.1E-04	5.1E-06
A46	OINC-Small	Sisterville, WV	510	1500	1005	4.4E-04	4.4E-06
A47	OINC-Small	Bartlesville, OK	420	1380	900	4.9E-04	4.9E-06
A55	OINC-Small	Rotterdam Jct., NY	700	1450	1075	4.1E-04	4.1E-06
B18	OINC-Small	Plaquemine, LA	650	1100	875	5.1E-04	5.1E-06
B23	OINC-Small	Port Neches, TX	490	1210	850	5.2E-04	5.2E-06
B31	OINC-Small	West Point, PA	680	1420	1050	4.2E-04	4.2E-06
b32	OINC-Small	Baytown, TX	510	1220	865	5.1E-04	5.1E-06
B37	OINC-Small	Pine Bluff, AR	450	1490	970	4.6E-04	4.6E-06
B44	OINC-Large	Deer Park, TX	510	1220	865	5.1E-04	5.1E-06

Table B-8. Dry Deposition Velocity for Divalent Mercury Vapor at all Modeled Sites

Site ID	Type of Combustor	Company Name	Location	Dry Deposition Velocity	
214	CINC	Rollins Environmental Services	Baton Rouge, LA	1.8	
221	CINC	Rollins Environmental Services	Deer Park, TX	1.7	
209	CINC	Laidlaw Environmental Services	Roebuck, SC	2.1	
210,211, 212	CINC	LWD, Inc.	Calvert City, KY	1.5	
325	CINC	Aptus	Coffeyville, KS	1.4	
324	CINC	Allied Corp.	Birmingham, AL	2.6	
331	CINC	Ross Incineration Serv	Grafton OH	1.5	
333, 612	CINC	Trade Waste Incineration	Sauget, IL	2.7	
359	CINC	Atochem	Carrolton, KY	1.8	
A15	CINC	BDT Inc.	Clarence, NY	2.0	
A18 (603)	CINC	Chemical Waste Mgmt	Port Arthur TX	1.2	
A29 (486, 487)	CINC	Ensco, Inc	El Dorado, AR	2.3	
601	CINC	Laidlaw Environmental Services INC	Clive, UT	0.6	
202	CK	Heartland Cement	Independence KS	1.5	
204	CK	Holnam, Inc.	Clarksville, MO	1.5	
302	CK	Lafarge	Paulding OH	1.3	
304	CK	Lone Star Indiustries	Greencastle, IN	1.6	
320	CK	Lafarge	Alpena, MI	1.5	
321	CK	Medusa Cement Company	Demopolis, AL	1.7	
200,201,680, 681	CK	Giant Cement Company	Harleysville, SC	1.9	
203	CK	Holnam Inc.	Artesia, MS	1.2	
205, 206	CK	Holnam, Inc.	Holy Hill, SC	1.9	
207, 208	CK	Keystone Cement Company	Bath, PA	1.2	
305, 335	CK	Medusa Cement	Wampum, PA	2.2	
318, 473	CK	Texas Industries	Midlothina, TX	2.5	
322, 323	CK	Lafarge	Fredonia, KS	1.4	
401, 402	CK	Ash Grove Cement Company	Chanute, KS	1.6	
403, 404, 228	CK	Ash Grove Cement Company	Foreman, AR	1.5	
225	LWAK	Solite	Norwood NC	1.5	
307, 479	LWAK	Thermalkem (Norlite)	Cohoes, NY	2.7	
310, 475	LWAK	Solite	Brooks KY	1.9	
311, 312, 336	LWAK	Solite	Cascade, VA	1.9	
313, 314	LWAK	Solite	Arvonia VA	1.9	
334	OINC-L	3M	Cottage Grove, MN	1.2	
464	OINC-L	B.P Chemicals	Lima, OH	2.4	
504	OINC-L	Chevron Chemical	Philadelphia, PA	2.6	
806	OINC-L	Amoco Oil, Co.	Whiting, IN	3.2	
915	OINC-L	Eastman Kodak	Rochester, NY	3.4	
353, 354	OINC-L	Dow Chemical Co.,	Midland, MI	2.5	
477, 478, 805	OINC-L	American Cyanamid	Hannibal MO	1.3	
705, 490	OINC-L	Ciba-Geigy Corporation	Mcintosh, AL	2.0	
711	OINC-L	Chevron Chemical Co.	Bell Chasse, LA	1.5	
809, 810	OINC-L	Tennessee Eastman	Kingsport TN	2.3	

(continued)

Table B-8. (continued)

Site ID	Type of Combustor	Company Name	Location	Dry Deposition Velocity	
A43	OINC-L	Occidental Chemical Corp	Niagara Falls, NY	2.9	
A50	OINC-L	Quantum Chemical Company	La Porte, TX	1.3	
A62	OINC-L	Texaco Chemical Co.	Conroe, TX	2.2	
B20	OINC-L	GSX Chemical Services	Cleveland, OH	2.3	
600	OINC-L	Dow Chemical	Freeport TX	1.7	
706/480	OINC-L	Ciba-Geigy	St. Gabriel, LA	1.5	
463	OINC-L	Miles	Kansas City, MO	2.8	
A32 (483)	OINC-L	Hoechst Celanese	Seabrook, TX	1.1	
453	OINC-S	Cargill Chemical Products	Forest Park, GA	2.9	
468	OINC-S	Lonza Chemical	Conshohocken, PA	2.8	
708	OINC-S	Burroughs Welcome	Greenville, NC	1.8	
824	OINC-S	Penwalt Corp.	Thorofare, NJ	2.0	
342	OINC-S	Upjohn Co.	Kalamazoo, MI	2.8	
701	OINC-S	Eli Lilly And Company	Clinton, IN	1.3	
704	OINC-S	Ashland Chemical Company	Los Angeles, CA	3.0	
725	OINC-S	Zeneca	Bayonne, NJ	2.1	
906	OINC-S	Monsanto Agricultural Company	Muscatine, IA	1.2	
A14 (604)	OINC-S	Basf Corporation	Geismar, LA	1.6	
A26 (484)	OINC-S	Eastman Chemical Co,	Magness, AR	1.4	
A31	OINC-S	Hercules, Inc	Franklin, VA	1.9	
A45	OINC-S	Occidental Chemical Vcm	Deer Park, TX	1.9	
A46	OINC-S	OSI Specialties Inc	Sisterville, WV	2.0	
A47	OINC-S	Phillips Research Center	Barlesville, OK	1.9	
A55	OINC-S	Schenectady International, Inc.	Rotterdam Jct., NY	2.1	
B18 (606)	OINC-S	Georgia Gulf Corp	Plaquemine, LA	1.5	
B23	OINC-S	Huntsman Corp.	Port Neches, TX	2.0	
B31 (607)	OINC-S	Merck and Co.	West Point, PA	2.1	
B32	OINC-S	Miles Corp.	Baytown, TX	2.1	
B37	OINC-S	Pine Bluff Arsenal	Pine Bluff, AR	2.5	
B44 (605)	OINC-S	Shell Chemical Co.	Deer Park, TX	1.9	
B53 (493, 494)	OINC-S	U.S. Army Tooele Depot North	Tooele, UT	1.6	
340	OINC-S	Miles Inc.	New Martinsville, WV	2.0	
904	OINC-S	First Chemical Co.	Pascagoula, MS	2.0	

Table B-9. Waterbody Data for Commercial Incinerators

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m^2)	Total Watershed Area (m^2)	Impervious Watershed Area (m^2)	Average Volumetric Flow Rate (m^3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
209	Lawsons Fork Creek	River	3	N	3.94E+05	1.67E+08	2.40E+07	1.13E+08	2.44E-01	2.71E-01	3.00E+02
209	Tyger River	River	3	N	1.79E+06	4.73E+08	6.81E+07	5.37E+08	4.02E-01	3.84E-01	3.00E+02
209	Fair Forest Creek	River	3	N	3.00E+05	2.49E+08	3.58E+07	8.81E+07	2.96E-01	2.01E-01	3.00E+02
209	Middle Tyger River	River	3	Y	2.06E+05	5.40E+07	7.78E+06	1.22E+08	3.38E-01	2.23E-01	3.00E+02
214	Fish Ponds	Lake	8	N	2.99E+06	2.99E+06	5.32E+05	6.73E+05	NA	4.00E+00	5.10E+02
214	Lake Clause	Lake	8	N	2.11E+05	1.44E+07	2.57E+06	3.25E+06	NA	4.00E+00	5.10E+02
214	University Lake/ City Park Lake	Lake	8	N	8.95E+05	2.52E+06	4.49E+05	5.68E+05	NA	4.00E+00	5.10E+02
214	Comite River	River	8	N	4.24E+05	3.24E+08	5.77E+07	4.97E+08	4.91E-01	3.47E-01	5.10E+02
221	Highlands Resevoir	Lake	12	N	1.89E+06	5.21E+06	1.11E+06	6.62E+05	NA	4.00E+00	3.00E+02
221	Sheldon Reservoir	Lake	12	N	5.30E+06	5.30E+06	1.13E+06	6.73E+05	NA	4.00E+00	3.00E+02
221	San Jacinto River / Houston Lake	River	12	Y	1.71E+07	1.10E+08	2.35E+07	2.33E+09	5.61E-01	3.51E-01	3.00E+02
324	Shades Creek	River	3	N	4.90E+05	1.63E+08	8.04E+07	1.88E+08	4.02E-01	2.13E-01	3.50E+02
324	Valley Creek	River	3	N	9.58E+05	3.93E+08	1.94E+08	2.80E+08	4.66E-01	4.39E-01	3.50E+02
324	Bayview Lake	Lake	3	N	1.67E+06	1.59E+08	7.83E+07	4.04E+07	NA	4.00E+00	3.50E+02
324	Cahaba River	River	3	Y	7.28E+05	1.48E+08	7.30E+07	3.49E+08	4.21E-01	4.60E-01	3.50E+02
325	Big Hill Creek	River	11	N	1.71E+05	1.12E+08	4.47E+06	5.70E+07	1.68E-01	6.10E-02	2.50E+02
325	Potato Creek	River	11	N	1.55E+04	4.44E+07	1.77E+06	8.74E+06	1.13E-01	2.40E-02	2.50E+02
325	Claymore Creek	River	11	N	1.65E+05	3.46E+07	1.39E+06	6.34E+07	5.58E-01	3.26E-01	2.50E+02
325	Verdigris River	River	11	Y	2.09E+06	1.01E+09	4.04E+07	1.72E+09	6.37E-01	1.89E-01	2.50E+02
331	Rocky River	River	4	N	1.10E+06	3.30E+08	2.47E+07	2.30E+08	6.40E-01	5.40E-01	1.25E+02
331	East Branch Black River	River	4	N	5.19E+05	2.58E+08	1.94E+07	1.73E+08	6.10E-01	4.70E-01	1.25E+02

(continued)

Table B-9. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m^2)	Total Watershed Area (m^2)	Impervious Watershed Area (m^2)	Average Volumetric Flow Rate (m^3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
331	Wyleswood Lake	Lake	4	N	4.69E+04	8.38E+04	6.28E+03	1.06E+04	N/A	4.00E+00	1.25E+02
331	Baldwin Lake	Lake	4	Y	1.26E+05	3.09E+07	2.32E+06	3.93E+06	N/A	4.00E+00	1.25E+02
359	Kentucky River	RIVER	5	N	2.51E+06	4.67E+08	5.09E+07	8.69E+09	8.96E-01	9.57E-01	1.80E+02
359	Indian Creek	RIVER	5	N	1.05E+05	1.16E+08	1.26E+07	1.62E+08	3.78E-01	7.90E-02	1.80E+02
359	Indian Kentuck Creek	RIVER	5	N	1.08E+05	1.13E+08	1.23E+07	3.15E+07	1.98E-01	1.37E-01	1.80E+02
359	Ohio River	RIVER	5	Y	1.99E+07	5.06E+08	5.51E+07	9.55E+10	1.17E+00	5.17E+00	1.80E+02
A15	Tonawanda Creek	River	4	N	1.65E+06	4.37E+08	6.29E+07	4.32E+08	4.60E-01	3.11E-01	1.00E+02
A15	Murder Creek	River	4	N	9.71E+04	1.07E+08	1.54E+07	3.59E+07	2.01E-01	5.79E-02	1.00E+02
A15	Ellicott Creek	River	4	Y	5.74E+05	2.69E+08	3.87E+07	1.41E+08	3.60E-01	2.07E-01	1.00E+02
A18	Taylor Bayou	River	12	Y	4.10E+05	3.88E+08	1.94E+06	1.73E+08	6.10E-01	4.70E-01	4.90E+02
A18	Hillebrandt Bayou	River	12	Y	1.21E+05	2.17E+08	1.09E+06	1.26E+07	4.60E-01	1.80E-01	4.90E+02
A18	Viterbo Reservoir	Lake	12	Y	6.36E+05	3.63E+06	1.82E+04	6.47E+05	NA	4.00E+00	4.90E+02
CAL	Tennessee River	River	6	N	6.13E+06	5.33E+08	5.81E+07	5.79E+10	1.58E+00	1.81E+00	2.10E+02
CAL	Kentucky Lake	Lake	6	N	5.59E+07	1.45E+08	1.58E+07	2.94E+07	NA	4.00E+00	2.10E+02
CAL	Barkley Lake	Lake	5	N	3.54E+07	1.05E+08	1.15E+07	2.13E+07	NA	4.00E+00	2.10E+02
CAL	Cumberland River	River	5	N	6.69E+06	3.10E+08	3.38E+07	2.89E+10	1.27E+00	9.36E-01	2.10E+02
ELD	Flat Creek	River	8	N	1.53E+05	9.37E+07	1.35E+07	6.62E+07	5.50E-01	3.40E-01	3.50E+02
ELD	Salt Creek	River	8	N	1.46E+05	4.72E+07	6.79E+06	1.02E+07	5.50E-01	1.68E-01	3.50E+02
ELD	Calion Lake	Lake	8	N	1.95E+06	4.82E+07	6.95E+06	1.04E+07	NA	4.00E+00	3.50E+02
ELD	Ouachita River	River	8	N	1.87E+06	3.58E+08	5.16E+07	3.60E+09	8.80E-01	1.65E+00	3.50E+02
SAU	Horseshoe Lake	Lake	7	N	9.06E+06	2.37E+07	1.25E+07	3.01E+06	NA	4.00E+00	2.10E+02

(continued)

Table B-9. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m^2)	Total Watershed Area (m^2)	Impervious Watershed Area (m^2)	Average Volumetric Flow Rate (m^3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
SAU	Old Cahokia Creek	River	7	N	2.25E+04	2.36E+06	1.24E+06	1.39E+07	4.60E-01	1.80E-01	2.10E+02
SAU	Mississippi River	River	7	Y	2.62E+07	1.10E+09	5.78E+08	3.94E+11	1.74E+00	1.19E+01	2.10E+02

(continued)

Table B-9. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
209	Lawsons Fork Creek	3.40E-01	1.29E+00	3.32E-02	8.51E-01	1.13E-01	2.40E+01	8.34E-01	1.37E+03	3.29E-02	1.37E-01
209	Tyger River	3.40E-01	1.49E+00	3.78E-02	8.12E-01	4.94E-02	2.40E+01	1.04E+00	2.66E+02	6.39E-03	1.37E-01
209	Fair Forest Creek	3.40E-01	1.34E+00	2.71E-02	9.20E-01	1.07E-01	2.40E+01	7.65E-01	2.53E+03	6.08E-02	1.37E-01
209	Middle Tyger River	3.40E-01	1.41E+00	4.40E-02	8.43E-01	1.30E-01	2.40E+01	1.19E+00	1.10E+03	2.64E-02	1.37E-01
214	Fish Ponds	3.40E-01	7.94E-02	7.35E-02	5.43E-01	2.17E-01	3.80E+01	1.23E-01	4.80E-01	1.82E-05	1.37E-01
214	Lake Clause	3.40E-01	9.19E-02	5.42E-02	6.70E-01	1.78E-01	3.80E+01	1.30E-01	2.63E+01	9.99E-04	1.37E-01
214	University Lake/ City Park Lake	3.40E-01	5.89E-01	6.15E-03	1.00E+00	3.01E-01	3.80E+01	1.41E-01	2.51E+00	9.53E-05	1.37E-01
214	Comite River	3.40E-01	1.64E-01	5.45E-02	7.79E-01	5.18E-02	1.63E+02	2.70E-01	0.00E+00	0.00E+00	1.37E-01
221	Highlands Resevoir	3.40E-01	6.93E-02	5.39E-02	6.63E-01	2.03E-01	7.00E+01	5.66E-02	1.02E-01	7.12E-06	1.36E-01
221	Sheldon Reservoir	3.40E-01	7.02E-02	2.61E-02	8.38E-01	2.02E-01	7.00E+01	3.51E-02	0.00E+00	0.00E+00	1.36E-01
221	San Jacinto River / Houston Lake	3.40E-01	8.50E-02	3.10E-02	8.58E-01	1.19E-01	7.20E+01	5.17E-02	0.00E+00	0.00E+00	1.36E-01
324	Shades Creek	3.40E-01	1.78E+00	1.80E-02	9.69E-01	1.13E-01	2.40E+01	8.30E-01	9.17E+02	2.20E-02	1.19E-01
324	Valley Creek	3.40E-01	1.63E+00	2.83E-02	9.75E-01	5.06E-02	2.40E+01	1.20E+00	7.47E+02	1.79E-02	1.19E-01
324	Bayview Lake	3.40E-01	1.27E+00	2.10E-02	9.88E-01	1.13E-01	6.00E+00	7.03E-01	1.24E+03	7.45E-03	1.19E-01
324	Cahaba River	3.40E-01	2.17E+00	1.81E-02	9.92E-01	1.14E-01	2.40E+01	1.04E+00	5.31E+02	1.27E-02	1.19E-01
325	Big Hill Creek	3.40E-01	3.52E-01	7.58E-02	5.29E-01	1.18E-01	2.06E+02	2.69E-01	0.00E+00	0.00E+00	2.04E-01
325	Potato Creek	3.40E-01	3.04E-01	7.77E-02	5.16E-01	1.33E-01	2.06E+02	2.32E-01	0.00E+00	0.00E+00	2.04E-01
325	Claymore Creek	3.40E-01	2.76E-01	7.52E-02	5.33E-01	1.37E-01	2.06E+02	2.10E-01	0.00E+00	0.00E+00	2.04E-01
325	Verdigris River	3.40E-01	3.28E-01	7.55E-02	5.41E-01	4.49E-02	2.06E+02	2.55E-01	0.00E+00	0.00E+00	2.04E-01
331	Rocky River	3.40E-01	4.72E-01	6.39E-02	6.60E-01	5.17E-02	2.10E+01	1.90E-01	0.00E+00	0.00E+00	1.69E-01

(continued)

Table B-9. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
331	East Branch Black River	3.40E-01	4.63E-01	7.00E-02	5.69E-01	1.07E-01	2.10E+01	1.76E-01	1.10E+02	2.31E-03	1.69E-01
331	Wyleswood Lake	3.40E-01	4.76E-01	8.00E-02	5.00E-01	5.09E-01	6.00E+00	1.82E-01	2.73E+01	1.64E-04	1.69E-01
331	Baldwin Lake	3.40E-01	5.14E-01	2.97E-02	8.54E-01	1.39E-01	6.00E+00	1.24E-01	6.73E+02	4.04E-03	1.69E-01
359	Kentucky River	3.40E-01	2.27E+00	4.73E-02	7.29E-01	4.95E-02	2.70E+01	1.07E+00	0.00E+00	0.00E+00	1.37E-01
359	Indian Creek	3.40E-01	2.78E+00	3.92E-02	7.73E-01	1.18E-01	2.70E+01	1.16E+00	4.00E+03	1.08E-01	1.37E-01
359	Indian Kentuck Creek	3.40E-01	3.16E+00	3.45E-02	8.03E-01	1.18E-01	2.70E+01	1.20E+00	5.22E+03	1.41E-01	1.37E-01
359	Ohio River	3.40E-01	2.40E+00	4.13E-02	7.79E-01	4.90E-02	2.70E+01	1.06E+00	0.00E+00	0.00E+00	1.37E-01
A15	Tonawanda Creek	3.40E-01	4.18E-01	2.40E-02	9.56E-01	4.99E-02	2.10E+01	7.32E-02	0.00E+00	0.00E+00	2.05E-01
A15	Murder Creek	3.40E-01	4.69E-01	2.93E-02	8.74E-01	1.19E-01	2.10E+01	9.15E-02	2.01E+02	4.22E-03	2.05E-01
A15	Ellicott Creek	3.40E-01	4.91E-01	6.49E-02	8.09E-01	5.30E-02	2.10E+01	1.97E-01	0.00E+00	0.00E+00	2.05E-01
A18	Taylor Bayou	3.40E-01	1.18E-01	5.09E-02	6.93E-01	5.06E-02	7.20E+01	1.56E-01	0.00E+00	0.00E+00	1.53E-01
A18	Hillebrandt Bayou	3.40E-01	1.17E-01	6.42E-02	6.06E-01	1.09E-01	7.20E+01	1.70E-01	3.58E+02	2.58E-02	1.53E-01
A18	Viterbo Reservoir	3.40E-01	1.24E-01	6.89E-02	5.69E-01	2.12E-01	7.00E+01	1.82E-01	2.13E+00	1.49E-04	1.53E-01
CAL	Tennessee River	3.40E-01	9.26E-01	5.52E-02	6.93E-01	4.87E-02	1.50E+01	5.67E-01	0.00E+00	0.00E+00	1.54E-01
CAL	Kentucky Lake	3.40E-01	1.95E+00	4.94E-02	9.28E-01	1.15E-01	6.00E+00	1.43E+00	7.01E+01	4.21E-04	1.54E-01
CAL	Barkley Lake	3.40E-01	2.88E+00	1.39E-02	9.30E-01	1.19E-01	6.00E+00	5.95E-01	3.45E+01	2.07E-04	1.54E-01
CAL	Cumberland River	3.40E-01	1.67E+00	6.05E-02	6.90E-01	5.21E-02	2.70E+01	1.12E+00	0.00E+00	0.00E+00	1.54E-01
ELD	Flat Creek	3.40E-01	4.93E-01	1.17E-02	9.75E-01	1.21E-01	1.63E+02	1.51E-01	0.00E+00	0.00E+00	1.53E-01
ELD	Salt Creek	3.40E-01	5.03E-01	5.78E-03	9.90E-01	1.32E-01	1.63E+02	7.68E-02	0.00E+00	0.00E+00	1.53E-01
ELD	Calion Lake	3.40E-01	5.81E-01	5.80E-03	9.92E-01	1.31E-01	3.80E+01	8.92E-02	2.29E+00	8.71E-05	1.53E-01

(continued)

Table B-9. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
ELD	Ouachita River	3.40E-01	4.10E-01	6.64E-03	9.83E-01	5.12E-02	1.63E+02	7.14E-02	0.00E+00	0.00E+00	1.53E-01
SAU	Horseshoe Lake	3.40E-01	1.66E-01	3.38E-02	7.98E-01	1.68E-01	3.80E+01	7.19E-02	4.97E-01	1.89E-05	1.70E-01
SAU	Old Cahokia Creek	3.40E-01	1.66E-01	1.99E-01	8.81E-01	3.03E-01	6.80E+01	4.68E-01	0.00E+00	0.00E+00	1.70E-01
SAU	Mississippi River	3.40E-01	6.84E-01	4.78E-02	8.51E-01	4.45E-02	6.80E+01	4.45E-01	0.00E+00	0.00E+00	1.70E-01

Table B-10. Waterbody Characteristics for Cement Kilns

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
202	Elk City Lake	Lake	11	N	1.28E+07	9.70E+07	7.27E+06	7.39E+06	NA	4.00E+00	2.15E+02
202	Montgomery County State Park Lake	Lake	11	N	3.58E+05	1.31E+07	9.85E+05	1.00E+06	NA	4.00E+00	2.15E+02
202	Verdigris River	River	11	Y	3.27E+06	8.98E+08	6.73E+07	1.61E+09	8.20E-01	1.25E+00	2.15E+02
203	Catalpa Creek	River	3	N	5.19E+05	2.82E+08	1.41E+06	1.06E+08	5.96E-01	4.05E-01	3.50E+02
203	Gilmer Creek	River	3	N	1.24E+05	1.26E+08	6.31E+05	1.34E+07	4.58E-01	1.71E-01	3.50E+02
203	N. Branch Magowah Creek	River	3	N	1.61E+05	3.62E+07	1.81E+05	6.34E+07	5.58E-01	3.26E-01	3.50E+02
203	Shotbag Creek	River	3	N	1.78E+05	7.53E+07	3.77E+05	6.34E+07	5.58E-01	3.26E-01	3.50E+02
204	Bay Creek	River	7	N	2.73E+05	1.23E+08	4.80E+06	1.20E+08	5.80E-01	4.00E-01	2.10E+02
204	Little Calumet Creek	River	7	N	8.87E+04	2.26E+07	8.83E+05	6.62E+07	5.50E-01	3.40E-01	2.10E+02
204	Upper and Lower Swan Lake	Lake	7	N	4.58E+05	5.23E+06	2.04E+05	5.96E+05	NA	4.00E+00	2.10E+02
204	Mississippi River	River	7	Y	1.52E+07	9.26E+08	3.61E+07	1.16E+11	1.46E+00	6.82E+00	2.10E+02
302	Maumee River	River	4	Y	2.99E+06	4.98E+08	1.99E+07	4.56E+10	7.90E-01	1.11E+00	1.50E+02
302	Auglaize River	River	4	Y	1.04E+06	6.53E+08	2.61E+07	5.68E+10	8.20E-01	1.25E+00	1.50E+02
302	Six Mile Creek	River	4	Y	1.99E+05	6.53E+07	2.61E+06	2.30E+09	5.50E-01	3.40E-01	1.50E+02
304	Big Walnut Creek	River	5	N	2.60E+06	4.19E+08	3.15E+07	3.04E+08	3.96E-01	1.34E-01	1.85E+02
304	Glenn Flint Lake	Lake	5	N	1.31E+06	4.03E+07	3.02E+06	6.04E+06	NA	4.00E+00	1.85E+02
304	Deer Creek	River	5	Y	1.86E+06	2.24E+08	1.68E+07	8.40E+07	2.90E-01	1.01E-01	1.85E+02
320	Mud Devils Lake	Lake	4	N	3.87E+06	8.44E+07	1.35E+07	1.07E+07	NA	4.00E+00	7.50E+01
320	Thunder Bay River	River	4	N	6.05E+06	3.56E+08	5.69E+07	8.93E+08	4.97E-01	4.69E-01	7.50E+01
320	Long Lake	Lake	4	N	1.90E+07	6.10E+07	9.76E+06	7.74E+06	NA	4.00E+00	7.50E+01
321	Black Warrior River (most inclusive data)	River	3	N	3.32E+06	4.25E+08	3.14E+07	5.60E+09	9.40E-01	2.04E+00	3.75E+02

(continued)

Table B-10. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
321	Powell Creek	River	3	N	2.92E+05	1.37E+08	1.01E+07	3.41E+08	7.00E-01	6.70E-01	3.75E+02
321	Lake Demopolis	Lake	3	N	4.28E+07	4.25E+08	3.14E+07	1.08E+08	NA	4.00E+00	3.75E+02
321	Lake Henry	Lake	3	N	1.20E+05	6.86E+06	5.07E+05	1.74E+06	NA	4.00E+00	3.75E+02
BAT	Monocacy Creek	River	2	N	1.11E+06	1.22E+08	4.88E+06	4.73E+07	5.40E-01	2.90E-01	1.75E+02
BAT	Lehigh River	River	2	Y	8.63E+06	8.19E+08	3.27E+07	2.13E+09	8.38E-01	7.22E-01	1.75E+02
CHA	Allen Lake	Lake	11	N	7.32E+04	1.33E+06	1.45E+05	1.25E+05	NA	4.00E+00	2.44E+02
CHA	Sante Fe Lake	Lake	11	N	2.55E+05	9.53E+06	1.04E+06	8.96E+05	NA	4.00E+00	2.44E+02
CHA	Neosho River	River	11	Y	1.23E+06	9.04E+08	9.85E+07	2.20E+09	5.46E-01	1.92E-01	2.44E+02
FOR	Walnut Bayou	River	11	N	5.53E+05	3.44E+08	1.38E+07	6.62E+07	5.50E-01	3.40E-01	2.10E+02
FOR	West Flat Creek	River	11	N	6.36E+04	4.38E+07	1.75E+06	9.46E+06	4.30E-01	1.30E-01	2.10E+02
FOR	Hamilton Lake	Lake	11	N	2.28E+05	6.02E+06	2.41E+05	1.30E+06	NA	4.00E+00	2.10E+02
FRE	Salt Creek	River	11	N	3.20E+04	4.88E+07	1.95E+06	2.78E+07	1.80E-01	3.96E-02	2.00E+02
FRE	Verdigris River	River	11	N	1.17E+06	4.80E+08	1.92E+07	1.13E+09	5.46E-01	5.49E-02	2.00E+02
FRE	Fall River	River	11	Y	6.16E+05	4.16E+08	1.66E+07	4.61E+08	4.75E-01	4.57E-02	2.00E+02
HAR	Indian Field Swamp	River	3	N	9.62E+05	9.62E+05	3.85E+04	1.23E+08	2.53E-01	1.46E-01	3.00E+02
HAR	Walnut Branch	River	3	N	2.67E+05	2.67E+05	1.07E+04	3.39E+08	6.91E-01	6.57E-01	3.00E+02
HAR	Huttos Lake	Lake	3	N	2.31E+05	8.77E+05	3.51E+04	1.11E+05	NA	4.00E+00	3.00E+02
HOL	Huttos Lake	Lake	3	N	2.31E+05	8.77E+05	3.51E+04	1.10E+05	NA	4.00E+00	3.25E+02
HOL	Lake Merkel	Lake	3	N	8.90E+04	8.38E+06	3.35E+05	1.05E+06	NA	4.00E+00	3.25E+02
TEX	Armstrong Creek	River	12	N	7.66E+04	6.66E+07	2.66E+06	1.39E+07	4.60E-01	1.74E-01	2.75E+02
TEX	Massey Lake	Lake	12	N	2.51E+05	1.45E+07	5.79E+05	3.62E+05	NA	4.00E+00	2.75E+02

(continued)

Table B-10. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
TEX	Mountain Creek	River	12	N	1.17E+05	3.40E+08	1.36E+07	2.26E+07	1.62E-01	6.71E-02	2.75E+02
TEX	Waxahachie Creek	River	12	Y	1.02E+05	1.52E+08	6.09E+06	8.79E+06	1.13E-01	1.01E-01	2.75E+02
WAM	Connoquenessing Creek	river	5	N	7.06E+05	2.94E+08	5.26E+07	4.65E+08	7.09E-01	7.16E-01	1.25E+02
WAM	Hereford Manor Lake	lake	5	N	1.88E+05	2.99E+06	5.35E+05	5.32E+05	n/a	4.00E+00	1.25E+02
WAM	Beaver River	river	5	Y	1.16E+06	5.07E+08	9.08E+07	3.25E+09	7.92E-01	1.37E+00	1.25E+02
WAM	Slippery Rock Creek	river	5	Y	1.84E+06	1.46E+08	2.61E+07	1.03E+09	6.52E-01	1.14E+00	1.25E+02

(continued)

Table B-10. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
202	Elk City Lake	3.40E-01	3.03E-01	5.33E-02	6.78E-01	1.20E-01	7.00E+01	1.79E-01	1.76E+00	1.23E-04	2.02E-01
202	Montgomery County State Park Lake	3.40E-01	4.75E-01	7.15E-02	5.55E-01	1.80E-01	7.00E+01	3.09E-01	2.64E+01	1.85E-03	2.02E-01
202	Verdigris River	3.40E-01	3.28E-01	7.22E-02	5.66E-01	4.56E-02	2.06E+02	2.20E-01	0.00E+00	0.00E+00	2.02E-01
203	Catalpa Creek	3.40E-01	3.39E-01	6.14E-02	6.27E-01	5.27E-02	2.40E+01	3.48E-01	2.10E+02	5.03E-03	1.19E-01
203	Gilmer Creek	3.40E-01	3.03E-01	6.44E-02	6.12E-01	1.17E-01	2.40E+01	3.18E-01	1.47E+03	3.53E-02	1.19E-01
203	N. Branch Magowah Creek	3.40E-01	3.15E-01	6.32E-02	6.12E-01	1.36E-01	2.40E+01	3.25E-01	2.16E+01	5.18E-04	1.19E-01
203	Shotbag Creek	3.40E-01	4.50E-01	4.21E-02	7.53E-01	1.24E-01	2.40E+01	3.80E-01	4.75E+02	1.14E-02	1.19E-01
204	Bay Creek	3.40E-01	1.34E+00	5.98E-02	6.35E-01	1.17E-01	6.80E+01	8.15E-01	1.92E+02	1.31E-02	1.70E-01
204	Little Calumet Creek	3.40E-01	1.53E+00	6.51E-02	6.21E-01	1.69E-01	6.80E+01	9.87E-01	0.00E+00	0.00E+00	1.70E-01
204	Upper and Lower Swan Lake	3.40E-01	1.66E-01	7.27E-02	5.46E-01	2.02E-01	3.80E+01	1.06E-01	5.13E+00	1.95E-04	1.70E-01
204	Mississippi River	3.40E-01	1.38E+00	5.44E-02	6.88E-01	4.54E-02	6.80E+01	8.26E-01	0.00E+00	0.00E+00	1.70E-01
302	Maumee River	3.40E-01	1.64E-01	7.61E-02	5.26E-01	4.91E-02	2.10E+01	7.51E-02	0.00E+00	0.00E+00	1.86E-01
302	Auglaize River	3.40E-01	1.40E-01	7.76E-02	5.31E-01	4.75E-02	2.10E+01	6.61E-02	0.00E+00	0.00E+00	1.86E-01
302	Six Mile Creek	3.40E-01	1.66E-01	9.69E-02	5.45E-01	1.27E-01	2.10E+01	1.00E-01	0.00E+00	0.00E+00	1.86E-01
304	Big Walnut Creek	3.40E-01	1.87E+00	7.13E-02	6.61E-01	5.02E-02	2.70E+01	1.24E+00	2.56E+02	6.91E-03	1.54E-01
304	Glenn Flint Lake	3.40E-01	1.04E+00	7.31E-02	5.57E-01	1.34E-01	6.00E+00	5.99E-01	4.06E+02	2.44E-03	1.54E-01
304	Deer Creek	3.40E-01	1.71E+00	6.77E-02	6.44E-01	1.08E-01	2.70E+01	1.05E+00	4.64E+02	1.25E-02	1.54E-01
320	Mud Devils Lake	3.40E-01	2.43E-01	2.44E-02	9.65E-01	1.23E-01	6.00E+00	3.27E-02	1.18E+01	7.09E-05	1.36E-01
320	Thunder Bay River	3.40E-01	4.86E-01	3.67E-02	8.23E-01	5.12E-02	2.10E+01	8.40E-02	0.00E+00	0.00E+00	1.36E-01
320	Long Lake	3.40E-01	4.11E-01	1.45E-02	9.68E-01	1.28E-01	6.00E+00	3.30E-02	1.85E+00	1.11E-05	1.36E-01

(continued)

Table B-10. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
321	Black Warrior River (most inclusive data)	3.40E-01	3.13E-01	5.35E-02	7.35E-01	5.01E-02	2.40E+01	3.52E-01	0.00E+00	0.00E+00	1.19E-01
321	Powell Creek	3.40E-01	5.69E-01	6.85E-02	6.31E-01	1.15E-01	2.40E+01	7.03E-01	4.14E+02	9.94E-03	1.19E-01
321	Lake Demopolis	3.40E-01	3.13E-01	5.35E-02	7.35E-01	5.01E-02	6.00E+00	3.52E-01	2.66E+01	1.60E-04	1.19E-01
321	Lake Henry	3.40E-01	9.81E-01	3.89E-02	7.81E-01	1.96E-01	6.00E+00	8.52E-01	1.57E+03	9.41E-03	1.19E-01
BAT	Monocacy Creek	3.40E-01	1.39E+00	8.09E-02	5.86E-01	1.17E-01	2.70E+01	8.79E-01	3.77E+02	1.02E-02	1.69E-01
BAT	Lehigh River	3.40E-01	1.71E+00	5.57E-02	7.59E-01	4.61E-02	2.70E+01	9.62E-01	0.00E+00	0.00E+00	1.69E-01
CHA	Allen Lake	3.40E-01	9.52E-02	6.78E-02	5.78E-01	3.26E-01	7.00E+01	6.95E-02	4.18E+00	2.93E-04	1.70E-01
CHA	Sante Fe Lake	3.40E-01	2.36E-01	5.96E-02	6.43E-01	1.88E-01	7.00E+01	1.68E-01	1.34E+01	9.35E-04	1.70E-01
CHA	Neosho River	3.40E-01	2.71E-01	7.74E-02	5.32E-01	4.56E-02	2.06E+02	2.08E-01	0.00E+00	0.00E+00	1.70E-01
FOR	Walnut Bayou	3.40E-01	1.96E-01	4.98E-02	7.13E-01	5.14E-02	2.06E+02	1.12E-01	0.00E+00	0.00E+00	1.53E-01
FOR	West Flat Creek	3.40E-01	3.21E-01	3.27E-02	8.49E-01	1.33E-01	2.06E+02	1.43E-01	0.00E+00	0.00E+00	1.53E-01
FOR	Hamilton Lake	3.40E-01	7.82E-02	5.85E-02	6.43E-01	1.99E-01	7.00E+01	4.71E-02	0.00E+00	0.00E+00	1.53E-01
FRE	Salt Creek	3.40E-01	2.67E-01	7.49E-02	5.72E-01	1.31E-01	2.06E+02	1.74E-01	0.00E+00	0.00E+00	2.05E-01
FRE	Verdigris River	3.40E-01	2.82E-01	6.85E-02	5.90E-01	4.93E-02	2.06E+02	1.74E-01	0.00E+00	0.00E+00	2.05E-01
FRE	Fall River	3.40E-01	4.78E-01	5.29E-02	6.92E-01	5.02E-02	2.06E+02	2.67E-01	0.00E+00	0.00E+00	2.05E-01
HAR	Indian Field Swamp	3.40E-01	1.99E-01	4.34E-02	8.09E-01	3.39E-01	2.40E+01	1.60E-01	0.00E+00	0.00E+00	1.37E-01
HAR	Walnut Branch	3.40E-01	1.90E-01	1.73E-02	9.17E-01	3.98E-01	2.40E+01	6.91E-02	0.00E+00	0.00E+00	1.37E-01
HAR	Huttos Lake	3.40E-01	2.36E-01	3.75E-02	7.67E-01	3.43E-01	6.00E+00	1.55E-01	3.33E+01	2.00E-04	1.37E-01
HOL	Huttos Lake	3.40E-01	2.36E-01	3.75E-02	7.67E-01	3.43E-01	6.00E+00	1.68E-01	3.61E+01	2.17E-04	1.37E-01
HOL	Lake Merkel	3.40E-01	1.83E-01	2.51E-02	8.65E-01	1.91E-01	6.00E+00	9.84E-02	2.83E+02	1.70E-03	1.37E-01

(continued)

Table B-10. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
TEX	Armstrong Creek	3.40E-01	4.64E-01	7.92E-02	5.05E-01	1.26E-01	7.20E+01	3.90E-01	4.12E+02	2.97E-02	1.88E-01
TEX	Massey Lake	3.40E-01	4.76E-01	7.87E-02	5.08E-01	1.78E-01	7.00E+01	4.00E-01	5.72E+01	4.01E-03	1.88E-01
TEX	Mountain Creek	3.40E-01	5.35E-01	7.92E-02	5.66E-01	5.15E-02	7.20E+01	5.02E-01	8.53E+02	6.14E-02	1.88E-01
TEX	Waxahachie Creek	3.40E-01	4.40E-01	7.29E-02	5.58E-01	1.14E-01	7.20E+01	3.75E-01	7.99E+02	5.75E-02	1.88E-01
WAM	Connoquenessing Creek	3.40E-01	2.22E+00	5.25E-02	7.64E-01	5.24E-02	2.70E+01	8.46E-01	2.57E+01	6.93E-04	1.70E-01
WAM	Hereford Manor Lake	3.40E-01	2.55E+00	4.79E-02	7.15E-01	2.17E-01	6.00E+00	8.32E-01	4.75E+02	2.85E-03	1.70E-01
WAM	Beaver River	3.40E-01	1.30E+00	5.81E-02	7.99E-01	4.90E-02	2.70E+01	5.77E-01	0.00E+00	0.00E+00	1.70E-01
WAM	Slippery Rock Creek	3.40E-01	1.50E+00	6.95E-02	7.59E-01	1.14E-01	2.70E+01	7.54E-01	0.00E+00	0.00E+00	1.70E-01

Table B-11. Waterbody Characteristics for Lightweight Aggregate Kilns

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
ARV	James River	River	2	N	3.43E+06	9.52E+08	3.81E+07	3.60E+09	8.80E-01	1.65E+00	1.70E+02
ARV	Sports Lake	Lake	2	N	2.76E+05	5.70E+07	2.28E+06	1.01E+07	N/A	4.00E+00	1.70E+02
ARV	Holman Creek	River	2	N	3.68E+04	1.23E+07	4.92E+05	1.26E+07	4.60E-01	1.80E-01	1.70E+02
ARV	Rivanna River	River	2	Y	1.30E+06	2.19E+08	8.75E+06	3.41E+08	7.00E-01	6.70E-01	1.70E+02
BRO	Bluelick Creek (includes Clear Run)	River	5	N	5.71E+04	2.10E+07	3.03E+06	1.26E+07	4.60E-01	1.80E-01	2.80E+02
BRO	McNeely Lake	Lake	5	N	3.11E+05	1.31E+07	1.88E+06	2.66E+06	NA	4.00E+00	2.80E+02
BRO	Silver Lake	Lake	5	N	5.12E+04	1.49E+05	2.14E+04	3.02E+04	NA	4.00E+00	2.80E+02
BRO	Salt River (includes Floyd's Fork)	River	5	Y	3.51E+06	7.74E+08	1.11E+08	1.29E+09	7.90E-01	1.11E+00	2.80E+02
CAS	Cascade Creek	River	3	N	4.14E+05	1.05E+08	7.86E+06	6.34E+07	5.60E-01	7.25E-01	2.00E+02
CAS	Smith River	River	3	N	1.44E+06	2.44E+08	1.83E+07	5.66E+08	4.11E-01	5.27E-01	2.00E+02
CAS	Dan River	River	3	Y	4.69E+06	6.15E+06	4.61E+05	1.94E+09	5.21E-01	3.30E-01	2.00E+02
COH	Troy Reservoir	Lake	2	N	1.78E+05	2.46E+06	1.12E+06	5.30E+05	NA	4.00E+00	1.25E+02
COH	Hudson River	River	2	Y	1.27E+07	8.47E+08	3.87E+08	1.30E+10	9.69E-01	1.59E+00	1.25E+02
COH	Mohawk River	River	2	Y	1.61E+07	2.64E+08	1.21E+08	5.18E+09	7.50E-01	6.00E-01	1.25E+02
COH	Tomahannock Reservoir	Lake	2	Y	7.03E+06	7.90E+07	3.61E+07	1.71E+07	NA	4.00E+00	1.25E+02
NOR	Rocky River (includes Bear Creek and Long Creek)	River	3	N	1.96E+06	8.71E+08	4.35E+06	9.74E+08	7.60E-01	9.60E-01	2.60E+02
NOR	Long Lake/Creek	Lake	3	N	5.99E+05	3.13E+07	1.56E+05	6.35E+06	NA	4.00E+00	2.60E+02
NOR	Lake Tillery	Lake	3	Y	1.88E+07	2.03E+08	1.02E+06	4.13E+07	NA	4.00E+00	2.60E+02

(continued)

Table B-11. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
ARV	James River	3.40E-01	1.30E+00	3.93E-02	8.82E-01	4.53E-02	2.70E+01	5.85E-01	0.00E+00	0.00E+00	1.19E-01
ARV	Sports Lake	3.40E-01	1.28E+00	6.15E-02	8.98E-01	1.29E-01	6.00E+00	9.15E-01	4.01E+03	2.41E-02	1.19E-01
ARV	Holman Creek	3.40E-01	1.84E+00	1.72E-02	9.23E-01	1.82E-01	2.70E+01	3.78E-01	5.08E+02	1.37E-02	1.19E-01
ARV	Rivanna River	3.40E-01	1.70E+00	2.94E-02	8.70E-01	1.09E-01	2.70E+01	5.63E-01	1.20E+02	3.23E-03	1.19E-01
BRO	Bluelick Creek (includes Clear Run)	3.40E-01	2.59E+00	5.09E-02	8.91E-01	1.70E-01	2.70E+01	2.51E+00	5.61E+03	1.51E-01	1.86E-01
BRO	McNeely Lake	3.40E-01	1.38E+00	4.03E-02	7.82E-01	1.81E-01	6.00E+00	9.27E-01	1.16E+03	6.98E-03	1.86E-01
BRO	Silver Lake	3.40E-01	1.58E-01	1.37E-03	9.95E-01	4.74E-01	6.00E+00	4.63E-03	4.72E-01	2.83E-06	1.86E-01
BRO	Salt River (includes Floyd's Fork)	3.40E-01	1.93E+00	3.82E-02	8.08E-01	4.65E-02	2.70E+01	1.27E+00	1.13E+02	3.06E-03	1.86E-01
CAS	Cascade Creek	3.40E-01	1.26E+00	3.96E-02	8.48E-01	1.19E-01	2.40E+01	6.47E-01	6.61E+02	1.59E-02	1.70E-01
CAS	Smith River	3.40E-01	1.66E+00	2.27E-02	8.89E-01	1.07E-01	2.40E+01	5.13E-01	0.00E+00	0.00E+00	1.70E-01
CAS	Dan River	3.40E-01	1.40E+00	4.07E-02	8.34E-01	1.98E-01	2.40E+01	7.24E-01	0.00E+00	0.00E+00	1.70E-01
COH	Troy Reservoir	3.40E-01	2.22E+00	4.77E-02	7.15E-01	3.02E-01	6.00E+00	7.20E-01	4.98E+02	2.99E-03	1.19E-01
COH	Hudson River	3.40E-01	1.15E+00	3.52E-02	8.59E-01	4.59E-02	2.70E+01	3.32E-01	0.00E+00	0.00E+00	1.19E-01
COH	Mohawk River	3.40E-01	7.42E-01	3.33E-02	9.16E-01	5.31E-02	2.70E+01	2.16E-01	0.00E+00	0.00E+00	1.19E-01
COH	Tomahannock Reservoir	3.40E-01	1.98E+00	3.72E-02	7.92E-01	1.24E-01	6.00E+00	5.55E-01	1.26E+02	7.57E-04	1.19E-01
NOR	Rocky River (includes Bear Creek and Long Creek)	3.40E-01	1.43E+00	5.49E-02	7.03E-01	4.58E-02	2.40E+01	1.10E+00	4.31E+02	1.03E-02	1.36E-01
NOR	Long Lake/Creek	3.40E-01	1.08E+00	6.37E-02	6.64E-01	1.39E-01	6.00E+00	9.05E-01	1.08E+03	6.50E-03	1.36E-01
NOR	Lake Tillery	3.40E-01	1.61E+00	5.76E-02	8.62E-01	1.10E-01	6.00E+00	1.58E+00	3.12E+02	1.87E-03	1.36E-01

Table B-12. Waterbody Characteristics for On-Site Incinerators

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
334	Mississippi River	River	7	N	2.92E+07	8.41E+08	3.28E+07	1.47E+10	1.01E+00	1.71E+00	1.50E+02
334	Vermillion River	River	7	N	1.68E+06	4.01E+08	1.56E+07	7.32E+07	2.74E-01	2.50E-01	1.50E+02
334	Colby Lake	Lake	7	N	4.49E+05	4.49E+05	1.75E+04	2.88E+04	NA	4.00E+00	1.50E+02
334	Lake Isabelle	Lake	7	N	3.32E+05	1.36E+06	5.31E+04	8.72E+04	NA	4.00E+00	1.50E+02
463	Blue River	River	10	N	5.52E+05	2.16E+08	1.06E+08	8.64E+06	2.74E-01	5.36E-01	2.10E+02
463	Rock Creek	River	10	N	5.89E+04	2.36E+07	1.16E+07	1.45E+07	4.60E-01	1.70E-01	2.10E+02
463	Shoal Creek	River	10	N	8.92E+04	1.67E+08	8.20E+07	2.21E+06	7.00E-02	1.37E-01	2.10E+02
463	Missouri River	River	10	Y	1.10E+07	8.73E+08	4.29E+08	3.35E+07	1.06E+00	1.94E+00	2.10E+02
464	Ottowa River	RIVER	4	Y	1.27E+06	3.77E+08	1.46E+08	1.53E+08	3.72E-01	1.48E+00	1.50E+02
464	Twin Lakes Reservoir	Lake	4	Y	5.33E+04	4.25E+05	1.65E+05	5.40E+04	NA	4.00E+00	1.50E+02
464	Metzger/Ferguson Reservoir	Lake	4	Y	1.84E+06	1.84E+06	7.12E+05	2.34E+05	NA	4.00E+00	1.50E+02
504	Pennsauken Creek	RIVER	2	N	9.73E+04	4.07E+07	2.00E+07	3.88E+07	2.07E-01	2.29E-01	1.80E+02
504	Darby Creek	RIVER	2	N	1.76E+05	1.76E+08	8.64E+07	8.80E+07	2.96E-01	1.58E-01	1.80E+02
504	Cooper River Lake	LAKE	2	N	4.40E+05	5.06E+07	2.49E+07	1.12E+07	N/A	4.00E+00	1.80E+02
504	Schuylkill River	RIVER	2	Y	7.43E+05	1.79E+08	8.79E+07	2.80E+09	7.56E-01	5.79E-01	1.80E+02
600	Lake Jackson	Lake	12	N	1.64E+06	2.23E+06	3.98E+05	1.42E+05	NA	4.00E+00	2.75E+02
600	Oyster Creek	River	12	N	1.11E+06	5.75E+07	1.03E+07	2.98E+08	4.75E-01	2.62E-01	2.75E+02
600	Brazos River	River	12	Y	4.86E+06	9.90E+07	1.77E+07	7.20E+09	7.83E-01	1.66E+00	2.75E+02
711	Brechtel Lake	Lake	8	N	1.41E+05	6.71E+05	4.96E+04	1.70E+05	NA	4.00E+00	5.50E+02
711	Mississippi River	River	8	Y	6.55E+07	7.66E+07	5.67E+06	4.18E+11	2.23E+00	6.69E+00	5.50E+02

(continued)

Table B-12. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
806	Wolf Lake	Lake	4	N	3.51E+06	1.21E+07	7.62E+06	1.54E+06	NA	4.00E+00	1.55E+02
806	Lake George	Lake	4	N	5.29E+05	1.63E+06	1.02E+06	2.06E+05	NA	4.00E+00	1.55E+02
806	Little Calumet River	River	7	N	5.61E+05	5.29E+08	3.34E+08	6.62E+07	5.50E-01	3.40E-01	1.55E+02
806	Grand Calumet River	River	4	N	1.75E+05	9.73E+07	6.13E+07	3.15E+07	4.90E-01	2.30E-01	1.55E+02
915	Genesee River	River	4	N	1.08E+06	3.00E+08	2.00E+08	2.52E+09	7.32E-01	5.12E-01	7.50E+01
915	Irondequoit Bay	Lake	4	N	6.88E+06	2.51E+08	1.67E+08	4.80E+07	NA	4.00E+00	7.50E+01
915	Highland Reservoir	Lake	4	Y	2.29E+04	2.29E+04	1.52E+04	4.36E+03	NA	4.00E+00	7.50E+01
A32	Armand Bayou	River	12	N	8.10E+04	1.28E+08	1.38E+07	1.08E+08	3.20E-01	1.65E-01	4.00E+02
A43	Twelvemile Creek	River	4	N	7.23E+04	6.93E+07	3.88E+07	4.10E+07	2.13E-01	9.10E-02	8.00E+01
A43	Bergholtz Creek	River	4	N	7.57E+04	4.75E+07	2.66E+07	1.34E+07	4.58E-01	1.71E-01	8.00E+01
A43	Cayuga Creek	River	4	N	1.37E+05	3.70E+07	2.07E+07	1.72E+08	3.87E-01	2.50E-01	8.00E+01
A43	Niagara River	River	4	Y	2.17E+06	7.34E+08	4.11E+08	8.06E+08	7.71E-01	8.75E-01	8.00E+01
A50	Carpenters Bayou	River	12	N	1.44E+05	5.84E+07	8.35E+06	7.45E+07	2.74E-01	1.43E-01	4.50E+02
A50	Highlands Reservoir	Lake	12	N	1.89E+06	5.21E+06	7.45E+05	7.92E+05	NA	4.00E+00	4.50E+02
A50	Buffulo Bayou	River	12	N	1.84E+06	2.18E+08	3.11E+07	3.43E+09	6.46E-01	1.20E+00	4.50E+02
A50	San Jacinto River	River	12	Y	7.56E+05	8.89E+07	1.27E+07	2.33E+09	5.61E-01	3.51E-01	4.50E+02
A62	Caney Creek	River	12	N	3.95E+05	1.96E+08	2.82E+07	1.33E+08	2.65E-01	1.40E-01	4.25E+02
A62	E & W Fork Crystal Cr.	River	12	N	3.41E+05	9.77E+07	1.41E+07	1.10E+08	7.80E-01	3.75E-01	4.25E+02
A62	Stewarts Creek	River	12	N	1.05E+05	5.63E+07	8.11E+06	4.31E+07	2.16E-01	9.45E-02	4.25E+02
A62	Lewis Creek Reservoir	Lake	12	N	1.75E+06	9.84E+06	1.42E+06	1.25E+06	NA	4.00E+00	4.25E+02
B20	Cuyahoga River	River	4	N	8.47E+05	3.82E+08	1.61E+08	6.56E+08	7.30E-01	8.20E-01	1.20E+02

(continued)

Table B-12. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
B20	Upper and Lower Shaker Lake	Lake	4	N	9.43E+04	1.27E+07	5.35E+06	1.62E+06	NA	4.00E+00	1.20E+02
B20	Euclid Creek	River	4	N	1.11E+05	5.40E+07	2.27E+07	3.15E+07	4.90E-01	2.30E-01	1.20E+02
B20	Fairmont Rerservoir	Lake	4	N	2.77E+04	3.24E+05	1.36E+05	4.12E+04	NA	4.00E+00	1.20E+02
HAN	Fabius River	River	7	N	1.42E+06	2.32E+08	1.16E+06	3.41E+08	7.00E-01	6.70E-01	2.00E+02
HAN	Spring Lake	Lake	7	N	2.73E+04	2.01E+05	1.00E+03	2.29E+04	NA	4.00E+00	2.00E+02
HAN	Mississippi River	River	7	Y	1.42E+07	8.67E+08	4.34E+06	7.03E+10	1.31E+00	5.57E+00	2.00E+02
KIN	North Fork Holston River	River	6	N	1.07E+06	3.16E+08	1.11E+08	3.41E+08	7.00E-01	6.70E-01	1.60E+02
KIN	Kingsport Reservoir	Lake	6	N	2.17E+05	1.34E+06	4.73E+05	3.08E+05	NA	4.00E+00	1.60E+02
KIN	South Fork Holston River	River	6	Y	1.77E+06	4.76E+08	1.68E+08	1.61E+09	8.20E-01	1.25E+00	1.60E+02
KIN	Reedy Creek	River	6	Y	2.03E+05	1.17E+08	4.14E+07	3.15E+07	4.90E-01	2.30E-01	1.60E+02
MCI	Hals Lake	Lake	3	N	1.12E+06	1.32E+08	5.15E+06	3.35E+07	NA	4.00E+00	4.10E+02
MCI	Hellcat Lake	Lake	3	N	2.24E+05	8.38E+06	3.27E+05	2.13E+06	NA	4.00E+00	4.10E+02
MCI	Alabama River	River	3	N	8.63E+06	2.14E+08	8.35E+06	2.08E+10	1.10E+00	3.51E+00	4.10E+02
MCI	Tombigbee River	River	3	Y	8.03E+06	7.33E+08	2.86E+07	1.64E+10	1.07E+00	3.15E+00	4.10E+02
MID	Tittabawassee River (plus Sanford Lake)	River	4	N	6.20E+06	3.65E+08	1.28E+08	1.61E+09	8.20E-01	1.25E+00	7.50E+01
MID	Sturgeon Creek	River	4	N	2.40E+05	1.45E+08	5.09E+07	6.62E+07	5.50E-01	3.40E-01	7.50E+01
MID	Kawkawlin River	River	4	N	3.88E+05	2.59E+08	9.13E+07	6.62E+07	5.50E-01	6.70E-01	7.50E+01
MID	Chippewa River (most inclusive data)	River	4	N	5.68E+05	1.01E+08	3.55E+07	3.41E+08	7.00E-01	6.70E-01	7.50E+01
STG	Bayou Plaquemine	River	8	N	5.71E+04	9.54E+06	7.06E+05	1.34E+07	4.60E-01	1.70E-01	5.00E+02
STG	Manchac Bayou	River	8	N	3.07E+05	3.64E+08	2.70E+07	1.19E+08	2.50E-01	2.53E-01	5.00E+02
STG	Bayou Fountain	River	8	N	3.16E+05	1.04E+08	7.72E+06	5.25E+07	2.38E-01	2.87E-01	5.00E+02
STG	Missisippi River	River	8	Y	7.29E+07	1.17E+08	8.67E+06	4.17E+11	2.23E+00	6.64E+00	5.00E+02

(continued)

Table B-12. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
334	Mississippi River	3.40E-01	9.68E-01	6.56E-02	6.47E-01	4.60E-02	6.80E+01	4.70E-01	0.00E+00	0.00E+00	2.06E-01
334	Vermillion River	3.40E-01	5.08E-01	7.48E-02	5.49E-01	5.04E-02	6.80E+01	2.39E-01	0.00E+00	0.00E+00	2.06E-01
334	Colby Lake	3.40E-01	1.05E+00	3.63E-02	7.73E-01	3.73E-01	3.80E+01	3.37E-01	3.25E+00	1.23E-04	2.06E-01
334	Lake Isabelle	3.40E-01	3.27E-01	6.29E-03	1.00E+00	3.25E-01	3.80E+01	2.35E-02	5.63E-01	2.14E-05	2.06E-01
463	Blue River	3.40E-01	8.60E-01	1.93E-02	9.97E-01	1.09E-01	1.20E+02	2.65E-01	7.86E+01	9.43E-03	1.89E-01
463	Rock Creek	3.40E-01	1.40E+00	9.87E-03	1.00E+00	1.68E-01	1.20E+02	2.20E-01	0.00E+00	0.00E+00	1.89E-01
463	Shoal Creek	3.40E-01	8.84E-01	5.78E-02	6.75E-01	1.13E-01	1.20E+02	5.52E-01	9.45E+02	1.13E-01	1.89E-01
463	Missouri River	3.40E-01	8.75E-01	4.38E-02	8.46E-01	4.58E-02	1.20E+02	5.19E-01	1.27E+01	1.53E-03	1.89E-01
464	Ottowa River	3.40E-01	4.54E-01	7.28E-02	6.18E-01	5.08E-02	2.10E+01	2.33E-01	4.73E+01	9.94E-04	1.70E-01
464	Twin Lakes Reservoir	3.40E-01	5.79E-01	1.47E-01	1.00E+00	3.76E-01	6.00E+00	9.74E-01	4.86E+02	2.91E-03	1.70E-01
464	Metzger/Ferguson Reservoir	3.40E-01	5.79E-01	2.68E-03	9.83E-01	3.13E-01	6.00E+00	1.74E-02	7.82E-01	4.69E-06	1.70E-01
504	Pennsauken Creek	3.40E-01	3.20E-01	4.32E-02	9.73E-01	1.34E-01	2.70E+01	1.84E-01	0.00E+00	0.00E+00	1.54E-01
504	Darby Creek	3.40E-01	9.72E-01	2.63E-02	9.89E-01	1.12E-01	2.70E+01	3.47E-01	9.36E+02	2.53E-02	1.54E-01
504	Cooper River Lake	3.40E-01	3.98E-01	1.38E-02	9.69E-01	1.31E-01	6.00E+00	7.31E-02	1.58E+02	9.46E-04	1.54E-01
504	Schuylkill River	3.40E-01	9.91E-01	2.62E-02	9.83E-01	1.12E-01	2.70E+01	3.50E-01	0.00E+00	0.00E+00	1.54E-01
600	Lake Jackson	3.40E-01	6.93E-02	7.36E-01	9.60E-01	3.06E-01	7.00E+01	1.03E+00	6.01E+00	4.20E-04	2.06E-01
600	Oyster Creek	3.40E-01	7.01E-02	3.51E-02	8.82E-01	1.29E-01	7.20E+01	4.54E-02	0.00E+00	0.00E+00	2.06E-01
600	Brazos River	3.40E-01	6.94E-02	5.17E-02	8.48E-01	1.20E-01	7.20E+01	6.37E-02	0.00E+00	0.00E+00	2.06E-01
711	Brechtel Lake	3.40E-01	6.93E-02	1.50E-03	1.00E+00	3.55E-01	3.80E+01	4.34E-03	0.00E+00	0.00E+00	1.37E-01
711	Mississippi River	3.40E-01	8.65E-02	1.05E-02	9.81E-01	1.24E-01	1.63E+02	3.73E-02	0.00E+00	0.00E+00	1.37E-01

(continued)

Table B-12. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
806	Wolf Lake	3.40E-01	5.94E-01	7.90E-02	1.00E+00	1.82E-01	6.00E+00	5.54E-01	5.77E+01	3.46E-04	1.53E-01
806	Lake George	3.40E-01	5.94E-01	1.91E-01	1.00E+00	3.18E-01	6.00E+00	1.34E+00	2.18E+02	1.31E-03	1.53E-01
806	Little Calumet River	3.40E-01	2.82E-01	4.55E-02	9.20E-01	4.87E-02	6.80E+01	1.39E-01	0.00E+00	0.00E+00	1.53E-01
806	Grand Calumet River	3.40E-01	5.94E-01	6.75E-02	9.91E-01	1.20E-01	2.10E+01	4.69E-01	1.32E+03	2.77E-02	1.53E-01
915	Genesee River	3.40E-01	6.87E-01	4.76E-02	7.74E-01	5.23E-02	2.10E+01	1.45E-01	0.00E+00	0.00E+00	1.88E-01
915	Irondequoit Bay	3.40E-01	9.61E-01	3.79E-02	8.67E-01	1.07E-01	6.00E+00	1.81E-01	1.11E+02	6.65E-04	1.88E-01
915	Highland Reservoir	3.40E-01	2.66E+00	1.00E-02	1.00E+00	5.99E-01	6.00E+00	1.52E-01	1.50E+01	9.01E-05	1.88E-01
A32	Armand Bayou	3.40E-01	6.93E-02	6.90E-02	6.75E-01	1.16E-01	7.20E+01	9.85E-02	0.00E+00	0.00E+00	1.36E-01
A43	Twelvemile Creek	3.40E-01	4.80E-01	9.68E-03	9.98E-01	1.26E-01	2.10E+01	2.83E-02	0.00E+00	0.00E+00	2.04E-01
A43	Bergholtz Creek	3.40E-01	5.50E-01	1.83E-02	1.00E+00	1.32E-01	2.10E+01	6.13E-02	6.42E+01	1.35E-03	2.04E-01
A43	Cayuga Creek	3.40E-01	4.04E-01	2.38E-02	1.00E+00	1.36E-01	2.10E+01	5.87E-02	0.00E+00	0.00E+00	2.04E-01
A43	Niagara River	3.40E-01	4.45E-01	2.69E-02	9.40E-01	4.68E-02	2.10E+01	6.87E-02	0.00E+00	0.00E+00	2.04E-01
A50	Carpenters Bayou	3.40E-01	8.64E-02	3.50E-02	8.11E-01	1.28E-01	7.20E+01	8.40E-02	0.00E+00	0.00E+00	1.37E-01
A50	Highlands Reservoir	3.40E-01	6.93E-02	5.39E-02	6.63E-01	2.03E-01	7.00E+01	8.50E-02	2.59E-01	1.81E-05	1.37E-01
A50	Buffulo Bayou	3.40E-01	7.10E-02	3.17E-02	8.84E-01	1.09E-01	7.20E+01	6.83E-02	0.00E+00	0.00E+00	1.37E-01
A50	San Jacinto River	3.40E-01	8.54E-02	3.20E-02	8.49E-01	1.22E-01	7.20E+01	7.97E-02	0.00E+00	0.00E+00	1.37E-01
A62	Caney Creek	3.40E-01	1.91E-01	1.13E-02	9.96E-01	1.10E-01	7.20E+01	6.96E-02	0.00E+00	0.00E+00	1.37E-01
A62	E & W Fork Crystal Cr.	3.40E-01	3.05E-01	3.79E-02	9.89E-01	1.20E-01	7.20E+01	3.70E-01	0.00E+00	0.00E+00	1.37E-01
A62	Stewarts Creek	3.40E-01	3.51E-01	1.41E-02	9.89E-01	1.29E-01	7.20E+01	1.58E-01	0.00E+00	0.00E+00	1.37E-01
A62	Lewis Creek Reservoir	3.40E-01	4.36E-01	5.34E-03	9.98E-01	1.87E-01	7.00E+01	7.53E-02	4.18E-01	2.92E-05	1.37E-01

(continued)

Table B-12. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
B20	Cuyahoga River	3.40E-01	1.04E+00	3.18E-02	9.31E-01	5.07E-02	2.10E+01	2.81E-01	0.00E+00	0.00E+00	1.70E-01
B20	Upper and Lower Shaker Lake	3.40E-01	7.77E-01	1.00E-02	1.00E+00	1.81E-01	6.00E+00	7.11E-02	2.73E+02	1.64E-03	1.70E-01
B20	Euclid Creek	3.40E-01	8.74E-01	1.96E-02	9.27E-01	1.30E-01	2.10E+01	1.45E-01	1.51E+02	3.18E-03	1.70E-01
B20	Fairmont Rerservoir	3.40E-01	9.70E-01	8.53E-03	1.00E+00	3.89E-01	6.00E+00	7.56E-02	5.60E+01	3.36E-04	1.70E-01
HAN	Fabius River	3.40E-01	9.04E-01	7.76E-02	5.41E-01	1.08E-01	6.80E+01	5.79E-01	0.00E+00	0.00E+00	1.69E-01
HAN	Spring Lake	3.40E-01	1.19E+00	9.61E-03	1.00E+00	4.56E-01	3.80E+01	1.74E-01	1.46E+01	5.54E-04	1.69E-01
HAN	Mississippi River	3.40E-01	8.87E-01	6.57E-02	6.28E-01	4.58E-02	6.80E+01	5.58E-01	0.00E+00	0.00E+00	1.69E-01
KIN	North Fork Holston River	3.40E-01	4.43E+00	2.74E-02	8.59E-01	5.20E-02	1.50E+01	1.27E+00	9.80E+02	1.47E-02	1.36E-01
KIN	Kingsport Reservoir	3.40E-01	5.19E+00	3.45E-03	1.00E+00	3.26E-01	6.00E+00	2.19E-01	7.20E+01	4.32E-04	1.36E-01
KIN	South Fork Holston River	3.40E-01	2.53E+00	4.94E-02	7.51E-01	4.94E-02	1.50E+01	1.14E+00	1.03E+02	1.55E-03	1.36E-01
KIN	Reedy Creek	3.40E-01	2.95E+00	3.25E-02	8.66E-01	1.18E-01	1.50E+01	1.01E+00	4.45E+03	6.67E-02	1.36E-01
MCI	Hals Lake	3.40E-01	7.40E-01	1.91E-03	9.96E-01	1.16E-01	6.00E+00	4.41E-02	7.04E+01	4.22E-04	1.53E-01
MCI	Hellcat Lake	3.40E-01	1.22E-01	2.38E-03	1.00E+00	1.91E-01	6.00E+00	9.10E-03	1.33E+00	7.98E-06	1.53E-01
MCI	Alabama River	3.40E-01	1.40E-01	2.90E-03	9.93E-01	1.09E-01	2.40E+01	1.26E-02	0.00E+00	0.00E+00	1.53E-01
MCI	Tombigbee River	3.40E-01	2.95E-01	1.47E-02	9.69E-01	4.68E-02	2.40E+01	1.31E-01	0.00E+00	0.00E+00	1.53E-01
MID	Tittabawassee River (plus Sanford Lake)	3.40E-01	1.19E-01	4.42E-02	7.95E-01	5.10E-02	2.10E+01	2.38E-02	0.00E+00	0.00E+00	1.70E-01
MID	Sturgeon Creek	3.40E-01	1.18E-01	3.05E-02	8.49E-01	1.15E-01	2.10E+01	1.74E-02	0.00E+00	0.00E+00	1.70E-01
MID	Kawkawlin River	3.40E-01	1.22E-01	6.95E-02	6.02E-01	5.33E-02	2.10E+01	2.92E-02	0.00E+00	0.00E+00	1.70E-01
MID	Chippewa River (most inclusive data)	3.40E-01	1.22E-01	3.53E-02	8.63E-01	1.20E-01	2.10E+01	2.13E-02	0.00E+00	0.00E+00	1.70E-01
STG	Bayou Plaquemine	3.40E-01	9.52E-02	6.13E-02	6.65E-01	1.88E-01	1.63E+02	1.48E-01	0.00E+00	0.00E+00	1.36E-01

(continued)

Table B-12. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
STG	Manchac Bayou	3.40E-01	2.77E-01	4.46E-02	8.04E-01	5.10E-02	1.63E+02	3.78E-01	0.00E+00	0.00E+00	1.36E-01
STG	Bayou Fountain	3.40E-01	2.41E-01	5.79E-02	7.68E-01	1.19E-01	1.63E+02	4.09E-01	0.00E+00	0.00E+00	1.36E-01
STG	Missisippi River	3.40E-01	1.70E-01	2.55E-02	9.58E-01	1.18E-01	1.63E+02	1.58E-01	0.00E+00	0.00E+00	1.36E-01

Table B-13. Waterbody Characteristics for On-Site Small Incinerators

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
340	Sunfish Creek	River	5	N	1.51E+05	1.33E+08	9.85E+06	1.17E+08	2.47E-01	9.80E-02	1.50E+02
340	Proctor Creek	River	5	N	1.48E+05	5.63E+07	4.17E+06	6.34E+07	5.60E-01	3.30E-01	1.50E+02
340	Fish Creek	River	5	N	6.50E+05	2.72E+08	2.01E+07	2.01E+08	3.26E-01	5.21E-01	1.50E+02
340	Ohio River	River	5	Y	1.32E+07	1.08E+09	8.00E+07	3.49E+10	8.17E-01	3.10E+00	1.50E+02
342	Kalamazoo River	River	4	N	2.47E+06	5.16E+08	2.54E+08	1.01E+09	5.21E-01	9.27E-01	1.50E+02
342	East Lake	Lake	4	N	4.84E+05	8.64E+06	4.25E+06	1.10E+06	NA	4.00E+00	1.50E+02
342	Portage Creek	River	4	N	3.06E+05	1.44E+08	7.08E+07	4.83E+07	5.39E-01	2.91E-01	1.50E+02
342	Portage River	River	4		3.77E+05	4.20E+08	2.07E+08	6.38E+07	2.56E-01	2.77E-01	1.50E+02
453	Lake Spivey	Lake	3	Y	1.90E+06	2.91E+07	1.53E+07	7.02E+06	NA	4.00E+00	3.00E+02
453	Jester Creek	River	3	Y	5.65E+04	2.94E+07	1.55E+07	3.15E+07	4.60E-01	1.80E-01	3.00E+02
453	Flint River	River	3	Y	4.09E+05	2.82E+08	1.48E+08	1.20E+08	5.80E-01	4.00E-01	3.00E+02
468	Wissahickon Creek	River	2	N	3.83E+05	1.62E+08	8.51E+07	8.58E+07	5.80E-01	3.70E-01	1.80E+02
468	Tacony Creek	River	2	N	1.17E+05	7.80E+07	4.10E+07	2.37E+07	7.05E+00	2.16E-01	1.80E+02
468	Schuylkill	River	2	Y	1.45E+06	5.88E+08	3.10E+08	2.80E+09	7.56E-01	5.79E-01	1.80E+02
468	Pickering Creek Reservoir	Lake	2	Y	5.33E+05	2.34E+07	1.23E+07	5.05E+06	NA	4.00E+00	1.80E+02
701	Wabash River	River	5	N	3.78E+06	7.93E+08	3.96E+06	9.21E+09	9.14E-01	8.50E-01	2.00E+02
701	Sugar Creek	River	5	N	2.25E+05	4.67E+07	2.33E+05	6.26E+08	5.36E-01	2.13E-01	2.00E+02
701	Big Racoon Creek	River	5	N	7.67E+05	3.68E+08	1.84E+06	4.70E+08	4.79E-01	3.54E-01	2.00E+02
704	Garvey Reservoir	Lake	18	N	1.17E+05	1.17E+05	8.19E+04	1.52E+03	NA	4.00E+00	5.00E+01
704	Legg Lake	Lake	18	N	1.36E+05	1.36E+05	9.50E+04	1.76E+03	NA	4.00E+00	5.00E+01

(continued)

Table B-13. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
704	Silver Lake Res.	Lake	18	Y	2.97E+05	1.24E+06	8.68E+05	1.61E+04	NA	4.00E+00	5.00E+01
708	Grindle Creek	River	3	N	5.06E+05	2.10E+08	2.29E+07	6.62E+07	5.50E-01	3.40E-01	3.00E+02
708	Parker Creek	River	3	N	6.38E+04	2.68E+07	2.92E+06	1.26E+07	4.60E-01	1.80E-01	3.00E+02
708	Tranters Creek	River	3	Y	1.04E+06	2.22E+08	2.42E+07	3.41E+08	7.00E-01	6.70E-01	3.00E+02
725	Passaic River	River	2	N	1.06E+08	1.79E+06	7.50E+05	1.25E+09	5.67E-01	5.18E-01	1.75E+02
725	Silver Lake Reservoir	Lake	2	Y	3.83E+05	1.57E+05	6.61E+04	4.00E+04	NA	4.00E+00	1.75E+02
725	Reservoir No. 2	Lake	2	Y	1.05E+05	3.52E+04	1.48E+04	8.94E+03	NA	4.00E+00	1.75E+02
725	Rahway River	River	2	Y	1.39E+08	7.33E+05	3.08E+05	1.54E+08	3.72E-01	4.60E-01	1.75E+02
824	Newton Lake	Lake	2	N	3.91E+05	1.19E+07	4.19E+06	2.73E+06	NA	4.00E+00	1.85E+02
824	Big Timber Creek	River	2	N	5.13E+04	1.34E+08	4.73E+07	8.10E+07	2.01E-01	2.01E-01	1.85E+02
824	Darby Creek	River	2	N	1.45E+05	1.42E+08	5.01E+07	8.80E+07	2.96E-01	1.58E-01	1.85E+02
824	Schuylkill River	River	2	Y	5.53E+05	9.24E+07	3.25E+07	2.80E+09	7.56E-01	5.79E-01	1.85E+02
904	Pascagoula River	River	3	N	9.20E+05	4.93E+07	1.05E+07	1.41E+10	1.05E+00	4.57E+00	5.50E+02
904	Escatawpa River	River	3	N	2.04E+06	1.86E+08	3.96E+07	2.33E+09	7.10E-01	9.51E-01	5.50E+02
906	Mississippi River	River	7	N	1.41E+07	5.40E+08	2.10E+07	4.88E+10	9.24E-01	2.94E+00	1.80E+02
906	Cooperas Creek	River	7	N	2.20E+05	9.87E+07	3.85E+06	9.96E+07	3.11E-01	2.74E-01	1.80E+02
906	Eliza Creek	River	7	N	2.75E+05	9.36E+07	3.65E+06	1.05E+08	3.20E-01	2.83E-01	1.80E+02
906	Muscatine Slough	River	7	N	2.94E+05	1.48E+08	5.78E+06	6.32E+00	5.60E-01	3.30E-01	1.80E+02
A14	New River	River	8	N	5.57E+05	2.16E+08	1.60E+07	1.07E+08	3.20E-01	2.93E-01	5.50E+02
A14	Bayou Conway	River	8	N	3.01E+05	1.34E+08	9.91E+06	6.32E+07	5.60E-01	3.30E-01	5.50E+02
A14	Mississippi River	River	8	Y	6.07E+07	7.21E+07	5.33E+06	4.16E+11	2.23E+00	6.66E+00	5.50E+02

(continued)

Table B-13. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
A14	Bayou Lafourche	River	8	Y	2.84E+05	3.53E+06	2.61E+05	2.29E+08	6.60E-01	5.60E-01	5.50E+02
A26	Big Creek (includes Sulfur Spring Creek)	River	11	Y	5.86E+04	4.67E+07	2.34E+05	1.26E+07	4.60E-01	1.80E-01	2.40E+02
A26	Carter Creek	River	11	Y	1.69E+05	1.03E+08	5.17E+05	6.62E+07	5.50E-01	3.40E-01	2.40E+02
A26	Dota Creek	River	11	Y	8.75E+05	1.64E+08	8.21E+05	3.41E+08	7.00E-01	6.70E-01	2.40E+02
A31	Nottaway River	River	3	N	2.35E+06	4.70E+08	3.53E+07	1.29E+09	7.90E-01	1.11E+00	2.50E+02
A31	Chowan River	River	3	N	3.45E+06	5.99E+08	4.50E+07	3.60E+09	8.80E-01	1.65E+00	2.50E+02
A31	Nottaway Swamp (a creek)	River	3	N	2.44E+05	7.54E+07	5.66E+06	6.62E+07	5.50E-01	3.40E-01	2.50E+02
A45	Sheldon Reservoir	Lake	12	N	5.30E+06	5.30E+06	1.50E+06	6.73E+05	NA	4.00E+00	3.00E+02
A45	Highlands Reservoir	Lake	12	N	1.89E+06	5.21E+06	1.47E+06	6.62E+05	NA	4.00E+00	3.00E+02
A45	Greens Bayou	River	12	N	4.71E+05	9.79E+07	2.77E+07	4.73E+07	5.20E-01	2.80E-01	3.00E+02
A45	Buffalo Bayou	River	12	Y	6.06E+05	3.87E+08	1.10E+08	2.84E+08	6.70E-01	6.00E-01	3.00E+02
A46	Little Muskingum River	River	5	N	4.31E+05	3.84E+08	1.92E+06	2.30E+08	6.40E-01	5.40E-01	1.50E+02
A46	Ohio River	River	5	Y	8.49E+06	3.49E+08	1.75E+06	2.52E+10	1.16E+00	4.22E+00	1.50E+02
A46	Middle Island Creek	River	5	Y	1.61E+06	4.80E+08	2.40E+06	3.41E+08	7.00E-01	6.70E-01	1.50E+02
A47	Caney River	River	11	N	1.80E+06	7.21E+08	1.04E+08	3.41E+08	7.00E-01	6.70E-01	2.50E+02
A47	Sand Creek	River	11	N	5.07E+05	3.23E+08	4.66E+07	6.62E+07	5.50E-01	3.40E-01	2.50E+02
A47	Bar-Dew Lake	Lake	11	N	1.65E+05	4.92E+06	7.09E+05	3.15E+05	NA	4.00E+00	2.50E+02
A47	Lake Hudson	Lake	11	Y	1.13E+06	3.10E+07	4.47E+06	1.98E+06	NA	4.00E+00	2.50E+02
A55	Mohawk River	River	2	N	2.71E+06	7.29E+08	7.94E+07	5.49E+09	7.68E-01	7.71E-01	1.25E+02
A55	Acplause Kill River	River	2	N	1.70E+05	1.49E+08	1.62E+07	8.89E+07	2.96E-01	1.83E-01	1.25E+02
A55	Stony Creek Reservoir	Lake	2	Y	1.72E+06	2.73E+07	2.98E+06	6.94E+06	NA	4.00E+00	1.25E+02

(continued)

Table B-13. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
A55	Watervliet Reservoir	Lake	2	Y	1.60E+06	2.42E+08	2.63E+07	6.14E+07	NA	4.00E+00	1.25E+02
B18	Gulf Intercoastal Waterway	River	8	N	1.46E+06	3.20E+08	4.61E+07	6.50E+08	4.36E-01	5.67E-01	5.00E+02
B18	Bayou La Butte	River	8	N	9.79E+04	4.86E+07	7.00E+06	6.34E+07	5.60E-01	3.30E-01	5.00E+02
B18	Mississippi River	River	8	Y	6.51E+07	1.10E+08	1.58E+07	4.17E+11	2.23E+00	6.64E+00	5.00E+02
B18	Bayou Manchac	River	8		1.74E+05	2.71E+08	3.90E+07	3.69E+07	2.01E-01	2.26E-01	5.00E+02
B23	Hillbrandt Bayou	River	12	N	3.26E+05	1.16E+08	3.28E+07	1.31E+08	3.47E-01	3.90E-01	4.30E+02
B23	Cow Bayou	River	12	N	3.80E+05	1.02E+08	2.89E+07	2.12E+08	4.21E-01	2.77E-01	4.30E+02
B23	Neches River	River	12	Y	3.56E+06	9.92E+07	2.81E+07	7.27E+09	8.44E-01	1.38E+00	4.30E+02
B23	Port Arthur Reservoir	Lake	12	Y	5.47E+05	7.45E+05	2.11E+05	1.04E+05	NA	4.00E+00	4.30E+02
B31	Wassahickon Creek	Lake	2	N	2.12E+05	1.56E+08	4.40E+07	7.78E+07	2.80E-01	2.04E-01	1.75E+02
B31	Neshaminy Creek	Lake	2	N	2.22E+05	1.62E+08	4.58E+07	3.36E+08	4.97E-01	2.32E-01	1.75E+02
B31	Peace Valley Reservoir	Lake	2	N	1.49E+06	1.75E+07	4.94E+06	4.44E+06	NA	4.00E+00	1.75E+02
B31	Sckuylkill River	Lake	2	Y	1.66E+06	7.30E+08	2.07E+08	2.63E+09	7.41E-01	7.19E-01	1.75E+02
B32	Cedar Bayou	River	12	N	1.75E+06	2.39E+08	7.58E+07	3.31E+08	4.94E-01	6.55E-01	4.50E+02
B32	Cary Bayou	River	12	N	1.36E+04	1.36E+07	4.32E+06	2.77E+06	3.80E-01	9.00E-02	4.50E+02
B32	Goose Creek	River	12	N	2.36E+04	6.70E+07	2.12E+07	7.66E+06	4.27E-01	1.35E-01	4.50E+02
B37	Arkansas River	River	11	N	7.11E+06	4.31E+08	1.52E+08	3.80E+10	8.41E-01	1.15E+00	2.40E+02
B37	Plum Bayou (includes Black Bayou and Bayou Pete)	River	11	N	7.34E+05	2.08E+08	7.35E+07	6.34E+07	5.60E-01	3.30E-01	2.40E+02
B37	Yellow Lake	Lake	11	N	1.76E+06	8.36E+06	2.95E+06	1.27E+06	NA	4.00E+00	2.40E+02
B37	Lake Pine Bluff	Lake	11		1.76E+06	1.10E+08	3.90E+07	1.68E+07	NA	4.00E+00	2.40E+02
B44	Sheldon Reservoir	Lake	12	N	5.17E+06	5.17E+06	1.46E+06	7.24E+05	NA	4.00E+00	4.50E+02

(continued)

Table B-13. (continued)

Site	Waterbody	Type	Hydrologic Region	Drinking Water Source? (Y/N)	Surface Area (m2)	Total Watershed Area (m2)	Impervious Watershed Area (m2)	Average Volumetric Flow Rate (m3/yr)	Current Velocity (m/s)	Depth of Water Column (m)	USLE Rainfall factor (RF) (1/yr)
B44	Greens Bayou	River	12	N	4.07E+05	9.79E+07	2.77E+07	2.04E+08	4.15E-01	4.08E-01	4.50E+02
B44	Buffulo Bayou	River	12	N	2.50E+06	3.38E+08	9.58E+07	3.43E+09	6.46E-01	1.20E+00	4.50E+02
B44	Hunting Bayou	River	12	N	1.15E+05	4.86E+07	1.38E+07	1.94E+07	4.81E-01	1.99E-01	4.50E+02
TOO	Rush Lake	Lake	16		1.13E+06	3.48E+08	6.23E+07	4.52E+06	NA	4.00E+00	2.00E+01
TOO	Box Elder Wash	River	16	N	2.92E+04	1.29E+08	2.31E+07	3.15E+05	3.00E-01	4.00E-02	2.00E+01
TOO	Blue Lakes	Lake	16	N	2.45E+05	1.08E+06	1.94E+05	1.41E+04	NA	4.00E+00	2.00E+01
TOO	Soldier Creek	River	16	Y	8.04E+04	3.86E+07	6.91E+06	1.32E+07	4.60E-01	1.70E-01	2.00E+01

(continued)

Table B-13. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
340	Sunfish Creek	3.40E-01	6.68E+00	3.33E-02	8.21E-01	1.16E-01	2.70E+01	2.09E+00	7.13E+03	1.93E-01	1.19E-01
340	Proctor Creek	3.40E-01	2.56E+00	2.04E-02	8.98E-01	1.29E-01	2.70E+01	5.34E-01	5.43E+02	1.47E-02	1.19E-01
340	Fish Creek	3.40E-01	2.99E+00	2.45E-02	8.70E-01	5.29E-02	2.70E+01	7.27E-01	2.87E+02	7.76E-03	1.19E-01
340	Ohio River	3.40E-01	3.94E+00	2.48E-02	8.86E-01	4.46E-02	2.70E+01	9.90E-01	0.00E+00	0.00E+00	1.19E-01
342	Kalamazoo River	3.40E-01	4.85E-01	6.22E-02	6.60E-01	4.89E-02	2.10E+01	2.28E-01	0.00E+00	0.00E+00	1.88E-01
342	East Lake	3.40E-01	3.18E-01	7.67E-02	5.21E-01	1.90E-01	6.00E+00	1.45E-01	8.00E+01	4.80E-04	1.88E-01
342	Portage Creek	3.40E-01	4.83E-01	5.03E-02	7.54E-01	1.15E-01	2.10E+01	2.10E-01	3.80E+02	7.99E-03	1.88E-01
342	Portage River	3.40E-01	5.31E-01	6.37E-02	6.05E-01	5.01E-02	2.10E+01	2.34E-01	4.54E+02	9.53E-03	1.88E-01
453	Lake Spivey	3.40E-01	1.80E+00	6.05E-02	9.26E-01	1.40E-01	6.00E+00	2.31E+00	8.23E+02	4.94E-03	1.53E-01
453	Jester Creek	3.40E-01	1.59E+00	8.16E-02	9.89E-01	1.40E-01	2.40E+01	2.93E+00	8.34E+03	2.00E-01	1.53E-01
453	Flint River	3.40E-01	1.35E+00	6.20E-02	9.13E-01	5.27E-02	2.40E+01	1.75E+00	2.36E+03	5.66E-02	1.53E-01
468	Wissahickon Creek	3.40E-01	7.66E-01	2.96E-02	8.92E-01	1.13E-01	2.70E+01	2.78E-01	2.67E+02	7.22E-03	1.54E-01
468	Tacony Creek	3.40E-01	1.23E+00	1.13E-02	1.00E+00	1.24E-01	2.70E+01	1.92E-01	3.83E+02	1.03E-02	1.54E-01
468	Schuylkill	3.40E-01	1.04E+00	4.50E-02	8.20E-01	4.81E-02	2.70E+01	5.28E-01	0.00E+00	0.00E+00	1.54E-01
468	Pickering Creek Reservoir	3.40E-01	1.51E+00	5.25E-02	7.42E-01	1.68E-01	6.00E+00	8.05E-01	9.78E+02	5.87E-03	1.54E-01
701	Wabash River	3.40E-01	5.31E-01	7.43E-02	5.92E-01	4.63E-02	2.70E+01	3.56E-01	0.00E+00	0.00E+00	1.54E-01
701	Sugar Creek	3.40E-01	1.00E+00	4.51E-02	7.33E-01	1.32E-01	2.70E+01	5.05E-01	0.00E+00	0.00E+00	1.54E-01
701	Big Racoon Creek	3.40E-01	1.49E+00	5.30E-02	6.82E-01	5.10E-02	2.70E+01	8.19E-01	1.30E+02	3.50E-03	1.54E-01
704	Garvey Reservoir	3.40E-01	4.50E-01	4.67E-03	1.00E+00	4.88E-01	9.00E+00	8.01E-03	4.22E-01	3.79E-06	1.37E-01
704	Legg Lake	3.40E-01	1.83E-01	1.56E-02	9.11E-01	4.79E-01	9.00E+00	9.90E-03	5.14E-01	4.63E-06	1.37E-01

(continued)

Table B-13. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
704	Silver Lake Res.	3.40E-01	7.09E+00	2.27E-01	1.00E+00	3.29E-01	9.00E+00	6.14E+00	9.35E+02	8.42E-03	1.37E-01
708	Grindle Creek	3.40E-01	1.85E-01	3.58E-02	7.94E-01	1.09E-01	2.40E+01	1.20E-01	9.67E+01	2.32E-03	1.36E-01
708	Parker Creek	3.40E-01	1.79E-01	8.13E-02	7.68E-01	1.41E-01	2.40E+01	2.56E-01	4.35E+02	1.04E-02	1.36E-01
708	Tranters Creek	3.40E-01	1.85E-01	3.20E-02	8.20E-01	1.09E-01	2.40E+01	1.11E-01	0.00E+00	0.00E+00	1.36E-01
725	Passaic River	3.40E-01	8.97E-01	2.54E-02	1.00E+00	3.14E-01	2.70E+01	3.03E-01	0.00E+00	0.00E+00	2.06E-01
725	Silver Lake Reservoir	3.40E-01	5.94E-01	4.34E-03	1.00E+00	4.71E-01	6.00E+00	3.43E-02	1.00E+00	6.02E-06	2.06E-01
725	Reservoir No. 2	3.40E-01	1.48E+00	5.18E-03	1.00E+00	5.67E-01	6.00E+00	1.02E-01	3.16E+00	1.90E-05	2.06E-01
725	Rahway River	3.40E-01	9.62E-01	1.51E-02	1.00E+00	3.51E-01	2.70E+01	1.94E-01	0.00E+00	0.00E+00	2.06E-01
824	Newton Lake	3.40E-01	4.02E-01	9.75E-03	1.00E+00	1.83E-01	6.00E+00	5.53E-02	4.43E+01	2.66E-04	1.54E-01
824	Big Timber Creek	3.40E-01	3.40E-01	4.22E-02	9.05E-01	1.16E-01	2.70E+01	1.83E-01	4.77E+02	1.29E-02	1.54E-01
824	Darby Creek	3.40E-01	8.82E-01	2.45E-02	1.00E+00	1.15E-01	2.70E+01	3.05E-01	6.67E+02	1.80E-02	1.54E-01
824	Schuylkill River	3.40E-01	6.76E-01	3.60E-02	1.00E+00	1.21E-01	2.70E+01	3.43E-01	0.00E+00	0.00E+00	1.54E-01
904	Pascagoula River	3.40E-01	1.62E-01	1.17E-02	9.47E-01	1.31E-01	2.40E+01	7.56E-02	0.00E+00	0.00E+00	1.53E-01
904	Escatawpa River	3.40E-01	1.79E-01	2.70E-02	9.00E-01	1.11E-01	2.40E+01	1.83E-01	0.00E+00	0.00E+00	1.53E-01
906	Mississippi River	3.40E-01	7.95E-01	4.99E-02	7.41E-01	4.86E-02	6.80E+01	4.03E-01	0.00E+00	0.00E+00	1.89E-01
906	Cooperas Creek	3.40E-01	1.07E+00	7.28E-02	5.49E-01	1.20E-01	6.80E+01	5.85E-01	1.11E+01	7.51E-04	1.89E-01
906	Eliza Creek	3.40E-01	1.17E+00	7.01E-02	5.68E-01	1.21E-01	6.80E+01	6.39E-01	4.63E+00	3.15E-04	1.89E-01
906	Muscatine Slough	3.40E-01	5.58E-01	7.08E-02	6.10E-01	1.14E-01	6.80E+01	3.30E-01	2.79E+02	1.90E-02	1.89E-01
A14	New River	3.40E-01	1.20E-01	3.47E-02	8.06E-01	1.09E-01	1.63E+02	1.41E-01	0.00E+00	0.00E+00	1.36E-01
A14	Bayou Conway	3.40E-01	8.81E-02	4.86E-02	7.92E-01	1.16E-01	1.63E+02	1.42E-01	0.00E+00	0.00E+00	1.36E-01

(continued)

Table B-13. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
A14	Mississippi River	3.40E-01	1.33E-01	1.40E-02	9.65E-01	1.25E-01	1.63E+02	7.54E-02	0.00E+00	0.00E+00	1.36E-01
A14	Bayou Lafourche	3.40E-01	1.83E-01	3.32E-02	8.34E-01	2.13E-01	1.63E+02	2.13E-01	0.00E+00	0.00E+00	1.36E-01
A26	Big Creek (includes Sulfur Spring Creek)	3.40E-01	1.98E+00	5.66E-02	6.56E-01	1.32E-01	2.06E+02	1.34E+00	4.72E+02	9.72E-02	1.69E-01
A26	Carter Creek	3.40E-01	8.89E-01	5.43E-02	6.71E-01	1.20E-01	2.06E+02	5.92E-01	0.00E+00	0.00E+00	1.69E-01
A26	Dota Creek	3.40E-01	2.05E+00	4.80E-02	7.13E-01	1.13E-01	2.06E+02	1.28E+00	0.00E+00	0.00E+00	1.69E-01
A31	Nottaway River	3.40E-01	7.05E-01	3.20E-02	8.18E-01	4.94E-02	2.40E+01	3.51E-01	0.00E+00	0.00E+00	1.19E-01
A31	Chowan River	3.40E-01	3.91E-01	3.76E-02	8.21E-01	4.80E-02	2.40E+01	2.30E-01	0.00E+00	0.00E+00	1.19E-01
A31	Nottaway Swamp (a creek)	3.40E-01	3.21E-01	3.36E-02	8.09E-01	1.24E-01	2.40E+01	1.66E-01	0.00E+00	0.00E+00	1.19E-01
A45	Sheldon Reservoir	3.40E-01	7.08E-02	2.76E-02	8.28E-01	2.02E-01	7.00E+01	3.70E-02	0.00E+00	0.00E+00	1.36E-01
A45	Highlands Reservoir	3.40E-01	6.93E-02	5.39E-02	6.63E-01	2.03E-01	7.00E+01	5.66E-02	1.02E-01	7.12E-06	1.36E-01
A45	Greens Bayou	3.40E-01	7.63E-02	1.28E-02	9.81E-01	1.20E-01	7.20E+01	2.19E-02	0.00E+00	0.00E+00	1.36E-01
A45	Buffalo Bayou	3.40E-01	7.36E-02	2.75E-02	8.95E-01	5.07E-02	7.20E+01	4.15E-02	0.00E+00	0.00E+00	1.36E-01
A46	Little Muskingum River	3.40E-01	5.08E+00	1.74E-02	9.17E-01	5.07E-02	2.70E+01	9.29E-01	1.02E+03	2.75E-02	1.19E-01
A46	Ohio River	3.40E-01	4.23E+00	1.73E-02	9.37E-01	5.13E-02	2.70E+01	7.82E-01	0.00E+00	0.00E+00	1.19E-01
A46	Middle Island Creek	3.40E-01	5.72E+00	1.93E-02	9.05E-01	4.93E-02	2.70E+01	1.14E+00	4.10E+02	1.11E-02	1.19E-01
A47	Caney River	3.40E-01	5.55E-01	5.59E-02	6.85E-01	4.69E-02	2.06E+02	4.06E-01	0.00E+00	0.00E+00	1.86E-01
A47	Sand Creek	3.40E-01	1.39E+00	9.96E-03	9.80E-01	5.18E-02	2.06E+02	2.59E-01	0.00E+00	0.00E+00	1.86E-01
A47	Bar-Dew Lake	3.40E-01	1.69E+00	7.68E-03	1.00E+00	2.04E-01	7.00E+01	2.47E-01	1.96E+01	1.37E-03	1.86E-01
A47	Lake Hudson	3.40E-01	1.28E+00	1.00E-02	9.87E-01	1.39E-01	7.00E+01	2.42E-01	1.14E+01	7.97E-04	1.86E-01
A55	Mohawk River	3.40E-01	8.29E-01	4.04E-02	8.34E-01	4.68E-02	2.70E+01	2.66E-01	0.00E+00	0.00E+00	1.70E-01

(continued)

Table B-13. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
A55	Acplause Kill River	3.40E-01	1.04E+00	3.38E-02	8.18E-01	1.14E-01	2.70E+01	2.75E-01	4.95E+02	1.34E-02	1.70E-01
A55	Stony Creek Reservoir	3.40E-01	9.00E-01	3.25E-02	8.76E-01	1.41E-01	6.00E+00	2.44E-01	8.71E+01	5.23E-04	1.70E-01
A55	Watervliet Reservoir	3.40E-01	7.57E-01	4.30E-02	8.09E-01	1.07E-01	6.00E+00	2.51E-01	6.39E+02	3.84E-03	1.70E-01
B18	Gulf Intercoastal Waterway	3.40E-01	7.98E-02	2.27E-02	8.91E-01	5.19E-02	1.63E+02	6.14E-02	0.00E+00	0.00E+00	1.36E-01
B18	Bayou La Butte	3.40E-01	8.89E-02	6.92E-02	6.34E-01	1.31E-01	1.63E+02	1.49E-01	0.00E+00	0.00E+00	1.36E-01
B18	Mississippi River	3.40E-01	1.43E-01	3.58E-02	9.42E-01	1.19E-01	1.63E+02	1.84E-01	0.00E+00	0.00E+00	1.36E-01
B18	Bayou Manchac	3.40E-01	1.37E-01	4.50E-02	7.78E-01	5.30E-02	1.63E+02	1.83E-01	0.00E+00	0.00E+00	1.36E-01
B23	Hillbrandt Bayou	3.40E-01	7.46E-02	3.79E-02	8.78E-01	1.18E-01	7.20E+01	8.14E-02	0.00E+00	0.00E+00	1.53E-01
B23	Cow Bayou	3.40E-01	1.15E-01	5.53E-02	6.69E-01	1.20E-01	7.20E+01	1.40E-01	0.00E+00	0.00E+00	1.53E-01
B23	Neches River	3.40E-01	8.23E-02	1.63E-02	9.62E-01	1.20E-01	7.20E+01	4.23E-02	0.00E+00	0.00E+00	1.53E-01
B23	Port Arthur Reservoir	3.40E-01	8.44E-02	1.88E-03	1.00E+00	3.51E-01	7.00E+01	5.20E-03	0.00E+00	0.00E+00	1.53E-01
B31	Wassahickon Creek	3.40E-01	7.42E-01	3.04E-02	8.87E-01	1.14E-01	2.70E+01	2.67E-01	4.57E+02	1.23E-02	1.71E-01
B31	Neshaminy Creek	3.40E-01	5.17E-01	6.72E-02	6.97E-01	1.13E-01	2.70E+01	3.22E-01	0.00E+00	0.00E+00	1.71E-01
B31	Peace Valley Reservoir	3.40E-01	5.04E-01	1.24E-01	5.90E-01	1.74E-01	6.00E+00	4.91E-01	1.64E+02	9.83E-04	1.71E-01
B31	Sckuylkill River	3.40E-01	9.87E-01	5.39E-02	7.33E-01	4.68E-02	2.70E+01	5.21E-01	0.00E+00	0.00E+00	1.71E-01
B32	Cedar Bayou	3.40E-01	8.92E-02	6.10E-02	6.31E-01	1.08E-01	7.20E+01	1.18E-01	0.00E+00	0.00E+00	1.37E-01
B32	Cary Bayou	3.40E-01	8.04E-02	8.48E-02	6.71E-01	1.80E-01	7.20E+01	1.57E-01	1.89E+02	1.36E-02	1.37E-01
B32	Goose Creek	3.40E-01	7.95E-02	6.11E-02	6.38E-01	1.26E-01	7.20E+01	1.06E-01	2.04E+02	1.47E-02	1.37E-01
B37	Arkansas River	3.40E-01	1.74E-01	3.62E-02	8.27E-01	5.00E-02	2.06E+02	9.52E-02	0.00E+00	0.00E+00	1.69E-01
B37	Plum Bayou (includes Black Bayou and Bayou Pete)	3.40E-01	7.37E-02	7.47E-02	5.37E-01	1.09E-01	2.06E+02	5.41E-02	0.00E+00	0.00E+00	1.69E-01

(continued)

Table B-13. (continued)

Site	Waterbody	USLE Soil erodibility factor (K) (ton/acre)	USLE Length-Slope factor (LS) (unitless)	USLE Cover Mgmt Factor (C) (unitless)	USLE Supporting practice factor (P) (unitless)	Watershed Sediment Delivery Ratio (unitless)	Median TSS (mg/L)	Unit Soil loss, Xe (kg/m2/yr)	Bottom sediment deposition rate, Wdep (m/yr)	Burial rate, Wb (m/yr)	Shear velocity, U* (m/s)
B37	Yellow Lake	3.40E-01	9.51E-02	1.99E-02	9.48E-01	1.91E-01	7.00E+01	3.29E-02	0.00E+00	0.00E+00	1.69E-01
B37	Lake Pine Bluff	3.40E-01	1.95E-01	1.48E-02	9.82E-01	1.19E-01	7.00E+01	5.19E-02	0.00E+00	0.00E+00	1.69E-01
B44	Sheldon Reservoir	3.40E-01	7.01E-02	2.67E-02	8.33E-01	2.03E-01	7.00E+01	5.35E-02	1.51E-02	1.06E-06	1.37E-01
B44	Greens Bayou	3.40E-01	7.63E-02	1.28E-02	9.81E-01	1.20E-01	7.20E+01	3.28E-02	0.00E+00	0.00E+00	1.37E-01
B44	Buffulo Bayou	3.40E-01	7.37E-02	2.89E-02	8.90E-01	5.15E-02	7.20E+01	6.49E-02	0.00E+00	0.00E+00	1.37E-01
B44	Hunting Bayou	3.40E-01	7.35E-02	1.82E-02	9.32E-01	1.31E-01	7.20E+01	4.28E-02	0.00E+00	0.00E+00	1.37E-01
TOO	Rush Lake	3.40E-01	2.41E+00	2.16E-02	9.37E-01	5.13E-02	1.00E+00	7.41E-02	1.17E+03	1.17E-03	1.53E-01
TOO	Box Elder Wash	3.40E-01	2.62E+00	1.52E-02	9.66E-01	1.16E-01	1.30E+01	5.88E-02	2.31E+03	3.00E-02	1.53E-01
TOO	Blue Lakes	3.40E-01	1.16E-01	5.58E-03	1.00E+00	3.35E-01	1.00E+00	9.85E-04	1.40E+00	1.40E-06	1.53E-01
TOO	Soldier Creek	3.40E-01	7.74E+00	9.58E-03	9.80E-01	1.35E-01	1.30E+01	1.11E-01	3.88E+02	5.05E-03	1.53E-01

Table B-14. Meteorological Data for Commercial Incinerators

Site ID	Average Annual Precipitation (cm/yr)	Average Annual Irrigation (cm/yr)	Average Annual Evapotranspiration (cm/yr)	Average Annual Runoff (cm/yr)	Ambient Air Temperature (K)	Mean Annual Wind Speed (m/s)	Dry Deposition Velocity for Divalent Mercury (cm/s)
209	1.08E+02	0	7.54E+01	2.54E+01	2.89E+02	4.13E+00	2.1E+00
214	1.44E+02	0	1.01E+02	2.25E+01	2.93E+02	4.12E+00	1.8E+00
221	1.19E+02	0	8.34E+01	1.27E+01	2.94E+02	4.10E+00	1.7E+00
324	1.36E+02	0	9.53E+01	2.54E+01	2.90E+02	3.60E+00	2.6E+00
325	7.44E+01	0	5.21E+01	7.60E+00	2.87E+02	6.17E+00	1.4E+00
331	9.42E+01	0	6.59E+01	1.27E+01	2.83E+02	5.10E+00	1.5E+00
359	1.12E+02	0	7.81E+01	2.03E+01	2.87E+02	4.13E+00	1.8E+00
A15	9.68E+01	0	6.77E+01	2.03E+01	2.82E+02	6.18E+00	2.0E+00
A18	1.41E+02	0	9.84E+01	1.78E+01	2.94E+02	4.60E+00	1.2E+00
CAL	1.02E+02	0	7.15E+01	2.03E+01	2.85E+02	4.63E+00	1.5E+00
ELD	1.16E+02	0	8.13E+01	2.16E+01	2.92E+02	4.61E+00	2.3E+00
SAU	9.35E+01	0	6.55E+01	1.27E+01	2.86E+02	5.12E+00	2.7E+00

Table B-15. Meteorological Data for Cement Kilns

Site ID	Average Annual Precipitation (cm/yr)	Average Annual Irrigation (cm/yr)	Average Annual Evapotranspiration (cm/yr)	Average Annual Runoff (cm/yr)	Ambient Air Temperature (K)	Mean Annual Wind Speed (m/s)	Dry Deposition Velocity for Divalent Mercury (cm/s)
202	7.44E+01	0	5.21E+01	7.62E+00	2.87E+02	6.10E+00	1.5E+00
203	1.39E+02	0	9.74E+01	2.41E+01	2.92E+02	3.60E+00	1.2E+00
204	7.75E+01	0	5.43E+01	1.14E+01	2.81E+02	5.12E+00	1.5E+00
302	9.12E+01	0	6.38E+01	1.27E+01	2.83E+02	5.60E+00	1.3E+00
304	1.01E+02	0	7.04E+01	1.50E+01	2.85E+02	4.63E+00	1.6E+00
320	7.32E+01	0	5.12E+01	1.27E+01	2.79E+02	4.10E+00	1.5E+00
321	1.32E+02	0	9.21E+01	2.54E+01	2.91E+02	3.58E+00	1.7E+00
BAT	1.12E+02	0	7.86E+01	2.22E+01	2.84E+02	5.10E+00	1.2E+00
CHA	1.05E+02	0	7.35E+01	9.40E+00	2.86E+02	5.14E+00	1.6E+00
FOR	1.16E+02	0	8.13E+01	2.16E+01	2.55E+02	4.61E+00	1.5E+00
FRE	7.44E+01	0	5.21E+01	5.10E+00	2.87E+02	6.18E+00	1.4E+00
HAR	1.32E+02	0	9.21E+01	1.27E+01	2.92E+02	4.13E+00	1.9E+00
HOL	1.30E+02	0	9.07E+01	1.25E+01	2.91E+02	4.12E+00	1.9E+00
TEX	8.20E+01	0	5.74E+01	2.50E+00	2.92E+02	5.66E+00	1.2E+00
WAM	9.42E+01	0	6.59E+01	1.78E+01	2.84E+02	5.13E+00	2.2E+00

Table B-16. Meteorological Data for Lightweight Aggregate Kilns

Site ID	Average Annual Precipitation (cm/yr)	Average Annual Irrigation (cm/yr)	Average Annual Evapotranspiration (cm/yr)	Average Annual Runoff (cm/yr)	Ambient Air Temperature (K)	Mean Annual Wind Speed (m/s)	Dry Deposition Velocity for Divalent Mercury (cm/s)
ARV	1.09E+02	0	7.64E+01	1.78E+01	2.88E+02	3.60E+00	1.9E+00
BRO	9.88E+01	0	6.92E+01	2.03E+01	2.89E+02	5.60E+00	1.9E+00
CAS	9.09E+01	0	6.36E+01	2.54E+01	2.82E+02	5.14E+00	1.9E+00
COH	1.08E+02	0	7.56E+01	2.16E+01	2.87E+02	3.60E+00	2.7E+00
NOR	1.09E+02	0	7.61E+01	2.03E+01	2.89E+02	4.10E+00	1.5E+00

Table B-17. Meteorological Data for On-Site Incinerators—Small

Site ID	Average Annual Precipitation (cm/yr)	Average Annual Irrigation (cm/yr)	Average Annual Evapotranspiration (cm/yr)	Average Annual Runoff (cm/yr)	Ambient Air Temperature (K)	Mean Annual Wind Speed (m/s)	Dry Deposition Velocity for Divalent Mercury (cm/s)
340	1.05E+02	0	7.36E+01	1.78E+01	2.86E+02	3.60E+00	2.0E+00
342	7.77E+01	0	5.44E+01	1.27E+01	2.82E+02	5.66E+00	2.8E+00
453	1.27E+02	0	8.86E+01	2.41E+01	2.90E+02	4.61E+00	2.9E+00
468	1.05E+02	0	7.36E+01	2.16E+01	2.86E+02	4.63E+00	2.8E+00
701	1.02E+02	0	7.15E+01	1.52E+01	2.85E+02	4.63E+00	1.3E+00
704	2.87E+01	0	2.01E+01	1.30E+00	2.90E+02	4.13E+00	3.0E+00
708	1.07E+02	0	7.47E+01	1.40E+01	2.89E+02	4.10E+00	1.8E+00
725	1.10E+02	0	7.67E+01	2.54E+01	2.86E+02	6.20E+00	2.1E+00
824	1.05E+02	0	7.36E+01	2.29E+01	2.86E+02	4.63E+00	2.0E+00
904	1.67E+02	0	1.17E+02	3.81E+01	2.93E+02	4.60E+00	2.0E+00
906	9.42E+01	0	6.59E+01	8.90E+00	2.83E+02	5.70E+00	1.2E+00
A14	1.46E+02	0	1.02E+02	2.29E+01	2.93E+02	4.10E+00	1.6E+00
A26	1.07E+02	0	7.47E+01	1.52E+01	2.87E+02	5.10E+00	1.4E+00
A31	1.09E+02	0	7.64E+01	1.78E+01	2.88E+02	3.58E+00	1.9E+00
A45	1.19E+02	0	8.34E+01	1.27E+01	2.94E+02	4.10E+00	1.9E+00
A46	1.05E+02	0	7.36E+01	1.78E+01	2.86E+02	3.60E+00	2.0E+00
A47	9.88E+01	0	6.92E+01	6.35E+00	2.89E+02	5.60E+00	1.9E+00

(continued)

Table B-17. (continued)

Site ID	Average Annual Precipitation (cm/yr)	Average Annual Irrigation (cm/yr)	Average Annual Evapotranspiration (cm/yr)	Average Annual Runoff (cm/yr)	Ambient Air Temperature (K)	Mean Annual Wind Speed (m/s)	Dry Deposition Velocity for Divalent Mercury (cm/s)
A55	9.09E+01	0	6.36E+01	2.54E+01	2.82E+02	5.14E+00	2.1E+00
B18	1.46E+02	0	1.02E+02	2.16E+01	2.93E+02	4.10E+00	1.5E+00
B23	1.41E+02	0	9.84E+01	1.40E+01	2.94E+02	4.60E+00	2.0E+00
B31	1.12E+02	0	7.86E+01	2.54E+01	2.84E+02	5.15E+00	2.1E+00
B32	1.19E+02	0	8.34E+01	1.52E+01	2.94E+02	4.13E+00	2.1E+00
B37	1.07E+02	0	7.47E+01	1.52E+01	2.87E+02	5.10E+00	2.5E+00
B44	1.19E+02	0	8.34E+01	1.40E+01	2.94E+02	4.13E+00	1.9E+00
TOO	3.96E+01	0	2.77E+01	1.27E+00	2.84E+02	4.62E+00	1.6E+00

Table B-18. Meteorological Data for On-Site Incinerators—Large

Site ID	Average Annual Precipitation (cm/yr)	Average Annual Irrigation (cm/yr)	Average Annual Evapotranspiration (cm/yr)	Average Annual Runoff (cm/yr)	Ambient Air Temperature (K)	Mean Annual Wind Speed (m/s)	Dry Deposition Velocity for Divalent Mercury (cm/s)
334	7.37E+01	0	5.16E+01	6.40E+00	2.80E+02	6.20E+00	1.2E+00
463	9.65E+01	0	6.76E+01	8.90E+00	2.85E+02	5.70E+00	2.8E+00
464	9.32E+01	0	6.52E+01	1.27E+01	2.84E+02	5.13E+00	2.4E+00
504	1.05E+02	0	7.36E+01	2.22E+01	2.86E+02	4.63E+00	2.6E+00
600	7.42E+01	0	5.19E+01	6.40E+00	2.95E+02	6.20E+00	1.7E+00
711	1.54E+02	0	1.08E+02	2.54E+01	2.94E+02	4.13E+00	1.5E+00
806	8.99E+01	0	6.29E+01	1.27E+01	2.83E+02	4.61E+00	3.2E+00
915	8.08E+01	0	5.65E+01	1.91E+01	2.82E+02	5.66E+00	3.4E+00
A32	1.19E+02	0	8.34E+01	1.27E+01	2.94E+02	4.10E+00	1.1E+00
A43	9.68E+01	0	6.78E+01	2.16E+01	2.82E+02	6.17E+00	2.9E+00
A50	1.19E+02	0	8.34E+01	1.52E+01	2.94E+02	4.13E+00	1.3E+00
A62	1.19E+02	0	8.34E+01	1.27E+01	2.94E+02	4.12E+00	2.2E+00
B20	9.42E+01	0	6.59E+01	1.27E+01	2.83E+02	5.12E+00	2.3E+00
HAN	9.35E+01	0	6.55E+01	1.27E+01	2.87E+02	5.10E+00	1.3E+00
KIN	1.05E+02	0	7.34E+01	2.29E+01	2.87E+02	4.10E+00	2.3E+00
MCI	1.67E+02	0	1.17E+02	2.54E+01	2.93E+02	4.61E+00	2.0E+00
MID	7.75E+01	0	5.43E+01	6.40E+00	2.81E+02	5.12E+00	2.5E+00
STG	1.46E+02	0	1.02E+02	2.29E+01	2.93E+02	4.10E+00	1.5E+00

Appendix C

Direct and Indirect Exposure Equations

Appendix C

Indirect Exposure Equations

Appendix C presents the equations that were used to calculate media and food concentrations of contaminants for the indirect exposure pathways. The following subsections contain the equations used to arrive at specific concentrations:

- **#** Section C.1: terrestrial pathway exposures for all chemicals
- **#** Section C.2: terrestrial food chain concentrations for all chemicals
- **#** Section C.3: aquatic food chain and drinking water concentrations (including soil concentrations averaged over the watershed) for all chemicals.

Also included in the appendix are equations used to estimate air concentrations, individual cancer risk and hazard quotients, breastmilk concentrations, and incremental margin of exposure for dioxins. Site-specific data are in Appendix B and parameter values and references are presented in Appendix D.

Equations are presented in a table format. The tables show the equations, identify the exposure scenarios, list all input parameters, and identify the default values where appropriate. The default value column of the tables may contain one of the following designations instead of (or in addition to) a default value:

- **#** **Shaded, no value**: This row of the table describes either the parameter being calculated by the given equation or a unit's conversion constant in the equation.
- **#** **Modeled**: A deposition rate or air concentration, as determined by the ISCST3 model, as described in Section 5.1.
- **#** **Calculated** (see Table C.x-x): An equation is given for calculating the parameter in the indicated table.
- **#** **Site-specific** (see Appendix B): The parameter is site-specific and no default value is considered appropriate.

- **Chemical-specific** (see Appendix D): The parameter is chemical-specific, and specific values are provided in Appendix D.

- **Varies** (see Appendix D): The parameter — typically an exposure parameter — varies, and specific values are provided in Appendix D.

C.1 Soil Concentration Equations

The equations in this section were used to calculate the soil concentration resulting from deposition of particle and vapor phase contaminants onto soils. The calculation of soil concentration includes a loss term that can account for loss of contaminant from the soil after deposition by several mechanisms, including leaching, erosion, runoff, degradation, and volatilization. These loss mechanisms all lower the soil concentration associated with a specific deposition rate. Although the degradation term is chemical-specific, it is set to zero for all contaminants.

Table C.1-1. Soil Concentration Due to Deposition for Carcinogenic Compounds

$$\overline{Sc} = \frac{Ds}{ks \bullet (Tc - T_1)} \bullet \left[\left(Tc + \frac{\exp(-ks \bullet Tc)}{ks} \right) - \left(T_1 + \frac{\exp(-ks \bullet T_1)}{ks} \right) \right] \text{for } T_1 < Tc$$

$$Ds = \frac{100 \bullet Q}{z \bullet BD} \bullet [F_v (0.31536 \bullet Vdv \bullet Cyv + Dywv) + (Dydp + Dywp) \bullet (1 - F_v)]$$

Parameter	Definition	Values
Sc	Average soil concentration over exposure duration (mg/kg)	
Ds	Deposition term (mg/kg-yr)	
ks	Soil loss constant (yr^{-1})	Calculated (see Table C.1-2)
Tc	Time period over which deposition occurs (yr)	30
T_1	Time at beginning of exposure period (yr)	Scenario-specific (see Appendix D)
100	Units conversion factor ([mg-m^2]/[kg-cm^2])	
Q	Stack emissions (g/s)	Calculated
Z	Soil mixing depth (cm)	Varies (see Appendix D)
BD	Soil bulk density (g/cm^3)	1.5
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)

(continued)

Table C.1-1. (continued)

Parameter	Definition	Values
0.31536	Units conversion factor (m-g-s/cm-µg-yr)	
Vdv	Dry deposition velocity (cm/s)	0.2 for Dioxins
Cyv	Normalized vapor phase air concentration (µg-s/g-m^3)	Modeled
Dywv	Normalized yearly wet deposition from vapor phase (s/m^2-yr)	Modeled
Dydp	Normalized yearly dry deposition from particle phase (s/m^2-yr)	Modeled
Dywp	Normalized yearly wet deposition from particle phase (s/m^2-yr)	Modeled

Description

These equations calculate an average soil concentration over the scenario exposure duration as a result of wet and dry deposition of particles and vapors to soil. Contaminants are assumed to be incorporated only to a finite depth (the mixing depth, Z). Soil concentration as calculated from this equation may vary for each scenario depending on location in relation to the source of emissions. T_1 in these equations corresponds to Tc minus the exposure duration and, therefore, is scenario-specific.

Table C.1-1. (continued)

Soil Concentration Due to Deposition for Noncarcinogenic Compounds

$$Sc_{Tc} = \frac{Ds \bullet (1 - \exp(-ks \bullet Tc))}{ks}$$

$$Ds = \frac{100 \bullet Q}{Z \bullet BD} \bullet [F_v (0.31536 \bullet Vdv \bullet Cyv + Dywv) + (Dydp + Dywp) \bullet (1 - F_v)]$$

Parameter	Definition	Values
Sc_{Tc}	Soil concentration at time Tc (mg/kg)	
Ds	Deposition term (mg/kg-yr)	
ks	Soil loss constant (yr^{-1})	Calculated (see Table C.1-2)
Tc	Time period over which deposition occurs (yr)	30
100	Units conversion factor ([mg-m^2]/[kg-cm^2])	
Q	Stack emissions (g/s)	Calculated
Z	Soil mixing depth (cm)	Varies (see Appendix D)
BD	Soil bulk density (g/cm^3)	1.5
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
0.31536	Units conversion factor (m-g-s/cm-µg-yr)	
Vdv	Dry deposition velocity (cm/s)	0.2 for Dioxins
Dywv	Normalized yearly wet deposition from vapor phase (s/m^2-yr)	Modeled
Dydp	Normalized yearly dry deposition from particle phase (s/m^2-yr)	Modeled
Dywp	Normalized yearly wet deposition from particle phase (s/m^2-yr)	Modeled

Description

These equations calculate a soil concentration at time Tc as a result of wet and dry deposition of particles and vapors to soil. Contaminants are assumed to be incorporated only to a finite depth (the mixing depth, Z). Soil concentration as calculated from this equation may vary for each scenario depending on location in relation to the source of emissions.

Table C.1-2. Soil Loss Constant

$$ks = ksl + kse + ksr + ksg + ksv$$

Parameter	Definition	Values
ks	Soil loss constant due to all processes (yr^{-1})	
ksl	Loss constant due to leaching (yr^{-1})	Calculated (see Table C.1-3)
kse	Loss constant due to soil erosion (yr^{-1})	0
ksr	Loss constant due to surface runoff (yr^{-1})	Calculated (see Table C.1-4)
ksg	Loss constant due to degradation (yr^{-1})	0
ksv	Loss constant due to volatilization (yr^{-1})	Calculated (see Table C.1-5)

Description

This equation calculates the soil loss constant, which accounts for the loss of contaminant from soil by several mechanisms. For erosion of soil from the agricultural field or home garden, the kse is set equal to 0 because soil erosion from these sites is assumed to be balanced by erosion onto these sites. The net result is no soil loss due to erosion from the home garden or agricultural field.

Table C.1-3. Loss Constant Due to Leaching

$$ksl = \frac{P + I - R - E_v}{\theta_s \bullet Z \bullet [1.0 + (BD \bullet Kd_s/\theta_s)]}$$

$$Kd_s = f_{oc} \bullet K_{oc}$$

Parameter	Definition	Values
ksl	Loss constant due to leaching (yr^{-1})	
P	Average annual precipitation (cm/yr)	Site-specific (see Appendix B)
I	Average annual irrigation (cm/yr)	0
R	Average annual runoff (cm/yr)	Site-specific (see Appendix B)
E_v	Average annual evapotranspiration (cm/yr)	Site-specific (see Appendix B)
θ_s	Soil volumetric water content (mL/cm^3)	0.2
Z	Soil depth from which leaching removal occurs (cm) (= soil mixing depth)	Varies (see Appendix D)
BD	Soil bulk density (g/cm^3)	1.5
Kd_s	Soil-water partition coefficient (cm^3/g)	Metals - see Appendix D: dioxins - calculated as above
f_{oc}	Fraction organic carbon in soil (unitless)	0.006
K_{oc}	Organic carbon partition coefficient (mL/g)	Chemical-specific (see Appendix D)

Description

This equation calculates the contaminant loss constant due to leaching from soil.

Table C.1-4. Loss Constant due to Runoff

$$ksr = \frac{R}{\theta_s \bullet Z} \bullet \left(\frac{1}{1 + (Kd_s \bullet BD / \theta_s)} \right)$$

Parameter	Definition	Values
ksr	Loss constant due to runoff (yr^{-1})	
R	Average annual runoff (cm/yr)	Site-specific (see Appendix B)
θ_s	Soil volumetric water content (ml/cm^3)	0.2
Z	Soil mixing depth (cm)	Varies (see Appendix D)
Kd_s	Soil-water partition coefficient (cm^3/g)	Calculated (see Table C.1-3)
BD	Soil bulk density (g/cm^3)	1.5

Description

This equation calculates the contaminant loss constant due to runoff from soil.

Table C.1-5. Loss Constant Due to Volatilization

$$ksv = \left[\frac{3.1536x10^{7} \bullet H}{Z \bullet Kd_s \bullet R \bullet T \bullet BD}\right] \bullet \left[0.482 \bullet u^{0.78} \bullet \left(\frac{\mu_a}{\rho_a \bullet Da}\right)^{-0.67} \bullet \left(\sqrt{\frac{4 \bullet A}{\pi}}\right)^{-0.11}\right]$$

Parameter	Definition	Values
ksv	Loss constant due to volatilization (yr^{-1})	
$3.1536x10^{7}$	Conversion constant (s/yr)	
H	Henry's law constant (atm-m^3/mol)	Chemical-specific (see Appendix D)
Z	Soil mixing depth (cm)	Varies (see Appendix D)
Kd_s	Soil-water partition coefficient (cm^3/g)	Calculated (see Table C.1-3)
R	Universal gas constant (atm-m^3/mol-K)	$8.205x10^{-5}$
T	Ambient air temperature (K)	Site-specific (see Appendix B)
BD	Soil bulk density (g/cm^3)	1.5
u	Average annual wind speed (m/s)	Site-specific (see Appendix B)
μ_a	Viscosity of air (g/cm-s)	$1.81x10^{-4}$
ρa	Density of air (g/cm^3)	$1.2x10^{-3}$
Da	Diffusivity of contaminant in air (cm^2/s)	Chemical-specific (see Appendix D)
A	Surface area of contaminated area (m^2)	Varies (see Appendix D)

Description

This equation calculates the contaminant loss constant due to volatilization from soil. The area of contamination cited in this scenario varies for different pathways. For soil ingestion by humans, the area of contamination is assumed to be 2,000 m^2. For terrestrial food chain pathways, the area of contamination is assumed to be a 300,000 m^2 agricultural field.

C.2 Terrestrial Food Chain Equations

The equations in this section are used to calculate contaminant concentrations in the terrestrial food chain, which encompasses aboveground produce and root vegetables, beef, pork, milk, poultry, and eggs. Soil concentrations required as input for the calculation of the food chain concentrations are calculated as discussed in Section C.1 of this appendix.

Aboveground produce may be contaminated by combustion emissions through several mechanisms, including direct deposition of contaminants onto the plant, direct uptake of vapor phase contaminants, and root uptake of contaminants deposited on the soil. Root vegetables may be contaminated via uptake of contaminants through the roots. Direct deposition and root uptake of contaminants are calculated at the location of the given scenario.

Animal tissue (beef, pork, poultry, eggs, and milk) may be contaminated through ingestion of contaminated forage, silage, and soil by livestock. Beef and dairy cattle ingest grain, silage, forage, and soil. Hogs ingest grain, silage, and soil. Chickens raised by the subsistence farmer are assumed to consume 10 percent of their diet as contaminated soil. In all cases, the grain is assumed to be uncontaminated.

The contamination of plant matter consumed by livestock differs depending on the type of plant. Forage, which includes pasture grass and hay, and silage may be contaminated by combustion emissions through direct deposition of contaminants onto the plant, direct uptake of vapor phase contaminants, and root uptake of contaminants deposited on the soil. Direct deposition and root uptake of contaminants are calculated at the location of the given scenario.

Table C.2-1. Vegetative Concentration Due to Direct Deposition

$$Pd_i = \frac{1000 \bullet Q \bullet (1 - F_v) \bullet [Dydp + (Fw \bullet Dywp)] \bullet Rp \bullet [(1.0 - \exp(-kp \bullet Tp)]}{Yp \bullet kp}$$

Parameter	Definition	Values
Pd_i	Concentration in plant type i due to direct deposition (mg/kg DW)	
1000	Units conversion factor (mg/g)	
Q	Stack emissions (g/s)	Calculated
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
Dydp	Normalized yearly dry deposition from particle phase (s/m^2-yr)	Modeled
Fw	Fraction of wet deposition that adheres to plant (dimensionless)	Chemical-specific (see Appendix D)
Dywp	Normalized yearly wet deposition from particle phase (s/m^2-yr)	Modeled
Rp	Interception fraction of edible portion of plant (dimensionless)	Varies (see Appendix D)
kp	Plant surface loss coefficient (yr^{-1})	18
Tp	Length of plant exposure to deposition of edible portion of plant, per harvest (yr)	Varies (see Appendix D)
Yp	Yield or standing crop biomass of the edible portion of the plant (kg DW/m^2)	Varies (see Appendix D)

Description

This equation calculates the contaminant concentration in aboveground vegetables, forage, and silage due to wet and dry deposition of contaminant on the plant surface.

Table C.2-2. Vegetative Concentration Due to Air-to-Plant Transfer

$$Pv_i = Q \bullet F_v \bullet \frac{Cyv \bullet Bv \bullet VG_{ag}}{\rho_a}$$

Parameter	Definition	Values
Pv_i	Concentration of pollutant in plant type i due to air-to-plant transfer (mg/kg Dw)	
Q	Stack emissions (g/s)	Calculated
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
Cyv	Normalized vapor phase air concentration (µg-s/g-m^3)	Modeled
Bv	Air-to-plant biotransfer factor ([mg pollutant/kg plant tissue DW]/[µg pollutant/g air])	Chemical-specific (see Appendix D)
VG_{ag}	Empirical correction factor for aboveground produce (dimensionless)	Varies according to produce and chemical (See Appendix D)
ρ_a	Density of air (g/m^3)	1.2 x 10^3

Description

This equation calculates the contaminant concentration in aboveground vegetation, forage, and silage due to direct uptake of vapor phase contaminants into the plant leaves.

Table C.2-3. Aboveground Vegetation Concentration Due to Root Uptake

$$Pr_i = Sc \bullet Br$$

Parameter	Definition	Values
Pr_i	Concentration of pollutant in plant type i due to direct uptake from soil (mg/kg Dw)	
Sc	Average soil concentration of pollutant over exposure duration (mg/kg)	Calculated (see Table C.1-1)
Br	Plant-soil bioconcentration factor for aboveground vegetation [µg/g DW]/[µg/g soil]	Chemical-specific (see Appendix D)

Description

This equation calculates the contaminant concentration in aboveground produce, forage, and silage due to direct uptake of contaminants from soil.

Table C.2-4. Root Vegetable Concentration Due to Root Uptake

$$Pr_{bg} = \frac{Sc \bullet RCF \bullet VG_{bg}}{Kd_s} \quad \text{(Dioxins)}$$

$$Pr_{bg} = Sc \bullet Br \quad \text{(Metals)}$$

Parameter	Definition	Values
Pr_{bg}	Concentration of pollutant in below ground plant parts due to root uptake (for dioxins (mg/kg Fw); for metals (mg/kg Dw))	
Sc	Soil concentration of pollutant (mg/kg)	Calculated (see Table C.1-1)
RCF	Ratio of concentration in roots to concentration in soil pore water ([mg pollutant/kg plant tissue FW] / [µg pollutant/mL pore water])	Chemical-specific (see Appendix D)
VG_{bg}	Empirical correction factor for root vegetables (unitless)	0.01
Kd_s	Soil-water partition coefficient (mL/g)	Calculated (see Table C.1-3)
Br	Plant-soil bioconcentration factor for root vegetables [µg/g Dw] / [µg/g soil]	Chemical-specific (see Appendix D)

Description

This equation calculates the contaminant concentration in root vegetables due to uptake from the soil water.

Table C.2-5. Beef Concentration Due to Plant and Soil Ingestion

$$A_{beef} = (\sum F_i \, Qp_i \bullet P_i + Qs \bullet S_c) \bullet Ba_{beef}$$

$$P_i = Pd_i + Pv_i + Pr_i$$

Parameter	Definition	Values
A_{beef}	Concentration of pollutant in beef (mg/kg Fw)[1]	
F_i	Fraction of plant grown on contaminated soil and eaten by the animal (dimensionless) for each plant type.	1
Qp_i	Quantity of plant matter eaten by the animal each day (kg plant tissue DW/d) for each plant type	Varies for each plant type and between subsistence and commercial farmers (see Appendix D)
P_i	Total concentration of pollutant in the each plant type eaten by the animal (mg/kg Dw)	Calculated (see Tables C.2-1, C.2-2, C.2-3)
Qs	Quantity of soil eaten by the animal (kg soil/d)	Varies between subsistence and commercial farmers (see Appendix D)
Sc	Soil concentration (mg/kg)	Calculated (see Table C.1-1)
Ba_{beef}	Biotransfer factor for beef (d/kg)	Chemical-specific (see Appendix D)

Description

This equation calculates the concentration of contaminant in beef from ingestion of forage, silage, and soil.

[1] For the chemicals selenium, cadmium, divalent mercury and methyl mercury the concentration in beef is in (mg/kg Dw).

Table C.2-6. Milk Concentration Due to Plant and Soil Ingestion

$$A_{milk} = (\sum F_i \bullet Qp_i \bullet P_i + Qs \bullet Sc) \bullet Ba_{milk}$$

$$P_i = Pd_i + Pv_i + Pr_i$$

Parameter	Definition	Values
A_{milk}	Concentration of pollutant in milk (mg/kg Fw)[2]	
F_i	Fraction of plant grown on contaminated soil and eaten by the animal (dimensionless) for each plant type.	1
Qp_i	Quantity of plant matter eaten by the animal each day (kg plant tissue DW/d) for each plant type	Varies for each plant type and between subsistence and commercial farmers (see Appendix D)
P_i	Total concentration of pollutant in the each plant type eaten by the animal (mg/kg)	Calculated (see Tables C.2-1, C.2-2, C.2-3)
Qs	Quantity of soil eaten by the animal (kg soil/d)	Varies between subsistence and commercial farmers (see Appendix D)
Sc	Soil concentration (mg/kg)	Calculated (see Table C.1-1)
Ba_{milk}	Biotransfer factor for milk (d/kg)	Chemical-specific (see Appendix D)

Description

This equation calculates the concentration of contaminant in milk from ingestion of forage, silage, and soil.

[2] For the chemicals selenium, cadmium, divalent mercury, and methyl mercury the concentration in milk is in (mg/kg Dw).

Table C.2-7. Pork Concentration Due to Plant and Soil Ingestion

$$A_{pork} = (F_{silage} \bullet Qp_{silage} \bullet P_{silage} + Qs \bullet Sc) Ba_{pork}$$

$$P_{silage} = Pd_{silage} + Pv_{silage} + Pr_{silage}$$

Parameter	Definition	Values
A_{pork}	Concentration of pollutant in pork (mg/kg Fw)[3]	
F_{silage}	Fraction of silage grown on contaminated soil and eaten by the animal (dimensionless)	1
Qp_{silage}	Quantity of silage eaten by the animal each day (kg plant tissue DW/d)	Varies for each plant type (see Appendix D)
P_{silage}	Total concentration of pollutant due to root uptake in silage eaten by the animal (mg/kg Dw)	Calculated (see Table C.2-1, C.2-2, & C.2-3)
Qs	Quantity of soil eaten by the animal (kg soil/d)	0.37 (see Appendix D)
Sc	Soil concentration (mg/kg)	Calculated (see Table C.1-1)
Ba_{pork}	Biotransfer factor for pork (d/kg)	Chemical-specific (see Appendix D)

Description

This equation calculates the concentration of contaminant in pork from ingestion of silage and soil. Forage ingestion was not used because hogs are not grazing animals.

[3] For the chemicals selenium, cadmium, divalent mercury, and methyl mercury the concentration in pork is in (mg/kg Dw).

Table C.2-8. Concentration in Eggs Due to Soil Uptake by Chickens

$$A_{eggs} = S_c \bullet Fd \bullet BCF_{egg}$$

Parameter	Definition	Values
A_{eggs}	Concentration of pollutant in eggs (mg/kg Fw)	
Sc	Concentration of congener in soil (mg/kg)	Calculated (see Table C.1-1)
Fd	Fraction of diet that is soil (dimensionless)	0.1
BCF_{egg}	Bioconcentration factor for congener in eggs (unitless)	Chemical-specific (see Appendix D)

Description

This equation calculates the concentration in eggs due to ingestion of contaminated soil by the chickens raised by the subsistence poultry farmer.

Table C.2-9. Concentration in Poultry Meat Due to Soil Uptake by Chickens

$$A_{poultry} = S_c \bullet Fd \bullet BCF_{chick}$$

Parameter	Definition	Values
$A_{poultry}$	Concentration of pollutant in poultry meat (mg/kg Fw)	
Sc	Concentration of congener in soil (mg/kg)	Calculated (see Table C.1-1)
Fd	Fraction of diet that is soil (dimensionless)	0.1
BCF_{chick}	Bioconcentration factor for congener in thigh meat	Chemical-specific (see Appendix D)

Description

This equation calculates the concentration in poultry meat due to ingestion of contaminated soil by the chickens raised by the subsistence poultry farmer.

C.3 Aquatic Food Chain and Drinking Water Equations

Equations for the aquatic food chain were used to calculate the contaminant concentration in the waterbody partitioned between dissolved phase, suspended sediment, and benthic sediment. Contaminant concentrations in fish were calculated from the contaminant concentrations in the waterbody, either dissolved or total water column concentrations or sediment concentrations.

Prior to calculating a load to the waterbody, the contaminant concentration of soil in the watershed was calculated using equations C.3-1 to C.3-5. The deposition rates and air concentration of vapors used in the calculations were aerially averaged over each watershed.

Five pathways caused contaminant loading of the waterbody: (1) direct deposition, (2) runoff from impervious surfaces within the watershed, (3) runoff from pervious surfaces within the watershed, (4) soil erosion from the watershed, and (5) direct diffusion of dry vapor phase contaminant into the surface water. Other pathways were omitted or their contributions were assumed to be negligible compared with the pathways being evaluated. Although internal transformation could be considered as a waterbody loading pathway, this pathway was also omitted. Instead, the effects of transformation processes for constituents that were transformed (e.g., inorganic mercury to methylmercury) were implicit in the waterbody to fish tissue partitioning factor (e.g., the bioaccumulation factor for mercury).

The total waterbody concentration (in the water column and sediments) from the waterbody load was calculated and partitioned into a dissolved water concentration, a total water column concentration, and a bed sediment concentration. Only one of these three concentrations was calculated for each chemical. Chemical dissipation from within the waterbody was also considered, specifically the dissipation due to volatilization and burial in benthic sediment.

The dissolved water concentration was used to calculate the exposure due to drinking water ingestion, because the drinking water was assumed to be treated to remove suspended particles before consumption. For most metals, the fish concentration was calculated from the dissolved water concentration, which is the most bioavailable form. The sediment bioaccumulation factor was used to calculate the fish concentration for the dioxin congeners.

Table C.3-1. Soil Concentration Due to Deposition for Carcinogenic Compounds

$$\overline{Sc} = \frac{Ds}{ks \bullet (Tc - T_1)} \bullet \left[\left(Tc + \frac{\exp(-ks \bullet Tc)}{ks} \right) - \left(T_1 + \frac{\exp(-ks \bullet T_1)}{ks} \right) \right] \text{for } T_1 < Tc$$

$$Ds = \frac{100 \bullet Q}{Z \bullet BD} \bullet [F_v (0.31536 \bullet Vdv \bullet Cywv + Dywwv) + Dytwp \bullet (1 - F_v)]$$

Parameter	Definition	Values
Sc	Average soil concentration over exposure duration (mg/kg)	
Ds	Deposition term (mg/kg-yr)	
ks	Soil loss constant (yr^{-1})	Calculated (see Table C.1-2)
Tc	Time period over which deposition occurs (yr)	30
T_1	Time at beginning of exposure period (yr)	Scenario-specific (see Appendix D)
100	Units conversion factor ([mg-m^2]/[kg-cm^2])	
Q	Stack emissions (g/s)	Calculated
Z	Soil mixing depth (cm)	1
BD	Soil bulk density (g/cm^3)	1.5
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
0.31536	Units conversion factor (m-g-s/cm-µg-yr)	
Vdv	Dry deposition velocity (cm/s)	0.2 for Dioxins
Cywv	Spatially averaged period average unit emission vapor phase air concentration (µg-s/g-m^3)	Modeled
Dywwv	Spatially averaged annualized period average unit emission vapor phase wet deposition (s/m^2-yr)	Modeled
Dytwp	Spatially averaged annualized period average unit emission particle phase total (wet and dry) deposition (s/m^2-yr)	Modeled

Description

These equations calculate an average soil concentration as a result of wet and dry deposition of particles and vapors onto soil. Contaminants are assumed to be incorporated only to a finite depth (the mixing depth, Z).

Table C.3-1. (continued)

Soil Concentration Due to Deposition for Noncarcinogenic Compounds

$$Sc_{Tc} = \frac{Ds \bullet (1 - \exp(-ks \bullet Tc))}{ks}$$

$$Ds = \frac{100 \bullet Q}{Z \bullet BD} \bullet [F_v(0.31536 \bullet Vdv \bullet Cywv + Dywwv) + Dywtp \bullet (1 - F_v)]$$

Parameter	Definition	Values
Sc_{Tc}	Soil concentration at time Tc (mg/kg)	
Ds	Deposition term (mg/kg-yr)	
ks	Soil loss constant (yr^{-1})	Calculated (see Table C.1-2)
Tc	Time period over which deposition occurs (yr)	30
100	Units conversion factor ([mg-m^2]/[kg-cm^2])	
Q	Stack emissions (g/s)	Calculated
Z	Soil mixing depth (cm)	1
BD	Soil bulk density (g/cm^3)	1.5
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
0.31536	Units conversion factor (m-g-s/cm-µg-yr)	
Vdv	Dry deposition velocity (cm/s)	0.2 for Dioxins
Cywv	Spatially averaged period average unit emission vapor phase air concentration (µg-s/g-m^3)	Modeled
Dywwv	Spatially averaged annualized period average unit emission vapor phase wet deposition (s/m^2-yr)	Modeled
Dywtp	Spatially averaged annualized period average unit emission particle phase total (wet and dry) deposition (s/m^2-yr)	Modeled

Description

These equations calculate a soil concentration at time Tc as a result of wet and dry deposition of particles and vapors onto soil. Contaminants are assumed to be incorporated only to a finite depth (the mixing depth, Z).

Table C.3-2. Soil Loss Constant

$$ks = ksl + kse + ksr + ksg + ksv$$

Parameter	Definition	Values
ks	Soil loss constant due to all processes (yr^{-1})	
ksl	Loss constant due to leaching (yr^{-1})	Calculated (see Table C.3-3)
kse	Loss constant due to soil erosion (yr^{-1})	Calculated (see Table C.3-6)
ksr	Loss constant due to surface runoff (yr^{-1})	Calculated (see Table C.3-4)
ksg	Loss constant due to degradation (yr^{-1})	0
ksv	Loss constant due to volatilization (yr^{-1})	Calculated (see Table C.3-5)

Description

This equation calculates the soil loss constant, which accounts for the loss of contaminant from soil by several mechanisms.

Table C.3-3. Loss Constant Due to Leaching

$$Kd_s = f_{oc} \bullet K_{oc}$$

$$ksl = \frac{P + I - R - E_v}{\theta_s \bullet Z \bullet [1.0 + (BD \bullet Kd_s/\theta_s)]}$$

Parameter	Definition	Values
ksl	Loss constant due to leaching (yr^{-1})	
P	Average annual precipitation (cm/yr)	Site-specific (see Appendix B)
I	Average annual irrigation (cm/yr)	0
R	Average annual runoff (cm/yr)	Site-specific (see Appendix B)
E_v	Average annual evapotranspiration (cm/yr)	Site-specific (see Appendix B)
θ_s	Soil volumetric water content (mL/cm^3)	0.2
Z	Soil depth from which leaching removal occurs (cm)	Varies (see Appendix D)
BD	Soil bulk density (g/cm^3)	1.5
Kd_s	Soil-water partition coefficient (cm^3/g)	Metals - see Appendix D: dioxins - calculated as above
f_{oc}	Fraction organic carbon is soil (unitless)	0.006
K_{oc}	Organic carbon partition coefficient (mL/g)	Chemical-specific (see Appendix D)

Description

This equation calculates the contaminant loss constant due to leaching from soil.

Table C.3-4. Loss Constant due to Runoff

$$ksr = \frac{R}{\theta_s \bullet Z} \bullet \left(\frac{1}{1 + (Kd_s \bullet BD / \theta_s)} \right)$$

Parameter	Definition	Values
ksr	Loss constant due to runoff (yr^{-1})	
R	Average annual runoff (cm/yr)	Site-specific (see Appendix B)
θ_s	Soil volumetric water content (mL/cm^3)	0.2
Z	Soil mixing depth (cm)	1
Kd_s	Soil-water partition coefficient (cm^3/g)	Calculated (see Table C.3-3)
BD	Soil bulk density (g/cm^3)	1.5

Description

This equation calculates the contaminant loss constant due to runoff from soil.

Table C.3-5. Loss Constant due to Volatilization

$$ksv = \left[\frac{3.1536x10^{7} \bullet H}{Z \bullet Kd_s \bullet R \bullet T \bullet BD}\right] \bullet \left[0.482 \bullet u^{0.78} \bullet \left(\frac{\mu_a}{\rho_a \bullet D_a}\right)^{-0.67} \bullet \left(\sqrt{\frac{4 \bullet A}{\pi}}\right)^{-0.11}\right]$$

Parameter	Definition	Values
ksv	Loss constant due to volatilization (yr^{-1})	
$3.1536x10^{7}$	Conversion constant (s/yr)	
H	Henry's law constant (atm-m^3/mol)	Chemical-specific (see Appendix D)
Z	Soil mixing depth (cm)	1
Kd_s	Soil-water partition coefficient (cm^3/g)	Calculated (see Table C.3-3)
R	Universal gas constant (atm-m^3/mol-K)	$8.205x10^{-5}$
BD	Soil bulk density (g/cm^3)	1.5
T	Ambient air temperature (K)	Site-specific (see Appendix B)
u	Average annual wind speed (m/s)	Site-specific (see Appendix B)
μ_a	Viscosity of air (g/cm-s)	$1.81x10^{-4}$
ρa	Density of air (g/cm^3)	$1.2x10^{-3}$
Da	Diffusivity of contaminant in air (cm^2/s)	Chemical-specific (see Appendix D)
A	Surface area of contaminated area (m^2)	Varies (see Appendix D)

Description

This equation calculates the contaminant loss constant due to volatilization from soil.

Table C.3-6. Soil Loss Constant Due to Erosion

$$kse = \frac{0.1 \bullet X_e \bullet SD \bullet ER}{BD \bullet Z} \bullet \left(\frac{Kd_s \bullet BD}{\theta_s + (Kd_s \bullet BD)} \right)$$

Parameter	Definition	Values
kse	Loss constant due to erosion (yr^{-1})	
X_e	Unit soil loss ($kg/m^2/yr$)	Calculated (see Table C.3-13)
SD	Sediment delivery ratio (unitless)	Calculated (see Table C.3-14)
ER	Contaminant enrichment ratio (unitless)	3
BD	Soil bulk density (g/cm^3)	1.5
Kd_s	Soil-water partition coefficient (cm^3/g)	Calculated (see Table C.3-3)
Z	Soil mixing depth (cm)	1
θ_s	Soil volumetric water content (mL/cm^3)	0.2

Description

This equation calculates the contaminant loss constant due to erosion from soil.

Table C.3-7. Total Waterbody Load

$$L_T = L_{Dep} + L_{Dif} + L_{RI} + L_R + L_E$$

Parameter	Definition	Values
L_T	Total contaminant load to the waterbody (g/yr)	
L_{Dep}	Total (wet and dry) particle phase and wet vapor phase contaminant direct deposition load to waterbody (g/yr)	Calculated (see Table C.3-8)
L_{Dif}	Vapor phase contaminant diffusion (dry deposition) load to waterbody (g/yr)	Calculated (see Table C.3-12)
L_{RI}	Runoff load from impervious surfaces (g/yr)	Calculated (see Table C.3-9)
L_R	Runoff load from pervious surfaces (g/yr)	Calculated (see Table C.3-10)
L_E	Soil erosion load (g/yr)	Calculated (see Table C.3-11)

Description

This equation calculates the total average waterbody load from wet and dry vapor and particle deposition, runoff, and erosion loads.

Table C.3-8. Deposition to Waterbody

$$L_{Dep} = Q \bullet [F_v \bullet Dywbwv + (1 - F_v) \bullet Dywbtp] \bullet WA_w$$

Parameter	Definition	Values
L_{Dep}	Total (wet and dry) particle phase and wet vapor phase contaminant direct deposition load to waterbody (g/yr)	
Q	Stack emissions (g/s)	Calculated
F_v	Fraction of air in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
Dywbwv	Normalized yearly waterbody average wet deposition from vapor phase (s/m^2-yr)	Modeled
Dywbtp	Normalized yearly waterbody average total (wet and dry) deposition from particle phase (s/m^2-yr)	Modeled
WA_w	Water body area (m^2)	Site-specific (see Appendix B)

Description

This equation calculates the average load to the waterbody from direct deposition of wet and dry particles and wet vapors onto the surface of the waterbody.

Table C.3-9. Impervious Runoff Load to Watershed

$$L_{RI} = Q \bullet [F_v \bullet Dywswv + (1.0 - F_v) \bullet Dywstp] \bullet WA_I$$

Parameter	Definition	Values
L_{RI}	Impervious surface runoff load (g/yr)	
Q	Stack emissions (g/s)	Calculated
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
Dywswv	Normalized yearly watershed average wet deposition from vapor phase (s/m^2-yr)	Modeled
Dywstp	Normalized yearly watershed average total (wet and dry) deposition from particle phase (s/m^2-yr)	Modeled
WA_I	Impervious watershed area receiving pollutant deposition (m^2)	Site-specific (see Appendix B)

Description

This equation calculates the average runoff load to the waterbody from impervious surfaces in the watershed from which runoff is conveyed directly to the waterbody.

Table C.3-10. Pervious Runoff Load to Waterbody

$$L_R = R \bullet (WA_L - WA_I) \bullet \frac{Sc \bullet BD}{\theta_s + Kd_s \bullet BD} \bullet 0.01$$

$$Kd_s = f_{oc} \bullet K_{oc}$$

Parameter	Definition	Values
L_R	Pervious surface runoff load (g/yr)	
R	Average annual surface runoff (cm/yr)	Site-specific (see Appendix B)
WA_L	Total watershed area receiving pollutant deposition (m^2)	Site-specific (see Appendix B)
WA_I	Impervious watershed area receiving pollutant deposition (m^2)	Site-specific (see Appendix B)
Sc	Pollutant concentration in watershed soils (mg/kg)	Calculated (see Table C.3-1)
BD	Soil bulk density (g/cm^3)	1.5
θ_s	Volumetric soil water content (cm^3/cm^3)	0.2
0.01	Units conversion factor ($kg\text{-}cm^2/mg\text{-}m^2$)	
Kd_s	Soil-water partition coefficient (L/kg)	For metals - see Appendix D: for dioxins - calculated as above
f_{oc}	Fraction organic carbon in soil (unitless)	0.006
K_{oc}	Organic carbon partition coefficient (mL/g)	Chemical-specific (see Appendix D)

Description

This equation calculates the average runoff load to the waterbody from pervious soil surfaces in the watershed.

Table C.3-11. Erosion Load to Waterbody

$$L_E = X_e \bullet (WA_L - WA_I) \bullet SD \bullet ER \bullet \frac{Sc \bullet Kd_s \bullet BD}{\theta_s + Kd_s \bullet BD} \bullet 0.001$$

$$Kd_s = f_{oc} \bullet K_{oc}$$

Parameter	Definition	Values
L_E	Soil erosion load (g/yr)	
X_e	Unit soil loss (kg/m^2/yr)	Calculated (see Table C.3-13)
WA_L	Total watershed area receiving pollutant deposition (m^2)	Site-specific (see Appendix B)
WA_I	Impervious watershed area receiving pollutant deposition (m^2)	Site-specific (see Appendix B)
SD	Watershed sediment delivery ratio (unitless)	Calculated (see Table C.3.14)
ER	Soil enrichment ratio (unitless)	3
Sc	Pollutant concentration in watershed soils (mg/kg)	Calculated (see Table C.3-1)
Kd_s	Soil-water partition coefficient (L/kg)	For metals see Appendix D-- for dioxins, calculated as above
BD	Soil bulk density (g/cm^3)	1.5
θ_s	Volumetric soil water content (cm^3/cm^3)	0.2
0.001	Units conversion factor ([g/kg]/[mg/kg])	
f_{oc}	Fraction organic carbon in soil (unitless)	0.006
K_{oc}	Organic carbon partition coefficient (mL/g)	Chemical-specific (see Appendix D)

Description

This equation calculates the load to the waterbody from soil erosion.

Table C.3-12. Diffusion Load to Waterbody

$$L_{Dif} = \frac{Kv \bullet Q \bullet F_v \bullet Cywbv \bullet WA_w \bullet 10^{-6}}{\frac{H}{R \bullet T_w}}$$

Parameter	Definition	Values
L_{Dif}	Dry vapor phase contaminant diffusion load to waterbody (g/yr)	
Kv	Overall transfer rate (m/yr)	Calculated (see Table C.3-19)
Q	Stack emissions (g/s)	Calculated
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
Cywbv	Normalized yearly watershed average vapor phase air concentration (µg-s/g-m^3)	Modeled
WA_w	Waterbody surface area (m^2)	Site-specific (see Appendix B)
10^{-6}	Units conversion factor (g/µg)	
H	Henry's law constant (atm-m^3/mol)	Chemical-specific (see Appendix D)
R	Universal gas constant (atm-m^3/mol-K)	8.205×10^{-5}
T_w	Waterbody temperature (K)	298

Description

This equation calculates the load to the waterbody from diffusion.

Table C.3-13. Universal Soil Loss Equation (USLE)

$$X_e = RF \bullet K \bullet LS \bullet C \bullet P \bullet \frac{907.18}{4047}$$

Parameter	Definition	Values
X_e	Unit soil loss ($kg/m^2/yr$)	
RF	USLE rainfall (or erosivity) factor (yr^{-1})	Site-specific
K	USLE erodibility factor (ton/acre)	0.29 (farm ponds) 0.34 (modeled waterbodies)
LS	USLE length-slope factor (unitless)	1.5 (farm ponds) site-specific (modeled waterbodies) (see Appendix B)
C	USLE cover management factor (unitless)	0.08 (farm ponds) site-specific (modeled waterbodies) (see Appendix B)
P	USLE supporting practice factor (unitless)	1 (farm ponds) site-specific (modeled waterbodies) (see Appendix B)
907.18	Conversion factor (kg/ton)	
4047	Conversion factor (m^2/acre)	

Description

This equation calculates the soil loss rate from the watershed, using the Universal Soil Loss Equation; the result is used in the soil erosion load equation.

Table C.3-14. Sediment Delivery Ratio

$$SD = a \bullet (WA_L)^{-b}$$

Parameter	Definition	Values
SD	Watershed sediment delivery ratio (unitless)	
a	Empirical intercept coefficient	Depends on watershed area; see table below
WA_L	Watershed area receiving fallout (m^2)	Site-specific (see Appendix B)
b	Empirical slope coefficient	0.125

Description

This equation calculates the sediment delivery ratio for the watershed; the result is used in the soil erosion load equation.

Values for Empirical Intercept Coefficient, a

Watershed area (sq. miles)	"a" coefficient (unitless)
≤ 0.1	2.1
1	1.9
10	1.4
100	1.2
1,000	0.6

1 sq. mile = 2.59×10^6 m^2

Table C.3-15. Total Waterbody Concentration

$$C_{wtot} = \frac{L_T}{Vf_x \bullet f_{water} + kwt \bullet WA_w \bullet (d_w + d_b)}$$

Parameter	Definition	Values
C_{wtot}	Total water body concentration, including water column and bed sediment (mg/L)	
L_T	Total chemical load into water body, including deposition, runoff, and erosion (g/yr)	Calculated (see Table C.3-7)
Vf_x	Average volumetric flow rate through water body (m^3/yr)	Site-specific (see Appendix B)
f_{water}	Fraction of total water body contaminant concentration that occurs in the water column (unitless)	Calculated (see Table C.3-16)
kwt	Overall total waterbody dissipation rate constant (unitless)	Calculated (see Table C.3-17)
WA_w	Waterbody surface area (m^2)	Site-specific (see Appendix B)
d_w	Depth of water column (m)	Site-specific (see Appendix B)
d_b	Depth of upper benthic layer (m)	0.03

Description

This equation calculates the total waterbody concentration, including both the water column and the bed sediment.

Table C.3-16. Fraction in Water Column and Benthic Sediment

$$f_{water} = \frac{(1 + Kd_{sw} \bullet TSS \bullet 10^{-6}) \bullet d_w/d_z}{(1 + Kd_{sw} \bullet TSS \bullet 10^{-6}) \bullet d_w/d_z + (\theta_{bs} + Kd_{bs} \bullet BS) \bullet d_b/d_z}$$

$$f_{benth} = 1 - f_{water}$$

$$Kd_{sw} = OC_{ss} \bullet K_{oc}$$

$$Kd_{bs} = OC_{sed} \bullet K_{oc}$$

Parameter	Definition	Values
f_{water}	Fraction of total water body contaminant concentration that occurs in the water column (unitless)	
Kd_{sw}	Suspended sediment/surface water partition coefficient (L/kg)	For metals - see Appendix D: for dioxins - calculated as above
TSS	Total suspended solids (mg/L)	Site-specific (see Appendix B)
10^{-6}	Conversion factor (kg/mg)	
d_w	Depth of the water column (m)	Site-specific (see Appendix B)
d_z	Total waterbody depth (water column and benthic layer) (m)	Calculated (d_w+d_b)
d_b	Depth of the upper benthic layer (m)	0.03
θ_{bs}	Bed sediment porosity (L_{water}/L)	0.6
Kd_{bs}	Bed sediment/sediment pore water partition coefficient (L/kg)	For metals see Appendix D--for dioxins, calculated as above
BS	Bed sediment concentration (g/cm^3)	1.0

(continued)

Table C.3-16 (continued)

Parameter	Definition	Values
f_{benth}	Fraction of total waterbody contaminant concentration that occurs in the benthic sediment (unitless)	
OC_{ss}	Fraction of organic carbon in suspended sediment	0.045
K_{oc}	Organic carbon portion coefficient (mL/g)	Chemical-specific (see Appendix D)
OC_{sed}	Fraction of organic carbon in bed sediment	0.024

Description

These equations calculate the fraction of total waterbody concentration occurring in the water column and the bed sediments.

Table C.3-17. Overall Total Waterbody Dissipation Rate Constant

$$k_{wt} = f_{water} \bullet k_v + f_{benth} \bullet k_b$$

Parameter	Definition	Values
k_{wt}	Overall total waterbody dissipation rate constant (yr^{-1})	
f_{water}	Fraction of total waterbody contaminant concentration that occurs in the water column	Calculated (see Table C.3-16)
k_v	Water column volatilization loss rate constant (yr^{-1})	Calculated (see Table C.3-18)
f_{benth}	Fraction of total waterbody contaminant concentration that occurs in the benthic sediment	Calculated (see Table C.3-16)
k_b	Benthic burial rate constant (yr^{-1})	Calculated (see Table C.3-22)

Description

This equation calculates the overall dissipation rate of contaminant in surface water due to volatilization and benthic burial.

Table C.3-18. Water Column Volatilization Loss Rate Constant

$$k_v = \frac{K_v}{d_w \bullet (1 + Kd_{sw} \bullet TSS \bullet 10^{-6})}$$

Parameter	Definition	Values
k_v	Water column volatilization rate constant (yr^{-1})	
K_v	Overall transfer rate (m/yr)	Calculated (see Table C.3-19)
d_w	Total water column depth (m)	Site-specific (see Appendix B)
Kd_{sw}	Suspended sediment/surface water partition coefficient (L/kg)	Chemical-specific (see Appendix D)
TSS	Total suspended solids (mg/L)	Site-specific
10^{-6}	Conversion factor (kg/mg)	

Description

This equation calculates the water column contaminant loss due to volatilization.

Table C.3-19. Overall Transfer Rate

$$Kv = \left[K_L^{-1} + \left(K_G \frac{H}{R \bullet T_k} \right)^{-1} \right]^{-1} \bullet \theta^{(T_k - 293)}$$

Parameter	Definition	Values
Kv	Overall transfer rate (m/yr)	
K_L	Liquid phase transfer coefficient (m/yr)	Calculated (see Table C.3-20)
K_G	Gas phase transfer coefficient (m/yr)	Calculated (see Table C.3-21)
H	Henry's law constant (atm-m^3/mol)	Chemical-specific (see Appendix D)
R	Universal gas constant (atm-m^3/mol-K)	8.205×10^{-5}
T_k	Waterbody temperature (K)	298
θ	Temperature correction factor (unitless)	1.026

Description

This equation calculates the overall transfer rate of contaminant due to volatilization from the waterbody.

Table C.3-20. Liquid Phase Transfer Coefficient

- Flowing stream or river

$$K_L = \sqrt{\frac{10^{-4} \bullet D_w \bullet u}{d_w}} \bullet 3.15x10^7$$

- Quiescent lake or pond

$$K_L = (C_d^{0.5} \bullet W) \bullet \left(\frac{\rho_a}{\rho_w}\right)^{0.5} \bullet \left(\frac{k^{0.33}}{\lambda_2}\right) \bullet \left(\frac{\mu_w}{\rho_w \bullet D_w}\right)^{-0.67} \bullet 3.15x10^7$$

Parameter	Definition	Values
K_L	Liquid phase transfer coefficient (m/yr)	
D_w	Diffusivity of chemical in water (cm^2/s)	Chemical-specific (see Appendix D)
u	Current velocity (m/s)	Site-specific (see Appendix B)
d_w	Total water column depth (m)	Site-specific (see Appendix B)
C_d	Drag coefficient	0.0011
W	Wind velocity,10 m above water surface (m/s)	Site-specific (see Appendix B)
ρ_a	Density of air corresponding to water temperature (g/cm^3)	1.2×10^{-3}
ρ_w	Density of water corresponding to water temperature (g/cm^3)	1
k	von Karman's constant	0.4
λ_2	Dimensionless viscous sublayer thickness	4
μ_w	Viscosity of water (g/cm-s)	1.69×10^{-2}
$3.15x10^7$	Conversion constant (s/yr)	

Description

This equation calculates the transfer rate of contaminant in the liquid phase for a flowing or quiescent system.

Table C.3-21. Gas Phase Transfer Coefficient

- Flowing stream or river

$$K_G = 36500 \text{ m/yr}$$

- Quiescent lake or pond

$$K_G = (C_d^{0.5} \bullet W) \bullet \left(\frac{k^{0.33}}{\lambda_2} \right) \bullet \left(\frac{\mu_a}{\rho_a \bullet D_a} \right)^{-0.67} \bullet 3.15x10^7$$

Parameter	Definition	Values
K_G	Gas phase transfer coefficient (m/yr)	
C_d	Drag coefficient	0.0011
W	Wind velocity, 10 m above water surface (m/s)	Site-specific (see Appendix B)
k	von Karman's constant	0.4
λ_2	Dimensionless viscous sublayer thickness	4
μ_a	Viscosity of air corresponding to the air temperature (g/cm-s)	1.81×10^{-4}
ρ_a	Density of air corresponding to water temperature (g/cm^3)	1.2×10^{-3}
D_a	Diffusivity of chemical in air (cm^2/s)	Chemical-specific (see Appendix D)
$3.15x10^7$	Conversion constant (s/yr)	

Description

This equation calculates the transfer rate of contaminant in the gas phase for a flowing or quiescent system.

Table C.3-22. Benthic Burial Rate Constant

$$k_b = \left(\frac{X_e \bullet WA_L \bullet SD \bullet 10^3 - Vf_x \bullet TSS}{WA_w \bullet TSS} \right) \left(\frac{TSS \bullet 10^{-6}}{BS \bullet d_b} \right)$$

Parameter	Definition	Values
k_b	Benthic burial rate constant (yr^{-1})	
X_e	Unit soil loss (kg/m^2/	Calculated (see Table C.3-13)
WA_L	Watershed area receiving fallout (m^2)	Site-specific (see Appendix B)
SD	Watershed sediment delivery ratio (unitless)	Calculated (see Table C.3-14)
10^3	Conversion factor (g/kg)	
Vf_x	Average volumetric flow rate through waterbody (m^3/yr)	Site-specific (see Appendix B)
TSS	Total suspended solids (mg/L) or (g/m^3)	Site-specific (see Appendix B)
WA_w	Waterbody surface area (m^2)	Site-specific (see Appendix B)
10^{-6}	Conversion factor (kg/mg)	
BS	Benthic solids concentration (kg/L)	1
d_b	Depth of upper benthic sediment layer (m)	0.03

Description

This equation calculates the water column contaminant loss due to sediment burial.

Table C.3-23. Total Water Column Concentration

$$C_{wt} = f_{water} \bullet C_{wtot} \bullet \frac{d_w + d_b}{d_w}$$

Parameter	Definition	Values
C_{wt}	Total concentration in water column (mg/L)	
f_{water}	Fraction of total water body contaminant concentration that occurs in the water column (unitless)	Calculated (see Table C.3-16)
C_{wtot}	Total water concentration in surface water system, including water column and bed sediment (mg/L)	Calculated (see Table C.3-15)
d_w	Depth of the water column (m)	Site-specific (see Appendix B)
d_b	Depth of upper benthic layer (m)	0.03

Description

This equation calculates the total water column concentration of contaminant; this includes both dissolved contaminant and contaminant sorbed to suspended solids.

Table C.3-24. Dissolved Water Concentration

$$C_{dw} = \frac{C_{wt}}{1 + Kd_{sw} \bullet TSS \bullet 10^{-6}}$$

$$Kd_{sw} = OC_{ss} \bullet K_{oc}$$

Parameter	Definition	Values
C_{dw}	Dissolved phase water concentration (mg/L)	
C_{wt}	Total concentration in water column (mg/L)	Calculated (see Table C.3-23)
Kd_{sw}	Suspended sediment/surface water partition coefficient (L/kg)	Metals see Appendix D dioxins, calculated as above
TSS	Total suspended solids (mg/L)	Site-specific (see Appendix B)
OC_{ss}	Fraction of organic carbon in suspended sediment	0.045
K_{oc}	Organic carbon partition coefficient (mL/g)	Chemical-specific (see Appendix D)

Description

This equation calculates the concentration of contaminant dissolved in the water column.

Table C.3-25. Concentration Sorbed to Bed Sediment

$$C_{sb} = f_{benth} \bullet C_{wtot} \bullet \frac{Kd_{bs}}{\theta_{bs} + Kd_{bs} \bullet BS} \bullet \frac{d_w + d_b}{d_b}$$

$$Kd_{bs} = OC_{sed} \bullet K_{oc}$$

Parameter	Definition	Values
C_{sb}	Concentration sorbed to bed sediments (mg/kg)	
f_{benth}	Fraction of total waterbody contaminant concentration that occurs in the bed sediment (unitless)	Calculated (see Table C.3-16)
C_{wtot}	Total water concentration in surface water system, including water column and bed sediment (mg/L)	Calculated (see Table C.3-15)
Kd_{bs}	Bed sediment/sediment pore water partition coefficient (L/kg)	Metals see Appendix D dioxins calculated as above
θ_{bs}	Bed sediment porosity (unitless)	0.6
BS	Bed sediment concentration (kg/L)	1.0
d_w	Total depth of water column (m)	Site-specific (see Appendix B)
d_b	Depth of the upper benthic layer (m)	0.03
OC_{sed}	Fraction of organic carbon in bed sediment	0.014
K_{oc}	Organic carbon partition coefficient (mL/g)	Chemical-specific (see Appendix D)

Description

This equation calculates the concentration of contaminant sorbed to bed sediments.

Table C.3-26. Fish Concentration from Dissolved Water Concentration

$$C_{fish} = C_{dw} \bullet BAF, \text{ or}$$

$$C_{fish} = C_{dw} \bullet BCF$$

Parameter	Definition	Values
C_{fish}	Fish concentration (mg/kg)	
C_{dw}	Dissolved water concentration (mg/L)	Calculated (see Table C.3-24)
BAF	Bioaccumulation factor (L/kg)	Chemical-specific (see Appendix D)
BCF	Bioconcentration factor (L/kg)	Chemical-specific (see Appendix D)

Description

This equation calculates fish concentration from dissolved water concentration, using either a bioaccumulation factor or a bioconcentration factor.

Table C.3-27. Fish Concentration from Bed Sediments

$$C_{fish} = \frac{C_{sb} \bullet f_{lipid} \bullet BSAF}{OC_{sed}}$$

Parameter	Definition	Values
C_{fish}	Fish concentration (mg/kg)	
C_{sb}	Concentration of contaminant sorbed to bed sediment (mg/kg)	Calculated (see Table C.3-25)
f_{lipid}	Fish lipid content (fraction)	0.03
BSAF	Biota to sediment accumulation factor (unitless)	Chemical-specific (see Appendix D)
OC_{sed}	Fraction organic carbon in bottom sediment (unitless)	0.014

Description

This equation calculates fish concentration from bed sediment concentration, using a biota-to-sediment accumulation factor.

Table C.3-28. Mercury Soil Concentration Due to Deposition onto Watershed Soil

$$Sc = \frac{L_w}{ks \bullet Z \bullet BD} (1 - e^{-ks \bullet Tc}) 100 + C_{sb}$$

$$L_w = \sum_i (D_{TDW,i} + D_{WVW,i} + L_{IS,i} + L_{Dif,i})$$

$$Sc_i = Sc \bullet fs_i$$

Parameter	Definition	Values
Sc	Average soil concentration of total mercury in watershed soil (µg/g)	
L_w	Load of total mercury to watershed soil on an areal basis (g/m^2-yr)	
ks	Soil loss constant for total mercury (yr^{-1})	Calculated (see Table C.3-31)
Z	Mixing depth of soil (cm)	1 cm
BD	Bulk density of soil (g/cm^3)	1.5
T_c	Time period of combustion	30
C_{sb}	Background "natural" soil concentration (µg/g)	0
$D_{TDW,i}$	Total (wet and dry) deposition of particles to the watershed soil for divalent mercury (g/m^2-yr)	Modeled
$D_{WVW,i}$	Wet deposition of divalent and elemental mercury vapors to watershed soil (g/m^2-yr)	Modeled
$L_{IS,i}$	Internal transformation load of mercury species (g/m^2-yr)	0
$L_{Dif,i}$	Diffusion flux of divalent and elemental mercury to watershed soil (g/m^2-yr)	Calculated (see Table C.3-30)
Sc_i	Soil concentration of mercury species "i" in watershed soil (µg/g)	
fs_i	Equilibrium fraction of mercury species "i" in watershed soil	Calculated (see Table C.3-29)

Description

These equations calculate a soil concentration for total mercury and the three mercury species at time T_i as a result of wet and dry deposition of particles and vapors to soil. Only elemental and divalent mercury are assumed to be deposited onto the soil.

Table C.3-29. Equilibrium Fraction of Mercury Species "i" in Soil

$$1 = \sum_{i} fs_i$$

$$fs_{elemental} + fs_{divalent} = 0.98$$

$$fs_{elemental} = \frac{ks_{red} \bullet 365}{ksv_{elemental}} \bullet fs_{divalent}$$

$$fs_{methylmercury} = 0.02$$

Parameter	Definition	Values
fs_i	Equilibrium fraction of mercury species "i" in watershed soil	
$fs_{elemental}$	Equilibrium fraction of elemental mercury in watershed soil	
$fs_{divalent}$	Equilibrium fraction of divalent mercury in watershed soil	
ks_{red}	Reduction rate constant of divalent mercury (day^{-1})	0.00005
365	Units conversion factor (days/yr)	
ksv	Soil loss constant due to volatilization for mercury species "i"(yr^{-1})	Calculated (see Table C.3-34)
$fs_{methylmercury}$	Equilibrium fraction of methylmercury in watershed soil	

Description

These equations calculate an equilibrium soil fraction for the three mercury species. Methylmercury is assumed to be constant at 2% and elemental and divalent mercury are assumed to comprise the other 98%.

Table C.3-30. Atmospheric Diffusion Flux to Watershed Soil

$$L_{Dif,i} = 0.31536 \bullet K_{t,i} \bullet C_{vws,i}$$

Parameter	Definition	Values
$L_{Dif,i}$	Diffusion flux of mercury species "i" to soil (g/m^2-yr)	
0.31536	Units conversion factor (m-g-s/cm-µg-yr)	
$K_{t,i}$	Dry deposition velocity for mercury species "i" (cm/s)	Elemental - 0 Divalent - site specific Methyl - NA
$C_{vws,i}$	Average vapor phase air concentration of the i^{th} species over the watershed ($\mu g/m^3$)	Modeled

Description

This equation calculates the diffusion flux of divalent and elemental mercury to soil. Methylmercury was assumed not to be emitted from hazardous waste combustors and, thus, no flux occurs for methylmercury.

Table C.3-31. Soil Loss Constant

$$ks = \sum ks_i \cdot fs_i$$

$$ks_i = ksl_i + kse_i + ksr_i + ksg_i + ksv_i$$

Parameter	Definition	Values
ks	Soil loss constant for total mercury (yr^{-1})	
ks_i	Soil loss constant due to all processes for mercury species "i" (yr^{-1})	
fs_i	Equilibrium fraction of mercury species "i" in watershed soils	Calculated (see Table C.3-29)
ksl_i	Loss constant due to leaching for mercury species "i" (yr^{-1})	Calculated (see Table C.3-32)
kse_i	Loss constant due to soil erosion for mercury species "i" (yr^{-1})	Calculated (see Table C.3-35)
ksr_i	Loss constant due to surface runoff for mercury species "i" (yr^{-1})	Calculated (see Table C.3-33)
ksg_i	Loss constant due to degradation for mercury species "i" (yr^{-1})	0
ksv_i	Loss constant due to volatilization for mercury species "i" (yr^{-1})	Calculated (see Table C.3-34)

Description

This equation calculates the soil loss constant, which accounts for the loss of contaminant from soil by several mechanisms.

Table C.3-32. Loss Constant Due to Leaching

$$ksl_i = \frac{P + I - R - E_v}{\theta_s \bullet Z \bullet [1.0 + (BD \bullet Kd_{s,i}/\theta_s)]}$$

Parameter	Definition	Values
ksl_i	Loss constant due to leaching for mercury species "i" (yr^{-1})	
P	Average annual precipitation (cm/yr)	Site-specific
I	Average annual irrigation (cm/yr)	0
R	Average annual runoff (cm/yr)	Site-specific
E_v	Average annual evapotranspiration (cm/yr)	Site-specific
θ_s	Soil volumetric water content (mL/cm^3)	0.2
Z	Soil depth from which leaching removal occurs (cm)	1
BD	Soil bulk density (g/cm^3)	1.5
$Kd_{s,i}$	Soil-water partition coefficient for mercury species "i" (cm^3/g)	Chemical-specific (see Appendix D)

Description

This equation calculates the contaminant loss constant due to leaching from soil.

Table C.3-33. Loss Constant Due to Runoff

$$ksr_i = \frac{R}{\theta_s \bullet Z} \bullet \left(\frac{1}{1 + (Kd_{s,i} \bullet BD / \theta_s)} \right)$$

Parameter	Definition	Values
ksr_i	Loss constant due to runoff for mercury species "i" (yr^{-1})	
R	Average annual runoff (cm/yr)	Site-specific
θ_s	Soil volumetric water content (mL/cm^3)	0.2
Z	Soil mixing depth (cm)	1
$Kd_{s,i}$	Soil-water partition coefficient for mercury species "i" (cm^3/g)	Chemical-specific (see Appendix D)
BD	Soil bulk density (g/cm^3)	1.5

Description

This equation calculates the contaminant loss constant due to runoff from soil.

Table C.3-34. Loss Constant Due to Volatilization

$$ksv_i = \left[\frac{3.1536x10^{7} \bullet H_i}{Z \bullet Kd_{s,i} \bullet R \bullet T \bullet BD}\right] \bullet \left[0.482 \bullet u^{0.78} \bullet \left(\frac{\mu_a}{\rho_a \bullet Da_i}\right)^{-0.67} \bullet \left(\sqrt{\frac{4 \bullet A}{\pi}}\right)^{-0.11}\right]$$

Parameter	Definition	Values
ksv_i	Loss constant due to volatilization for mercury species "i" (yr^{-1})	
$3.1536x10^7$	Units conversion factor (s/yr)	
H_i	Henry's law constant (atm-m^3/mol)	Chemical-specific (see Appendix D)
Z	Soil mixing depth (cm)	Varies (see Appendix D)
$Kd_{s,i}$	Soil-water partition coefficient (cm^3/g)	Chemical-specific (see Appendix D)
R	Universal gas constant (atm-m^3/mol-K)	$8.205x10^{-5}$
T	Ambient air temperature (K)	Site-specific
BD	Soil bulk density (g/cm^3)	1.5
u	Average annual wind speed (m/s)	Site-specific
μ_a	Viscosity of air (g/cm-s)	$1.81x10^{-4}$
ρa	Density of air (g/cm^3)	$1.2x10^{-3}$
Da_i	Diffusivity of contaminant in air for mercury species "i" (cm^2/s)	Chemical-specific (see Appendix D)
A	Surface area of contaminated area (m^2)	Site-specific

Description

This equation calculates the contaminant loss constant due to volatilization from soil.

Table C.3-35. Soil Loss Constant Due to Erosion

$$kse_i = \frac{0.1 \bullet X_e \bullet SD \bullet ER}{BD \bullet Z} \bullet \left(\frac{Kd_{s,i} \bullet BD}{\theta_s + (Kd_{s,i} \bullet BD)} \right)$$

Parameter	Definition	Values
kse_i	Loss constant due to erosion for mercury species "i" (yr^{-1})	
X_e	Unit soil loss ($kg/m^2/yr$)	Calculated (see Table C.3-36)
SD	Sediment delivery ratio (unitless)	Calculated (see Table C.3-37)
ER	Contaminant enrichment ratio (unitless)	3
BD	Soil bulk density (g/cm^3)	1.5
Z	Soil mixing depth (cm)	1
$Kd_{s,i}$	Soil-water partition coefficient for mercury species "i" (cm^3/g)	
θ_s	Soil volumetric water content (mL/cm^3)	0.2

Description

This equation calculates the contaminant loss constant due to erosion from soil.

Table C.3-36. Universal Soil Loss Equation (USLE)

$$X_e = RF \bullet K \bullet LS \bullet C \bullet P \bullet \frac{907.18}{4047}$$

Parameter	Definition	Values
X_e	Unit soil loss ($kg/m^2/yr$)	
RF	USLE rainfall (or erosivity) factor (yr^{-1})	Site-specific
K	USLE erodibility factor (ton/acre)	0.34 (modeled waterbodies) 0.29 (farm ponds)
LS	USLE length-slope factor (unitless)	Site-specific (modeled waterbodies) 1.5 (farm ponds)
C	USLE cover management factor (unitless)	Site-specific (modeled waterbodies) 0.08 (farm ponds)
P	USLE supporting practice factor (unitless)	Site-specific (modeled waterbodies) 1 (farm ponds)
907.18	Units conversion factor (kg/ton)	
4047	Units conversion factor (m^2/acre)	

Description

This equation calculates the soil loss rate from the watershed, using the Universal Soil Loss Equation; the result is used in the soil erosion load equation.

Table C.3-37. Sediment Delivery Ratio

$$SD = a \bullet (WA_L)^{-b}$$

Parameter	Definition	Values
SD	Watershed sediment delivery ratio (unitless)	
a	Empirical intercept coefficient	Depends on watershed area; see table below
WA_L	Watershed area receiving fallout (m^2)	Site-specific
b	Empirical slope coefficient	0.125

Description

This equation calculates the sediment delivery ratio for the watershed; the result is used in the soil erosion load equation.

Values for Empirical Intercept Coefficient, a

Watershed area (sq. miles)	"a" coefficient (unitless)
≤ 0.1	2.1
1	1.9
10	1.4
100	1.2
1,000	0.6

1 sq. mile = 2.59×10^6 m^2

Table C.3-38. Total Waterbody Load

$$L_{T,i} = \sum(L_{Dep,i} + L_{Dif,i} + L_{RI,i} + L_{R,i} + L_{E,i})$$

$$L_T = \sum L_{T,i}$$

Parameter	Definition	Values
$L_{T,i}$	Total contaminant load of the i^{th} species to the waterbody (g/yr)	
$L_{Dep,i}$	Total (wet and dry) particle phase and wet vapor phase contaminant direct deposition load to waterbody for mercury species "i" (g/yr)	Calculated (see Table C.3-39)
$L_{Dif,i}$	Vapor phase contaminant diffusion (dry deposition) load to waterbody for mercury species "i" (g/yr)	Calculated (see Table C.3-43)
$L_{RI,i}$	Runoff load from impervious surfaces for mercury species "i" (g/yr)	Calculated (see Table C.3-40)
$L_{R,i}$	Runoff load from pervious surfaces for mercury species "i" (g/yr)	Calculated (see Table C.3-41)
$L_{E,i}$	Soil erosion load for mercury species "i" (g/yr)	Calculated (see Table C.3-42)
L_T	Total contaminant load to the waterbody (g/yr)	

Description

This equation calculates the total average waterbody load from wet and dry vapor and particle deposition, runoff, and erosion loads.

Table C.3-39. Deposition to Waterbody

$$L_{Dep,i} = Q_i \bullet [\, Fv_i \bullet Dywbwv_i + (1 - Fv_i) \bullet Dywbtp_i \,] \bullet WA_w$$

Parameter	Definition	Values
$L_{Dep,i}$	Total (wet and dry) particle phase and wet vapor phase contaminant direct deposition load to waterbody for mercury species "i" (g/yr)	
Q_i	Stack emissions for mercury species "i" (g/s)	Site-specific
Fv_i	Fraction of air concentration in the vapor phase for mercury species "i" (unitless)	Chemical-specific (see Appendix D)
$Dywbwv_i$	Normalized yearly waterbody average wet deposition from vapor phase for mercury species "i" (s/m^2-yr)	Modeled
$Dywbtp_i$	Normalized yearly waterbody average total (wet and dry) deposition from particle phase for mercury species "i" (s/m^2-yr)	Modeled
WA_w	Waterbody area (m^2)	Site-specific

Description

This equation calculates the average load to the waterbody from direct deposition of wet and dry particles and wet vapors onto the surface of the waterbody.

Table C.3-40. Impervious Runoff Load to Watershed

$$L_{RI,i} = Q_i \bullet [\, Fv_i \bullet Dywswv_i + (1.0 - Fv_i) \bullet Dywstp_i \,] \bullet WA_I$$

Parameter	Definition	Values
$L_{RI,i}$	Impervious surface runoff load for mercury species "i" (g/yr)	
Q_i	Stack emissions for mercury species "i" (g/s)	Site-specific
Fv_i	Fraction of air concentration in vapor phase for mercury species "i" (dimensionless)	Chemical-specific (see Appendix D)
$Dywswv_i$	Normalized yearly watershed average wet deposition from vapor phase (s/m^2-yr)	Modeled
$Dywstp_i$	Normalized yearly watershed average total (wet and dry) deposition from particle phase (s/m^2-yr)	Modeled
WA_I	Impervious watershed area receiving pollutant deposition (m^2)	Site-specific

Description

This equation calculates the average runoff load to the waterbody from impervious surfaces in the watershed from which runoff is conveyed directly to the waterbody.

Table C.3-41. Pervious Runoff Load to Waterbody

$$L_{R,i} = R \bullet (WA_L - WA_I) \bullet \frac{Sc_i \bullet BD}{\theta_s + Kd_{s,i} \bullet BD} \bullet 0.01$$

Parameter	Definition	Values
$L_{R,i}$	Pervious surface runoff load for mercury species "i" (g/yr)	
R	Average annual surface runoff (cm/yr)	Site-specific
WA_L	Total watershed area receiving pollutant deposition (m^2)	Site-specific
WA_I	Impervious watershed area receiving pollutant deposition (m^2)	Site-specific
Sc_i	Pollutant concentration in watershed soils (mg/kg)	Calculated (see Table C.3-28)
BD	Soil bulk density (g/cm^3)	1.5
θ_s	Volumetric soil water content (cm^3/cm^3)	0.2
$Kd_{s,i}$	Soil-water partition coefficient for mercury species "i" (L/kg)	Chemical-specific (see Appendix D)
0.01	Units conversion factor (kg-cm^2/mg-m^2)	

Description

This equation calculates the average runoff load to the waterbody from pervious soil surfaces in the watershed.

Table C.3-42. Erosion Load to Waterbody

$$L_{E,i} = X_e \bullet (WA_L - WA_I) \bullet SD \bullet ER \bullet \frac{Sc_i \bullet Kd_{s,i} \bullet BD}{\theta_s + Kd_{s,i} \bullet BD} \bullet 0.001$$

Parameter	Definition	Values
$L_{E,i}$	Soil erosion load for mercury species "i" (g/yr)	
X_e	Unit soil loss (kg/m^2/yr)	Calculated (see Table C.3-36)
WA_L	Total watershed area receiving pollutant deposition (m^2)	Site-specific
WA_I	Impervious watershed area receiving pollutant deposition (m^2)	Site-specific
SD	Watershed sediment delivery ratio (unitless)	Calculated (see Table C.3-37)
ER	Soil enrichment ratio (unitless)	3
Sc_i	Pollutant concentration in watershed soils for mercury species "i" (mg/kg)	Calculated (see Table C.3-28)
$Kd_{s,i}$	Soil-water partition coefficient (L/kg)	Chemical-specific (see Appendix D)
BD	Soil bulk density (g/cm^3)	1.5
θ_s	Volumetric soil water content (cm^3/cm^3)	0.2
0.001	Units conversion factor ([g/kg]/[mg/kg])	

Description

This equation calculates the load to the waterbody from soil erosion.

Table C.3-43. Diffusion Load to Waterbody

$$L_{Dif,i} = \frac{Kv_i \bullet Q_i \bullet Fv_i \bullet Cywbv_i \bullet WA_w \bullet 10^{-6}}{\frac{H_i}{R \bullet T_w}}$$

Parameter	Definition	Values
$L_{Dif,i}$	Dry vapor phase contaminant diffusion load to waterbody for mercury species "i" (g/yr)	
Kv_i	Diffusive mass transfer coefficient for mercury species "i" (m/yr)	Calculated (see Table C.3-44)
Q_i	Stack emissions for mercury species "i" (g/s)	Site-specific
Fv_i	Fraction of air concentration in vapor phase for mercury species "i" (dimensionless)	Chemical-specific (see Appendix D)
$Cywbv_i$	Normalized yearly watershed average vapor phase air concentration for mercury species "i" (µg-s/g-m^3)	Modeled
WA_w	Waterbody surface area (m^2)	Site-specific
10^{-6}	Units conversion factor (g/µg)	
H_i	Henry's Law constant for mercury species "i" (atm-m^3/mol)	Chemical-specific (see Appendix D)
R	Universal gas constant (atm-m^3/mol-K)	8.205×10^{-5}
T_w	Waterbody temperature (K)	298

Description

This equation calculates the load to the waterbody as a result of vapor diffusion.

Table C.3-44. Overall Transfer Rate

$$Kv_i = \left[K_{L,i}^{-1} + \left(K_{G,i} \frac{H_i}{R \bullet T_k} \right)^{-1} \right]^{-1} \bullet \theta^{(T_k - 293)}$$

Parameter	Definition	Values
Kv_i	Overall transfer rate for mercury species "i" (m/yr)	
$K_{L,i}$	Liquid phase transfer coefficient for mercury species "i" (m/yr)	Calculated (see Table C.3-45)
$K_{G,i}$	Gas phase transfer coefficient for mercury species "i" (m/yr)	Calculated (see Table C.3-46)
H_i	Henry's law constant for mercury species "i" (atm-m^3/mol)	Chemical-specific (see Appendix D)
R	Universal gas constant (atm-m^3/mol-K)	8.205×10^{-5}
T_k	Waterbody temperature (K)	298
θ	Temperature correction factor (unitless)	1.026

Description

This equation calculates the overall transfer rate of contaminant due to volatilization from the waterbody.

Table C.3-45. Liquid Phase Transfer Coefficient

- Flowing stream or river

$$K_{L,i} = \sqrt{\frac{10^{-4} \bullet Dw_i \bullet u}{d_w}} \bullet 3.15x10^7$$

- Quiescent lake or pond

$$K_{L,i} = (C_d^{0.5} \bullet W) \bullet \left(\frac{\rho_a}{\rho_w}\right)^{0.5} \bullet \left(\frac{k^{0.33}}{\lambda_2}\right) \bullet \left(\frac{\mu_w}{\rho_w \bullet Dw_i}\right)^{-0.67} \bullet 3.15x10^7$$

Parameter	Definition	Values
$K_{L,i}$	Liquid phase transfer coefficient for mercury species "i" (m/yr)	
Dw_i	Diffusivity of chemical in water for mercury species "i" (cm^2/s)	Chemical-specific (see Appendix D)
u	Current velocity (m/s)	Site-specific
d_w	Total water column depth (m)	Site-specific
C_d	Drag coefficient	0.0011
W	Wind velocity, 10 m above water surface (m/s)	Site-specific
ρ_a	Density of air corresponding to water temperature (g/cm^3)	1.2×10^{-3}
ρ_w	Density of water corresponding to water temperature (g/cm^3)	1
k	von Karman's constant	0.4
λ_2	Dimensionless viscous sublayer thickness	4
μ_w	Viscosity of water corresponding to the water temperature (g/cm-s)	1.69×10^{-2}
$3.15x10^7$	Units conversion factor (s/yr)	

Description

This equation calculates the transfer rate of contaminant in the liquid phase for a flowing or quiescent system.

Table C.3-46. Gas Phase Transfer Coefficient

- Flowing stream or river

$$K_{G,i} = 36{,}500 \text{ m/yr}$$

- Quiescent lake or pond

$$K_{G,i} = (C_d^{0.5} \bullet W) \bullet \left(\frac{k^{0.33}}{\lambda_2} \right) \bullet \left(\frac{\mu_a}{\rho_a \bullet Da_i} \right)^{-0.67} \bullet 3.15x10^7$$

Parameter	Definition	Values
$K_{G,i}$	Gas phase transfer coefficient for mercury species "i" (m/yr)	
C_d	Drag coefficient	0.0011
W	Wind velocity, 10 m above water surface (m/s)	Site-specific
k	von Karman's constant	0.4
λ_2	Dimensionless viscous sublayer thickness	4
μ_a	Viscosity of air corresponding to the air temperature (g/cm-s)	1.81×10^{-4}
ρ_a	Density of air corresponding to water temperature (g/cm^3)	1.2×10^{-3}
Da_i	Diffusivity of chemical in air for mercury species "i" (cm^2/s)	Chemical-specific (see Appendix D)
$3.15x10^7$	Units conversion constant (s/yr)	

Description

This equation calculates the transfer rate of contaminant in the gas phase for a flowing or quiescent system.

Table C.3-47. Fraction in Water Column and Benthic Sediment

$$f_{water} = \sum f_{water,i} \bullet fw_i$$

$$f_{water,i} = \frac{(1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6}) \bullet d_w/d_z}{(1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6}) \bullet d_w/d_z + (\theta_{bs} + Kd_{bs,i} \bullet BS) \bullet d_b/d_z}$$

$$f_{benth,i} = 1 - f_{water,i}$$

Parameter	Definition	Values
f_{water}	Fraction of total waterbody contaminant concentration that occurs in water column for total mercury (unitless)	
$f_{water,i}$	Fraction of total water body contaminant concentration that occurs in the water column for mercury species "i" (unitless)	
fw_i	Equilibrium fraction of mercury species "i" in water column	Elemental = 0.02 Divalent = 0.83 Methyl = 0.15
$Kd_{sw,i}$	Suspended sediment/surface water partition coefficient for mercury species "i" (L/kg)	Chemical-specific (See Appendix D)
TSS	Total suspended solids (mg/L)	Site-specific
10^{-6}	Units conversion factor (kg/mg)	
d_w	Depth of the water column (m)	Site-specific
d_z	Total waterbody depth (m)	Calculated (d_w+d_b)
θ_{bs}	Bed sediment porosity (L_{water}/L)	0.6
$Kd_{bs,i}$	Bed sediment/sediment pore water partition coefficient for mercury species "i" (L/kg)	Chemical-specific (See Appendix D)
BS	Bed sediment concentration (g/cm^3)	1.0
d_b	Depth of the upper benthic layer (m)	0.03
$f_{benth,i}$	Fraction of total water body contaminant concentration that occurs in the benthic sediment for mercury species "i" (unitless)	

Description

These equations calculate the fraction of total waterbody concentration occurring in the water column and the bed sediments.

Table C.3-48. Water Column Volatilization Loss Rate Constant

$$kv_i = \frac{Kv_i}{d_w \bullet (1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6})}$$

Parameter	Definition	Values
kv_i	Water column volatilization rate constant for mercury species "i" (yr^{-1})	
Kv_i	Overall transfer rate for mercury species "i" (m/yr)	Calculated (see Table C-3.44)
d_w	Total water column depth (m)	Site-specific
$Kd_{sw,i}$	Suspended sediment/surface water partition coefficient (L/kg)	Chemical-specific (See Appendix D)
TSS	Total suspended solids (mg/L)	Site-specific
10^{-6}	Units conversion factor (kg/mg)	

Description

This equation calculates the water column contaminant loss due to volatilization.

Table C.3.49. Overall Total Waterbody Dissipation Rate Constant

$$kwt = \sum kwt_i \bullet R_i$$

$$kwt_i = f_{water,i} \bullet kv_i + f_{benth,i} \bullet k_b$$

$$R_i = \frac{fw_i \bullet \left(\frac{d_w}{d_z} + (\theta_{bs} + Kd_{bs,i} \bullet BS) \bullet \frac{d_b}{d_z} \bullet \frac{1}{1 + Kd_{bs,i} \bullet TSS \bullet 10^{-6}}\right)}{\sum fw_i \bullet \left(\frac{d_w}{d_z} + (\theta_{bs} + Kd_{bs,i} \bullet BS) \bullet \frac{d_b}{d_z} \bullet \frac{1}{1 + Kd_{bs,i} \bullet TSS \bullet 10^{-6}}\right)}$$

Parameter	Definition	Values
kwt	Overall total waterbody dissipation rate constant for total mercury (yr^{-1})	
kwt_i	Overall total waterbody dissipation rate constant for mercury species "i" (yr^{-1})	
R_i	Relative fraction of the i^{th} species in the waterbody	
$f_{water,i}$	Fraction of total waterbody contaminant concentration that occurs in the water column for mercury species "i"	calculated (see Table C-3.47)
kv_i	Water column volatilization rate constant for mercury species "i" (yr^{-1})	calculated (see Table C-3.48)
$f_{benth,i}$	Fraction of total waterbody contaminant concentration that occurs in the benthic sediment for mercury species "i"	calculated (see Table C-3.47)
k_b	Benthic burial rate constant (yr^{-1})	calculated (see Table C-3.50)
fw_i	Equilibrium fraction of mercury species "i" in water	Elemental = 0.02 Divalent = 0.83 Methyl = 0.15
d_w	Total water column depth (m)	Site-specific
d_z	Total waterbody depth (m)	Site-specific
θ_{bs}	Bed sediment porosity (L_{water}/L)	0.6
$Kd_{bs,i}$	Bed sediment/sediment pore water partition coefficient for mercury species "i" (L/kg)	Chemical-specific (See Appendix D)

(continued)

Table C.3-49. (continued)

Parameter	Definition	Values
BS	Bed sediment concentration (g/cm^3)	1.0
d_b	Depth of upper benthic layer (m)	0.03
$Kd_{sw,i}$	Suspended sediment/surface water partition coefficient (L/kg)	Chemical-specific (See Appendix D)
TSS	Total suspended solids (mg/L)	Site-specific
10^{-6}	Units conversion factor (kg/mg)	

Description

This equation calculates the overall dissipation rate of contaminant in surface water due to volatilization and benthic burial.

Table C.3-50. Benthic Burial Rate Constant

$$k_b = \left(\frac{X_e \bullet WA_L \bullet SD \bullet 10^3 - Vf_x \bullet TSS}{WA_w \bullet TSS} \right) \left(\frac{TSS \bullet 10^{-6}}{BS \bullet d_b} \right)$$

Parameter	Definition	Values
k_b	Benthic burial rate constant (yr^{-1})	
X_e	Unit soil loss ($kg/m^2/yr$)	Calculated (see Table C-3.36)
WA_L	Watershed area receiving fallout (m^2)	Site-specific
SD	Watershed sediment delivery ratio (unitless)	Calculated (see Table C-3.37)
10^3	Units conversion factor (g/kg)	
Vf_x	Average volumetric flow rate through waterbody (m^3/yr)	Site-specific
TSS	Total suspended solids (mg/L) or (g/m^3)	Site-specific
WA_w	Waterbody surface area (m^2)	Site-specific
10^{-6}	Units conversion factor (kg/mg)	
BS	Benthic solids concentration (kg/L)	1
d_b	Depth of upper benthic sediment layer (m)	0.03

Description

This equation calculates the water column contaminant loss due to sediment burial.

Table C.3-51. Total Water Column Concentration

$$Cwt = \frac{L_T}{[Vf_x \bullet f_{water} \bullet \frac{d_z}{d_w}] + [kwt \bullet V_z]} \Big/ \sum fw_i \bullet [\frac{d_w}{d_z} + \frac{(\theta bs + Kd_{bs,i} \bullet BS) \bullet d_b}{1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6} \bullet d_z}]$$

$$Cwt_i = Cwt \bullet fw_i$$

Parameter	Definition	Values
Cwt	Total waterbody concentration of mercury, mg/L	
L_T	Total load to waterbody, g/yr	Calculated (see Table C-3.38)
Vf_x	Dilution flow	Site-specific
f_{water}	Fraction of total waterbody total mercury concentration that occurs in the water column (unitless)	Calculated (see Table C-3.47)
d_z	Waterbody depth, m	Site-specific
d_w	Water column depth, m	Site-specific
kwt	Overall total mercury dissipation rate constant	Calculated
V_z	Waterbody volume, m^3	Site-specific
fw_i	Relative fraction of i^{th} species in the water column	Elemental = 0.02 Divalent = 0.83 Methyl = 0.15
θbs	Bed sediment porosity, L/L	0.6
$Kd_{bs,i}$	Sediment-water partition coefficient of the i^{th} species	Elemental = 3E3 Divalent = 5E4 Methyl = 3E3
BS	Bed sediment concentration, kg/L	1
d_b	Depth of the upper benthic layer, m	0.003
$kd_{sw,i}$	Suspended solids-water partition coefficient of the i^{th} species	Elemental = 1E3 Divalent = 1E5 Methyl = 1E5
TSS	Total suspended solids	Site-specific

(continued)

Table C.3-51. (continued)

Parameter	Definition	Values
Cwt_i	Total concentration of i^{th} species in water column (mg/L)	

Description

This equation calculates the total water column concentration of contaminant; this includes both dissolved contaminant and contaminant sorbed to suspended solids. For a more detailed explanation of this equation, see Appendix F.

Table C.3-52. Dissolved Water Concentration

$$Cdw = \sum Cdw_i$$

$$Cdw_i = \frac{Cwt_i}{1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6}}$$

Parameter	Definition	Values
Cdw	Dissolved phase water concentration for total mercury (mg/L)	
Cdw_i	Dissolved phase water concentration for mercury species "i"	
Cwt_i	Total concentration of i^{th} species in water column (mg/L)	Calculated (see Table C-3.51)
$Kd_{sw,i}$	Suspended sediment/surface water partition coefficient for mercury species "i" (L/kg)	Chemical-specific (See Appendix D)
TSS	Total suspended solids (mg/L)	Site-specific

Description

This equation calculates the concentration of contaminant dissolved in the water column.

Table C.3-53. Fish Concentration from Dissolved Water Concentration

$$C_{fish} = BAF \bullet Cdw$$

Parameter	Definition	Values
C_{fish}	Fish concentration (mg/kg)	
BAF	Bioaccumulation factor (L/kg)	Trophic level 3: 66,200 Trophic level 4: 335,000
Cdw	Dissolved water concentration of total mercury (mg/L)	Calculated (see Table C-3.52)

Description

This equation calculates fish concentration from dissolved water concentration, using a bioaccumulation factor. The BAFs applied to fish in farm ponds were from the 1996 MRTC.

4. Total Air Concentration

Air concentration for direct inhalation was calculated from the sum of both the vapor phase and particle phase concentrations as seen in Table C.4-1. For each scenario considered in this analysis, risks of direct inhalation were calculated for chemicals that had inhalation health criteria or benchmarks and were emitted by the combustion source. Risk calculations for inhalation are included in Section 5 of this appendix.

Table C.4-1 Air Concentration

$$C_a = Q \bullet [F_v \bullet Cyv + (1.0 - F_v) \bullet C_{yp}]$$

Parameter	Definition	Values
C_a	Total air concentration (µg/m^3)	
Q	Stack emissions (g/s)	Calculated
F_v	Fraction of air concentration in vapor phase (dimensionless)	Chemical-specific (see Appendix D)
C_{yv}	Normalized vapor phase air concentration (µg - s/g - m^3)	Modeled
C_{yp}	Normalized particle phase air concentration (µg - s/g - m^3)	Modeled

Description

This equation calculates the total air concentration of a constituent based on the fraction in vapor phase and the fraction in particle phase.

5. Risk Characterization

The equations in this section were used for estimating individual cancer risk and hazard quotients for the various chemicals considered in this analysis. Each table provides the mathematical form of the equation, identifies the parameters in the equation, and provides the parameter values where appropriate. The equations listed in this section were used for all scenarios. However, exposure parameters listed in the equations (the consumption rates, body weights, and exposure durations) varied between scenarios. These exposure parameters are contained in Appendix D.

For each of the scenarios, an estimate was made of the dose (or intake) of each contaminant from all oral routes of exposure. For example, for the beef subsistence farmer, the daily intake of each contaminant was calculated for soil ingestion (Table C.5-1); aboveground produce and root vegetable ingestion (Table C.5-2); beef, milk, pork, poultry, and egg ingestion (Table C.5-3); fish ingestion (Table C.5-4); and drinking water ingestion (Table C.5-5). The total daily oral intake of a contaminant was calculated by adding together the intake from each pathway (Table C.5-6). For each carcinogen, the excess lifetime individual cancer risk was calculated using the cancer slope factor and lifetime average daily dose (LADD) (Table C.5-7). For each chemical with noncancer health effects, a hazard quotient (HQ) was calculated using the RfD and the average daily dose (ADD) (Table C.5-8).

Individual cancer risks and hazard quotients due to direct inhalation were also calculated for each chemical. For each scenario considered in this analysis, risks of direct inhalation were calculated for chemicals that had inhalation health criteria or benchmarks and were emitted by the combustion source. Benchmarks included unit risk factors (URFs), carcinogenic slope factors (CSFs), or reference concentrations (RfCs) in the Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST). URFs were converted to CSFs and applied to an inhalation LADD.

Note: The fraction contaminated is assumed to be one for all intakes.

Table C.5-1. Contaminant Intake from Soil

$$I_{soil} = Sc \bullet CR_{soil} \bullet F_{soil}$$

Parameter	Description	Values
I_{soil}	Daily intake of contaminant from soil (mg/d)	
Sc	Soil concentration (mg/kg)	Calculated (see Table C.1-1)
CR_{soil}	Consumption rate of soil (kg/d)	Varies (see Appendix D)
F_{soil}	Fraction of consumed soil contaminated (unitless)	1

Description

This equation calculates the daily intake of contaminant from soil consumption. The soil concentration will vary with each scenario, and the soil consumption rate varies by age group.

Table C.5-2 . Contaminant Intake from Produce

$$I_{ag} = (Pd + Pv + Pr) \bullet CR_{ag} \bullet F_{ag}$$

$$I_{fruit} = (Pd + Pv + Pr) \bullet CR_{fruit} \bullet F_{fruit}$$

$$I_{bg} = Pr_{bg} \bullet CR_{bg} \bullet F_{bg}$$

Parameter	Description	Values
I_{ag}	Daily intake of contaminant from aboveground vegetables (mg/kg Fw)	
Pd	Concentration in aboveground produce due to deposition (mg/kg Dw)	Calculated (see Table C.2-1)
Pv	Concentration in aboveground produce due to air-to-plant transfer (mg/kg Dw)	Calculated (see Table C.2-2)
Pr	Concentration in aboveground produce due to root uptake (mg/kg Dw)	Calculated (see Table C.2-3)
CR_{ag}	Consumption rate of aboveground vegetables (kg Dw/d)	Varies (see Appendix D)
F_{ag},F_{fruit},F_{bg}	Fraction contaminated (unitless)	1
I_{fruit}	Daily intake of contaminant from fruit (mg/kg Fw)	
CR_{fruit}	Consumption rate of root vegetables for dioxins (kg Fw/d); for metals (kg Dw/d)	Varies (see Appendix D)
I_{bg}	Daily intake of contaminant from belowground vegetables for dioxins (mg/kg Fw); for metals (mg/kg DW)	
Pr_{bg}	Concentration in root vegetables due to root uptake for dioxins (mg/kg Fw); for metals (mg/kg Dw)	Calculated (see Table C.2-4)
CR_{bg}	Consumption rate of fruits (kg Dw/d)	Varies (see Appendix D)

Description

This equation calculates the daily intake of contaminant from ingestion of aboveground produce and root vegetables. The consumption rate varies by age group and produce type.

Table C.5-3. Contaminant Intake from Beef, Milk, Pork, Poultry and Eggs

$$I_i = A_i \bullet CR_i \bullet F_i$$

Parameter	Description	Values
I_i	Daily intake of contaminant from animal tissue *i* (mg/d)	
A_i	Concentration in animal tissue *i* (mg/kg Fw)[4]	Calculated (see C.2-5 to C.2-9)
CR_i	Consumption rate of animal tissue *i* (kg Fw/d)[6]	Varies (see Appendix D)
F_i	Fraction of animal tissue *i* contaminated (unitless)	Varies (see Appendix D)

Description

This equation calculates the daily intake of contaminant from ingestion of animal tissue (where the "*i*" in the above equation refers to beef, milk, pork, poultry, or eggs). Intake of poultry and eggs is only applicable to dioxins. The consumption rate varies by age group and for the type of animal tissue. The concentration in the animal tissue will vary with each scenario.

[4] For the metals cadmium, selenium, divalent mercury, and methylmercury the concentration in beef, milk, and pork and the consumption rate are in kilograms dry weight per day. Wet weight to dry weight conversion factors for beef and milk are 0.4 and 0.1, respectively. The pork conversion factor is assumed equal to the beef conversion factor.

Table C.5-4 . Contaminant Intake from Fish

$$I_{fish} = C_{fish} \bullet CR_{fish} \bullet F_{fish}$$

Parameter	Description	Values
I_{fish}	Daily intake of contaminant from fish (mg/d)	
C_{fish}	Concentration in fish (mg/kg)	Calculated (see C.3-26 to C.3-27)
CR_{fish}	Consumption rate of fish (kg/d)	Varies (see Appendix D)
F_{fish}	Fraction of fish contaminated (unitless)	Varies (see Appendix D)

Description

This equation calculates the daily intake of contaminant from ingestion of fish. The contaminant concentration in fish will vary for each waterbody. The consumption rate varies by age group and receptor population.

Table C.5-5. Contaminant Intake from Drinking Water

$$I_{dw} = C_{dw} \bullet CR_{dw} \bullet F_{dw}$$

Parameter	Description	Values
I_{dw}	Daily intake of contaminant from drinking water (mg/d)	
C_{dw}	Dissolved contaminant concentration in drinking water (mg/L)	Calculated (see Table C.3-24)
CR_{dw}	Consumption rate of drinking water (L/d)	Varies (see Appendix D)
F_{dw}	Fraction of drinking water contaminated (unitless)	1

Description

This equation calculates the intake of contaminant from drinking water. The contaminant concentration will vary for each waterbody. The consumption rate varies by age group.

Table C.5-6. Total Daily Intake

$$I = I_{soil} + I_{ag} + I_{bg} + I_{beef} + I_{milk} + I_{pork} + I_{poultry} + I_{eggs} + I_{fish} + I_{dw}$$

Parameter	Description	Values
I	Total daily intake of contaminant (mg/d)	
I_{soil}	Daily intake of contaminant from soil (mg/d)	Calculated (see Table C.5-1)
I_{ag}, I_{bg}	Daily intake of contaminant from produce (mg/d)	Calculated (see Table C.5-2)
I_{beef}, I_{milk}, I_{pork}, $I_{poultry}$, I_{eggs}	Daily intake of contaminant from animal tissue (mg/d)	Calculated (see Table C.5-3)
I_{fish}	Daily intake of contaminant from fish (mg/d)	Calculated (see Table C.5-4)
I_{dw}	Daily intake of contaminant from drinking water (mg/d)	Calculated (see Table C.5-5)

Description

This equation calculates the daily intake of contaminant via all indirect pathways. Ingestion of poultry and eggs is only applicable to dioxins.

Table C.5-7. Individual Cancer Risk from Indirect Exposures

$$LADD = \frac{I}{BW} \bullet \frac{ED}{AT} \bullet \frac{EF}{365}$$

$$\text{Cancer Risk} = LADD \bullet CSF$$

Parameter	Description	Values
LADD	Lifetime average daily dose (mg/kg/d)	
I	Total daily intake of contaminant (mg/d)	Calculated (see Table C.5-6)
BW	Body weight (kg)	Varies (see Appendix D)
ED	Exposure duration (yr)	Varies (see Appendix D)
AT	Averaging time (yr)	70
EF	Exposure frequency (d/yr)	350
365	Units conversion factor (d/yr)	
Cancer Risk	Individual lifetime cancer risk (unitless)	
CSF	Oral cancer slope factor (per mg/kg/d)	Chemical-specific (see Appendix D)

Description

This equation calculates the individual cancer risk from indirect exposure to carcinogenic chemicals. The body weight varies by age group.

Table C.5-8. Hazard Quotient from Indirect Exposures

$$ADD = \frac{I}{BW}$$

$$HQ = \frac{ADD}{RfD}$$

Parameter	Description	Values
ADD	Average daily dose (mg/kg/d)	
I	Total daily intake of contaminant (mg/d)	Calculated (see Table C.5-6)
BW	Body weight (kg)	Varies (see Appendix D)
HQ	Hazard quotient (unitless)	
RfD	Reference dose (mg/kg/d)	Chemical-specific (see Appendix D)

Description

This equation calculates the hazard quotient for indirect exposure to noncarcinogenic chemicals. The body weight varies by age group.

Table C.5-9. Calculation of Cancer Risk due to Direct Inhalation using CSF

$$CR = LADD \bullet CSF(inh)$$

$$LADD_{inh} = \frac{C_a \bullet IR}{10^3\ BW} \bullet \frac{ED}{AT} \bullet \frac{EF}{365}$$

$$CSF(inh) = URF \bullet 3500$$

Parameter	Definition	Values
CR	Cancer Risk	
$LADD_{inh}$	Lifetime average daily dose due to direct inhalation (mg/kg/d)	Calculated (see Table C.5-7)
CSF (inh)	Inhalation carcinogenic slope factor (per mg/kg/d)	Chemical-specific (see Appendix D)
C_a	Total air concentration (µg/m^3)	Calculated (see Table C.4-1)
IR	Inhalation rate (m^3/day)	Scenario-specific (see Appendix D)
BW	Body weight (Kg)	Scenario-specific (see Appendix D)
ED	Exposure duration (years)	Scenario-specific (see Appendix D)
AT	Averaging time (years)	70
EF	Exposure frequency (d/yr)	350
365	Units conversion factor (d/yr)	
URF	Inhalation unit risk factor (µg/m^3)$^{-1}$	Chemical-specific (see Appendix D)
3500	Factor to convert URF to CSF based on a 70 kg body weight and a 20 m^3/day inhalation rate for an adult.	
1,000	Units conversion factor (µg/mg)	

Description

This equation calculates the cancer risk from direct inhalation of a chemical for each scenario.

Table C.5-10. Hazard Quotient Due to Direct Inhalation

$$HQ = \frac{Ca}{RfC} \bullet 10^{-3}$$

Parameter	Definition	Values
HQ	Hazard quotient via inhalation	
C_a	Total air concentration (µg/m³)	Calculated (see Table C.4-1)
RfC	Reference concentration (mg/m³)	Chemical-specific (see Appendix D)
10^{-3}	Units conversion factor (mg/m³)	

Description

This equation calculates the hazard quotient for direct inhalation of a chemical.

6. Breast Milk Exposure for Dioxins

To determine the average daily dose for a breast-feeding infant, the concentration of dioxin in the mother's milk was first determined. Nine mother scenarios were considered in the breastmilk exposure analysis, corresponding to the nine adult exposure scenarios (e.g., subsistence farmers, subsistence fisher, recreational fisher, home gardeners, and adult resident). Table C.6-1 provides equations for calculating the concentration of dioxin in maternal milk. Once the contaminant concentration in maternal milk was determined, the equation in Table C.6-2 was used to determine the average daily dose for infant exposure in pg/kg/d. The daily dose to the infant was converted to 2,3,7,8-TCDD TEQ for comparison with the background concentration of 50 pg/kg/d (16 ppt) in maternal breastmilk.

Table C.6-1. Concentration in Maternal Milk

$$C_{(milkfat)} = \frac{ADD_m \bullet 10^9 \bullet h \bullet f_1}{0.693 \bullet f_2}$$

Parameter	Description	Values
$C_{(milkfat)}$	Concentration in maternal milk (pg/kg of milkfat)	
ADD_m	Average maternal daily dose of dioxin (mg/kg/d)	Calculated (see Table C.5-8)
10^9	Conversion constant (pg/mg)	
h	Half-life of dioxin in adults (days)	2,555
f_1	Proportion of ingested dioxin that is stored in fat (unitless)	0.9
f_2	Proportion of mother's weight that is fat (unitless)	0.3

Table C.6-2. Average Daily Dose to the Exposed Infant

$$ADD_{(infant)} = \frac{C_{(milkfat)} \bullet f_3 \bullet f_4 \bullet IR_{milk} \bullet ED}{BW_{infant} \bullet AT}$$

Parameter	Description	Values
$ADD_{(infant)}$	Average daily dose for infant exposed to contaminated breastmilk (pg/kg/d)	
$C_{(milkfat)}$	Concentration in maternal milk (pg/kg of milkfat)	Calculated (see Table C.6-1)
f_3	Fraction of fat in breastmilk (unitless)	0.04
f_4	Fraction ingested contaminant which is absorbed (unitless)	0.9
IR_{milk}	Ingestion rate of breastmilk (kg/d)	0.8
ED	Exposure duration (year)	1
BW_{infant}	Body weight of infant (kg)	10
AT	Averaging time (year)	1

Appendix D

Parameter Derivation and Citations

Appendix D

Parameter Derivation and Citations

This appendix lists the chemical-specific, fate and transport, and exposure parameters used in this risk analysis. A complete list of the references for the derivation of these parameters is also included.

D.1 Chemical-Specific Parameters

Tables D-1 to D-17 contain the physical and chemical properties for the dioxin and furan congeners. Each dioxin and furan congener is considered independently in the risk assessment. Any constituent-specific values for dioxins/furans not reported in this appendix were calculated using the physical and chemical properties in the tables. The information presented in the tables includes some or all of the following:

- Vapor fraction (F_v)
- Soil adsorption coefficient (K_{oc})
- Octanol-water partition coefficient (K_{ow})
- Vapor pressure (VP)
- Water solubility (S)
- Molecular weight (MW)
- Henry's law constant (H)
- Diffusivity coefficients in water and air (D_w and D_a)
- Air-to-plant biotransfer factor (Bv)
- Root concentration factor (RCF)
- Soil-to-plant biotransfer factor (Br)
- Biotransfer factor for beef (Ba_{beef})
- Biotransfer factor for pork (Ba_{pork})
- Biotransfer factor for milk (Ba_{milk})
- Bioconcentration factor for chicken (BCF_{chick})
- Biotransfer factor for eggs (BCF_{egg})
- Fish biota to sediment accumulation factor (BSAF)
- Fraction of wet deposition that adheres to plant surface (Fw)
- Oral cancer inhalation slope factor (CSF)
- Oral reference dose (RfD)

- Unit risk factor (URF)
- Reference concentration (RfC).

Values for sediment and soil partition coefficients (Kd_{sw}, Kd_{bs}, and Kd_s) are calculated from equations in Appendix C for the dioxin and furan congeners. Following the tables is a list of references used to obtain the chemical and physical properties. The reference numbers cited in Tables D-1 to D-17 refer to these references.

Tables D-18 to D-35 list the physical and chemical properties for the metals considered in the risk analysis. Any constituent-specific values not reported in this appendix were calculated using the physical and chemical properties listed in these tables. The information presented in Tables D-18 to D-35 includes some or all of the following:

- Vapor fraction (F_v)
- Soil-water partition coefficient (Kd_s)
- Suspended sediment-surface water partition coefficient (Kd_{sw})
- Bed sediment-pore water partition coefficient (Kd_{bs})
- Henry's law constant (H)
- Diffusivity coefficients in water and air (D_w and D_a)
- Air-to-plant biotransfer factor (Bv)
- Soil-to-plant biotransfer factor (Br)
- Biotransfer factor for beef (Ba_{beef})
- Biotransfer factor for pork (Ba_{pork})
- Biotransfer factor for milk (Ba_{milk})
- Fish biota concentration factor (BCF)
- Fish biota accumulation factor (BAF)
- Oral cancer inhalation slope factor (CSF)
- Oral reference dose (RfD)
- Unit risk factor (URF)
- Reference concentration (RfC).

Tables D-36 and D-37 list the inputs used for Cl_2 + HCl. Following the tables is a list of references used to obtain the chemical and physical properties. The reference numbers cited in Tables D-18 to D-37 refer to these references.

D.2 Fate and Transport Parameters

Table D-38 contains the references and values for the fate and transport parameters used in this analysis. The parameters listed in the table are not constituent or site-specific. Constituent-specific parameters are listed in Tables D-38 to D-75. The site-specific surface water and meteorological parameters that affect fate and transport are listed in Appendix B.

D.3 Exposure Parameters

Tables D-76 and D-77 list the exposure parameters used in this analysis. Table D-76 contains exposure parameters that are not site-specific and are applicable to all 11 facilities. Table D-77 contains site-specific data on the fraction of consumption that was assumed to be

contaminated. The values in this table were developed using production and processing data from counties within 50 kilometers of each site. Commercial farmers, which were also determined from the county data, are highlighted in Table D-77 for each case. A complete discussion of the references and methodology used to obtain the values listed in Tables D-76 and D-77 is contained in Section 6.0 of this report and is not repeated in this appendix.

Table D-1. Chemical-Specific Inputs for 2,3,7,8-TCDD

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	5.5E-1	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	2.7E+6	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	4.4E+6	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	9.7E-13	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	1.9E-5	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	322	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	1.6E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.7E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	6.1E+4	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	3.9E+3	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	5.6E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	5.4E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	1.0E-2	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	1.11	d
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	1.27	d
BAF_{worms}	Bioconcentration factor for TCDD-TEQ in worms (unitless)	9.1	Sample et al., 1998a
$BAF_{invertebrates}$	Bioaccumulation factor for TCDD-TEQ in invertebrates (unitless)	1.3	Sample et al., 1998b
$BAF_{vertebrates}$	Bioaccumulation factor for TCDD-TEQ in vertebrates (unitless)	7.2	Sample et al., 1997
BSAF	Fish biota to sediment accumulation factor (unitless)	0.76	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
CSF	Cancer slope factor (per mg/kg/d)	156,000	U.S. EPA, 1984
RfD	Reference dose (mg/kg/d)	NA	

Table D-1. (continued)

Parameter	Definition	Value	Ref
URF	Unit risk factor (per µg/m^3)	3.3E-8	U.S. EPA, 1998
RfC	Reference concentration (mg/m^3)	NA	
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	1	Van den Berg et al., 1998

NA = Not applicable.

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).
[d] No BCFs for these chemical are presented due to low concentration of these isomers. Values for these chemicals are taken from the most structurally similar isomer listed in Stephens et al., 1992.

Table D-2. Chemical-Specific Inputs for 2,3,7,8-TCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	7.1E-1	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	2.1E+6	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	3.4E+6	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	1.2E-11	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	4.2E-4	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	306	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	8.6E-6	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm2/s)	4.8E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	8.1E+4	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	3.2E+3	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	6.5E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	1.6E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	3.0E-3	Lorber & Rice, 1993
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.92	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	0.46	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.23	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	1	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-3. Chemical-Specific Inputs for 1,2,3,7,8-PeCDD

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	2.6E-1	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	2.7E+6	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	4.4E+6	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	1.2E-12	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	1.2E-4	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	356.4	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	2.6E-6	U.S. EPA, 1994a, b
Da	Diffusivity in air (cm^2/s)	4.5E-2	U.S. EPA, 1994a, b
Dw	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	1.2E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	3.9E+3	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	5.6E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	5.4E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	1E-2	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	1.11	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	1.27	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.57	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	1.0	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	1.0	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-4. Chemical-Specific Inputs for 1,2,3,7,8-PeCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	4.2E-1	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	3.8E+6	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	6.2E+6	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	3.6E-12	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	2.4E-4	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	340.4	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	6.2E-6	U.S. EPA, 1994a, b
Da	Diffusivity in air (cm^2/s)	4.6E-2	U.S. EPA, 1994a, b
Dw	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	4.6E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	5.1E+3	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	4.6E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	1.1E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	2.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	1.20	d
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	2.50	d
BSAF	Fish biota to sediment accumulation factor (unitless)	0.26	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.05	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.1	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).
[d] No BCFs for these chemical are presented due to low concentration of these isomers. Values for these chemicals are taken from the most structurally similar isomer listed in Stephens et al., 1992.

Table D-5. Chemical-Specific Inputs for 2,3,4,7,8-PeCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	3.0E-1	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	5.1E+6	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	8.3E+6	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	4.3E-12	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	2.4E-4	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	340.4	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	6.2E-6	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.6E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	4.6E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	6.4E+3	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	3.9E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	4.9E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	9.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	1.20	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	2.50	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.39	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.5	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	1.0	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-6. Chemical-Specific Inputs for 1,2,3,4,7,8-HxCDD

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	7E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	3.8E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	6.2E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	1.3E-13	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	4.4E-6	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	390.9	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	1.2E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.3E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	4.5E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	3.0E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	1.2E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	3.2E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	6.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.85	U.S. EPA, 1994a, b
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	1.46	U.S. EPA, 1994a, b
BSAF	Fish biota to sediment accumulation factor (unitless)	0.16	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.05	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-7. Chemical-Specific Inputs for 1,2,3,6,7,8-HxCDD

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	4.0E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	1.2E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	2.0E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	4.7E-14	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	4.4E-6	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	390.9	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	1.2E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.3E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	4.5E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	1.3E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	2.3E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	2.7E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	5.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.99	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	1.62	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.17	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.01	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-8. Chemical-Specific Inputs for 1,2,3,7,8,9-HxCDD

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	2E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	1.2E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	2.0E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	6.4E-14	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	4.4E-6	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	390.9	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	1.2E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.3E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	4.5E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	1.3E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	2.3E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	3E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	6E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.50	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	1.05	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.045	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.1	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-9. Chemical-Specific Inputs for 1,2,3,4,7,8-HxCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	6.0E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	1.2E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	2.0E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	3.2E-13	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	8.3E-6	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	374.9	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	1.4E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.4E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	1.5E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	1.3E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	2.3E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	3.8E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	7.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.86	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	1.89	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.056	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.1	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-10. Chemical-Specific Inputs for 1,2,3,6,7,8-HxCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	6.0E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	1.2E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	2.0E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	2.9E-13	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	1.8E-5	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	374.9	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	6.1E-6	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.4E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	1.5E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	1.3E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	2.3E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	3.2E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	6.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.73	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	1.68	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.093	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.1	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-11. Chemical-Specific Inputs for 1,2,3,7,8,9-HxCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	1.1E-1	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	1.2E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	2.0E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	3.7E-13	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	1.3E-5	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	374.9	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	1.0E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.4E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	1.5E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	1.3E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	2.3E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	3.2E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	6.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.73	d
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	1.68	d
BSAF	Fish biota to sediment accumulation factor (unitless)	0.15	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.1	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).
[d] No BCFs for these chemical are presented due to low concentration of these isomers. Values for these chemicals are taken from the most structurally similar isomer listed in Stephens et al., 1992.

Table D-12. Chemical-Specific Inputs for 2,3,4,6,7,8-HxCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	7.0E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	1.2E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	2.0E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	2.6E-13	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	1.3E-5	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	374.9	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	1.0E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.4E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	1.5E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	1.3E4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	2.3E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	2.7E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	5.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.39	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	0.54	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.18	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.1	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.1	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-13. Chemical-Specific Inputs for 1,2,3,4,6,7,8-HpCDD

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	2E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	9.8E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	1.6E+8	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	4.2E-14	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	2.4E-6	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	425.3	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	7.5E-6	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.1E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	3.5E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	6.2E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	7.1E-4	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	5.4E-3	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	1E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.22	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	0.98	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.033	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.01	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.001	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-14. Chemical-Specific Inputs for 1,2,3,4,6,7,8-HpCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	4.0E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	4.9E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	7.9E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	1.8E-13	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	1.4E-6	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	409.3	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	5.3E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.2E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	4.4E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	3.7E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	1.1E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	5.4E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	1.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.18	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	0.68	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.011	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.01	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.01	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-15. Chemical-Specific Inputs for 1,2,3,4,7,8,9-HpCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	3.0E-2	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	4.9E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	7.9E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	1.4E-13	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	1.4E-6	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	409.3	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	5.3E-5	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.2E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	4.4E+5	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	3.7E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	1.1E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	1.6E-2	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	3.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.16	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	0.49	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.027	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.01	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.01	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).

Table D-16. Chemical-Specific Inputs for 1,2,3,4,5,7,8,9-OCDD

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	2.0E-4	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	2.4E+7	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	3.9E+7	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	1.1E-15	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	7.4E-8	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	460.8	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	7.0E-9	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	3.9E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	8.6E+6	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	2.1E+4	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	1.6E-3	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	5.4E-3	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	1.0E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.04	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	0.47	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.034	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.0001	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.0001	d

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995).
[d] Default to mammalian value due to a lack of bird data.

Table D-17. Chemical-Specific Inputs for 1,2,3,4,6,7,8,9-OCDF

Parameter	Definition	Value	Ref
Chemical/Physical Properties			
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)	2E-3	U.S. EPA, 1994a, b
K_{oc}	Soil adsorption coefficient (mL/g)	3.9E+8	U.S. EPA, 1994a, b
K_{ow}	Octanol-water partition coefficient (unitless)	6.3E+8	U.S. EPA, 1994a, b
VP	Vapor pressure (atm)	4.9E-15	U.S. EPA, 1994a, b
S	Water solubility (mL/g)	1.2E-6	U.S. EPA, 1994a, b
MW	Molecular weight (g/mol)	444.8	U.S. EPA, 1994a, b
H	Henry's law constant (atm-m^3/mol)	1.9E-6	U.S. EPA, 1994a, b
D_a	Diffusivity in air (cm^2/s)	4.0E-2	U.S. EPA, 1994a, b
D_w	Diffusivity in water (cm^2/s)	8.0E-6	U.S. EPA, 1994c
Transfer Factors			
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g air])	1.3E+6	Lorber, 1995
RCF	Root concentration factor ([µg pollutant/g plant tissue FW]/[µg pollutant/g soil water])	1.8E+5	U.S. EPA, 1994a, b
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	3.2E-4	a
Ba_{beef}/Ba_{pork}	Biotransfer factor for beef or pork (d/kg)[b]	5.4E-3	c
Ba_{milk}	Biotransfer factor for milk (d/kg)	1E-3	Lorber & Rice, 1995
BCF_{chick}	Bioconcentration factor for TCDD-TEQ in poultry (unitless)	0.07	Stephens et al., 1992
BCF_{egg}	Bioconcentration factor for TCDD-TEQ in eggs (unitless)	0.30	Stephens et al., 1992
BSAF	Fish biota to sediment accumulation factor (unitless)	0.0033	Bauer, 1992
Other Parameters			
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)	6.0E-1	Lorber & Rice, 1995
Health Benchmarks			
$TEF_{H,M}$	Toxicity equivalency factor for humans and mammals	0.0001	Van den Berg et al., 1998
TEF_B	Toxicity equivalency factor for birds	0.0001	Van den Berg et al., 1998

[a] Calculated from an equation in Travis and Arms, 1988.
[b] Pork biotransfer factor set equal to beef biotransfer factor.
[c] The Ba_{beef} for dioxin congeners was calculated from the Ba_{milk} and the ratio of percent beef fat to percent milk fat. Therefore, the biotransfer factor for beef is 5.4 times higher than for milk. The Ba_{pork} was assumed to be the same as the Ba_{beef} (Lorber & Rice, 1995)

Table D-18. Chemical-Specific Inputs for Antimony

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		2	Strenge and Peterson, 1989
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		2	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		2	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.03 0.2 0.2	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.001	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		0.0001	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		0.001	d
BCF	Fish bioconcentration factor (L/kg)		0	Stephan, 1993
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.2	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		0.0004	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-19. Chemical-Specific Inputs for Arsenic

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		29	U.S. EPA, 1996
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		29	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		29	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.008 0.036 0.06	U.S. EPA, 1992b U.S. EPA, 1992b U.S. EPA, 1992b
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.002	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		6E-05	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		0.002	d
BCF	Fish bioconcentration factor (L/kg)		3.5	Stephan, 1993
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.2	c
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		1.5	U.S. EPA, 1998
RfD	Reference dose (mg/kg/d)		0.0003	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		0.0043	U.S. EPA, 1998
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-20. Chemical-Specific Inputs for Barium

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		8,265	b
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		8,265	c
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		8,265	d
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.015 0.15 0.15	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		1.5E-4	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		3.5E-4	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		1.5E-4	e
BCF	Fish bioconcentration factor (L/kg)		NA	
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	f
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		0.07	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		0.0005	U.S. EPA, 1997b

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] The value for K_{ds} for barium was taken from the average of the range of K_{ds} from literature (530 to 16,000 l/kg for a pH range of 5 to 9) as given in Table 43, U.S. EPA, 1996. This value differs from the predicted value given in Table 46 of that document.

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[e] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[f] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-21. Chemical-Specific Inputs for Beryllium

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		4,600	U.S. EPA, 1996
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		4,600	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		4,600	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.0015 0.01 0.01	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.001	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		9E-7	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		0.001	d
BCF	Fish bioconcentration factor (L/kg)		19	Barrows et al., 1980
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		0.002	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		0.0024	U.S. EPA, 1998
RfC	Reference concentration (mg/m^3)		2E-5	U.S. EPA, 1998

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-22. Chemical-Specific Inputs for Cadmium

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		120	U.S. EPA, 1996
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		120	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		120	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.064 0.36 0.14	U.S. EPA, 1992b U.S. EPA, 1992b U.S. EPA, 1992b
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.0004	Lorber & Rice, 1995
Ba_{milk}	Biotransfer factor for milk (d/kg)		0.0001	Lorber & Rice, 1995
Ba_{pork}	Biotransfer factor for pork (d/kg)		6E-4	Lorber & Rice, 1995
BCF	Fish bioconcentration factor (L/kg)		187	d
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		1E-3 soil 5E-4 water	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		0.0018	U.S. EPA, 1998
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] Value derived from a geomean of 15 values (Kumada et al., 1980; Kumada et al., 1972; U.S. EPA, 1992c; Williams and Geisey, 1978; Giesey et al., 1977; Canton and Slooff, 1982; Taylor 1983; Eisler, 1985).

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-23. Chemical-Specific Inputs for Chromium III

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		3.32E+6	RTI, 1994
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		3.32E+6	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		3.32E+6	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.0045 0.0075 0.0075	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		5.5E-3	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		0.0015	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		5.5E-3	d
BCF	Fish bioconcentration factor (L/kg)		0.6	Stephan, 1993
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		1	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-24. Chemical-Specific Inputs for Chromium VI

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		19	U.S. EPA, 1996
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		19	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		19	c
Transfer Factors				
B_r	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.0045 0.0075 0.0075	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.0055	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		0.0015	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		0.0055	d
BCF	Fish bioconcentration factor (L/kg)		0.6	Stephan, 1993
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		0.005	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		0.012	U.S. EPA, 1998
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-25. Chemical-Specific Inputs for Cobalt

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		4.5E+1	Baes et al., 1984
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		4.5E+1	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		4.5E+1	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	7.0E-5 2.0E-2 2.0E-2	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		2.0E-2	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		2.0E-3	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		2.0E-2	d
BCF	Fish bioconcentration factor (L/kg)		NA	
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)[1]		6.0E-2	U.S. EPA, n.d.
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		3.5E-5	ATSDR, 1992

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

[1] Dietary guideline - Risk Assessment paper by EPA's NCEA (U.S. EPA, n.d.).

Table D-26 Chemical-Specific Inputs for Copper

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		2.2E+1	RTI, 1994
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		2.2E+1	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		2.2E+1	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	2.5E-1 4.0E-1 2.4E-2	Baes et al., 1984 Baes et al., 1984 U.S. EPA, 1992b
Ba_{beef}	Biotransfer factor for beef (d/kg)		1.0E-2	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		1.5E-3	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		1.0E-2	d
BCF	Fish bioconcentration factor (L/kg)		0	Stephan, 1993
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		NA	
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-27. Chemical-Specific Inputs for Manganese

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		6.5E+1	Baes et al., 1984
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		6.5E+1	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		6.5E+1	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	5.0E-2 2.5E-1 2.5E-1	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		4.0E-4	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		3.5E-4	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		4.0E-4	d
BCF	Fish bioconcentration factor (L/kg)		NA	
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		1.4E-1	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		5.0E-5	U.S. EPA, 1998

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-28. Chemical-Specific Inputs for Mercury - Divalent

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		site-specific	
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		5.8E+4	U.S. EPA, 1997c
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		1E+5	U.S. EPA, 1997c
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		5E+4	U.S. EPA, 1997c
Ks_{red}	Reduction rate constant (day^{-1})		0.00005	U.S. EPA, 1997c
H	Henry's law constant (atm-m^3/mol)		7.1E-10	U.S. EPA, 1997c
D_a	Diffusivity in air (cm^2/s)		5.5E-2	U.S. EPA, 1997c
D_w	Diffusivity in water (cm^2/s)		8.0E-6	U.S. EPA, 1995a
Transfer Factors				
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue]/[µg pollutant/g air])	leafy vegetables forage/silage	2.1E+4 1.8E+4	U.S. EPA, 1997c
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	6.8E-2 1.3E-2 0	U.S. EPA, 1997c
Ba_{beef}	Biotransfer factor for beef (d/kg)		2.0E-2	U.S. EPA, 1997c
Ba_{milk}	Biotransfer factor for milk (d/kg)		2.0E-2	U.S. EPA, 1997c
Ba_{pork}	Biotransfer factor for pork (d/kg)		1.3E-4	U.S. EPA, 1997c
BCF	Fish bioconcentration factor (L/kg)		NA	
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	U.S. EPA, 1997c
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		3.0E-4	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

Table D-29. Chemical-Specific Inputs for Mercury - Elemental

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		1	U.S. EPA, 1997c
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		1.0E+3	U.S. EPA, 1997c
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		1.0E+3	U.S. EPA, 1997c
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		3E+3	U.S. EPA, 1997c
H	Henry's law constant (atm-m^3/mol)		7.1E-3	U.S. EPA, 1997c
D_a	Diffusivity in air (cm^2/s)		5.5E-2	U.S. EPA, 1997c
D_w	Diffusivity in water (cm^2/s)		8.0E-6	EPA 1988
Transfer Factors				
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue]/[µg pollutant/g air])	leafy vegetables forage/silage	0	U.S. EPA, 1997c
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0	U.S. EPA, 1997c
Ba_{beef}	Biotransfer factor for beef (d/kg)		2.0E-2	U.S. EPA, 1997c
Ba_{milk}	Biotransfer factor for milk (d/kg)		2.0E-2	U.S. EPA, 1997c
Ba_{pork}	Biotransfer factor for pork (d/kg)		1.3E-4	U.S. EPA, 1997c
BCF	Fish bioconcentration factor (L/kg)		NA	
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	U.S. EPA, 1997c
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		NA	
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		3E-4	U.S. EPA, 1998

NA = Not applicable.

Table D-30. Chemical-Specific Inputs for Methylmercury

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		NA	
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		7E+3	U.S. EPA, 1997c
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		1.0E+5	U.S. EPA, 1997c
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		3E+3	U.S. EPA, 1997c
H	Henry's law constant (atm-m^3/mol)		4.7E-7	U.S. EPA, 1997c
D_a	Diffusivity in air (cm^2/s)		5.3E-2	U.S. EPA, 1997c
D_w	Diffusivity in water (cm^2/s)		8.0E-6	U.S. EPA, 1995a
Transfer Factors				
Bv	Air-to-plant biotransfer factor ([µg pollutant/g plant tissue]/[µg pollutant/g air])	leafy vegetables forage/silage	2.4E+3 5.0E+3	U.S. EPA, 1997c U.S. EPA, 1997c
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	1.5E-1 1.7E-2 0	U.S. EPA, 1997c U.S. EPA, 1997c U.S. EPA, 1997c
Ba_{beef}	Biotransfer factor for beef (d/kg)		2.0E-2	U.S. EPA, 1997c
Ba_{milk}	Biotransfer factor for milk (d/kg)		2.0E-2	U.S. EPA, 1997c
Ba_{pork}	Biotransfer factor for pork (d/kg)		1.3E-4	U.S. EPA, 1997c
BAF	Fish bioaccumulation factor - Trophic Level 3 (L/kg)		1.6E6	U.S. EPA, 1997c
BAF	Fish bioaccumulation factor - Trophic Level 4 (L/kg)		6.8E6	U.S. EPA, 1997c
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	a
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		1.0E-4	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-31. Chemical-Specific Inputs for Lead

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		2.8E+5	b
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		2.8E+5	c
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		2.8E+5	d
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	9.0E-3 4.5E-2 4.5E-2	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		3E-4	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		2.5E-4	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		3e-4	e
BCF	Fish bioconcentration factor (L/kg)		NA	
BAF	Fish bioaccumulation factor (L/kg)		46	Stephan, 1993
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	f
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		NA	
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] Calculated for neutral pH conditions from an equation from U.S. EPA, 1992a:

$$\log Kd = 0.11\,pH + 1.102$$

where Kd is soil-water partition coefficient (mL/g) and pH is soil pH, assumed to be 7 (neutral conditions).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

Footnotes for Table D-31 (continued)

[d] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[e] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[f] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-32. Chemical-Specific Inputs for Nickel

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		21	U.S. EPA, 1996
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		21	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		21	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.008 0.032 0.11	U.S. EPA, 1992b U.S. EPA, 1992b U.S. EPA, 1992b
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.006	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		0.001	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		0.006	d
BCF	Fish bioconcentration factor (L/kg)		0.8	Stephan, 1993
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		0.02	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		2.4E-4	U.S. EPA, 1998
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-33. Chemical-Specific Inputs for Selenium

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		5	U.S. EPA, 1996
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		5	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		5	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.022 0.016 0.006	U.S. EPA, 1992b
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.0076	Lorber & Rice, 1995
Ba_{milk}	Biotransfer factor for milk (d/kg)		0.0451	Lorber & Rice, 1995
Ba_{pork}	Biotransfer factor for pork (d/kg)		0.63	Lorber & Rice, 1995
BCF	Fish bioconcentration factor (L/kg)		NA	
BAF	Fish bioaccumulation factor (L/kg)		1258	Lemly, 1985
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.2	d
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		0.005	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-34. Chemical-Specific Inputs for Silver

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		0.4	Strenge and Peterson, 1989
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		0.4	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		0.4	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.1 0.4 0.4	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.003	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		0.02	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		0.003	d
BCF	Fish bioconcentration factor (L/kg)		0	Stephan, 1993
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		0.005	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-35. Chemical-Specific Inputs for Thallium (I)

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		0	a
Kd_s	Soil-water partition coefficient (mL/g or L/kg)		71	U.S. EPA, 1996
Kd_{sw}	Suspended sediment-surface water partition coefficient (L/kg)		71	b
Kd_{bs}	Bottom sediment-sediment pore water partition coefficient (L/kg)		71	c
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	0.0004 0.004 0.004	Baes et al., 1984 Baes et al., 1984 Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		0.04	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		0.002	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		0.04	d
BCF	Fish bioconcentration factor (L/kg)		67	U.S. EPA, 1992c
BAF	Fish bioaccumulation factor (L/kg)		NA	
Other Parameters				
F_w	Fraction of wet deposition that adheres to plant surfaces (dimensionless)		0.6	e
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		8E-5	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		NA	

NA = Not applicable.

[a] Constituent is a nonvolatile metal, therefore, it is assumed to be 100% in the particulate phase and 0% in the vapor phase.

[b] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[c] For metals, the K_d value for soil (Kd_s) was used to approximate the K_d values for suspended sediment (Kd_{sw}) and bottom sediment (Kd_{bs}).

[d] The pork biotransfer factor was assumed to equal the biotransfer factor for beef because no biotransfer factor for pork was available for this chemical.

[e] Derived from data in Hoffman et al., 1992. Hoffman et al. present experimental values of what they term "interception fraction," which corresponds in the methodology used here to the product of Rp and F_w. F_w values were estimated from the Hoffmann et al. values by dividing by an Rp of 0.47 for forage. The values used here apply to anions and correspond to moderate rainfall.

Table D-36. Chemical-Specific Inputs for Chlorine

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		1	a
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	7E+1 7E+1 7E+1	Baes et al., 1984
Ba_{beef}	Biotransfer factor for beef (d/kg)		8E-2	Baes et al., 1984
Ba_{milk}	Biotransfer factor for milk (d/kg)		1.5E-2	Baes et al., 1984
Ba_{pork}	Biotransfer factor for pork (d/kg)		8E-2	b
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		1E-1	U.S. EPA, 1998
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)[a]		1E-3	c

[a] Gas presumed to exist entirely in vapor phase.
[b] Pork biotransfer factor set equal to beef.
[c] Provisional value developed by RTI.

Table D-37. Chemical-Specific Inputs for Hydrogen Chloride

Parameter	Definition		Value	Ref
Chemical/Physical Properties				
F_v	Fraction of pollutant air concentration present in the vapor phase (dimensionless)		1	
Transfer Factors				
Br	Soil-to-plant biotransfer factor ([µg pollutant/g plant tissue DW]/[µg pollutant/g soil])	root vegetables leafy vegetables forage/silage	NA	
Ba_{beef}	Biotransfer factor for beef (d/kg)		NA	
Ba_{milk}	Biotransfer factor for milk (d/kg)		NA	
Ba_{pork}	Biotransfer factor for pork (d/kg)		NA	
Health Benchmarks				
CSF	Cancer slope factor (per mg/kg/d)		NA	
RfD	Reference dose (mg/kg/d)		NA	
URF	Unit risk factor (per µg/m^3)		NA	
RfC	Reference concentration (mg/m^3)		2E-2	U.S. EPA, 1998

Table D-38. Data Sources for Fate and Transport Equations

Parameter	Definition	Value	Derivation
		Soil Concentration	
Z	Soil mixing depth for soil ingestion (cm)	1	Reflects untilled soil (U.S. EPA, 1993)
BD	Soil bulk density (g/cm^3)	1.5	Based on mean for loam soil from Carsel et al. (1988). Also recommended as center of range of values in *Addendum* (U.S. EPA, 1993).
f_{oc}	Fraction of organic carbon in soil (unitless)	0.006	U.S. EPA, 1996
Vdv	Dry deposition velocity of vapors (cm/s)	0.2	The value for dioxins was taken from Koester and Hites, 1992. Dry deposition velocity was not used for the metals because they were considered to be nonvolatile.
θ_s	Soil volumetric water content (mL/cm^3)	0.2	Calculated per SEAM (U.S. EPA, 1988) $\theta_s = \theta_{sat}\left(\frac{Q}{K}\right)^{\left(\frac{1}{2b+3}\right)}$ where (values from Carsel et al., 1988, for silt loam) θsat = Saturated volumetric water content of soil (0.45 mL/cm_3) Q = Average annual recharge rate (0.18 m/yr) K = Saturated hydraulic conductivity (0.45 m/h) b = Moisture retention exponent (5.3)
R	Universal gas constant ($atm\text{-}m^3/mol\text{-}K$)	8.205e-5	Standard value
μ_a	Viscosity of air (g/cm-s)	1.81e-4	*CRC Handbook* (Weast, 1979). Taken at standard conditions (temperature = 20 °C, pressure = 1 atm or 760 mm Hg).
ρ_a	Density of air (g/cm^3)	0.0012	*CRC Handbook* (Weast, 1979). Taken at standard conditions (temperature = 20 °C, pressure = 1 atm or 760 mm Hg).

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
		Terrestrial Food Chain	
Z	Soil mixing depth (cm)	20 tilled	Reflects tilled soil (U.S. EPA, 1993). Used in calculating concentrations in root vegetables and aboveground produce consumed by humans and in silage consumed by livestock.
		1 untilled	Reflects untilled soil (U.S. EPA, 1993). Used in calculating concentrations in forage and soil which is then consumed by livestock
kp	Plant surface loss coefficient (yr^{-1})	18	Corresponds to a half-life of 14 days, and reflects physical processes only, no chemical degradation (U.S. EPA, 1993)
Tp	Length of the plant's exposure to deposition per harvest (yrs)	0.12 forage	U.S. EPA, 1990. 45 days; based on the average of average period between successive hay harvests (60 days) and average period between successive grazing (30 days) in Belcher and Travis (1989). Used in calculating concentration in forage feed to cattle.
		0.16 other	U.S. EPA, 1990. 60 days; based on average period between successive hay harvests in Belcher and Travis (1989). Used in calculating concentration in aboveground produce and root vegetables consumed by humans and silage consumed by animals.

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
Yp	Yield or standing crop biomass aboveground fruits and vegetables (kg DW/m^2)	0.25 fruits 3.0 above-ground vegetables	The value for Yp was calculated from data in Rice (1994a). Yp may be estimated from dry harvest yield (Yh) and area harvested (Ah): $$Yp \approx \frac{Yh}{Ah}$$ Here, Yp was estimated for fruits, fruiting vegetables, legumes, and leafy vegetables using U.S. average Yh and Ah values for a variety of fruits and vegetables for 1993; Yh values were converted to dry weight using average conversion factors for fruits, fruiting vegetables, legumes, and leafy vegetables. The following fruits and vegetables were included in each category: Fruits: apple, apricot, berry, cherry, cranberry, grape, peach, pear, plum/prune, strawberry Fr. veg: asparagus, cucumber, eggplant, sweet pepper, tomato Legumes: snap beans Leafy: broccoli, brussels sprout, cabbage, cauliflower, celery, lettuce, and spinach The calculated Yp values for fruiting vegetables, legumes, and leafy vegetables were then weighted by relative ingestion of each group to determine the weighted average Yp given here. Unweighted Yp (kg DW/m^2) and the ingestion rates (kg DW/d) used for weighing were as follows: Fr. veg. Yp 10.5 Intake 4.2 Leafy Yp 0.34 Intake 2.0 Legume Yp 0.075 Intake 8.8

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
		Terrestrial Food Chain	
Yp	Yield or standing crop biomass (kg DW/m^2)	0.24 forage	Weighted average of crop yields for pasture grass (forage) and hay. Weights were based on the fraction of a year cattle could be pastured; the weights used here were 0.75 for pasture grass and 0.25 for hay, based on 9 months/year in pasture and 3 months per year not in pasture (and fed hay). Unweighted Yp values were 0.15 kg DW/m^2 for pasture grass (U.S. EPA, 1994b) and 0.5 for hay. The Yp for hay was estimated from dry harvest yield (Yh) and area harvested (Ah) (Rice, 1994a): $$Yp \approx \frac{Yh}{Ah}$$ Yh = 1.22E+11 kg DW: U.S. average Yh for hay for 1993 is 1.35E+11 kg (Rice, G., 1994a); this is converted to dry weight using a conversion factor of 0.9 (Rice, 1994a). Ah = 2.45E+11 m^2: U.S. average Ah for hay for 1993 (Rice, 1994a)
		0.8 silage	Production weighted U.S. average for silage (Rice, 1994a). Crop yield for grains was not used because it was considered a protected species.

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
Rp	Interception fraction (dimensionless)	1.0E-2 fruits 7.4E-02 above-ground vegetables	Calculated (Rice, 1994a): $Rp = 1 - e^{-\gamma \cdot Yp}$ γ = empirical constant; 0.0846 for leafy vegetables; 0.0324 for fruits, fruiting vegetables, and legumes. Yp = estimated as shown above for fruits, fruiting vegetables, legumes, and leafy vegetables. The following fruits and vegetables were included in each category: Fruits: apple, apricot, berry, cherry, cranberry, grape, peach, pear, plum/prune, strawberry Fr. veg: asparagus, cucumber, eggplant, sweet pepper, tomato Legumes: snap beans Leafy: broccoli, brussels sprout, cabbage, cauliflower, celery, lettuce, and spinach The calculated Rp values for fruiting vegetables, legumes, and leafy vegetables were then weighted by relative ingestion of each group to determine the weighted average Rp given here. Unweighted Rp and the ingestion rates (kg DW/d) used for weighing were as follows: Rp Intake Fr. veg. 0.26 4.2 Leafy 0.016 2.0 Legume 0.002 8.8 The ingestion rates were presented as dry weight in U.S. EPA, 1992b.

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
		Terrestrial Food Chain	
Rp	Interception fraction (dimensionless)	0.5 forage	Calculated (Chamberlain, 1970): $Rp = 1 - e^{-\gamma \cdot Yp}$ γ = empirical constant; Chamberlain (1970) gives range as 2.3-3.33; the midpoint of the range, 2.88 is used (Baes et al., 1984) Yp = 0.24 kg DW/m^2 (see above)
		0.46 silage	Calculated from Yp of 0.8 for silage Interception fractions were not used for grains because it was considered a protected species.
VG_{ag}	Empirical correction factor that reduces produce concentration because Bv was developed for azalea leaves	varies	For dioxins, the VG_{ag} was assumed to be 0.01 for fruits and fruiting vegetables. For leafy vegetables and forage, VG_{ag} was assumed to equal 1 (U.S. EPA, 1994b). The VG_{ag} was assumed to be 0.5 for silage. The VG_{ag} was not used for grains because it was considered a protected species.
VG_{bg}	Empirical correction factor that reduces produce concentration	0.01 dioxins	For dioxins, the VG_{bg} was assumed to be 0.01 for root vegetables (U.S. EPA, 1994b).
		1.0 metals	For metals, the VG_{bg} was assumed to be 1.0 (U.S. EPA, 1993a).

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
		Terrestrial Food Chain	
Qp	Quantity of plant matter eaten by cattle (kg plant tissue DW/d		
	Subsistence Beef Farmer	8.8 forage 0.47 grain 2.5 silage	Forage intake = 75% of total dry matter intake (DMI) for beef cattle on subsistence farms (i.e., unsupplemented) (Rice, 1994b) Grain intake = 3.9% of total dry matter intake (DMI) for beef cattle on subsistence farms (i.e., unsupplemented) Silage intake = 21% of total dry matter intake (DMI) for beef cattle on subsistence farms (i.e., unsupplemented) DMI = 2% of body weight for beef cattle (Rice, 1994b) Average body weight for beef cattle = 590 kg (Rice, 1994b)
	Commercial Beef Farmer	3.8 forage 3.1 grain 1.0 silage	(Rice, 1994b). Values here include grain supplement during growing phase for beef cattle.
	Subsistence Dairy Farmer	13.2 forage 3.0 grain 4.1 silage	Forage intake = 65% of total dry matter intake (DMI) for dairy cattle on subsistence farms (Rice, 1994b) Grain intake = 15% of total dry matter intake (DMI) for dairy cattle on subsistence farms Silage intake = 20% of total dry matter intake (DMI) for dairy cattle on subsistence farms DMI = 3.2% of body weight for dairy cattle (Rice, 1994b) Average body weight for dairy cattle = 630 kg (Rice, 1994b)
	Commercial Dairy Farmer	6.2 forage 12.2 grain 1.9 silage	Taken from Rice (1994b)

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
		Terrestrial Food Chain	
Qs	Quantity of soil eaten by cattle (kg soil/d)		
	Subsistence Beef Farmer	0.5	Soil intake = 4% of DMI for beef cattle on subsistence farms (Rice, 1994b) DMI = 2% of body weight (Rice, 1994b) Average body weight for beef cattle = 590 kg (Rice, 1994b)
	Commercial Beef Farmer	0.25	(Rice, 1994b)
	Subsistence Dairy Farmer	0.4	Soil intake = 2% of DMI for dairy cattle on subsistence farms (Rice, 1994b) DMI = 3.2% of body weight (Rice, 1994b) Average body weight for dairy cattle = 630 kg (Rice, 1994b)
	Commercial Dairy Farmer	0.2	(Rice, 1994b)
		Terrestrial Food Chain	
Qp	Quantity of plant matter eaten by hog (kg plant tissue DW/d)	3.0 grain 1.3 silage	Grain intake = 70% of average daily intake (U.S. EPA, 1990). Silage intake = 30% of average daily intake (U.S. EPA, 1990). Hogs are not grazing animals and are not assumed to eat forage.
Qs	Quantity of soil eaten by hogs (kg soil /d)	0.37	Soil intake = 8% of DMI for hogs (U.S. EPA, 1993)
F_d	Fraction of chicken diet that is soil (unitless)	0.1	Biotransfer factors for poultry were calculated for chickens consuming 10% of their diet as contaminated soil. (Stephens et al., 1992). Only chickens raised by subsistence poultry farmers were assumed to eat soil. These chickens consumed no contaminated grain. No consumption rate of soil is used in the calculation of dioxin concentration in poultry because the bioconcentration factor for poultry is unitless.

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
		Aquatic Food Chain	
Z	Soil mixing depth for watershed (cm)	1	Reflects untilled soil (U.S. EPA, 1993).
ER	Soil enrichment ratio (unitless)	3	(U.S. EPA, 1993).
T_w (also T_k)	Waterbody temperature (K)	298	Assumption; equals 25 °C.
K	USLE erodibility factor (ton/acre)[a]	0.34	National value for silt loam obtained for consistency with the national parameterization of other soil properties required for the model. STATSGO national soils data was used to estimate central tendency statistics for the more than 1,400 STATSGO map units across the country with silt loam soils and nonzero K values. All central tendency statistics (mean, median, mode, area-weighted mean) were 0.34.
K	USLE erodibility factor (ton/acre) *for farm ponds*	0.29	Average of default values provided in U.S. EPA, 1997c (western = 0.28; eastern = 0.30).
LS	USLE length-slope factor (unitless) *for farm ponds*	1.5	Average of default values provided in U.S. EPA, 1997c (2.5 for eastern location and 0.4 for western location)
C	USLE cover management factor (unitless) *for farm ponds*	0.8	The value for "cropland and pasture" and "other agricultural land" categories in a table on page 407 of *Stormwater Management* (Wanielista and Yousef, 1993).
P	USLE supporting practice factor (unitless) *for farm ponds*	1	Represents no erosion/runoff control measures (U.S. EPA, 1993).
b	Empirical slope coefficient for sediment delivery ratio calculation	0.125	U.S. EPA, 1993.

[a] Modeled waterbodies have site-specific values for all USLE parameters except K; a national default value was used for K. To maintain consistency with default values selected for farm ponds, a different default value was applied.

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
		Aquatic Food Chain	
a	Empirical intercept coefficient for sediment delivery ratio calculation	0.6-2.1	Depends on watershed area; values are as follows (U.S. EPA, 1993): (Note 1 sq. mile = 2.59×10^6 m^2) Watershed Area (sq. miles) — a ≤ 0.1 — 2.1 1 — 1.9 10 — 1.4 100 — 1.2 1,000 — 0.6
d_b	Depth of the upper benthic layer (m)	0.03	Based on center of range given in U.S. EPA, 1993
BS	Bed sediment concentration (g/cm^3)	1	U.S. EPA, 1993
θ_{bs}	Bed sediment porosity (L_{water}/L)	0.6	Calculated from bed sediment concentration (BS = 1, see above) and solids density (ρ_s = 2.65 g/cm^3) as follows U.S. EPA, 1993: $\theta_{bs} = 1 - \frac{BS}{P_s}$
θ	Temperature correction factor (unitless)	1.026	U.S. EPA, 1993
C_d	Drag coefficient (unitless)	0.0011	U.S. EPA, 1993

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
		Aquatic Food Chain	
ρ_w	Density of water (g/cm^3)	1	*CRC Handbook* (Weast, 1979).
k	von Karman's constant	0.4	U.S. EPA, 1993.
μ_w	Viscosity of water (g/cm-sec)[b]	1.69E-2	U.S. EPA, 1993.
λ_2	Dimensionless viscous sublayer thickness (unitless)	4	U.S. EPA, 1993.
f_{lipid}	Fish lipid content (fraction)	0.03	Great Lakes Water Quality Initiative apportioned by 36/64 percent TL 3 and TL 4 ingestion rates using 1997 EFH table 10-66 "Total Consumption of Freshwater Fish Caught by all Survey Respondents During the 1990 Season" (U.S. EPA, 1997a)
OC_{ss}	Fraction of organic carbon in suspended solids (unitless)	0.045	Corresponds roughly to a surface soil fraction organic carbon of 0.006.
OC_{sed}	Fraction organic carbon in bottom sediment (unitless)	0.014	Mean value, Suedel and Rodgers, 1991
		0.024	Used to calculate Kd_{bs} for dioxins as $Kd_{bs} = Koc * OC_{sed}$. Value of OC_{sed} is 4*foc (U.S. EPA, 1993)

[b] Temperature-based viscosity of water calculated per U.S. EPA 1993; the equation as presented in U.S. EPA 1993 contains a typographical error that does not significantly impact risk results.

1997 EFH refers to U.S. EPA, 1997a.

(continued)

Table D-38. (continued)

Parameter	Definition	Value	Derivation
Breast Milk Exposure for Dioxins			
h	Half-life of dioxin in adults (days)	2555	U.S. EPA, 1994a
f_1	Proportion of ingested dioxin that is stored in fat (unitless)	0.9	U.S. EPA, 1994a
f_2	Proportion of mother's weight that is fat (unitless)	0.3	U.S. EPA, 1994a
f_3	Fraction of fat in breastmilk (unitless)	0.04	U.S. EPA, 1994a
f_4	Fraction ingested contaminant which is adsorbed (unitless)	0.9	U.S. EPA, 1994a

Table D-39. Intake Rates and Other Exposure Factors Applicable for All Cases

Parameter	Exposure Factor		Reference
Body Weight			
Body weight (kg)	Adult (>19 years)	71.8	Body Weights of Adults (kg) (1997 EFH Table 7-2)
	Adult female (>19 years)	65.4	Same
	Child (12-19 years)	58.3	Body Weights of Children (kg) (1997 EFH Table 7-3)
	Child (6-11 years)	30.7	Same
	Child (0-5 years)	14.3	Same
Inhalation of Air			
Intake rate of air (m^3/d)	Adult (>19 years)	13.3	EFH-recommended value
	Child (12-19 years)	14.0	Daily Inhalation Rates Calculated from Food-Energy Intakes (1997 EFH Table 5-11)
	Child (6-11 years)	11.8	Same
	Child (0-5 years)	6.5	Same
Ingestion of Drinking Water			
Intake of drinking water (L/d)	Adult (>19 years)	1.38	Total Tapwater Intake (mL/d) for Both Sexes Combined (1997 EFH Table 3-6)
	Child (12-19 years)	0.96	Same
	Child (6-11 years)	0.79	Same
	Child (0-5 years)	0.65	Same
Ingestion of Soil			
Intake of soil (g/d)	Adult (>19 years)	50	EFH Chapter 4 Recommendation
	Child (12-19 years)	100	Same
	Child (6-11 years)	100	Same
	Child (0-5 years)	179	Distribution of Average (Mean) Daily Soil Ingestion Estimates Per Child for 64 Children (mg/d) (1997 EFH Table 4-9)
Exposure Duration			
Exposure duration (yr)	Adult Farmer and Adult Subsistence Fisher (>19 years)	17.3	Values and Their Standard Errors for Average Total Residence Time, T, for Each Group in Survey (1997 EFH Table 15-163)
	Adult Non-farmer/ Non-Subsistence Scenario (>19 years)	13.5	Descriptive Statistics for Both Genders by Current Age (1997 EFH Table 15-168)
	Child (12-19 years)	9.1	Same
	Child (6-11 years)	8.9	Same
	Child (0-5 years)	6.5	Same
	Infant	1	U.S. EPA, 1994b

(continued)

Table D-39. (continued)

Parameter	Exposure Factor		Reference
Miscellaneous			
Lifetime/averaging time for carcinogens (yr)	70		Standard Value
Exposure frequency (d/yr)	350		Fields & Diamond, 1991
Loss-Adjusted Ingestion of Produce			
Intake of root vegetables (g whole weight/d)	Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	16.5 11.7 8.90 5.86	Consumer-Only Intake of Homegrown Exposed Root Vegetables (g/kg-day) (1997 EFH Table 13-65)
Intake aboveground produce (fruits and vegetables) (g DW/d)	Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	15.4 11.9 10.8 6.15	Consumer-Only Intake of Homegrown Exposed Fruit (g/kg-day) (1997 EFH Table 13-61), and Consumer-Only Intake of Homegrown Exposed Vegetables (g/kg-day) (1997 EFH Table 13-63)
Loss-Adjusted Ingestion of Animal Products			
Intake of beef (g FW/d)[a]	Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	79 55.4 65.7 25.7	Consumer-Only Intake of Home-Produced Beef (1997 EFH Table 13-36)
Intake of milk (g FW/d)[a]	Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	510 945 1083 1001	Consumer-Only Intake of Home-Produced Dairy (g/kg-day) (1997 EFH Table 13-28)
Intake of pork (g FW/d)[a]	Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	36.6 34.4 27.9 21.5	Consumer-Only Intake of Home-Produced Pork (1997 EFH Table 13-54)
Intake of chicken (g FW/d)	Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	45.2 37.3 39.9 24.3	Consumer-Only Intake of Home-Produced Poultry (1997 EFH Table 13-55)

(continued)

Table D-39. (continued)

Parameter	Exposure Factor		Reference
Intake of eggs (g FW/d)	Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	43.8 38.5 33.8 24.2	Consumer-Only Intake of Home-Produced Eggs (g/kg-day) (1997 EFH Table 13-43)
Ingestion of Fish			
Intake of fish (g/d)	Subsistence Fisher Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	 69.6 59.6 42.1 19.6	EFH-Recommended Values (Chapter 12), U.S. EPA, 1997a
	Recreational Fisher and Subsistence Farmer Adult (>19 years) Child (12-19 years) Child (6-11 years) Child (0-5 years)	 11.5 8.7 8.6 5.3	Mean Fish Intake Among Individuals Who Eat Fish and Reside in Households with Recreational Fish Consumption (1997 EFH Table 10-61)
Ingestion of Breastmilk by the Infant			
Ingestion rate of breastmilk (kg/d)	0.8		U.S. EPA, 1994a

[a] For cadmium and selenium, these consumption rates have to be multiplied by dry weight conversion factors before being used to calculate individual hazard quotients. The conversion factors are 0.4 and 0.1 for beef and milk, respectively (Lorber & Rice, 1995). The conversion factor for pork is assumed to equal that for beef.

1997 EFH refers to U.S. EPA, 1997a.

References

ATSDR (Agency for Toxic Substances and Disease Registry). 1992. *Toxicological Profile for Cobalt*. TP-91/10. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA.

Baes, C.F., III, R.D. Sharp, A.L. Sjoreen, and R.W. Shor. 1984. *A Review and Analysis of Parameters for Assessing Transport of Environmentally Released Radionuclides Through Agriculture*. Publication No. ORNL-5786. Prepared for U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN. pp. 10, 11, 50, and 51.

Barrows, M.E., S.R. Petrocelli, K.J. Macek, and J.J. Carroll. 1980. Chapter 24: Bioconcentration and elimination of selected water pollutants by bluegill sunfish (*Lepomis macrochirus*). In: *Dynamics, Exposure and Hazard Assessment of Toxic Chemicals*, R. Haque (ed.), Ann Arbor Science Publishers Inc., Ann Arbor, MI. pp. 379 to 392.

Bauer, K.M. 1992. *Multivariate Statistical Analyses of Dioxin and Furan Levels in Fish, Sediment, and Soil Samples Collected Near Resource Recovery Facilities. Final Report.* Prepared for Connecticut Department of Environmental Protection. Midwest Research Institute, Kansas City, MO.

Belcher, G.D., and C.C. Travis. 1989. *Modeling Support for the Rura and Municipal Waste Combustion Projects: Final Report on Sensitivity and Uncertainty Analysis for the Terrestrial Food Chain Model*. Interagency Agreement No. 1824-A020-A1. Prepared for U.S. Environmental Protection Agency. Oak Ridge National Laboratory, Office of Risk Analysis, Health and Safety Research Division, Oak Ridge, TN. pp. 18 to 20.

Canton, J.H., and W. Slooff. 1982. Toxicity and accumulation studies of cadmium (Cd^{2+}) with freshwater organisms of different trophic levels. *Ecotoxicology and Environmental Safety* 6:113-128.

Carsel, R.F., R.S. Parrish, R.L. Jones, J.L. Hansen, and R.L. Lamb. 1988. Characterizing the uncertainty of pesticide leaching in agricultural soils. *Journal of Contaminant Hydrology* 2:111-124.

Chamberlain, A.C. 1970. Interception and retention of radioactive aerosols by vegetation. *Atmospheric Environment* 4:57-78.

Eisler, R. 1985. Cadmium hazards to fish, wildlife, and invertebrates: a synoptic review. In: *Contaminant Hazard Reviews, Report No. 2*. U.S. Fish and Wildlife Service, U.S. Department of the Interior, Laurel, MD.

Fields, T., Jr., and B. Diamond. 1991. Human health evaluation manual, supplemental guidance: "standard default exposure factors". OSWER Directive 9285.6-03. Memorandum. U.S. Environmental Protection Agency, Washington, DC. March 25.

Geisey, J.P., Jr., G.J. Leversee, and D.R. Williams. 1977. Effects of naturally occurring aquatic organic fractions on cadmium toxicity to *Simocephalus serrulatus* (Daphnidae) and *Gambusia affinis* (Poeciliidae). *Water Research* 11:1013-1020.

Hoffman, F.O., K.M. Thiessen, M.L. Frank, and B.G. Blaylock. 1992. Quantification of the interception and initial retention of radioactive contaminants deposited on pasture grass by simulated rain. *Atmospheric Environment* 26A(18):3313-3321.

Koester, C.J., and R.A. Hites. 1992. Wet and dry deposition of chlorinated dioxins and furans. *Environmental Science and Technology* 26:1375-1382.

Kumada, H., S. Kimura, and M. Yokote. 1980. Accumulation and biological effects of cadmium in rainbow trout. *Bulletin of the Japanese Society of Scientific Fisheries* 46(1):97-103.

Kumada, H., S. Kimura, M. Yokote, and Y. Matida. 1972. Acute and chronic toxicity, uptake, and retention of cadmium in freshwater organisms. *Bulletin of Freshwater Fisheries Research Laboratory* 22(2):157-165.

Lemly, A.D. 1985. Toxicology of selenium in a freshwater reservoir: implications for environmental hazard evaluation and safety. *Ecotoxicology and Environmental Safety* 10:314-338.

Lorber, M. 1995. Development of an air-to-leaf vapor phase transfer factor for dioxins and furans. In: *Organohalogen Compounds: Proceedings of the 15th International Symposium on Chlorinated Dioxins and Related Compounds,* Volume 24, pp. 179-186. August 21-25, 1995, Edmonton, Canada.

Lorber, M., and G. Rice. 1995. Further issues for modeling the indirect exposure impacts from combuster emissions. Memorandum to Anna M. Burke, Marian Olsen, Deborah Forman, Elmer Akin, Carol T. Braverman, Mario Mangino, Gerald Carney, Jon Rauscher, Mary Rouse, Bob Fields, Suzanne Wuerthele, Arnold Den, Pat Cirone, Bob Ambrose, Joanne Griffith, and Alec McBride. U.S. Environmental Protection Agency, Washington, DC. January 20.

Rice, G. 1994a. Interception Fraction and Associated Parameters. Draft Working Papers (Unpublished). Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC.

Rice, G. 1994b. Quantity of Plants and Soil Consumed by Animal. Draft Working Papers (Unpublished). Office of Research and Development, U.S. Environmental Protection Agency, Washington, DC.

RTI (Research Triangle Institute). 1994. *Chemical properties for soil screening levels* (Draft). 5629-240-03D. Research Triangle Park, NC.

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter, II, and C.J.E. Welsh. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*. ORNL/TM-13391. Prepared for Office of Environmental Policy and Assistance, U.S. Department of Energy. Prepared by Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1998a. *Development and Validation of Bioaccumulation Models for Small Mammals*. ES/ER/TM-219. Prepared for Office of Environmental Management, U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter, II, and T.L. Ashwood. 1998b. *Development and Validation of Bioaccumulation Models for Earthworms*. ES/ER/TM-220. Prepared for Office of Environmental Management, U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN.

Stephan, C.E. 1993. *Derivation of Proposed Human Health and Wildlife Bioaccumulation Factors for the Great Lakes Initiative*. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Duluth, MN.

Stephens, R.D., M.X. Petreas, and D.G. Hayward. 1992. Biotransfer and bioaccumulation of dioxins and dibenzofurans from soil. In: *Organohalogen Compounds: Proceedings of the 12th International Symposium on Dioxins and Related Compounds,* Volume 8, pp. 377-380.

Strenge, D.L., and S.R. Peterson. 1989. *Chemical Databases for the Multimedia Environmental Pollutant Assessment System (MEPAS): Version 1*. PNL-7415. Prepared for U.S. Department of Energy. Battelle Memorial Institute, Richland, WA. pp. 4.1 to 4.7.

Suedel, B.C., and J.H. Rodgers, Jr. 1991. Variability of bottom sediment characteristics of the continental United States. *Water Resources Bulletin* 27(1):101-109.

Taylor, D. 1983. The significance of the accumulation of cadmium by aquatic organisms. *Ecotoxicology and Environmental Safety* 7:33-42.

Travis, C.C., and A.D. Arms. 1988. Bioconcentration of organics in beef, milk, and vegetation. *Environmental Science and Technology* 22(3):271-274.

U.S. EPA (Environmental Protection Agency). n.d. *Risk Assessment Issue Paper for: Oral Reference Dose for Cobalt*. National Center for Environmental Assessment, Cincinnati, OH.

U.S. EPA (Environmental Protection Agency). 1984. *Health Effects Assessment for 2,3,7,8-Tetrachlorodibenzo-p-dioxin*. EPA/540/1-86-044. Office of Emergency and Remedial Response, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1988. *Superfund Exposure Assessment Manual*. EPA/540/1-88/001. Office of Remedial Response, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1990. *Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions* (Interim Final). EPA/600/6-90/003. Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1992a. *Background Document for Finite Source Methodology for Wastes Containing Metals*. HWEP-S0040. Office of Solid Waste, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1992b. *Technical Support Document for Land Application of Sewage Sludge. Volume I* . EPA 822/R-93-001a. Office of Water, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1992c. *TSC1292 Criteria Chart. 304(a) Criteria and Related Information for Toxic Pollutants*. Region IV - Water Management Division, Atlanta, GA.

U.S. EPA (Environmental Protection Agency). 1993. *Addendum to Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions* (External Review Draft). EPA/600/AP-93/003. Exposure Assessment Group, Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1994a. *Estimating Exposure to Dioxin-Like Compounds. Volume II: Properties, Sources, Occurrence and Background Exposures* (External Review Draft). EPA/600/6-88/005Cb. Office of Research and Development, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1994b. *Estimating Exposure to Dioxin-Like Compounds. Volume III: Site-specific Assessment Procedures*. EPA/600/6-88/005Cc. Office of Research and Development, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1994c. *User's Guide for Wastewater Treatment Compound Property Processor and Air Emissions Estimator (WATER8)*. EPA-453/C-94-080C. Office of Air Quality Planning and Standards, Research Triangle Park, NC.

U.S. EPA (Environmental Protection Agency). 1995. WATER8. Version 4.0. Office of Air Quality Planning and Standards, Research Triangle Park, NC.

U.S. EPA (Environmental Protection Agency). 1996. *Soil Screening Guidance Technical Background Document*. EPA/540/R/95/128. Office of Solid Waste and Emergency Response, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1997a. *Exposure Factors Handbook*. EPA/600/P-95/002Fa. Office of Research and Development, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1997b. *Health Effects Assessment Summary Tables. FY 1997 Update*. Prepared by International Consultants, Inc., for National Center for Environmental Protection, Cincinnati, OH.

U.S. EPA (Environmental Protection Agency). 1997. *Mercury Study Report to Congress. Volume III - Fate and Transport of Mercury in the Environment.* EPA 452/R-97/005. Office of Air Quality Planning and Standards and Office of Research and Development, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1998. Integrated Risk Information System (IRIS) Database. Cincinnati, OH. August.

Van den Berg, M., L.S. Birnbaum, A.T.C. Bosveld, B. Brunström, P.M. Cook, M. Feeley, J.P. Giesy, Jr., A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X.R. van Leeuwen, A.K.D. Liem, C. Nolt, R.E. Peterson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Wærn, and T. Zacharewski. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. *Environmental Health Perspectives* 106(12):775-792.

Wanielista, M.P., and Y.A. Yousef. 1993. *Stormwater Management*. John Wiley & Sons, Inc., New York, NY. pp. 399 to 410.

Weast, R.C. (ed). 1979. *CRC Handbook of Chemistry and Physics*. 60th Edition. CRC Press, Boca Raton, FL. pp. F-11 to F-58

Williams, D.R., and J.P. Geisey, Jr. 1978. Relative importance of food and water sources to cadmium uptake by *Gambusia affinis* (Poeciliidae). *Environmental Research* 16:326-332.

Appendix E

Particulate Matter (PM) Risk Assessment for the Proposed Combustor Emissions MACT Standard

Abt Associates Inc.
Hampden Square-Suite 600 ■ 4800 Montgomery Lane ■ Bethesda, MD 20814-5341 ■ (301) 913-0500

M E M O R A N D U M

TO: Tony Marimpietri and Zach Pekar, Research Triangle Institute

FROM: Amy Benson and Nathan Brodeur, Abt Associates Inc.

DATE: May 14, 1999

SUBJECT: Particulate Matter (PM) Risk Assessment for the Proposed Combustor Emissions MACT Standard

---

1.0 INTRODUCTION

This memorandum describes the method used to estimate changes in incidence of health effects resulting from the attainment of technical standards for PM emissions from hazardous waste combustion units. The changes in incidence are estimated using the Criteria Air Pollutant Modeling System (CAPMS), which has been used as the primary analytical tool for evaluating benefits attributable to the Clean Air Act and for evaluating proposed alternatives to the current PM and ozone national ambient air quality standards (NAAQS).

The method used in this analysis is described below. Specifically, this memorandum addresses: (1) the use of modeled PM concentrations in the analysis, (2) application of health effect concentration-response functions to the PM concentrations, (3) the method used to estimate the exposed population and baseline incidences for use with the concentration-response functions to estimate total reductions in incidence of health endpoints, and (4) the method used to sum results to present estimates aggregated over a year. Results of applying the method are aggregated for all facilities and presented separately by individual class of combustion unit. In addition, the results are presented for all health endpoints modeled in the analysis. However, because there is some overlap among health endpoints and populations modeled, suggestions are also made for how to avoid double counting of the presented effects.

2.0 USE OF PM CONCENTRATION DATA

The Research Triangle Institute (RTI) estimated ambient PM concentrations from five years of emissions data, for 1216 sectors associated with 76 sites containing hazardous waste combustion units. A "baseline" scenario was developed by RTI. The baseline reflects ambient PM conditions for the case in which no additional emissions controls (beyond those currently in place) are implemented. A "MACT control" scenario, with PM concentrations corresponding to the MACT control levels, was also developed.

Several types of modeled ambient PM concentrations were used in this analysis. Mean and median concentrations estimated using five years of data, and 24-hour average concentrations of both PM-2.5 and PM-10 measures were used[1]. The type of measure used in this analysis depends on the PM measure used in the epidemiology studies which from which the concentration-response functions were derived. The five-year mean and median concentrations were used with the concentration-response functions based on long-term PM concentrations (averaged over one or more years). The 24-hour average concentrations, in the custom distribution form described below, were used to evaluate concentration-response functions based on short-term PM concentrations averaged over one to several days.

2.1 CAPMS AIR QUALITY DATA FORMAT

For each air quality scenario, CAPMS requires that the temporal distribution of concentrations be described for each location and pollutant being examined for the entire period modeled. For efficiency, CAPMS uses a reduced form of the temporal distribution of concentrations rather than every modeled concentration in chronological order. The reduced form distribution, or concentration profile, is outlined below.

Concentration profiles can be developed for any averaging time (ranging from hourly and daily averages to annual means or medians). Averaging times are selected to match those reported by published epidemiological and/or clinical studies used to derive concentration-response relationships. Characterizing a year's worth of air quality concentrations using an annual statistic, such as the mean or median, is straightforward; a single value describes ambient conditions in a given location across the entire year. For this analysis, RTI provided Abt Associates with five-year mean and five-year median PM concentrations which were used to evaluate the concentration-response functions based on long-term PM concentrations. Developing concentration profiles of pollutant concentrations for shorter averaging times, however, requires some data processing.

A custom distribution was created for shorter averaging times. In the custom distribution, the number of values describing pollutant concentrations across the modeled time period were reduced to 20. For example, the 365 24-hour averages across a year were reduced to 20 points by ranking the concentrations chronologically, apportioning them to 20 equally-sized bins, and taking the average value for each bin. The value in each bin is a central estimate of the daily average concentration for $1/20^{th}$ of the year. A 20-point distribution must be provided for each location-pollutant-averaging time combination for both air quality scenarios (Baseline and MACT). CAPMS then uses the concentrations reported for each scenario to calculate the change in air quality (ΔQ) at each of the 20 points (MACT scenario concentrations are subtracted from corresponding Baseline concentrations).

For this analysis, RTI modeled five years of air quality data. Therefore, RTI predicted 1825 24-hour average PM concentrations across a five-year period. These 1825 24-hour average

[1]PM10 includes all air particles that are 10 μm in diameter and smaller; PM2.5 includes all particles that are 2.5 μm in diameter and smaller.

PM concentrations were then reduced to a 20-point distribution. For the purpose of benefits modeling, this 20-point distribution was then assumed to be representative of the distribution of 24-hour average PM concentrations across a single year. This 20-point custom distribution was then used to evaluate concentration-response functions which rely on short-term PM concentrations averaged over one to several days, as described below.

2.2 TRANSLATING AIR QUALITY IMPROVEMENTS INTO ANNUAL HEALTH BENEFITS USING THE CAPMS CUSTOM DISTRIBUTION

The concentrations from the custom distribution are used together with concentration-response functions to translate air quality improvements into estimates of avoided adverse health effects. For example, the number of avoided mortality cases attributable to short-term PM reductions can be estimated using the concentration-response function from Schwartz et al. (1996a). In this case, the function is evaluated using each of the 20 "daily" ΔQ values estimated as described in Section 2.1. Each of the resulting 20 estimates represents the number of mortality cases avoided each day during the period of the year associated with a given ΔQ value.

Each estimate of daily mortality cases avoided is multiplied by the number of days in the period (365 days per year/20 periods per year = 18.25 days per period) to derive a total number of cases for that period. An estimate of the annual number of avoided mortality cases is the sum of the estimates for the 20 periods. Estimates of the number of cases avoided are calculated in this manner for each modeled location. The general approach outlined for this PM mortality example applies to the evaluation of all concentration-response functions based on short-term average PM concentrations.

3.0 USE OF CONCENTRATION-RESPONSE FUNCTIONS

Epidemiological studies have estimated the relationship between PM and health endpoints in different geographic locations. The concentration-response functions estimated by these studies differ from each other in several ways. They may have different functional forms; they may have measured PM concentrations in different ways; they may have characterized the health endpoint, y, in slightly different ways; or they may have considered different types of populations. For example, some studies of the relationship between ambient PM concentrations and mortality have excluded accidental deaths from their mortality counts; others have included all deaths. One study may have measured daily (24-hour) average PM concentrations while another study may have used two-day averages. Some studies have assumed that the relationship between y and PM is best described by a linear form (i.e., the relationship between y and PM is estimated by a linear regression in which y is the dependent variable and PM is one of several independent variables). Other studies have assumed that the relationship is best described by a log-linear form (i.e., the relationship between the natural logarithm of y and PM is estimated by a linear regression).[2] Finally, some studies have considered changes in the health endpoint only

[2]The log-linear form used in the epidemiological literature on PM-related health effects is often referred to as "Poisson regression" because the error term in the regression is assumed to have a Poisson distribution rather than the usual normal distribution. The form of the regression, however, is still log-linear.

among members of a particular subgroup of the population (e.g., individuals 65 and older), while other studies have considered the entire population in the study location. Furthermore, some of the epidemiological studies measuring the relationship between PM air pollution and adverse effects quantify the relationship in terms of PM-10, while others focus exclusively on the fine fraction, PM-2.5. (Because modeled predictions of the change in ambient PM-10 and PM-2.5 concentrations are both available, this analysis evaluated each concentration-response function using the appropriate PM indicator.)

To estimate changes in health effects in this analysis, CAPMS applies the concentration-response functions available in epidemiological studies to changes in PM concentrations between the baseline and the control air quality scenarios investigated. Several issues related to the use of the concentration-response functions are described in the following sections. Section 3.1 describes the health effects modeled in this analysis and issues related to the overlap in these effects; Section 3.2 describes the type functional forms of the majority of concentration-response functions used in this analysis; and Section 3.3 describes how concentration-response functions are "pooled" before being used to estimate changes in health effects. Exhibit 3.1 summarizes the concentration-response functions used to quantify changes in health effects in this analysis. Much of the discussion in the following sections is taken from the Retrospective Analysis of the Clean Air Act (U.S. EPA, 1997a) and documents supporting the Regulatory Impact Analysis of the Particulate Matter and Ozone NAAQS (U.S. EPA, 1997b). Additional information is included where necessary.

3.1 Description and Overlap of Health Effects Modeled

Epidemiological studies that have estimated relationships between ambient PM concentrations and health effects are available for several health effects and several different population groups. The broad categories of health endpoints for which concentration-response functions have been estimated based on measures of PM are:

(1) mortality,
(2) hospital admissions, and
(3) respiratory symptoms and restricted activity days (not requiring hospitalization).

The health endpoints included in each of these categories and the possible overlap among health effects and populations studied are described below. Descriptions of the populations investigated in the relevant studies are important because, in most cases, the concentration-response functions from these studies are applied only to the subpopulation (e.g., asthmatic children) investigated in the epidemiological study.

Exhibit 3.1 Concentration-Response Functions Used to Estimate Health Effects Associated with Exposure to Particulate Matter

Endpoint	Concentration-Response Function		PM Averaging Time		Population[a]	Annual Baseline Incidence (per 100,000 population)[b]	Pollutant Coefficient[c]
	Source	Functional Form	Studied	Applied			
Mortality							
Mortality (Long-Term exposure), using PM2.5 indicator	Pope et al., 1995	log-linear	median of four years of data	annual median[d]	ages 30+	759 (number of nonaccidental deaths in the population ages 30 + divided by 100,000 individuals of all ages .)	0.006408
Mortality (Short-Term exposure), using PM2.5 indicator	Schwartz et al., 1996a (Boston, Knoxville, St. Louis, Steubenville, Portage & Topeka)	log-linear	2-day average	1-day average[e]	all	803 (nonaccidental deaths in general pop.)	0.001433
Mortality (Short-Term exposure), using PM10 indicator[e]	Ito & Thurston, 1996 (Chicago)	log-linear	2-day average	1-day average[f]	all	803 (nonaccidental deaths in general pop.)	0.000782
	Kinney et al., 1995 (Los Angeles)	log-linear	1-day average		all		
	Pope et al., 1992 (Utah)	log-linear	5-day average		all		
	Schwartz, 1993a (Birmingham)	log-linear	3-day average		all		
	Schwartz et al., 1996a (Boston)	log-linear	2-day average		all		
	Schwartz et al., 1996a (Knoxville)	log-linear	2-day average		all		
	Schwartz et al., 1996a (St. Louis)	log-linear	2-day average		all		
	Schwartz et al., 1996a (Steubenville)	log-linear	2-day average		all		
	Schwartz et al., 1996a (Portage)	log-linear	2-day average		all		
	Schwartz et al., 1996a (Topeka)	log-linear	2-day average		all		

(continued)

Exhibit 3.1 (continued)

Endpoint	Concentration-Response Function		PM Averaging Time		Population[a]	Annual Baseline Incidence (per 100,000 population)[b]	Pollutant Coefficient[c]
	Source	Functional Form	Studied	Applied			
Hospital Admissions							
All respiratory illnesses, using PM2.5 indicator	Thurston et al., 1994 (Toronto)	linear	1-day average	1-day average	all	n/a	3.45 X 10^{-8} [f]
All respiratory illnesses, using PM10 indicator	Schwartz, 1995 (Tacoma)	log-linear	1-day average	1-day average	age 65+	504 (general pop.)	0.00170
	Schwartz, 1995 (New Haven)	log-linear	1-day average		age 65+		
	Schwartz, 1996 (Spokane)	log-linear	1-day average		age 65+		
COPD, using PM10 indicator	Schwartz, 1994a (Birmingham)	log-linear	1-day average	1-day average	age 65+	103 (general pop.)	0.002533
	Schwartz, 1994b (Detroit)	log-linear	1-day average		age 65+		
	Schwartz, 1996 (Spokane)	log-linear	1-day average		age 65+		
Pneumonia, using PM10 indicator	Schwartz, 1994a (Birmingham)	log-linear	1-day average	1-day average	age 65+	229 (general pop.)	0.0013345
	Schwartz, 1994b (Detroit)	log-linear	1-day average		age 65+		
	Schwartz, 1994c (Minneapolis)	log-linear	1-day average		age 65+		
	Schwartz, 1996 (Spokane)	log-linear	1-day average		age 65+		
Congestive heart failure, using PM10 indicator	Schwartz and Morris, 1995 (Detroit)	log-linear	2-day average	1-day average	age 65+	231 (general pop.)	0.00098
Ischemic heart disease, using PM10 indicator	Schwartz & Morris, 1995 (Detroit)	log-linear	1-day average	1-day average	age 65+	450 (general pop.)	0.00056

(continued)

Exhibit 3.1 (continued)

Endpoint	Concentration-Response Function		PM Averaging Time		Population[a]	Annual Baseline Incidence (per 100,000 population)[b]	Pollutant Coefficient[c]
	Source	Functional Form	Studied	Applied			
Respiratory Symptoms/Illnesses not requiring hospitalization							
Chronic bronchitis, using PM10 indicator	Schwartz, 1993b		annual mean	annual mean	all	n/a	0.012
Acute bronchitis, using PM2.5 indicator	Dockery et al., 1989	logistic	annual mean	annual mean[d]	ages 10-12	n/a	0.0298
Upper respiratory symptoms (URS), using PM10 indicator	Pope et al., 1991	log-linear	1-day average	1-day average	asthmatics, ages 9-11	38,187 (applied pop.)	0.0036
Lower respiratory symptoms (LRS), using PM2.5 indicator	Schwartz et al., 1994	logistic	1-day average	1-day average	ages 8-12	n/a	0.01823
MRADs, using PM2.5 indicator	Ostro and Rothschild, 1989	log-linear	2-week average	1-day average	ages 18-65	780,000 days/year (applied pop.)	0.00741
RADs, using PM2.5 indicator	Ostro, 1987	log-linear	2-week average	1-day average	ages 18-65	400,531 days/year (applied pop.)	0.00475
Acute respiratory symptoms (any of 19), using PM10 indicator	Krupnick et al., 1990	logistic	1-day average COH	1-day average	ages 18-65 (study examined "adults")	n/a	0.00046
Shortness of breath (days), using PM10 indicator	Ostro et al., 1995	logistic	1-day average	1-day average[d]	African-American asthmatics, ages 7-12	n/a	0.00841

(continued)

Exhibit 3.1 (continued)

Endpoint	Concentration-Response Function		PM Averaging Time		Population[a]	Annual Baseline Incidence (per 100,000 population)[b]	Pollutant Coefficient[c]
	Source	Functional Form	Studied	Applied			
Work loss days (WLDs), using PM2.5 indicator	Ostro, 1987	log-linear	2-week average	1-day average	ages 18-65	150,750 days/year (applied pop.)	0.0046

NOTES:

[a] The population examined in the study and to which this analysis applies the reported concentration-response relationship. In general, epidemiological studies analyzed the concentration-response relationship for a specific age group (e.g., ages 65+) in a specific geographical area. This analysis applies the reported pollutant coefficient to all individuals in the age group nationwide.

[b] annual baseline incidence in the applied population per 100,000 individuals in the indicated population. For hospital admissions and mortality, the national baseline incidence rates are meant to provide the reader with a general perspective of the potential magnitude of the baseline incidence; for other endpoints, the annual baseline incidence estimates were taken directly from the epidemiological literature and were applied to all sectors in the analysis.

[c] a single pollutant coefficient reported for several studies indicates a pooled analysis; see text for discussion of pooling concentration-response relationships across studies.

[d] The following studies report a lowest observed pollution level:

Pope et al., 1995	Mortality (long-term exposure)	9 $\mu g/m^3$ $PM_{2.5}$
Dockery et al., 1995	Acute Bronchitis	11.8 $\mu g/m^3$ $PM_{2.5}$ (20.1 $\mu g/m^3$ PM_{10})
Ostro et al., 1995	Shortness of Breath, days	19.63 $\mu g/m^3$ PM_{10}

The remaining studies did not report lowest observed concentrations.

[e] Pooling of the ten studies used for this endpoint is described in EPA (1996).

[f] All 1-day averages are 24-hour averages, 2-day averages are 48-hour averages, etc.

* See U.S. EPA 1997 for citations

Mortality Studies

The studies that associate PM exposures with premature mortality presented in this analysis differ primarily in the type of PM exposure which is used as input to the concentration response functions (i.e., whether PM2.5 or PM10 is used and whether short-term or long-term exposure is used). The mortality studies also differ slightly in the populations studied. Brief descriptions of the mortality studies used in this analysis and the issues related to the overlap in the incidence predicted from these studies are discussed here.

One long-term exposure study is presented here. Pope et al. (1995) is a prospective cohort study which investigated the association between long-term exposure to ambient PM2.5 concentrations (measured in the study as the median of all daily concentrations measured over a four-year period) and mortality in a cohort of adults thirty years and older.[3]

Two estimates of the relationship between mortality and short-term exposure to PM are presented. One estimate is from a pooled analysis of 10 individual studies, in which PM-10 concentrations are averaged over a period of 1 to 5 days. The second estimate is taken from Schwartz et al. (1996), and uses a 2-day average PM-2.5 measure. In both cases, short-term exposure is related to daily mortality for the full population.

Long-term studies may be preferable to "short-term" (daily average) studies for estimating health effects for a couple of reasons. First, by their basic design, daily studies detect acute effects but cannot detect the effects of long-term exposures. A chronic exposure study design (a prospective cohort study) is best able to identify the long-term exposure effects, and will likely detect some of the short-term exposure effects as well.

The second reason that long-term studies may be preferable to short-term studies is that long-term study results may be less likely to be affected by deaths that are premature by only a very short amount of time. Critics of the use of short-term studies for policy analysis purposes correctly point out that an added risk factor that results in terminally ill individuals dying a few days or weeks earlier than they otherwise would have (a phenomenon referred to as "harvesting") is potentially included in the measured PM mortality "signal" detected in such a study. Because the short-term study design does not examine individual people (but instead uses daily mortality rates in large, typically city, populations), it is impossible to know anything about the overall health status of the people who die on any given day. While some of the excess deaths associated with peak PM exposures may have resulted in a substantial loss of life (measuring loss of life in terms of lost years of remaining life), others may have resulted in a relatively short amount of lifespan lost. While it is not clear that the results of prospective cohort (long-term) studies are completely unaffected by "harvesting," because they follow individuals such studies are better able to examine the health status of individuals who die during the course of the study.

[3] Dockery et al., 1993, is another study relating long-term exposures to PM to premature mortality. However, the study by Pope et al. considered a much larger population and included many more locations (52 cities versus six in the Dockery study). The Pope study is therefore considered to be preferable.

Although long-term exposure studies may be preferable, only one is presented in this analysis. Therefore, results of studies which use short-term PM exposures are also presented in this analysis for comparison. However, because a long-term exposure study may detect some of the same short-term exposure effects detected by short-term studies, including both types of study in a benefit analysis would likely result in some degree of double counting of benefits.

Hospital Admissions Studies

Several studies have investigated the association between ambient PM concentrations and increased hospital admissions for a variety of ailments and among different population groups. These studies and the issues of overlap among the endpoints and populations investigated are described below. All of these studies compare PM concentrations averaged over one to two days with daily hospital admissions.

Hospital Admissions for Respiratory Illnesses

Several studies have investigated hospital admissions specifically for respiratory ailments. Two estimates are available for hospital admissions for "all respiratory illnesses". The first study, Thurston et al. (1994), investigated respiratory admissions for individuals of all ages. The pooled analysis using information from Schwartz (1995 and 1996) estimates all respiratory hospital admissions for individuals aged 65 years and older. Studies of hospital admissions for chronic obstructive pulmonary disease (COPD) and pneumonia, which are both subsets of hospital admissions for all respiratory diseases are also presented.

Because Thurston et al. (1994) includes hospital admissions for a large group of respiratory illnesses and all age groups, this study is the most comprehensive and is therefore considered to be the most appropriate study for predicting changes in hospital admissions for respiratory illnesses related to PM exposure. Because Schwartz (1994a,b,c; 1996) estimates incidence for a subset of hospital admissions counted by Thurston et al. (1994), the incidence predicted by the Schwartz studies should not be added to the incidence predicted by Thurston et al. (1994).

Hospital Admissions for Cardiac Disease

Hospital admissions for ischemic heart disease and congestive heart failure related to PM exposure have been investigated by Schwartz and Morris (1995). These admissions are not included in the group of respiratory illness hospital admissions. In addition, there is no overlap between hospital admissions for ischemic heart disease and admissions for congestive heart failure. Therefore, they can both be counted as benefits associated with reducing exposure to PM.

Respiratory Symptoms and Restricted Activity Days

Several studies have investigated changes in a variety of respiratory symptoms not requiring admission to the hospital. These studies have investigated illnesses in both the general population and in asthmatic individuals; many of the studies have used children as the study

population. The types of symptoms investigated and issues related to potential overlap among the symptoms examined in these studies are described here. Because some of these symptoms may vary only slightly among the studies, there is considerable overlap among the health effects investigated in these studies. Exhibit 3.2 defines the symptoms and the populations investigated for each of the studies presented in this analysis.

Exhibit 3.2 Descriptions of Studies of Respiratory Symptoms not Requiring Hospitalization

Health Endpoint, PM Indicator	Definition of Health Endpoint	Population Studied	Reference
Chronic bronchitis, using PM10 indicator	Chronic bronchitis was defined as positive responses to the following questions: (1) whether a doctor had ever told the subject that he or she had chronic bronchitis, and (2) whether he or she still had bronchitis at the time of the study.	all	Schwartz, 1993
Acute bronchitis, using PM2.5 indicator	Bronchitis was defined as a doctor's diagnosis of bronchitis reported within the year prior to the study. Occurrence of bronchitis diagnosed during the year was compared with the annual mean PM concentration reported during the year.	ages 10-12	Dockery et al., 1989
Upper respiratory symptoms (URS), using PM10 indicator	URS includes runny or stuffy nose; wet cough; and burning, aching, or red eyes. Presence of symptoms on a given day were compared with the PM concentration on the same day.	asthmatics, ages 9-11	Pope et al., 1991
Lower respiratory symptoms (LRS), using PM2.5 indicator	LRS is the presence of at least two of the following symptoms: cough, chest pain, phlegm, or wheeze. Presence of symptoms on a given day was compared with PM concentrations measured on the previous day; symptoms were counted only if they were not present on the previous day.	ages 8-12	Schwartz et al., 1994

(continued)

Exhibit 3.2 (continued)

Health Endpoint, PM Indicator	Definition of Health Endpoint	Population Studied	Reference
Minor Restricted Activity Days (MRADs), using PM2.5 indicator	An MRAD is a day in which an individual restricts his or her activity due to either respiratory or nonrespiratory symptoms; an MRAD does not result in either work loss or bed disability Occurrence of MRADs was compared with PM concentrations averaged over a 2 week period.	ages 18-65	Ostro and Rothschild, 1989
Restricted Activity Days (RADs), using PM2.5 indicator	A RAD is a day in which an individual restricts his activity; RADs include both days of work loss or bed disability as well as minor restrictions. Occurrence of RADs was compared with 2-week average PM concentrations.	ages 18-65	Ostro, 1987
Acute respiratory symptoms (any of 19), using PM10 indicator	The study measured daily presence of any of 19 symptoms, including chest discomfort, coughing, wheezing, sore throat, cold, doctor-diagnosed flu, asthma, hay fever [all symptoms considered were not reported in the study]	adults	Krupnick et al., 1990
Shortness of breath, using PM10 indicator	The study measured daily presence of shortness of breath.	African-American asthmatics, ages 7-12	Ostro et al., 1995
Work loss days (WLDs), using PM2.5 indicator	Days of work loss were compared with 2-week average PM concentrations.	ages 18-65	Ostro, 1987

Respiratory Illnesses Measured in the General Population

There may be some overlap between bronchitis studied by Dockery et al. (1989) and chronic bronchitis defined by Schwartz (1993). In particular, Dockery et al. (1989) considered the effects of PM exposure on bronchitis which was diagnosed by a doctor within the previous year, which may include some of the same types of cases investigated by Schwartz (1993). Although the bronchitis measured in Dockery et al. (1989) is likely to include more cases of acute bronchitis than the bronchitis cases measured by Schwartz (1993), the measure in Dockery et al. (1989) may also include some cases of chronic bronchitis, if the cases diagnosed in the year prior to the study continue into future years. For this reason, and because the populations studied

overlap each other, the estimates of avoided incidence based on these studies are not necessarily mutually exclusive. However, both studies give valuable information regarding the incidence of bronchitis avoided in two different population groups.

Lower respiratory symptoms (LRS) as described in Schwartz et al. (1994) are distinct from doctor-diagnosed bronchitis, and therefore do not overlap with the avoided cases of bronchitis.

There are several aggregation issues related to the set of endpoints that are studied in adults. Acute respiratory symptoms (any of 19 symptoms) studied by Krupnick et al. (1990) may overlap with minor restricted activity days (MRADs) studied by Ostro and Rothschild (1989), because the age ranges of the populations studied are the same, and it is possible that an acute respiratory symptom could result in a minor respiratory restricted activity day. The degree of overlap, however, is not known, and it is possible that some of the benefit associated with each endpoint is not included within the benefit associated with the other endpoint.

MRADs and Work Loss Days (WLDs) are defined specifically as mutually exclusive endpoints (Ostro and Rothschild, 1989). Both of these estimates (MRADs and WLDs) are subsets of Restricted Activity Days (RADs). However, because the concentration-response functions for RADs and MRADs were estimated by different studies, there is no guarantee that the predicted incidence of MRADs will be less than the predicted incidence of RADs.

Respiratory Illnesses Measured in the Asthmatic Population

Three studies in Exhibit 3.2 measured respiratory illnesses exclusively in asthmatic individuals. Pope et al. (1991) studied upper respiratory symptoms (URS) in children aged 9-11. Ostro et al. (1995) measured shortness of breath among African-American asthmatics aged 7-12.[4] Estimates using Pope et al. (1991) do not appear to overlap with estimates predicted using Ostro et al. (1995).

3.2 Functional Forms of the Concentration Response Functions Used in the Health Effects Studies

The concentration-response functions presented in the available health effects studies estimate a change in health effects associated with a change in PM. The estimated relationship between PM and a health endpoint in a study location is specific to the type of population studied, the measure of PM used, and the characterization of the health endpoint considered. When using a concentration-response function estimated in an epidemiological study to estimate changes in the incidence of a health endpoint corresponding to a particular change in PM, it is

[4]Another study, Ostro et al. (1991), measured days of moderate or worse asthma status in adults. Although this study investigated health effects in a population (asthmatics) which is important to consider, the concentration-response function from the study was not used in the current analysis because the incidence estimated using the study is very sensitive to the actual baseline and control scenario air quality data. Because this analysis uses only at the air quality contributed only by hazardous waste combustors without adding other ambient anthropogenic and natural air concentrations, the actual incidence could not be estimated.

important that the inputs be appropriate for the concentration-response function being used. For example, it is important that the measure of PM, the type of population, and the characterization of the health endpoint be the same as (or as close as possible to) those used in the study that estimated the concentration-response function.

Estimating the relationship between PM and a health endpoint, y, consists of (1) choosing a functional form of the relationship and (2) estimating the values of the parameters in the function assumed. The two most common functional forms in the epidemiological literature on PM and health effects are the log-linear and the linear relationship. The log-linear relationship is of the form

$$y = Be^{\beta PM} \quad , \tag{1}$$

or, equivalently,

$$\ln(y) = \alpha + \beta PM \quad , \tag{2}$$

where the parameter B is the incidence of y when the concentration of PM is zero, the parameter β is the coefficient of PM, ln(y) is the natural logarithm of y, and $\alpha = \ln(B)$. If the functional form of the concentration-response relationship is log-linear, the relationship between ΔPM and Δy is

$$\Delta y = y[e^{\beta * \Delta PM} - 1] \quad , \tag{3}$$

where y is the baseline incidence of the health effect (i.e., the incidence before the change in PM). For a log-linear concentration-response function, the relative risk (RR) associated with the change (ΔPM) is

$$RR_{\Delta PM} = e^{\beta * \Delta PM} \quad . \tag{4}$$

Epidemiological studies often report a relative risk for a given ΔPM, rather than the coefficient, β, in the concentration-response function. The coefficient can be derived from the reported relative risk and ΔPM by solving for β in equation (4):

$$\beta = \ln(RR)/\Delta PM \quad . \tag{5}$$

The linear relationship is of the form

$$y = \alpha + \beta PM \quad , \tag{6}$$

where α incorporates all the other independent variables in the regression (evaluated at their mean values, for example) multiplied by the respective coefficients. If the functional form of the concentration-response relationship is linear, the relationship between ΔPM and Δy is simply

$$\Delta y = \beta * \Delta PM \quad . \tag{7}$$

A few epidemiological studies have used functional forms other than linear or log-linear forms. Of these, logistic regressions were the most common. The details of the models used in these studies are given in the papers reporting the methods and results of the studies.

The input components (including PM averaging time, the applied population, and the baseline incidence) necessary to estimate incidence changes using concentration-response functions from individual studies are shown in Exhibit 3.1. In the case of PM averaging time, both the averaging time used in the epidemiological study (indicated as "Studied" in Exhibit 3.1), and the averaging time used to estimate sector-specific incidence changes in this analysis (indicated as "Applied" in Exhibit 3.1) are presented.

3.3 Pooling Several Concentration-Response Functions to Estimate one Concentration-Response Function

When there are several estimates of the relationship between PM and a given health endpoint (perhaps using estimates from different studies or different geographic locations), the results of the studies can be pooled to derive a single estimate. In this analysis, several studies were pooled to obtain a "central tendency" concentration response function if the functional forms, pollutant averaging times, and study populations were judged to be similar enough among the studies or locations.

The method in which the estimates of PM coefficients from different studies are used in a pooled analysis depends on the underlying assumption about how the different estimates are related to each other. It is reasonable that a "pooled estimate" which combines the estimates from different studies should give more weight to estimates from studies with little reported uncertainty than to estimates with a great deal of uncertainty.

The analysis presented here assumes that there is a distribution of PM coefficients (β's), rather than one estimate of the relationship between PM and a given health effect. Specifically, the coefficients reported in different studies or different geographic locations may be estimates of *different* underlying PM coefficients, rather than just different estimates of the same PM coefficient. Therefore, this analysis uses the random-effects model to pool results from different studies, because the random effects model does not assume that all studies are estimating the same parameter.[5]

Five separate pooled analyses using the random-effects model were carried out in this analysis:

(1) An analysis of PM-10 mortality, using the ten short-term exposure PM-10 studies,

[5] In studies of the effects of PM-10 on mortality, for example, if the composition of PM-10 varies among study locations, the underlying relationship between mortality and PM-10 may be different from one study location to another. For example, fine particles make up a greater fraction of PM-10 in Philadelphia County than in Southeast Los Angeles County. If fine particles are disproportionately responsible for mortality relative to coarse particles, then one would expect the true value of β for PM-10 in Philadelphia County to be greater than the true value of β for PM-10 in Southeast Los Angeles County.

(2) An analysis of PM-2.5 mortality, using six different locations at which concentration-response functions for mortality and short-term exposure to PM2.5 were estimated by Schwartz et al. (1996),

(3) An analysis of respiratory illness hospital admissions, using three "all respiratory illness" hospital admissions studies,

(4) An analysis of COPD hospital admissions, using three studies, and

(5) An analysis of pneumonia hospital admissions, using four pneumonia hospital admissions studies.

For those health-effects studies which used PM concentrations averaged over one to several days (e.g., mortality studies), PM concentrations averaged over one day were used in this analysis, because daily averages are the only short-term air quality measurements available as described in Section 2.0. The health effects studies which use multi-day averages are in effect using a smoothed data set, comparing each day's mortality to recent average exposure rather than to exposure on the same day that the health effect was observed. The more nearly linear the concentration-response function, however, the less difference it makes whether multi-day averaging functions are used with single-day PM data.[6] The concentration-response functions considered here are nearly linear.

4.0 ESTIMATES OF BASELINE INCIDENCES USED WITH LOG-LINEAR FUNCTIONS AND EXPOSED POPULATIONS

Some types of concentration-response functions used in this analysis estimate health effects in given subpopulations. To use these functions, the analysis requires an estimate of the size of such subpopulations.[7] For example, the Schwartz (1995, 1996) study of hospital admissions for all respiratory symptoms examined respiratory hospital admissions for people ages 65 and over. Therefore, in order to estimate the change in incidence of respiratory hospital admissions predicted by the Schwartz (1995, 1996) study for a given change in air quality, it is necessary to have an estimate of the number of persons aged 65 and older that are exposed to that air quality change. The general method of using available data to make baseline and sub-population estimates is described below.

Other concentration-response functions require baseline incidences because these functions estimate changes in risk as a percent change in incidence between the baseline and the control scenarios. To use these functions, the analysis requires an estimate of the baseline

[6]If the functions were perfectly linear, using one day averages rather than multi-day averages would make no difference at all.

[7]Although the concentration-response functions might be applicable to a wider segment of the population than was included in the epidemiological study of interest, this was not done in the current analysis.

incidence of the health effect being studied. "Baseline" incidences are those expected to occur under conditions where the MACT standard has not been implemented.

4.1 EXPOSED POPULATIONS

This analysis focuses on sectors (which are geographic areas generally smaller than counties) that are associated with particular hazardous waste combustion units. Each hazardous waste facility has 16 sectors associated with it, which form concentric circles radiating out from the combustion stack. These sectors are situated at varying distances from the stack and have varying pollutant concentrations, as well as varying exposed populations. As noted above, in order to evaluate concentration-response functions which examine a specific sub-population (ages 65 and over, for example), it is necessary to have estimates of the number of people in a particular population subgroup that are exposed to given change in air quality. Therefore, for this analysis, ideally it would be possible to have sector-level population estimates for the variety of population subgroups that are examined in the concentration-response functions. However, population estimates at the sector level were available for some but not all of the pertinent sub-populations.

Sector-level population estimates were available for two age categories which were commonly examined in the concentration-response functions used in this analysis: ages 18-65, and ages 65 and over. In those cases where it was not possible to obtain sector-specific sub-population data, the percentage of persons in the subpopulation at the county level was applied to the sector level. For example, Census data is available which estimates that in Autauga County, Alabama, 5% of the population is between the ages of 8 and 12 (the examined population in Schwartz et al.'s (1994) study of Lower Respiratory Symptoms). This percentage was then multiplied by the total sector population to estimate the total number of children aged 8-12 in a sector which lies completely within Autauga County.

While the method described in the preceding paragraph works in those cases where a sector lies completely within one county, many sectors lie in multiple counties. In those cases where a sector lies in more than one county, the sector was assigned a spatially-weighted average of the county-level sub-population percentage breakdowns. This spatially-weighted average was determined by multiplying the proportion of each sector (in terms of area) located in a given county by that county's sub-population percentage. The resulting proportion-adjusted county-specific data is then summed for all the counties in which a sector lies, giving an estimate of sector-level sub-population percentages. This spatially-weighted average method assumes that county populations are uniformly distributed throughout the county.

4.2 BASELINE INCIDENCE

As mentioned above, some concentration-response functions require estimates of baseline incidence. It was necessary to estimate sector-level baseline incidence in order to evaluate those concentration-response functions at the sector-level. Sector-specific baseline incidence estimates were not available for any endpoints, so the spatially-weighted averages of county-specific data were also applied in determining sector-specific baseline incidence estimates. Unlike estimates

of the exposed population, for which all of the pertinent county-level sub-population breakdowns were available from the U.S. Census, county-level baseline incidence estimates were obtained from a variety of sources, as documented below.

County-specific mortality rates (across all ages) were obtained for each county in the United States from the National Center for Health Statistics (NCHS). Because most PM studies that estimated concentration-response functions for mortality considered only non-accidental mortality, county-specific baseline mortality rates used in the estimation of PM-related mortality were adjusted to reflect an estimate of county-specific non-accidental mortality. This estimate was determined by multiplying each county-specific mortality rate by the ratio of national non-accidental mortality to national total mortality (0.93).

Although total mortality incidences (over all ages) were available for counties, age-specific mortality incidences were not available at the county level. County-specific baseline mortality incidences among individuals aged 30 and over (necessary for PM2.5-related long-term exposure mortality, estimated by Pope et al., 1995) were therefore estimated by applying national age-specific death rates to county-specific age distributions, and adjusting the resulting estimated age-specific incidences so that the estimated total incidences (including all ages) equaled the actual county-specific total incidences. For example, if the total of the estimated age-specific incidences obtained in this way was 5% higher than the actual total incidence for a county, then each of the estimated age-specific incidences was multiplied by (1/1.05). These county-specific, age-specific mortality incidence estimates were then applied at the sector level using the spatially-weighted average method described in Section 4.1.

Each county-specific hospital admissions baseline incidence rate was obtained by multiplying the national hospital admissions rate for the relevant International Classification of Diseases (ICD) code(s) per 100,000 exposed population by the county-specific population, and then adjusting this incidence by the ratio of the county-specific proportion of the population that was aged 65 or older to the national proportion of the population aged 65 or older[8]. These county-specific hospital admissions baseline incidence rates were then used to determine spatially-weighted average baseline incidence rates at the sector level using the spatially-weighted average method described in Section 4.1.

While county-level baseline incidence estimates could be obtained for the mortality and hospital admissions endpoints, they were not available for all endpoints. Baseline incidence rates for all respiratory symptoms and illnesses included in the benefit analysis and for restricted activity days were obtained from the studies reporting concentration-response functions for those

[8] Except for Thurston et al., 1994, all hospital admissions studies used in the national benefit analysis apply only to individuals 65 and older. The Thurston study used a linear concentration-response function, which does not require a baseline incidence rate for calculation of PM-related incidence.

health endpoints. No baseline incidence rates were available from other sources for these endpoints. In these cases, the same baseline incidence was applied to all sectors in the analysis[9].

5.0 AGGREGATING INCIDENCE OVER A YEAR

This analysis presents total changes in health effects expected to occur over a one-year time period for the population exposed to PM emissions from combustors. However, several of the epidemiological studies measure changes in health effects for time periods other than one year. For example, some studies of respiratory symptoms estimate changes in the occurrence of symptoms during a single day. To present changes in health effects avoided during a given year, this analysis uses appropriate multipliers to adjust the changes in health effects predicted by studies which estimate these changes for time periods shorter than one year, as described in greater detail in Section 2.

There is one exception to presenting results as the number of cases avoided per year. Schwartz (1993) defines chronic bronchitis as positive responses to the following questions: (1) whether a doctor had ever told the subject that he or she had chronic bronchitis, and (2) whether he or she still had bronchitis at the time of the study. Therefore, the duration of an individual case of chronic bronchitis is not defined, and the results using information from this study cannot be reported as the number of cases avoided per year. Instead, the results are reported as the number of cases avoided for some time period greater than one year, but which cannot be specified given the available information.

It should be noted that this analysis estimates the avoidance of recurring health effects for a given individual. For example, if an individual avoids ten incidents of shortness of breath during a given year as a result of implementing the MACT standard, all ten incidents will be counted in the results.

6.0 BENEFITS ESTIMATES: NO-THRESHOLD ASSUMPTIONS

The current analysis assumes that health effects may occur at any PM concentration level down to zero. Even if the modeled PM concentrations in the baseline and MACT control scenarios are below the lowest observed PM concentrations seen in the available epidemiological studies or below National Ambient Air Quality Standards (NAAQS) for PM-10 or PM-2.5, health effects are assumed to result from the changes in PM concentrations between the two scenarios.

Consideration of thresholds may, however, be important. Systemic toxicants (chemicals and other substances that cause noncarcinogenic and nonmutagenic health effects) have often been treated as having concentration levels below which there are no observable adverse effects,

[9] For hospital admissions and mortality, the national baseline incidence rates provided in Exhibit 3.1 are meant to provide the reader with a general perspective of the potential magnitude of the baseline incidence; for other endpoints, the annual baseline incidence estimates in Exhibit 3.1 were taken directly from the epidemiological literature and were applied to all sectors in the analysis.

based on our understanding of the adaptive and homeostatic mechanisms of these types of toxicants (U.S. EPA, 1988). The lowest observed levels seen in some of the epidemiological studies in this analysis or the PM NAAQS may represent plausible estimates of such thresholds.

This project did not estimate total ambient PM concentrations; only the contribution to total PM from hazardous waste combustors was estimated. Without estimates of total PM concentrations, it is not possible to conduct any threshold analyses. Given the opportunity and additional resources, it would be appropriate to determine estimates of site-specific ambient PM concentrations, which, coupled with the change in modeled combustor emissions evaluated in this analysis, would allow for an alternate estimate of benefits using the lowest observed effect levels reported in the above three studies or the NAAQS as threshold levels below which health effects do not occur. However, given the current scope of this analysis and the available information, it was not feasible to address threshold issues at this time.

7.0 UNCERTAINTY

There are several sources of uncertainty in the health effects estimates associated with using the available concentration-response functions in this analysis. There is uncertainty about how well the studies estimated the concentration-response relationships in the study locations; there is uncertainty about how applicable these concentration-response functions are to other locations (the "assessment locations"); and there is uncertainty about extrapolating the estimated concentration-response functions beyond the range of PM concentrations that were used to estimate these functions. Finally, there are uncertainties associated with other aspects of applying concentration-response functions to estimate changes in incidence associated with changes in PM concentrations.

An obvious uncertainty in an estimated concentration-response function is the statistical uncertainty surrounding estimates of parameters in the function. The standard errors reported along with parameter estimates describe this statistical uncertainty. A less obvious uncertainty, however, is whether the functional form of the relationship being estimated is correct. The form of the relationship between PM and the health effect studied in a given epidemiological study is based on the available data, and evaluated to determine how well the data fit the relationship. It is possible that a functional form not examined in a particular study may fit the data better than the form chosen by the authors. In addition, if data are sparse, the functional form used may not be as good as a form that might be chosen if more data were available. For example, many concentration-response relationships are estimated by "Poisson regression," and assume a log-linear relationship between the expected value of the health endpoint and PM. This is a no-threshold model, which assumes that at any level of PM there will be some effect. Although good research investigates which model is most consistent with the data, there is always some degree of uncertainty about whether the model estimated is the functional form that best describes the relationship under investigation. Finally, confounding effects and modifying effects not sufficiently accounted for in the studies may contribute to error in the estimation of concentration-response functions and therefore in the estimation of incidence, based on these functions.

Uncertainties associated with other aspects of model specification contribute additional uncertainty to the estimates of PM-related incidence. One source of uncertainty is the measure of particulate matter used in concentration-response functions. Some studies use TSP (total suspended particulates) as the measure of particulate matter; others use PM10; because of a lack of monitoring data, only a few studies have used PM2.5. If only a component of particulate matter (e.g., PM2.5) is causally related to a health endpoint, other measures of particulate matter could be poor proxies for the correct measure, potentially leading to biased estimates of the concentration-response function and therefore misestimation of PM-related incidence.

Even if an estimated concentration-response function provides a good description of the relationship between a health endpoint and PM for the location in which it was estimated, it is not necessarily a good description of this relationship in a different location. The concentration-response relationship may differ from one location to another as, for example, the composition of the PM and/or the composition of the exposed populations differ.

In applying estimated concentration-response functions to estimate changes in incidence associated with changes in PM concentrations, the PM concentrations considered in the analysis may extend beyond the range of those used to estimate the concentration-response function. Extrapolation of the concentration-response function to PM concentrations that are lower than or higher than those used to estimate the function could bias the results of the analysis. For example, if there is a PM concentration threshold below which there is no association between PM and the studied health effect, extrapolation down to zero of a concentration-response function based on higher levels of PM could result in an overestimate of incidence.

There are several additional sources of uncertainty in applying estimated concentration-response functions in this analysis. In most cases, concentration-response functions are applied to the population group investigated in the study which estimated the function. Using concentration-response functions in this manner may potentially result in an underestimate of the incidence of health effects because the incidence in that portion of the population not covered in the study is implicitly zero. Health effects for which this underestimation of incidence may be most pronounced are those that were studied only in the elderly or in certain subsets of children but occur in wider age ranges in the population. For example, studies of hospital admissions were often limited to observation of effects in the population 65 years and older. The incidence of hospital admissions was then estimated for the same population of individuals. To the extent that younger individuals are also affected by PM 2.5, the number of PM-related hospital admissions may be underestimated in the current analysis. Also, several functions investigated respiratory effects in children in a limited age group (e.g., ages 10-12 years); to the extent that these respiratory symptoms may be observed in younger or older children, this analysis may underestimate the number of effects seen in the population surrounding hazardous waste combustors.

Many concentration-response functions are based on a relative risk model. In this case, the number of new cases of an effect (or the number of cases avoided, if PM levels decline) is calculated as a percent change from the baseline incidence. When such concentration-response functions are used, a measure of baseline incidence is therefore required. Ideally, location-specific baseline incidence rates would be used. However, for some health effects, the only

available information on baseline incidence is from the study that estimated the concentration-response function. Applying the incidence rate specific to the study location to other areas examined in this analysis may underestimate or overestimate the number of cases associated with a change in PM concentrations in a given area. The extent of over- or underestimation on the current analysis is not known.

8.0 RESULTS

The results generated from this analysis are contained in the attached tables. Results are presented as avoided incidence per year for each health endpoint presented. The results are aggregated by facility type (as provided by RTI). Each table contains one facility type. For example, one sheet presents the aggregated results of all LWAK sites. Each health end-point presented in the table has been modeled using the modeled PM concentrations as inputs. It should be noted, however, that although the model runs both the PM2.5 and PM10 concentration-functions for estimating changes in incidence of acute bronchitis (predicted using Dockery et al., 1989) and changes in incidence of lower respiratory functions (predicted using Schwartz et al., 1994), results are presented only for the model which uses PM2.5 as the input. A table presenting results aggregated across all incinerator categories is also provided.

8.1 Aggregation of the Health Effects

Results are presented for the health endpoints investigated in the concentration-response studies described in Section 3. However, because there are several issues related to the overlap of some of these health endpoints, the reader should refer to Section 3.1 for suggestions about how to interpret these results. For all health endpoints except mortality, total changes in incidence which cover the largest number of PM-related health effects for the largest portion of the population and which avoid double counting of effects are indicated in bold in the results file.

Special note should be given to one study (Krupnick et al., 1990) which estimates fairly large changes in incidence, but which is not included in the aggregated (i.e. bolded) set of results. The estimates of avoiding incidence of any of 19 acute symptoms predicted using Krupnick et al. (1990) may overlap with the estimates of avoided MRADs predicted using Ostro and Rothschild (1989). Therefore, it is possible that many of the avoided health effects which would be predicted using the Krupnick et al. (1990) study are included in the suggested aggregation of results.

In the case of mortality, Pope et al. (1995) is bolded because it investigates long-term exposure, which may be preferable to studies that use short-term estimates (as discussed in Section 3). However, because Pope et al. (1995) is the only long-term study used in this analysis and is applied only to the population of individuals 30 years and older, the results of using the short-term studies are also presented. The short-term studies are applied to the full population.

8.2 Magnitude of Benefits Estimates

The avoided incidence estimates are relatively small in magnitude for the majority of endpoints, even when estimates are aggregated across all of the facilities of a particular combustion unit type. This is consistent with the small changes in 24-hour average PM concentrations between the baseline and MACT air quality scenarios.

Because Pope et al. (1995) is a long-term study, it may be expected that the results of applying the Pope et al. (1995) mortality study to the full population would result in higher estimates of incidence than applying the results of Schwartz et al. (1996a). However, it is possible that the change in air quality is greater using the data required by the Schwartz function than the data required by the Pope function because the studies use different measures of air quality data. Specifically, estimates of annual avoided mortality incidence are calculated by the CAPMS computer model for the Pope study based on the change in the annual median PM 2.5 air quality concentration. In contrast, CAPMS calculates mortality incidence estimates for the Schwartz study based on the change in 20 separate daily average PM 2.5 concentrations which are representative of the distribution of daily average PM 2.5 concentrations across a year. Each of these 20 daily average concentrations represents 1/20th of a year, or 18.25 days. CAPMS then sums the incidence estimates for each of these 20 daily average concentrations to calculate an annual avoided mortality incidence for the Schwartz study.

Point Estimate Benefits - Avoided Incidence

Air Quality Scenario- PMMactJuly Incremental to PMBaseJuly
Facility Type-CINC
Modeled Population= 5355230.65

Endpoint	Reference	Avoided Incidence for No-Threshold Analysis (cases/year)
Mortality (long-term exp. - ages 30+)	**Pope et al., 1995**	**0.01**
Mortality (short-term exp.) - PM10	pooled analysis (10 functions)	0.05
Mortality (short-term exp.) - PM2.5	Schwartz et al., 1996a	0.07
Chronic Bronchitis	**Schwartz, 1993b**	**0.51**
Hosp. Admissions - All Respiratory (all ages)	**Thurston et al., 1994**	**0.07**
All Respiratory (ages 65+)	Schwartz, 1995, 1996 (pooled analysis)	0.06
Pneumonia (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.02
COPD (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.02
Hosp. Admissions - Congestive Heart Failure	**Schwartz and Morris, 1995**	**0.02**
Hosp. Admissions - Ischemic Heart Disease	**Schwartz and Morris, 1995**	**0.02**
Acute Bronchitis	**Dockery et al., 1989**	**0.46**
Lower Respiratory Symptoms	**Schwartz et al., 1994**	**4.09**
Upper Respiratory Symptoms	**Pope et al., 1991**	**0.47**
Any of 19 Acute Symptoms	Krupnick et al., 1990	116.20
Shortness of breath	Ostro et al., 1995	1.97
Work Loss Days	**Ostro, 1987**	**37.33**
MRAD	**Ostro and Rothschild, 1989**	**311.08**
RAD	Ostro, 1987	102.41

*The method of measuring chronic bronchitis in Schwartz (1993) does not necessarily result in the number of cases avoided/year. Instead, this value may represent number of cases avoided over a period of years.

Point Estimate Benefits - Avoided Incidence

Air Quality Scenario- PMMactJuly Incremental to PMBaseJuly
Facility Type-CK
Modeled Population= 1088193.9

Endpoint	Reference	Avoided Incidence for No-Threshold Analysis (cases/year)
Mortality (long-term exp. - ages 30+)	Pope et al., 1995	0.00
Mortality (short-term exp.) - PM10	pooled analysis (10 functions)	0.02
Mortality (short-term exp.) - PM2.5	Schwartz et al., 1996a	0.02
Chronic Bronchitis	**Schwartz, 1993b**	**0.15**
Hosp. Admissions - All Respiratory (all ages)	**Thurston et al., 1994**	**0.02**
All Respiratory (ages 65+)	Schwartz, 1995, 1996 (pooled analysis)	0.02
Pneumonia (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.01
COPD (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.01
Hosp. Admissions - Congestive Heart Failure	**Schwartz and Morris, 1995**	**0.01**
Hosp. Admissions - Ischemic Heart Disease	**Schwartz and Morris, 1995**	**0.01**
Acute Bronchitis	**Dockery et al., 1989**	**0.13**
Lower Respiratory Symptoms	**Schwartz et al., 1994**	**1.18**
Upper Respiratory Symptoms	**Pope et al., 1991**	**0.14**
Any of 19 Acute Symptoms	Krupnick et al., 1990	31.36
Shortness of breath	Ostro et al., 1995	0.22
Work Loss Days	**Ostro, 1987**	**7.62**
MRAD	**Ostro and Rothschild, 1989**	**63.50**
RAD	Ostro, 1987	20.90

*The method of measuring chronic bronchitis in Schwartz (1993) does not necessarily result in the number of cases avoided/year. Instead, this value may represent number of cases avoided over a period of years.

Point Estimate Benefits - Avoided Incidence
Air Quality Scenario- PMMactJuly Incremental to PMBaseJuly
Facility Type-LWAK
Modeled Population= 944791.62

Endpoint	Reference	Avoided Incidence for No-Threshold Analysis (cases/year)
Mortality (long-term exp. - ages 30+)	**Pope et al., 1995**	**0.00**
Mortality (short-term exp.) - PM10	pooled analysis (10 functions)	0.01
Mortality (short-term exp.) - PM2.5	Schwartz et al., 1996a	0.01
Chronic Bronchitis	**Schwartz, 1993b**	**0.07**
Hosp. Admissions - All Respiratory (all ages)	**Thurston et al., 1994**	**0.01**
All Respiratory (ages 65+)	Schwartz, 1995, 1996 (pooled analysis)	0.01
Pneumonia (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.00
COPD (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.00
Hosp. Admissions - Congestive Heart Failure	**Schwartz and Morris, 1995**	**0.00**
Hosp. Admissions - Ischemic Heart Disease	**Schwartz and Morris, 1995**	**0.00**
Acute Bronchitis	**Dockery et al., 1989**	**0.05**
Lower Respiratory Symptoms	**Schwartz et al., 1994**	**0.44**
Upper Respiratory Symptoms	**Pope et al., 1991**	**0.05**
Any of 19 Acute Symptoms	Krupnick et al., 1990	16.09
Shortness of breath	Ostro et al., 1995	0.06
Work Loss Days	**Ostro, 1987**	**3.91**
MRAD	**Ostro and Rothschild, 1989**	**32.58**
RAD	Ostro, 1987	10.73

*The method of measuring chronic bronchitis in Schwartz (1993) does not necessarily result in the number of cases avoided/year. Instead, this value may represent number of cases avoided over a period of years.

Point Estimate Benefits - Avoided Incidence

Air Quality Scenario- PMMactJuly Incremental to PMBaseJuly
Facility Type-OINC-Large
Modeled Population= 18848701.57

Endpoint	Reference	Avoided Incidence for No-Threshold Analysis (cases/year)
Mortality (long-term exp. - ages 30+)	**Pope et al., 1995**	**1.42**
Mortality (short-term exp.) - PM10	pooled analysis (10 functions)	2.19
Mortality (short-term exp.) - PM2.5	Schwartz et al., 1996a	3.61
Chronic Bronchitis	**Schwartz, 1993b**	**22.05**
Hosp. Admissions - All Respiratory (all ages)	**Thurston et al., 1994**	**3.48**
All Respiratory (ages 65+)	Schwartz, 1995, 1996 (pooled analysis)	2.97
Pneumonia (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	1.07
COPD (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.91
Hosp. Admissions - Congestive Heart Failure	**Schwartz and Morris, 1995**	**0.79**
Hosp. Admissions - Ischemic Heart Disease	**Schwartz and Morris, 1995**	**0.88**
Acute Bronchitis	**Dockery et al., 1989**	**17.86**
Lower Respiratory Symptoms	**Schwartz et al., 1994**	**158.42**
Upper Respiratory Symptoms	**Pope et al., 1991**	**18.38**
Any of 19 Acute Symptoms	Krupnick et al., 1990	4,990.20
Shortness of breath	Ostro et al., 1995	70.66
Work Loss Days	**Ostro, 1987**	**1,841.54**
MRAD	**Ostro and Rothschild, 1989**	**15,340.16**
RAD	Ostro, 1987	5,052.23

*The method of measuring chronic bronchitis in Schwartz (1993) does not necessarily result in the number of cases avoided/year. Instead, this value may represent number of cases avoided over a period of years.

Point Estimate Benefits - Avoided Incidence

Air Quality Scenario- PMMactJuly Incremental to PMBaseJuly
Facility Type-OINC-Small
Modeled Population= 53033181.14

Endpoint	Reference	Avoided Incidence for No-Threshold Analysis (cases/year)
Mortality (long-term exp. - ages 30+)	**Pope et al., 1995**	**0.06**
Mortality (short-term exp.) - PM10	pooled analysis (10 functions)	0.24
Mortality (short-term exp.) - PM2.5	Schwartz et al., 1996a	0.41
Chronic Bronchitis	**Schwartz, 1993b**	**2.59**
Hosp. Admissions - All Respiratory (all ages)	**Thurston et al., 1994**	**0.42**
All Respiratory (ages 65+)	Schwartz, 1995, 1996 (pooled analysis)	0.31
Pneumonia (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.11
COPD (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.10
Hosp. Admissions - Congestive Heart Failure	**Schwartz and Morris, 1995**	**0.08**
Hosp. Admissions - Ischemic Heart Disease	**Schwartz and Morris, 1995**	**0.09**
Acute Bronchitis	**Dockery et al., 1989**	**2.08**
Lower Respiratory Symptoms	**Schwartz et al., 1994**	**18.49**
Upper Respiratory Symptoms	**Pope et al., 1991**	**2.13**
Any of 19 Acute Symptoms	Krupnick et al., 1990	604.52
Shortness of breath	Ostro et al., 1995	6.85
Work Loss Days	**Ostro, 1987**	**228.06**
MRAD	**Ostro and Rothschild, 1989**	**1,900.72**
RAD	Ostro, 1987	625.68

*The method of measuring chronic bronchitis in Schwartz (1993) does not necessarily result in the number of cases avoided/year. Instead, this value may represent number of cases avoided over a period of years.

Point Estimate Benefits - Avoided Incidence

Air Quality Scenario- PMMactJuly Incremental to PMBaseJuly
Facility Type-Area Source CK
Modeled Population= 41626

Endpoint	Reference	Avoided Incidence for No-Threshold Analysis (cases/year)
Mortality (long-term exp. - ages 30+)	**Pope et al., 1995**	**0.00**
Mortality (short-term exp.) - PM10	pooled analysis (10 functions)	0.00
Mortality (short-term exp.) - PM2.5	Schwartz et al., 1996a	0.00
Chronic Bronchitis	**Schwartz, 1993b**	**0.00**
Hosp. Admissions - All Respiratory (all ages)	**Thurston et al., 1994**	**0.00**
All Respiratory (ages 65+)	Schwartz, 1995, 1996 (pooled analysis)	0.00
Pneumonia (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.00
COPD (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.00
Hosp. Admissions - Congestive Heart Failure	**Schwartz and Morris, 1995**	**0.00**
Hosp. Admissions - Ischemic Heart Disease	**Schwartz and Morris, 1995**	**0.00**
Acute Bronchitis	**Dockery et al., 1989**	**0.00**
Lower Respiratory Symptoms	**Schwartz et al., 1994**	**0.00**
Upper Respiratory Symptoms	**Pope et al., 1991**	**0.00**
Any of 19 Acute Symptoms	Krupnick et al., 1990	0.00
Shortness of breath	Ostro et al., 1995	0.00
Work Loss Days	**Ostro, 1987**	**0.00**
MRAD	**Ostro and Rothschild, 1989**	**0.00**
RAD	Ostro, 1987	0.00

*The method of measuring chronic bronchitis in Schwartz (1993) does not necessarily result in the number of cases avoided/year. Instead, this value may represent number of cases avoided over a period of years.

Point Estimate Benefits - Avoided Incidence

Air Quality Scenario- PMMactJuly Incremental to PMBaseJuly
Facility Type-Area Source INC
Modeled Population= 3951983

Endpoint	Reference	Avoided Incidence for No-Threshold Analysis (cases/year)
Mortality (long-term exp. - ages 30+)	**Pope et al., 1995**	**0.01**
Mortality (short-term exp.) - PM10	pooled analysis (10 functions)	0.04
Mortality (short-term exp.) - PM2.5	Schwartz et al., 1996a	0.06
Chronic Bronchitis	**Schwartz, 1993b**	**0.45**
Hosp. Admissions - All Respiratory (all ages)	**Thurston et al., 1994**	**0.06**
All Respiratory (ages 65+)	Schwartz, 1995, 1996 (pooled analysis)	0.05
Pneumonia (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.02
COPD (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	0.01
Hosp. Admissions - Congestive Heart Failure	**Schwartz and Morris, 1995**	**0.01**
Hosp. Admissions - Ischemic Heart Disease	**Schwartz and Morris, 1995**	**0.01**
Acute Bronchitis	**Dockery et al., 1989**	**0.40**
Lower Respiratory Symptoms	**Schwartz et al., 1994**	**3.61**
Upper Respiratory Symptoms	**Pope et al., 1991**	**0.42**
Any of 19 Acute Symptoms	Krupnick et al., 1990	103.70
Shortness of breath	Ostro et al., 1995	1.59
Work Loss Days	**Ostro, 1987**	**33.31**
MRAD	**Ostro and Rothschild, 1989**	**277.61**
RAD	Ostro, 1987	91.39

*The method of measuring chronic bronchitis in Schwartz (1993) does not necessarily result in the number of cases avoided/year. Instead, this value may represent number of cases avoided over a period of years.

Point Estimate Benefits - Avoided Incidence

Air Quality Scenario- PMMactJuly Incremental to PMBaseJuly
Facility Type-All Incinerators
Modeled Population= 77237114

Endpoint	Reference	Avoided Incidence for No-Threshold Analysis (cases/year)
Mortality (long-term exp. - ages 30+)	**Pope et al., 1995**	**1.49**
Mortality (short-term exp.) - PM10	pooled analysis (10 functions)	2.48
Mortality (short-term exp.) - PM2.5	Schwartz et al., 1996a	4.09
Chronic Bronchitis	**Schwartz, 1993b**	**25.15**
Hosp. Admissions - All Respiratory (all ages)	**Thurston et al., 1994**	**3.96**
All Respiratory (ages 65+)	Schwartz, 1995, 1996 (pooled analysis)	3.34
Pneumonia (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	1.20
COPD (ages 65+)	Schwartz, 1994a,b,c, 1996 (pooled analysis)	1.02
Hosp. Admissions - Congestive Heart Failure	**Schwartz and Morris, 1995**	**0.89**
Hosp. Admissions - Ischemic Heart Disease	**Schwartz and Morris, 1995**	**0.98**
Acute Bronchitis	**Dockery et al., 1989**	**20.40**
Lower Respiratory Symptoms	**Schwartz et al., 1994**	**181.00**
Upper Respiratory Symptoms	**Pope et al., 1991**	**20.99**
Any of 19 Acute Symptoms	Krupnick et al., 1990	5,710.92
Shortness of breath	Ostro et al., 1995	79.48
Work Loss Days	**Ostro, 1987**	**2,106.92**
MRAD	**Ostro and Rothschild, 1989**	**17,551.95**
RAD	Ostro, 1987	5,780.31

*The method of measuring chronic bronchitis in Schwartz (1993) does not necessarily result in the number of cases avoided/year. Instead, this value may represent number of cases avoided over a period of years.

9.0 REFERENCES

Abt Associates Inc., July 3, 1996 (Revised November 1996). "A Particulate Matter Risk Assessment for Philadelphia and Los Angeles," prepared for the Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Contract No. 68-W4-0029, Work Assignments 9, 9-1, and 15-1.

Dockery, D.W., F.E. Speizer, D.O. Stram, J.H. Ware, J.D. Spengler, and B.G. Ferris, Jr. 1989. Effects of Inhalable Particles on Respiratory Health of Children. *Am. Rev. Respir. Dis.* 139: 587-594.

Ito, K. and Thurston, G.D. 1996. Daily PM10/Mortality Associations: An Investigation of At-Risk Subpopulations. *Journal of Exposure Analysis and Environmental Epidemiology* 6(1): 79-225.

Kinney et al. 1995. A Sensitivity Analysis of Mortality/PM10 Associations in Los Angeles. *Inhalation Toxicology* 7: 59-69.

Krupnick A.J., Harrington W., Ostro B. 1990. Ambient Ozone and Acute Health Effects: Evidence from Daily Data. *Journal of Environmental Economics and Management* 18:1-18.

Ostro, B.D. 1987. Air Pollution and Morbidity Revisited: a Specification Test. *J. Environ. Econ. Manage.* 14: 87-98.

Ostro B.D. and S. Rothschild. 1989. Air Pollution and Acute Respiratory Morbidity: An Observational Study of Multiple Pollutants. *Environmental Research* 50:238-247.

Ostro, B.D., M.J. Lipsett, M.B. Wiener, and J.C. Selner. 1991. Asthmatic Responses to Airborne Acid Aerosols. *American Journal of Public Health* 81: 694-702.

Ostro, B.D., M.J. Lipsett, J.K. Mann, H. Braxton-Owens, and M.C. White. 1995. Air Pollution and Asthma Exacerbations Among African American Children in Los Angeles. *Inhalation Toxicology.*

Pope, C.A., III, D.W. Dockery, J.D. Spengler, and M.E. Raizenne. 1991. Respiratory Health and PM_{10} Pollution: a Daily Time Series Analysis. *Am. Rev. Respir. Dis.* 144: 668-674.

Pope, C.A., III, Schwartz, J., and M.R. Ransom. 1992. Daily mortality and PM_{10} in Utah valley. *Arch. Environ. Health* 47: 211-217.

Pope, C.A., III, M.J. Thun, M.M. Namboodiri, D.W. Dockery, J.S. Evans, F.E. Speizer, and C.W. Heath, Jr. 1995. Particulate Air Pollution as a Predictor of Mortality in a Prospective Study of U.S. Adults. *Am. J. Respir. Crit. Care Med.* 151: 669-674.

Schwartz, J. 1993a. Air pollution and daily mortality in Birmingham, Alabama. *Am. J. Epidemiol.* 137: 1136-1147.

Schwartz, J. 1993b. Particulate Air Pollution and Chronic Respiratory Disease. *Environmental Research* 62: 7-13.

Schwartz, J. 1994a. Air Pollution and Hospital Admissions in Elderly Patients in Birmingham, Alabama. *American Journal of Epidemiology* 139:589-98.

Schwartz, J. 1994b. Air Pollution and Hospital Admissions for the Elderly in Detroit, Michigan. *American Journal of Respiratory Care Med* 150:648-55.

Schwartz, J. 1994c. PM_{10}, Ozone and Hospital Admissions for the Elderly in Minneapolis-St. Paul, Minnesota. *Archives of Environmental Health* 49(5): 366-374.

Schwartz, J. 1995. Short Term Fluctuations in Air Pollution and Hospital Admissions of the Elderly for Respiratory Disease. *Thorax* 50:531-538.

Schwartz, J. 1996. Air Pollution and Hospital Admissions for Respiratory Disease. *Epidemiology* 7(1): 20-28.

Schwartz, J. and R. Morris. 1995. Air Pollution and Hospital Admissions for Cardiovascular Disease in Detroit, Michigan. *Am. J. Epidemiol.* 142: 23-35.

Schwartz, J. D. W. Dockery, L.M. Neas, D. Wypij, J.H. Ware, J.D. Spengler, P. Koutrakis, F.E.Speizer, and B.G. Ferris, Jr. 1994. Acute Effects of Summer Air Pollution on Respiratory Symptom Reporting in Children. *Am. J. Respir. Crit. Care Med.* 150: 1234-1242.

Schwartz, J., Dockery, D., and L. Neas. 1996a. Is Daily Mortality Specifically Associated With Fine Particles? *J. Air & Waste Man. Assoc.* 46: 927-939.

Thurston, G. K. Ito, C. Hayes, D. Bates, and M. Lippmann. 1994. Respiratory Hospital Admission and Summertime Haze Air Pollution in Toronto, Ontario: Consideration of the Role of Acid Aerosols. *Environmental Research* 65: 271-290.

U.S. Environmental Protection Agency (EPA). 1988. Background Document 1; Reference Dose (RfD): Description and Use in Health Risk Assessments. February 10.

U.S. Environmental Protection Agency (EPA)/ Office of Air Quality Planning and Standards, 1996. *Review of National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information (Staff Paper)*. EPA-452\R-96-013.

U.S. Environmental Protection Agency(EPA)/ Office of Air Quality Planning and Standards, 1997a. *The Benefits and Costs of the Clean Air Act: 1970 to 1990.* October. Appendix D.

U.S. Environmental Protection Agency (EPA)/Office of Air Quality Planning and Standards, 1997b. *Regulatory Impact Analyses for the Particulate Matter and Ozone National Ambient Air Quality Standards and Proposed Regional Haze Rule.* Appendix I.

Appendix F

Derivation of Total Mercury Water Column Concentration, Cwt, as Used to Model the Drinking Water Ingestion Pathway

Appendix F

Derivation of Total Mercury Water Column Concentration, Cwt, as Used to Model the Drinking Water Ingestion Pathway

Mercury modeling for the HWC risk assessment began in 1996 with IEM-2, the model available at the onset of the HWC risk assessment project. This model was reported in the Addendum (EPA, 1993) and provided the basis for modeling contained in the 1996 draft *Mercury Study Report to Congress* (MRTC, U.S. EPA, 1996). After the modeling analysis for the HWC risk assessment was well underway, EPA released the 1997 MRTC. The 1997 MRTC (U.S. EPA, 1997) contains IEM-2M, a peer-reviewed version of IEM-2 that has been improved for modeling mercury in aquatic systems. Because IEM-2M is a more robust model with an improved capability to represent physical and chemical processes in the waterbody, it was used to redo the mercury modeling results so that the output of the two versions could be compared for consistency or significant discrepancies. Although the soil modeling results were generally in accord, the aquatic modeling results showed significant differences (see Lyon et al., 1998). Based on these large discrepancies in modeling results for waterbodies and the fact that IEM-2M is a more robust model that better represents the physical and chemical processes involved, the IEM-2M model was selected for use in the HWC risk assessment for those human and ecological receptors for which mercury is a significant risk driver in the aquatic pathway.

The IEM-2M model was used to model mercury in the aquatic pathway for two human receptor populations - recreational fishers and subsistence fishers - and for the ecological receptors. These populations were chosen because their consumption of fish increases their ingestion of mercury from the aquatic pathway. The application of the 1997 MRTC methodology is discussed in detail in Section 5.3.3.2. IEM-2M was not applied to receptors that are not significantly impacted by mercury via the aquatic pathway because the only other waterbody-related pathway, the drinking water pathway, is not a significant risk driver. Since the IEM-2M generally results in lower waterbody mercury concentrations than IEM-2, new mercury concentrations modeled using IEM-2M would only lessen the significance of the drinking water pathway.

This appendix presents:

- # Differences between the HWC modified IEM-2 model and the IEM-2M model
- # The procedure followed to generate risk results for all human receptor populations except recreational fishers and subsistence fishers (i.e., use of the HWC modified IEM-2 methodology to assess the drinking water pathway).

Note that, in applying the HWC modified IEM-2 methodology, the 1997 MRTC was used to update parameter values where new information was available and appropriate. These values are cited and referenced in Appendix D of this report.

Differences between IEM-2M and IEM-2 As indicated, the IEM-2M model was applied to selected receptor populations following model output comparisons conducted after the preliminary HWC results were obtained using the HWC-adapted IEM-2. The differences between these models are summarized in Table F-1. A detailed analysis of the comparison is found in Lyon et al. (1998).

Mercury Waterbody Calculations - Drinking Water. Fate and transport of mercury through waterbodies for the drinking water ingestion pathway for all human receptors except the subsistence scenarios (farmer and fisher) and the recreational fisher were modeled following the methods contained in the draft *Mercury Study Report to Congress* (U.S. EPA, 1996). The method applied in the mercury waterbody calculations corresponds to the 1996 report, and the procedure followed is outlined below. The 1997 report was used to update parameter values where new information was available and appropriate. These values are cited and referenced in Appendix D of this report.

Modeling was undertaken with the ultimate goal of defining Cw_{tot} (the concentration of total mercury in the waterbody) in terms of Cwt (the concentration of total mercury in the water column). After the concentration of mercury in the waterbody was calculated, the water column, dissolved water column, and sorbed sediment concentrations could then be calculated. This approach relies on the assumption of equivalency between the dissolved mercury concentration in the water column and in the sediment pore water and incorporates a speciated waterbody model that maintains mass balance within the system.

The concentration of total mercury (elemental, divalent, and methyl) within the total waterbody (water column and benthic layer), Cw_{tot}, was defined based on loading to and losses from the system. Similar to other constituents, loading of mercury species into the waterbody comes from the atmosphere and from watershed surfaces and soils. With regard to watersheds, atmospheric deposition modeling for this analysis resulted in deposition of the divalent mercury species via wet and dry deposition for the particle phase fraction and via dry and wet deposition of its vapor phase fraction. Wet deposition of elemental vapor was modeled to deposit on soils; however, dry vapor deposition for elemental mercury was assumed to be zero (see Section 5.1). A fraction of the mercury in soil was assumed to be methylated; the remaining mercury in soil was assumed to be comprised of elemental and divalent mercury. All three mercury species were loaded into the waterbody from the watershed, as a result of impervious and pervious runoff and erosion. The equations that describe these calculations are presented in Tables C.3-37 to C.3-45

Table F-1. Primary Differences in Methodology between IEM-2 and IEM-2M Models

Process/Assumption	IEM-2[a]	IEM-2M[b]
Mercury speciation in soil, water, and sediment	Assumed to be constant and input to the model	Calculated based on transformation rates between the three mercury species
Watershed-waterbody interaction	Loads from watershed determined based on calculated values at the end of the facility's lifetime (T = 30 yr)	Watershed and waterbody linked throughout facility lifetime
Waterbody dynamics	Assumed to be at steady-state	Steady-state not assumed
Fish concentration	Calculated based on a BAF for dissolved total mercury in the water column	Calculated based on a BAF for dissolved methylmercury concentration

[a] This model was used for the 1996 Draft of the *Mercury Study Report to Congress*
[b] This model was used for the 1997 *Mercury Study Report to Congress*

in Appendix C. The erosion loads were modeled using site-specific USLE parameters as discussed in Section 5.3.2.1.

Losses from the waterbody included volatilization and benthic burial, each of which were weighted by the relative presence of the three mercury species, because loss rates are species-specific. Volatilization rate, burial rate, and the fraction of total waterbody contaminant concentration that occurred in the water column were all dependent on total suspended solids (TSS). The overall mass balance in the waterbody was a function of flow rate, volatilization rate, burial rate, as well as the fraction of total waterbody contaminant concentration that occurred in the water column.

At steady state, total chemical loading equaled the sum of chemical outflow and chemical loss due to volatilization from the water column and benthic burial. Although the principle of chemical inputs equaling chemical losses holds at steady state, modeling was complicated by the fact that losses vary based on the fractions of mercury in the water column and in the benthic layer. The mercury modeling in the waterbody was further complicated by the need to consider mercury speciation, which must be considered in the calculation of both the fraction of the total mercury concentration that occurs in the water column and the fraction of the total mercury concentration that occurs in the benthic layer. The following text describes the derivation of an expression of the total mercury concentration in the waterbody in terms of the total mercury concentration in the water column.

The calculation of the fractions of total mercury concentration that occur in the water column and in the benthic layer and the relative species ratio in the total waterbody were based on mass balance for the total waterbody and equivalency relationship between dissolved water column and dissolved sediment (i.e., in pore water) concentrations. The relative fractions in the

total waterbody are dependent on chemical- and site-specific parameters, including partitioning coefficients, TSS, and the fixed speciation ratio within the water column. The concentration of total mercury in the water column was equal to the sum of the concentrations of the three mercury species in the water column. The relative fractions of the three mercury species in the water column were fixed in this analysis.

Once the total mercury concentration in the water column was apportioned between species using the fixed relative fractions, the dissolved water concentration of each species was calculated using partitioning coefficients and TSS. Based on equivalency, this dissolved concentration for each species was assumed to equal the concentration of that species in the pore water. Using sediment-water partitioning coefficients, the sorbed benthic concentration of each species was determined from the dissolved benthic concentration. Substituting expressions allows the sorbed benthic concentration of each species to be expressed in terms of the total water column concentration of each species. Because the dissolved benthic concentration was equal to the dissolved water column concentration, the dissolved benthic concentration was also expressed in terms of the total water column concentration of each species. Therefore, the total concentration in the benthic layer can be expressed in terms of the total water column concentration of each species.

Based on a mass balance for each species, the concentration of each species in the waterbody can be expressed as having a water column component and a benthic component. Expressing the benthic component in terms of the total water column concentration of each species results in a definition of the concentration of each species in the waterbody in terms of the total water column concentration.

The relative fraction of each species in the waterbody was equal to the ratio of the concentration of the species to the concentration of total mercury in the waterbody (expressed as the sum of the three species). Application of this relative fraction allows the derivation of an expression for the total mercury concentration in the entire waterbody, presented in terms of the total mercury concentration in the water column. The relative fraction was used to sum losses of each species into an overall total mercury dissipation rate constant.

This derived value for the total mercury concentration in the waterbody in terms of the total mercury concentration in the water column was equal to a defined value of total mercury concentration in the water column based on loadings to and losses from the system. Ultimately, the total mercury concentration in the water column could be solved for using site- and species-specific parameters and could be used to calculate related concentrations (dissolved water column, dissolved benthic, and sorbed benthic) discussed above. The mathematical derivation of the total mercury water column concentration, Cwt, follows.

The concentration of total mercury in the water column, Cwt, was defined as the sum of the mercury species concentrations in the water column, or

$$Cwt = Cwt_e + Cwt_d + Cwt_m. \qquad \text{(F-1)}$$

In this case, Cwt_i, the water column concentration of species i is equal to Cwt times the relative fraction of species i in the water column, as shown in Equation F-2.

$$Cwt_i = Cwt \bullet (f_i) \qquad \text{(F-2)}$$

where

Cwt = Total water column concentration of mercury

Cwt_i = Total waterbody concentration of the i^{th} species of mercury

f_i = Relative fraction of the i^{th} species of mercury in the water column.

The relative fraction of the three mercury species in the water column is fixed in this analysis. The fixed ratio applied to the mercury species is as follows.

- Elemental mercury: 2 percent (f_e)
- Divalent mercury: 83 percent (f_d)
- Methyl mercury: 15 percent (f_m)

The dissolved water concentration of each mercury species, Cdw_i, can be determined from the concentration of total mercury in the water column, Cwt, using a species-specific soil-water partitioning coefficient, $Kdsw_i$, and the TSS parameter value. This relationship is represented for each mercury species as:

$$Cdw_i = \frac{Cwt_i}{1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6}} \qquad \text{(F-3)}$$

where

Cdw_i = Dissolved water column concentration of the i^{th} species
Cwt_i = Total water column concentration of the i^{th} species
TSS = Total suspended solids
$Kd_{sw,i}$ = Suspended solids-water partition coefficient of the i^{th} species
10^{-6} = Units conversion factor.

Following the 1996 draft MRTC, the concentration of each mercury species present in the water column was assumed to equal the concentration of that species dissolved in the pore water present in the benthic layer, expressed in terms of Cwt_i:

$$Cdb_i = Cdw_i = \frac{Cwt_i}{1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6}} \qquad \text{(F-4)}$$

where

Cdb_i = Dissolved benthic concentration of the i^{th} species
Cdw_i = Dissolved water column concentration of the i^{th} species
Cwt_i = Total water column concentration of the i^{th} species
$Kd_{sw,i}$ = Suspended solids-water partition coefficient of the i^{th} species
TSS = Total suspended solids
10^{-6} = Units conversion factor.

Again employing the principle of partitioning, the sorbed sediment concentration of each mercury species, Csb_i, can be calculated from Cdb_i. This incorporates a sediment-water partitioning coefficient, as follows:

$$Csb_i = Kd_{bs,i} \bullet Cdb_i \qquad \text{(F-5)}$$

where

Csb_i = Sorbed benthic concentration of the i^{th} species
$Kd_{bs,i}$ = Sediment-water partition coefficient of the i^{th} species
Cdb_i = Dissolved benthic concentration of the i^{th} species

Substituting the previous expression for Cdb_i results in the definition of Csb_i in terms of Cwt_i:

$$Csb_i = Kd_{bs,i} \bullet \frac{Cwt_i}{1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6}} \qquad \text{(F-6)}$$

where

Csb_i = Sorbed benthic concentration of the i^{th} species
$Kd_{bs,i}$ = Sediment-water partition coefficient of the i^{th} species
Cwt_i = Total water column concentration of the i^{th} species
TSS = Total suspended solids
$Kd_{sw,i}$ = Suspended solids-water partition coefficient of the i^{th} species
10^{-6} = Units conversion factor.

Because the mercury species concentration in the benthic layer is comprised of the dissolved and the sorbed fractions, it is true that:

$$Cbt_i = Cdb_i \bullet \theta bs + Csb_i \bullet BS \qquad \text{(F-7)}$$

where

Cbt_i = Total benthic concentration of the i^{th} species
Cdb_i = Dissolved benthic concentration of the i^{th} species
θbs = Bed sediment porosity
Csb_i = Sorbed benthic concentration of the i^{th} species
BS = Bed sediment concentration (dry weight).

As both the dissolved and sorbed sediment concentrations (Cdb_i and Csb_i, respectively) have been defined previously in terms of the water column concentration of mercury $Cw_{t,i}$, this expression for the concentration of each mercury species within the benthic layer can be rewritten by substituting for Cdb_i and Csb_i and therefore becomes:

$$Cbt_i = \frac{Cwt_i \bullet (\theta bs + Kd_{bs,i} \bullet BS)}{1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6}} \qquad \text{(F-8)}$$

where

Cbt_i = Total benthic concentration of the i^{th} species
Cwt_i = Total water column concentration of the i^{th} species
θbs = Bed sediment porosity
$Kd_{bs,i}$ = Sediment-water partition coefficient of the i^{th} species
BS = Bed sediment concentration (dry weight)
$Kd_{sw,i}$ = Suspended solids-water partition coefficient of the i^{th} species
TSS = Total suspended solids

The total mercury concentration in the benthic layer is the sum of the concentration of the three mercury species within the benthic layer:

$$Cbt = Cbt_e + Cbt_d + Cbt_m \qquad \text{(F-9)}$$

where

Cbt = Total benthic concentration of mercury
Cbt_e = Total benthic concentration of elemental mercury

Cbt_d = Total benthic concentration of divalent mercury
Cbt_m = Total benthic concentration of methylmercury.

Based on a mass balance for each species, the concentration of each species in the waterbody (water column plus benthic layer), $Cw_{tot,i}$, can be solved for. $Cw_{tot,i}$ is defined as follows:

$$Cw_{tot,i} = (Cwt_i \bullet \frac{d_w}{d_z}) + (Cbt_i \bullet \frac{d_b}{d_z}) \qquad \text{(F-10)}$$

where

$Cw_{tot,i}$ = Total waterbody concentration of the i^{th} species
Cwt_i = Total water column concentration of the i^{th} species
d_w = Water column depth
d_z = Waterbody depth
Cbt_i = Total benthic concentration of the i^{th} species
d_b = Benthic layer depth.

Substituting in the above expression for Cbt_i as written in terms of Cwt_i, this expression for $Cw_{tot,i}$ can be rewritten in terms of the water column concentration Cwt_i and site- and chemical-specific parameters:

$$Cw_{tot,i} = Cwt_i \bullet [\frac{d_w}{d_z} + \frac{(\theta bs + Kd_{bs,i} \bullet BS) \bullet d_b}{1 + Kd_{sw,i} \bullet TSS \bullet 10^{-6} \bullet d_z}] \qquad \text{(F-11)}$$

where

$Cw_{tot,i}$ = Total waterbody concentration of the i^{th} species
Cwt_i = Total water column concentration of the i^{th} species
d_w = Water column depth, m
d_z = Waterbody depth, m
θbs = Bed sediment porosity
$Kd_{bs,i}$ = Sediment-water partition coefficient of the i^{th} species
BS = Bed sediment concentration (dry weight)
d_b = Benthic layer depth
$Kd_{sw,i}$ = Suspended solids-water partition coefficient of the i^{th} species
TSS = Total suspended solids.

This equation presents the total concentration of each mercury species in the waterbody expressed in terms of the water column concentration and site- and species-specific parameters. The total mercury present in the entire waterbody, therefore, is the sum of the total concentration of the three mercury species in the waterbody:

$$Cw_{tot} = Cw_{tot,e} + Cw_{tot,d} + Cw_{tot,m} \quad \text{(F-12)}$$

where

Cw_{tot} = Total waterbody concentration of mercury
$Cw_{tot,e}$ = Total waterbody concentration of elemental mercury
$Cw_{tot,d}$ = Total waterbody concentration of divalent mercury
$Cw_{tot,m}$ = Total waterbody concentration of methyl mercury.

In this case, $Cw_{tot,\,i}$ is equal to Cw_{tot} times the relative fraction of species i in the waterbody:

$$Cw_{tot,e} = Ce_{tot} \bullet R_e \quad \text{(F-13)}$$

where

$Cw_{tot,e}$ = Total waterbody concentration of elemental mercury (or the i^{th} species)
Cw_{tot} = Total waterbody concentration of mercury
R_e = Relative fraction of elemental mercury (or the i^{th} species) in the waterbody.

The relative fraction of the three mercury species in the waterbody is equal to the concentration of the i^{th} species concentration in the waterbody to the concentration of the total mercury in the waterbody.

Application of this relative fraction allows the derivation of an expression for the total mercury concentration in the entire waterbody, presented in terms of the total mercury concentration in the water column.

This derived value for Cw_{tot} can be set equal to a defined value for Cw_{tot} based on the loadings to and losses from the system. Based on mass balance, Cw_{tot} is as follows:

$$Cw_{tot} = \frac{L_T}{[Vf_x \bullet f_{water} \bullet \frac{d_z}{d_w}] + [kwt \bullet V_z]} \quad . \quad \text{(F-14)}$$

This incorporates the use of the following constants:

L_T = Total load to the waterbody

Vf_x = Dilution flow

f_{water} = Fraction of total mercury concentration that occurs in the water column (see Equation F-15)

d_w = Water column depth, m

d_z = Waterbody depth, m

V_z = Waterbody volume, m^3

kwt = Overall waterbody total mercury dissipation rate constant (see Equation F-16).

The f_{water} and kwt terms in Equation F-14 are defined in Equations F-15 and F-16, respectively.

$$f_{water} = \frac{Cwt \bullet d_w}{Cw_{tot} \bullet d_z} \quad \text{(F-15)}$$

$$kwt = \sum(R_i \bullet kwt_i) \quad \text{(F-16)}$$

where

R_i = Relative fraction of i^{th} species in the waterbody, or $Cw_{tot,i}/Cw_{tot}$
kwt_i = Overall total waterbody dissipation rate constant, 1/year.

Through defining Cw_{tot} in terms of constants and deriving Cw_{tot} in terms of Cwt, the two equations can be set equal to one another, and an expression for Cwt can be created. This expression follows:

$$Cwt = \frac{\dfrac{L_T}{[Vf_x \bullet f_{water} \bullet \frac{d_z}{d_w}] + [kwt \bullet V_z]}}{f_e \bullet [\frac{d_w}{d_z} + \frac{(\theta bs + Kd_{bs,e} \bullet BS) \bullet d_b}{1 + Kd_{sw,e} \bullet TSS \bullet 10^{-6} \bullet d_z}] + f_d \bullet [\frac{d_w}{d_z} + \frac{(\theta bs + Kd_{bs,d} \bullet BS) \bullet d_b}{1 + Kd_{sw,m} \bullet TSS \bullet 10^{-6} \bullet d_z}] + f_m \bullet [\frac{d_w}{d_z} + \frac{(\theta bs + Kd_{bs,m} \bullet BS) \bullet d_b}{1 + Kd_{sw,m} \bullet TSS \bullet 10^{-6} \bullet d_z}]} \quad \text{(F-17)}$$

The value for Cwt can be calculated using site- and species-specific parameters; once a value for Cwt has been calculated, it then can be used to calculate the corresponding values for Cdw (equal to Cdb) and Csb assuming equilibrium speciation and using the above equations for Cdw_i and Csb_i.

The procedure corresponds to the conceptual guidance of the 1996 draft MRTC. In so doing, this maintains the goals of achieving equivalency and mass balance. Equivalency is

achieved through the assumption of Cdw = Cdb. Mass balance is incorporated in the steady-state assumption of inputs equal to outputs.

Reference

Lyon, B., M.R. Gilkinson, and T.B. Marimpietri. 1998. *Application of the IEM-2M Surface Water Model to Airborne Mercury Deposited From Hazardous Waste Combustors*. Lyon Technical Consulting, Knoxville, TN.

U.S. EPA (Environmental Protection Agency). 1993. *Addendum to Methodology for Assessing Health Risks Associated with Indirect Exposure to Combustor Emissions* (External Review Draft). EPA/600/AP-93/003. Exposure Assessment Group, Office of Health and Environmental Assessment, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1996. *Mercury Study Report to Congress. SAB Review Draft*. EPA-452/R-96-001a-h. Office of Air Quality Planning and Standards and Office of Research and Development, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1997. *Mercury Study Report to Congress. Volume III - Fate and Transport of Mercury in the Environment*. EPA 452/R-97/005. Office of Air Quality Planning and Standards and Office of Research and Development, Washington, DC.

Appendix G

IEM-2M Mercury Modeling Parameters

Table G-1. IEM-2M Input Parameters for all Waterbodies, Baseline and Floor/Standard

Parameter Name	Parameter Abbreviation	Value	Units
Mineralization for benthic solids	Vmin	1.00E-03	m/yr
Abiotic solids deposition velocity	Vs	7.30E+02	m/yr
Pore water diffusion coefficient	Esw	1.58E-01	m^2/yr
Biotic solids deposition velocity	Vsb	7.30E+01	m/yr
Net internal production of biotic solids	Lbio	1.00E+03	g[solids]/m^2-yr
Biotic mortality rate	Kmort	3.00E-02	day^{-1}
Hg0 Suspended biotic solids-water partition coefficient	Hg0 Kbio	1.00E+03	L/kg
Hg2 Suspended biotic solids-water partition coefficient	Hg2 Kbio	2.00E+05	L/kg
MHg Suspended biotic solids-water partition coefficient	MHg Kbio	5.00E+05	L/kg
Soil reduction rate constant	Ksr	5.00E-04	day^{-1}
Reference depth for soil base reduction	zr	5.00E-03	m
Water content for soil base reduction	Ow	1.00E+00	L[water]/L[soil volume]
Reference depth for soil base volatilization	zv	5.00E-03	m
Soil methylation rate constant	Ksm	1.83E-02	day^{-1}
Soil mer cleavage demethylation rate constant	Ksmd	0.00E+00	day^{-1}
Soil demethylation rate constant	Ksdm	9.13E-01	day^{-1}
Soil oxidation rate constant	Kso	0.00E+00	day^{-1}
Surface water reduction rate constant	Kwr	2.74E+00	day^{-1}
Surface water methylation rate constant, lakes	Kwm, lakes	3.65E-01	day^{-1}
Surface water methylation rate constant, rivers	Kwm, rivers	3.65E-02	day^{-1}
Surface water mer cleavage demethylation rate constant	Kwmd	0.00E+00	day^{-1}
Surface water demethylation rate constant	Kwdm	5.48E+00	day^{-1}
Surface water oxidation rate constant	Kwo	0.00E+00	day^{-1}
Sediment reduction rate constant	Kbr	1.00E-06	day^{-1}
Sediment methylation rate constant, lakes	Kbm, lakes	3.65E-02	day^{-1}
Sediment methylation rate constant, rivers	Kbm, rivers	3.65E-03	day^{-1}
Sediment mer cleavage demethylation rate constant	Kbmd	0.00E+00	day^{-1}
Sediment demethylation rate constant	Kbdm	7.30E-01	day^{-1}
Sediment oxidation rate constant	Kbo	0.00E+00	day^{-1}
Time of facility operation	Td	3.00E+01	yr
Trophic level 3 fish bioaccumulation factor	BAF TL3	1.60E+06	L/kg
Trophic level 4 fish bioaccumulation factor	BAF TL4	6.80E+06	L/kg
Density of air	pa	1.20E-03	g/cm^3
Viscosity of air	ua	1.80E-04	g/cm-sec
Ideal gas constant	R	8.20E-05	m^3-atm/mole-K
Assumed water temperature	Twater	2.98E+02	K
Soil depth (untilled)	Z	1.00E+00	cm
Fraction void space	Ov	2.30E-01	L[void space]/L[soil volume]
Soil water content	Ow	2.20E-01	L[water]/L[soil volume]
Soil bulk density	BD	1.50E+00	kg[soil particles]/L[soil volume]
Sediment depth	zb	3.00E-02	m
Sediment porosity	Obs	6.20E-01	L[water]/L[sediment volume]
Benthic sediment concentration	S_B	7.50E+04	mg[sed. Particles]/L[sed. volume]
Hg0 molecular weight	Hg0 MW	2.01E+02	g/mol
Hg2 molecular weight	Hg2 MW	2.01E+02	g/mol
MHg molecular weight	MHg MW	2.16E+02	g/mol
Hg0 air diffusion coefficient	Hg0 D_a	5.50E-02	cm^2/s
Hg2 air diffusion coefficient	Hg2 D_a	5.50E-02	cm^2/s
MHg air diffusion coefficient	MHg D_a	5.30E-02	cm^2/s
Hg0 water diffusion coefficient	Hg0 D_w	6.41E-06	cm^2/s
Hg2 water diffusion coefficient	Hg2 D_w	6.41E-06	cm^2/s
MHg water diffusion coefficient	MHg D_w	6.11E-06	cm^2/s
Hg0 Henry's Law constant	Hg0 H	7.10E-03	atm-m^3/mol
Hg2 Henry's Law constant	Hg2 H	7.10E-10	atm-m^3/mol

Continued

Table G-1. IEM-2M Input Parameters for all Waterbodies, Baseline and Floor/Standard

Parameter Name	Parameter Abbreviation	Value	Units
MHg Henry's Law constant	MHg H	4.70E-07	atm-m^3/mol
Hg0 soil-water partition coefficient	Hg0 Kd	1.00E+03	L/kg
Hg2 soil-water partition coefficient	Hg2 Kd	5.80E+04	L/kg
MHg soil-water partition coefficient	MHg Kd	7.00E+03	L/kg
Hg0 suspended sediment-water partition coefficient	Hg0 Kdw	1.00E+03	L/kg
Hg2 suspended sediment-water partition coefficient	Hg2 Kdw	1.00E+05	L/kg
MHg suspended sediment-water partition coefficient	MHg Kdw	1.00E+05	L/kg
Hg0 benthic sediment-water partition coefficient	Hg0 Kdb	3.00E+03	L/kg
Hg2 benthic sediment-water partition coefficient	Hg2 Kdb	5.00E+04	L/kg
MHg benthic sediment-water partition coefficient	MHg Kdb	3.00E+03	L/kg
Erodibility factor	K	3.40E-01	tons/acre
Average annual irrigation	I	0.00E+00	cm/yr
Enrichment factor	EF	3.00E+00	unitless

Table G-2. Mercury Waterbody Characteristics Used for Baseline and Floor/Standard

Site	Waterbody	Air Temp. (K)	Wind-speed (m/s)	WS Area Impervious to Fallout (km^2)	Area, Including Impervious Area (km^2)	Current Velocity (m/s)	Type	WB Depth (m)	WB Area (m^2)	Sediment Area (m^2)	Erosivity Factor, R (yr^{-1})	Topo-graphic Factor, LS (unitless)	Cover Mgmt Factor, C (unitless)	Support Practice Factor, Ps (unitless)	Average Annual Runoff, Ro (cm/yr)	Average Annual Precip-itation, P (cm/yr)	Average Annual Evapo-trans, Ev (cm/yr)	Dilution Outflow (m^3/yr)	Hydrologic Region TSS (g/m^3)	Resus-pension Velocity, vrs (m/yr)
209	Lawsons Fork Creek	289	4.13	2.40E+01	1.67E+02	0.244	River	0.271	3.94E+05	3.94E+05	300	1.29E+00	3.33E-02	8.51E-01	25.4	108	75.4	1.13E+08	2.40E+01	2.34E-01
209	Tyger River	289	4.13	6.81E+01	4.73E+02	0.402	River	0.384	1.79E+06	1.79E+06	300	1.49E+00	3.80E-02	8.11E-01	25.4	108	75.4	5.37E+08	2.40E+01	2.34E-01
209	Fair Forest Creek	289	4.13	3.58E+01	2.49E+02	0.296	River	0.201	3.00E+05	3.00E+05	300	1.34E+00	2.72E-02	9.20E-01	25.4	108	75.4	8.81E+07	2.40E+01	2.34E-01
209	Middle Tyger River	289	4.13	7.78E+00	5.40E+01	0.338	River	0.223	2.06E+05	2.06E+05	300	1.41E+00	4.40E-02	8.43E-01	25.4	108	75.4	1.22E+08	2.40E+01	2.34E-01
214	Fish Ponds	293	4.12	5.32E-01	2.99E+00	NA	Lake	4.000	2.99E+06	2.99E+06	510	7.94E-02	7.35E-02	5.43E-01	22.5	144	100.7	6.73E+05	3.80E+01	3.70E-01
214	Lake Clause	293	4.12	2.57E+00	1.44E+01	NA	Lake	4.000	2.11E+05	2.11E+05	510	9.19E-02	5.85E-02	6.44E-01	22.5	144	100.7	3.25E+06	3.80E+01	3.70E-01
214	University Lake/ City Park Lake	293	4.12	4.49E-01	2.52E+00	NA	Lake	4.000	8.95E+05	8.95E+05	510	5.89E-01	9.82E-03	1.00E+00	22.5	144	100.7	5.68E+05	3.80E+01	3.70E-01
214	Comite River	293	4.12	5.77E+01	3.24E+02	0.491	River	0.347	4.24E+05	4.24E+05	510	1.64E-01	5.46E-02	7.79E-01	22.5	144	100.7	4.97E+08	1.63E+02	1.59E+00
221	Highlands Reservoir	294	4.10	1.11E+00	5.21E+00	NA	Lake	4.000	1.89E+06	1.89E+06	300	6.93E-02	8.00E-02	5.00E-01	12.7	119	83.4	6.62E+05	7.00E+01	6.81E-01
221	Sheldon Reservoir	294	4.10	1.13E+00	5.30E+00	NA	Lake	4.000	5.30E+06	5.30E+06	300	7.02E-02	7.23E-02	5.52E-01	12.7	119	83.4	6.73E+05	7.00E+01	6.81E-01
221	San Jacinto River / Houston Lake	294	4.10	2.35E+01	1.10E+02	0.561	River	0.351	1.71E+07	1.71E+07	300	8.50E-02	3.37E-02	8.46E-01	12.7	119	83.4	2.33E+09	7.20E+01	7.01E-01
324	Shades Creek	290	3.60	8.04E+01	1.63E+02	0.402	River	0.213	4.90E+05	4.90E+05	350	1.78E+00	1.82E-02	9.69E-01	25.4	136	95.3	1.88E+08	2.40E+01	2.34E-01
324	Valley Creek	290	3.60	1.94E+02	3.93E+02	0.466	River	0.439	9.58E+05	9.58E+05	350	1.63E+00	2.83E-02	9.75E-01	25.4	136	95.3	2.80E+08	2.40E+01	2.34E-01
324	Bayview Lake	290	3.60	7.83E+01	1.59E+02	NA	Lake	4.000	1.67E+06	1.67E+06	350	1.27E+00	2.13E-02	9.88E-01	25.4	136	95.3	4.04E+07	6.00E+00	5.84E-02
324	Cahaba River	290	3.60	7.30E+01	1.48E+02	0.421	River	0.460	7.28E+05	7.28E+05	350	2.17E+00	1.83E-02	9.92E-01	25.4	136	95.3	3.49E+08	2.40E+01	2.34E-01
325	Big Hill Creek	287	6.17	4.47E+00	1.12E+02	0.168	River	0.061	1.71E+05	1.71E+05	250	3.52E-01	7.60E-02	5.27E-01	7.6	74	52.1	5.70E+07	2.06E+02	2.01E+00
325	Potato Creek	287	6.17	1.77E+00	4.44E+01	0.113	River	0.024	1.55E+04	1.55E+04	250	3.04E-01	7.77E-02	5.16E-01	7.6	74	52.1	8.74E+06	2.06E+02	2.01E+00
325	Claymore Creek	287	6.17	1.39E+00	3.46E+01	0.558	River	0.326	1.65E+05	1.65E+05	250	2.76E-01	7.53E-02	5.32E-01	7.6	74	52.1	6.34E+07	2.06E+02	2.01E+00
325	Verdigris River	287	6.17	4.04E+01	1.01E+03	0.637	River	0.189	2.09E+06	2.09E+06	250	3.28E-01	7.57E-02	5.40E-01	7.6	74	52.1	1.72E+09	2.06E+02	2.01E+00
331	Rocky River	283	5.10	2.47E+01	3.30E+02	0.640	River	0.540	1.10E+06	1.10E+06	125	4.72E-01	6.49E-02	6.54E-01	12.7	94	65.9	2.30E+08	2.10E+01	2.04E-01
331	East Branch Black River	283	5.10	1.94E+01	2.58E+02	0.610	River	0.470	5.19E+05	5.19E+05	125	4.63E-01	7.00E-02	5.69E-01	12.7	94	65.9	1.73E+08	2.10E+01	2.04E-01
331	Wyleswood Lake	283	5.10	6.28E-03	8.38E-02	N/A	Lake	4.000	4.69E+04	4.69E+04	125	4.76E-01	8.00E-02	5.00E-01	12.7	94	65.9	1.06E+04	6.00E+00	5.84E-02
331	Baldwin Lake	283	5.10	2.32E+00	3.09E+01	N/A	Lake	4.000	1.26E+05	1.26E+05	125	5.14E-01	2.98E-02	8.53E-01	12.7	94	65.9	3.93E+06	6.00E+00	5.84E-02
359	Kentucky River	287	4.13	5.09E+01	4.67E+02	0.896	River	0.957	2.51E+06	2.51E+06	180	2.27E+00	4.77E-02	7.27E-01	20.3	112	78.1	8.69E+09	2.70E+01	2.63E-01
359	Indian Creek	287	4.13	1.26E+01	1.16E+02	0.378	River	0.079	1.05E+05	1.05E+05	180	2.78E+00	3.92E-02	7.73E-01	20.3	112	78.1	1.62E+08	2.70E+01	2.63E-01
359	Indian Kentuck Creek	287	4.13	1.23E+01	1.13E+02	0.198	River	0.137	1.08E+05	1.08E+05	180	3.16E+00	3.45E-02	8.03E-01	20.3	112	78.1	3.15E+07	2.70E+01	2.63E-01
359	Ohio River	287	4.13	5.51E+01	5.06E+02	1.167	River	5.172	1.99E+07	1.99E+07	180	2.40E+00	4.34E-02	7.68E-01	20.3	112	78.1	9.55E+10	2.70E+01	2.63E-01
A15	Tonawanda Creek	282	6.18	6.29E+01	4.37E+02	0.460	River	0.311	1.65E+06	1.65E+06	100	4.18E-01	2.44E-02	9.55E-01	20.3	97	67.7	4.32E+08	2.10E+01	2.04E-01
A15	Murder Creek	282	6.18	1.54E+01	1.07E+02	0.201	River	0.058	9.71E+04	9.71E+04	100	4.69E-01	3.12E-02	8.66E-01	20.3	97	67.7	3.59E+07	2.10E+01	2.04E-01
A15	Ellicott Creek	282	6.18	3.87E+01	2.69E+02	0.360	River	0.207	5.74E+05	5.74E+05	100	4.91E-01	6.56E-02	8.07E-01	20.3	97	67.7	1.41E+08	2.10E+01	2.04E-01
A18	Taylor Bayou	294	4.60	1.94E+00	3.88E+02	0.610	River	0.470	4.10E+05	4.10E+05	490	1.18E-01	6.58E-02	6.03E-01	17.8	141	98.4	1.73E+08	7.20E+01	7.01E-01
A18	Hillebrandt Bayou	294	4.60	1.09E+00	2.17E+02	0.460	River	0.180	1.21E+05	1.21E+05	490	1.17E-01	6.61E-02	5.95E-01	17.8	141	98.4	1.26E+07	7.20E+01	7.01E-01
A18	Viterbo Reservoir	294	4.60	1.82E-02	3.63E+00	NA	Lake	4.000	6.36E+05	6.36E+05	490	1.24E-01	8.00E-02	5.00E-01	17.8	141	98.4	6.47E+05	7.00E+01	6.81E-01
CAL	Tennessee River	285	4.63	5.81E+01	5.33E+02	1.576	River	1.814	6.13E+06	6.13E+06	210	9.26E-01	6.35E-02	6.46E-01	20.3	102	71.5	5.79E+10	1.50E+01	1.46E-01
CAL	Kentucky Lake	285	4.63	1.58E+01	1.45E+02	NA	Lake	4.000	5.59E+07	5.59E+07	210	1.95E+00	8.13E-02	8.81E-01	20.3	102	71.5	2.94E+07	6.00E+00	5.84E-02
CAL	Barkley Lake	285	4.63	1.15E+01	1.05E+02	NA	Lake	4.000	3.54E+07	3.54E+07	210	2.88E+00	2.13E-02	8.92E-01	20.3	102	71.5	2.13E+07	6.00E+00	5.84E-02
CAL	Cumberland River	285	4.63	3.38E+01	3.10E+02	1.271	River	0.936	6.69E+06	6.69E+06	210	1.67E+00	6.30E-02	6.77E-01	20.3	102	71.5	2.89E+10	2.70E+01	2.63E-01
ELD	Flat Creek	292	4.61	1.35E+01	9.37E+01	0.550	River	0.340	1.53E+05	1.53E+05	350	4.93E-01	1.57E-02	9.67E-01	21.6	116	81.3	6.62E+07	1.63E+02	1.59E+00
ELD	Salt Creek	292	4.61	6.79E+00	4.72E+01	0.550	River	0.168	1.46E+05	1.46E+05	350	5.03E-01	6.92E-03	9.87E-01	21.6	116	81.3	1.02E+07	1.63E+02	1.59E+00
ELD	Calion Lake	292	4.61	6.95E+00	4.82E+01	NA	Lake	4.000	1.95E+06	1.95E+06	350	5.81E-01	6.53E-03	9.91E-01	21.6	116	81.3	1.04E+07	3.80E+01	3.70E-01
ELD	Ouachita River	292	4.61	5.16E+01	3.58E+02	0.880	River	1.650	1.87E+06	1.87E+06	350	4.10E-01	1.01E-02	9.75E-01	21.6	116	81.3	3.60E+09	1.63E+02	1.59E+00
SAU	Horseshoe Lake	286	5.12	1.25E+01	2.37E+01	NA	Lake	4.000	9.06E+06	9.06E+06	210	1.66E-01	6.15E-02	6.32E-01	12.7	94	65.5	3.01E+06	3.80E+01	3.70E-01
SAU	Old Cahokia Creek	286	5.12	1.24E+00	2.36E+00	0.460	River	0.180	2.25E+04	2.25E+04	210	1.66E-01	4.26E-01	7.47E-01	12.7	94	65.5	1.39E+07	6.80E+01	6.62E-01
SAU	Mississippi River	286	5.12	5.78E+02	1.10E+03	1.740	River	11.940	2.62E+07	2.62E+07	210	6.84E-01	5.02E-02	8.43E-01	12.7	94	65.5	3.94E+11	6.80E+01	6.62E-01

Table G-2. Mercury Waterbody Characteristics Used for Baseline and Floor/Standard

Site	Waterbody	Air Temp. (K)	Wind-speed (m/s)	WS Area Impervious to Fallout (km^2)	Area, Including Impervious Area (km^2)	Current Velocity (m/s)	Type	WB Depth (m)	WB Area (m^2)	Sediment Area (m^2)	Erosivity Factor, R (yr^{-1})	Topo-graphic Factor, LS (unitless)	Cover Mgmt Factor, C (unitless)	Support Practice Factor, Ps (unitless)	Average Annual Runoff, Ro (cm/yr)	Average Annual Precip-itation, P (cm/yr)	Average Annual Evapo-trans, Ev (cm/yr)	Dilution Outflow (m^3/yr)	Hydrologic Region TSS (g/m^3)	Resus-pension Velocity, vrs (m/yr)
202	Elk City Lake	287	6.10	7.27E+00	9.70E+01	NA	Lake	4.000	1.28E+07	1.28E+07	215	3.03E-01	6.23E-02	6.23E-01	7.6	74	52.1	7.39E+06	7.00E+01	6.81E-01
202	Montgomery County State Park Lake	287	6.10	9.85E-01	1.31E+01	NA	Lake	4.000	3.58E+05	3.58E+05	215	4.75E-01	7.58E-02	5.28E-01	7.6	74	52.1	1.00E+06	7.00E+01	6.81E-01
202	Verdigris River	287	6.10	6.73E+01	8.98E+02	0.820	River	1.250	3.27E+06	3.27E+06	215	3.28E-01	7.23E-02	5.66E-01	7.6	74	52.1	1.61E+09	2.06E+02	2.01E+00
203	Catalpa Creek	292	3.60	1.41E+00	2.82E+02	0.596	River	0.405	5.19E+05	5.19E+05	350	3.39E-01	6.15E-02	6.26E-01	24.1	139	97.4	1.06E+08	2.40E+01	2.34E-01
203	Gilmer Creek	292	3.60	6.31E-01	1.26E+02	0.458	River	0.171	1.24E+05	1.24E+05	350	3.03E-01	6.45E-02	6.11E-01	24.1	139	97.4	1.34E+07	2.40E+01	2.34E-01
203	N. Branch Magowah Creek	292	3.60	1.81E-01	3.62E+01	0.558	River	0.326	1.61E+05	1.61E+05	350	3.15E-01	6.34E-02	6.11E-01	24.1	139	97.4	6.34E+07	2.40E+01	2.34E-01
203	Shotbag Creek	292	3.60	3.77E-01	7.53E+01	0.558	River	0.326	1.78E+05	1.78E+05	350	4.50E-01	4.21E-02	7.53E-01	24.1	139	97.4	6.34E+07	2.40E+01	2.34E-01
204	Bay Creek	281	5.12	4.80E+00	1.23E+02	0.580	River	0.400	2.73E+05	2.73E+05	210	1.34E+00	5.98E-02	6.35E-01	11.4	78	54.3	1.20E+08	6.80E+01	6.62E-01
204	Little Calumet Creek	281	5.12	8.83E-01	2.26E+01	0.550	River	0.340	8.87E+04	8.87E+04	210	1.53E+00	6.51E-02	6.21E-01	11.4	78	54.3	6.62E+07	6.80E+01	6.62E-01
204	Upper and Lower Swan Lake	281	5.12	2.04E-01	5.23E+00	NA	Lake	4.000	4.58E+05	4.58E+05	210	1.66E-01	8.00E-02	5.00E-01	11.4	78	54.3	5.96E+05	3.80E+01	3.70E-01
204	Mississippi River	281	5.12	3.61E+01	9.26E+02	1.460	River	6.820	1.52E+07	1.52E+07	210	1.38E+00	5.83E-02	6.66E-01	11.4	78	54.3	1.16E+11	6.80E+01	6.62E-01
302	Maumee River	283	5.60	1.99E+01	4.98E+02	0.790	River	1.110	2.99E+06	2.99E+06	150	1.64E-01	7.61E-02	5.26E-01	12.7	91	63.8	4.56E+10	2.10E+01	2.04E-01
302	Auglaize River	283	5.60	2.61E+01	6.53E+02	0.820	River	1.250	1.04E+06	1.04E+06	150	1.40E-01	7.78E-02	5.30E-01	12.7	91	63.8	5.68E+10	2.10E+01	2.04E-01
302	Six Mile Creek	283	5.60	2.61E+00	6.53E+01	0.550	River	0.340	1.99E+05	1.99E+05	150	1.66E-01	9.74E-02	5.42E-01	12.7	91	63.8	2.30E+09	2.10E+01	2.04E-01
304	Big Walnut Creek	285	4.63	3.15E+01	4.19E+02	0.396	River	0.134	2.60E+06	2.60E+06	185	1.87E+00	7.16E-02	6.59E-01	15.0	101	70.4	3.04E+08	2.70E+01	2.63E-01
304	Glenn Flint Lake	285	4.63	3.02E+00	4.03E+01	NA	Lake	4.000	1.31E+06	1.31E+06	185	1.04E+00	7.45E-02	5.49E-01	15.0	101	70.4	6.04E+06	6.00E+00	5.84E-02
304	Deer Creek	285	4.63	1.68E+01	2.24E+02	0.290	River	0.101	1.86E+06	1.86E+06	185	1.71E+00	6.78E-02	6.44E-01	15.0	101	70.4	8.40E+07	2.70E+01	2.63E-01
320	Mud Devils Lake	279	4.10	1.35E+01	8.44E+01	NA	Lake	4.000	3.87E+06	3.87E+06	75	2.43E-01	2.87E-02	9.59E-01	12.7	73	51.2	1.07E+07	6.00E+00	5.84E-02
320	Thunder Bay River	279	4.10	5.69E+01	3.56E+02	0.497	River	0.469	6.05E+06	6.05E+06	75	4.86E-01	4.99E-02	7.60E-01	12.7	73	51.2	8.93E+08	2.10E+01	2.04E-01
320	Long Lake	279	4.10	9.76E+00	6.10E+01	NA	Lake	4.000	1.90E+07	1.90E+07	75	4.11E-01	2.37E-02	9.48E-01	12.7	73	51.2	7.74E+06	6.00E+00	5.84E-02
321	Black Warrior River	291	3.58	3.14E+01	4.25E+02	0.940	River	2.040	3.32E+06	3.32E+06	375	3.13E-01	5.65E-02	7.20E-01	25.4	132	92.1	5.60E+09	2.40E+01	2.34E-01
321	Powell Creek	291	3.58	1.01E+01	1.37E+02	0.700	River	0.670	2.92E+05	2.92E+05	375	5.69E-01	6.87E-02	6.30E-01	25.4	132	92.1	3.41E+08	2.40E+01	2.34E-01
321	Lake Demopolis	291	3.58	3.14E+01	4.25E+02	NA	Lake	4.000	4.28E+07	4.28E+07	375	3.13E-01	5.65E-02	7.20E-01	25.4	132	92.1	1.08E+08	6.00E+00	5.84E-02
321	Lake Henry	291	3.58	5.07E-01	6.86E+00	NA	Lake	4.000	1.20E+05	1.20E+05	375	9.81E-01	3.94E-02	7.78E-01	25.4	132	92.1	1.74E+06	6.00E+00	5.84E-02
BAT	Monocacy Creek	284	5.10	4.88E+00	1.22E+02	0.540	River	0.290	1.11E+06	1.11E+06	175	1.39E+00	8.12E-02	5.85E-01	22.2	112	78.6	4.73E+07	2.70E+01	2.63E-01
BAT	Lehigh River	284	5.10	3.27E+01	8.19E+02	0.838	River	0.722	8.63E+06	8.63E+06	175	1.71E+00	5.60E-02	7.57E-01	22.2	112	78.6	2.13E+09	2.70E+01	2.63E-01
CHA	Allen Lake	286	5.14	1.45E-01	1.33E+00	NA	Lake	4.000	7.32E+04	7.32E+04	244	9.52E-02	7.37E-02	5.42E-01	9.4	105	73.5	1.25E+05	7.00E+01	6.81E-01
CHA	Santa Fe Lake	286	5.14	1.04E+00	9.53E+00	NA	Lake	4.000	2.55E+05	2.55E+05	244	2.36E-01	6.22E-02	6.27E-01	9.4	105	73.5	8.96E+05	7.00E+01	6.81E-01
CHA	Neosho River	286	5.14	9.85E+01	9.04E+02	0.546	River	0.192	1.23E+06	1.23E+06	244	2.71E-01	7.75E-02	5.32E-01	9.4	105	73.5	2.20E+09	2.06E+02	2.01E+00
FOR	Walnut Bayou	255	4.61	1.38E+01	3.44E+02	0.550	River	0.340	5.53E+05	5.53E+05	210	1.96E-01	5.00E-02	7.12E-01	21.6	116	81.3	6.62E+07	2.06E+02	2.01E+00
FOR	West Flat Creek	255	4.61	1.75E+00	4.38E+01	0.430	River	0.130	6.36E+04	6.36E+04	210	3.21E-01	3.27E-02	8.49E-01	21.6	116	81.3	9.46E+06	2.06E+02	2.01E+00
FOR	Hamilton Lake	255	4.61	2.41E-01	6.02E+00	NA	Lake	4.000	2.28E+05	2.28E+05	210	7.82E-02	5.85E-02	6.43E-01	21.6	116	81.3	1.30E+06	7.00E+01	6.81E-01
FRE	Salt Creek	287	6.18	1.95E+00	4.88E+01	0.180	River	0.040	3.20E+04	3.20E+04	200	2.67E-01	7.50E-02	5.72E-01	5.1	74	52.1	2.78E+07	2.06E+02	2.01E+00
FRE	Verdigris River	287	6.18	1.92E+01	4.80E+02	0.546	River	0.055	1.17E+06	1.17E+06	200	2.82E-01	6.85E-02	5.90E-01	5.1	74	52.1	1.13E+09	2.06E+02	2.01E+00
FRE	Fall River	287	6.18	1.66E+01	4.16E+02	0.475	River	0.046	6.16E+05	6.16E+05	200	4.78E-01	5.29E-02	6.91E-01	5.1	74	52.1	4.61E+08	2.06E+02	2.01E+00
HAR	Indian Field Swamp	292	4.13	3.85E-02	9.62E-01	0.253	River	0.146	9.62E+05	9.62E+05	300	1.99E-01	4.96E-02	7.82E-01	12.7	132	92.1	1.23E+08	2.40E+01	2.34E-01
HAR	Walnut Branch	292	4.13	1.07E-02	2.67E-01	0.691	River	0.657	2.67E+05	2.67E+05	300	1.90E-01	1.83E-02	9.12E-01	12.7	132	92.1	3.39E+08	2.40E+01	2.34E-01
HAR	Huttos Lake	292	4.13	3.51E-02	8.77E-01	NA	Lake	4.000	2.31E+05	2.31E+05	300	2.36E-01	7.66E-02	5.24E-01	12.7	132	92.1	1.11E+05	6.00E+00	5.84E-02
HOL	Huttos Lake	291	4.12	3.51E-02	8.77E-01	NA	Lake	4.000	2.31E+05	2.31E+05	325	2.36E-01	7.66E-02	5.24E-01	12.5	130	90.7	1.10E+05	6.00E+00	5.84E-02
HOL	Lake Merkel	291	4.12	3.35E-01	8.38E+00	NA	Lake	4.000	8.90E+04	8.90E+04	325	1.83E-01	2.61E-02	8.59E-01	12.5	130	90.7	1.05E+06	6.00E+00	5.84E-02

Table G-2. Mercury Waterbody Characteristics Used for Baseline and Floor/Standard

Site	Waterbody	Air Temp. (K)	Wind-speed (m/s)	WS Area Impervious to Fallout (km^2)	Area, Including Impervious Area (km^2)	Current Velocity (m/s)	Type	WB Depth (m)	WB Area (m^2)	Sediment Area (m^2)	Erosivity Factor, R (yr^{-1})	Topo-graphic Factor, LS (unitless)	Cover Mgmt Factor, C (unitless)	Support Practice Factor, Ps (unitless)	Average Annual Runoff, Ro (cm/yr)	Average Annual Precip-itation, P (cm/yr)	Average Annual Evapo-trans, Ev (cm/yr)	Dilution Outflow (m^3/yr)	Hydrologic Region TSS (g/m^3)	Resus-pension Velocity, vrs (m/yr)
TEX	Armstrong Creek	292	5.66	2.66E+00	6.66E+01	0.460	River	0.174	7.66E+04	7.66E+04	275	4.64E-01	7.92E-02	5.05E-01	2.5	82	57.4	1.39E+07	7.20E+01	7.01E-01
TEX	Massey Lake	292	5.66	5.79E-01	1.45E+01	NA	Lake	4.000	2.51E+05	2.51E+05	275	4.76E-01	7.94E-02	5.04E-01	2.5	82	57.4	3.62E+05	7.00E+01	6.81E-01
TEX	Mountain Creek	292	5.66	1.36E+01	3.40E+02	0.162	River	0.067	1.17E+05	1.17E+05	275	5.35E-01	7.94E-02	5.65E-01	2.5	82	57.4	2.26E+07	7.20E+01	7.01E-01
TEX	Waxahachie Creek	292	5.66	6.09E+00	1.52E+02	0.113	River	0.101	1.02E+05	1.02E+05	275	4.40E-01	7.35E-02	5.54E-01	2.5	82	57.4	8.79E+06	7.20E+01	7.01E-01
WAM	Connoquenessing Creek	284	5.13	5.26E+01	2.94E+02	0.709	River	0.716	7.06E+05	7.06E+05	125	2.22E+00	5.25E-02	7.64E-01	17.8	94	65.9	4.65E+08	2.70E+01	2.63E-01
WAM	Hereford Manor Lake	284	5.13	5.35E-01	2.99E+00	n/a	Lake	4.000	1.88E+05	1.88E+05	125	2.55E+00	5.13E-02	6.95E-01	17.8	94	65.9	5.32E+05	6.00E+00	5.84E-02
WAM	Beaver River	284	5.13	9.08E+01	5.07E+02	0.792	River	1.372	1.16E+06	1.16E+06	125	1.30E+00	5.83E-02	7.98E-01	17.8	94	65.9	3.25E+09	2.70E+01	2.63E-01
WAM	Slippery Rock Creek	284	5.13	2.61E+01	1.46E+02	0.652	River	1.140	1.84E+06	1.84E+06	125	1.50E+00	7.03E-02	7.56E-01	17.8	94	65.9	1.03E+09	2.70E+01	2.63E-01
ARV	James River	288	3.60	3.81E+01	9.52E+02	0.880	River	1.650	3.43E+06	3.43E+06	170	1.30E+00	3.98E-02	8.80E-01	17.8	109	76.4	3.60E+09	2.70E+01	2.63E-01
ARV	Sports Lake	288	3.60	2.28E+00	5.70E+01	N/A	Lake	4.000	2.76E+05	2.76E+05	170	1.28E+00	6.19E-02	8.97E-01	17.8	109	76.4	1.01E+07	6.00E+00	5.84E-02
ARV	Holman Creek	288	3.60	4.92E-01	1.23E+01	0.460	River	0.180	3.68E+04	3.68E+04	170	1.84E+00	1.72E-02	9.23E-01	17.8	109	76.4	1.26E+07	2.70E+01	2.63E-01
ARV	Rivanna River	288	3.60	8.75E+00	2.19E+02	0.700	River	0.670	1.30E+06	1.30E+06	170	1.70E+00	2.94E-02	8.70E-01	17.8	109	76.4	3.41E+08	2.70E+01	2.63E-01
BRO	Bluelick Creek	289	5.60	3.03E+00	2.10E+01	0.460	River	0.180	5.71E+04	5.71E+04	280	2.59E+00	5.09E-02	8.91E-01	20.3	99	69.2	1.26E+07	2.70E+01	2.63E-01
BRO	McNeely Lake	289	5.60	1.88E+00	1.31E+01	NA	Lake	4.000	3.11E+05	3.11E+05	280	1.38E+00	4.05E-02	7.81E-01	20.3	99	69.2	2.66E+06	6.00E+00	5.84E-02
BRO	Silver Lake	289	5.60	2.14E-02	1.49E-01	NA	Lake	4.000	5.12E+04	5.12E+04	280	1.58E-01	1.08E-02	9.61E-01	20.3	99	69.2	3.02E+04	6.00E+00	5.84E-02
BRO	Salt River	289	5.60	1.11E+02	7.74E+02	0.790	River	1.110	3.51E+06	3.51E+06	280	1.93E+00	3.83E-02	8.07E-01	20.3	99	69.2	1.29E+09	2.70E+01	2.63E-01
CAS	Cascade Creek	282	5.14	7.86E+00	1.05E+02	0.560	River	0.725	4.14E+05	4.14E+05	200	1.26E+00	3.96E-02	8.48E-01	25.4	91	63.6	6.34E+07	2.40E+01	2.34E-01
CAS	Smith River	282	5.14	1.83E+01	2.44E+02	0.411	River	0.527	1.44E+06	1.44E+06	200	1.66E+00	2.28E-02	8.89E-01	25.4	91	63.6	5.66E+08	2.40E+01	2.34E-01
CAS	Dan River	282	5.14	4.61E-01	6.15E+00	0.521	River	0.330	4.69E+06	4.69E+06	200	1.40E+00	4.08E-02	8.34E-01	25.4	91	63.6	1.94E+09	2.40E+01	2.34E-01
COH	Troy Reservoir	287	3.60	1.12E+00	2.46E+00	NA	Lake	4.000	1.78E+05	1.78E+05	125	2.22E+00	5.43E-02	6.75E-01	21.6	108	75.6	5.30E+05	6.00E+00	5.84E-02
COH	Hudson River	287	3.60	3.87E+02	8.47E+02	0.969	River	1.591	1.27E+07	1.27E+07	125	1.15E+00	3.62E-02	8.55E-01	21.6	108	75.6	1.30E+10	2.70E+01	2.63E-01
COH	Mohawk River	287	3.60	1.21E+02	2.64E+02	0.750	River	0.600	1.61E+07	1.61E+07	125	7.42E-01	3.55E-02	9.11E-01	21.6	108	75.6	5.18E+09	2.70E+01	2.63E-01
COH	Tomahannock Reservoir	287	3.60	3.61E+01	7.90E+01	NA	Lake	4.000	7.03E+06	7.03E+06	125	1.98E+00	4.06E-02	7.72E-01	21.6	108	75.6	1.71E+07	6.00E+00	5.84E-02
NOR	Rocky River	289	4.10	4.35E+00	8.71E+02	0.760	River	0.960	1.96E+06	1.96E+06	260	1.43E+00	5.52E-02	7.01E-01	20.3	109	76.1	9.74E+08	2.40E+01	2.34E-01
NOR	Long Lake/Creek	289	4.10	1.56E-01	3.13E+01	NA	Lake	4.000	5.99E+05	5.99E+05	260	1.08E+00	6.52E-02	6.56E-01	20.3	109	76.1	6.35E+06	6.00E+00	5.84E-02
NOR	Lake Tillery	289	4.10	1.02E+00	2.03E+02	NA	Lake	4.000	1.88E+07	1.88E+07	260	1.61E+00	6.34E-02	8.48E-01	20.3	109	76.1	4.13E+07	6.00E+00	5.84E-02
334	Mississippi River	280	6.20	3.28E+01	8.41E+02	1.012	River	1.713	2.92E+07	2.92E+07	150	9.68E-01	7.17E-02	6.14E-01	6.4	74	51.6	1.47E+10	6.80E+01	6.62E-01
334	Vermilion River	280	6.20	1.56E+01	4.01E+02	0.274	River	0.250	1.68E+06	1.68E+06	150	5.08E-01	7.66E-02	5.38E-01	6.4	74	51.6	7.32E+07	6.80E+01	6.62E-01
334	Colby Lake	280	6.20	1.75E-02	4.49E-01	NA	Lake	4.000	4.49E+05	4.49E+05	150	1.05E+00	8.00E-02	5.00E-01	6.4	74	51.6	2.88E+04	3.80E+01	3.70E-01
334	Lake Isabelle	280	6.20	5.31E-02	1.36E+00	NA	Lake	4.000	3.32E+05	3.32E+05	150	3.27E-01	8.62E-03	1.00E+00	6.4	74	51.6	8.72E+04	3.80E+01	3.70E-01
463	Blue River	285	5.70	1.06E+02	2.16E+02	0.274	River	0.536	5.52E+05	5.52E+05	210	8.60E-01	1.93E-02	9.97E-01	8.9	97	67.6	8.64E+06	1.20E+02	1.17E+00
463	Rock Creek	285	5.70	1.16E+01	2.36E+01	0.460	River	0.170	5.89E+04	5.89E+04	210	1.40E+00	9.87E-03	1.00E+00	8.9	97	67.6	1.45E+07	1.20E+02	1.17E+00
463	Shoal Creek	285	5.70	8.20E+01	1.67E+02	0.070	River	0.137	8.92E+04	8.92E+04	210	8.84E-01	5.79E-02	6.75E-01	8.9	97	67.6	2.21E+06	1.20E+02	1.17E+00
463	Missouri River	285	5.70	4.29E+02	8.73E+02	1.061	River	1.939	1.10E+07	1.10E+07	210	8.75E-01	4.57E-02	8.39E-01	8.9	97	67.6	3.35E+07	1.20E+02	1.17E+00
464	Ottawa River	284	5.13	1.46E+02	3.77E+02	0.372	River	1.478	1.27E+06	1.27E+06	150	4.54E-01	7.35E-02	6.15E-01	12.7	93	65.2	1.53E+08	2.10E+01	2.04E-01
464	Twin Lakes Reservoir	284	5.13	1.65E-01	4.25E-01	NA	Lake	4.000	5.33E+04	5.33E+04	150	5.79E-01	1.87E-01	1.00E+00	12.7	93	65.2	5.40E+04	6.00E+00	5.84E-02
464	Metzger/Ferguson Reservoir	284	5.13	7.12E-01	1.84E+00	NA	Lake	4.000	1.84E+06	1.84E+06	150	5.79E-01	7.60E-02	5.28E-01	12.7	93	65.2	2.34E+05	6.00E+00	5.84E-02
504	Pennsauken Creek	286	4.63	2.00E+01	4.07E+01	0.207	River	0.229	9.73E+04	9.73E+04	180	3.20E-01	4.53E-02	9.72E-01	22.2	105	73.6	3.88E+07	2.70E+01	2.63E-01
504	Darby Creek	286	4.63	8.64E+01	1.76E+02	0.296	River	0.158	1.76E+05	1.76E+05	180	9.72E-01	2.75E-02	9.89E-01	22.2	105	73.6	8.80E+07	2.70E+01	2.63E-01
504	Cooper River Lake	286	4.63	2.49E+01	5.06E+01	N/A	Lake	4.000	4.40E+05	4.40E+05	180	3.98E-01	1.41E-02	9.68E-01	22.2	105	73.6	1.12E+07	6.00E+00	5.84E-02
504	Schuylkill River	286	4.63	8.79E+01	1.79E+02	0.756	River	0.579	7.43E+05	7.43E+05	180	9.91E-01	2.76E-02	9.82E-01	22.2	105	73.6	2.80E+09	2.70E+01	2.63E-01
600	Lake Jackson	295	6.20	3.98E-01	2.23E+00	NA	Lake	4.000	1.64E+06	1.64E+06	275	6.93E-02	7.36E-01	9.60E-01	6.4	74	51.9	1.42E+05	7.00E+01	6.81E-01
600	Oyster Creek	295	6.20	1.03E+01	5.75E+01	0.475	River	0.262	1.11E+06	1.11E+06	275	7.01E-02	4.27E-02	8.56E-01	6.4	74	51.9	2.98E+08	7.20E+01	7.01E-01
600	Brazos River	295	6.20	1.77E+01	9.90E+01	0.783	River	1.664	4.86E+06	4.86E+06	275	6.94E-02	6.05E-02	8.22E-01	6.4	74	51.9	7.20E+09	7.20E+01	7.01E-01

Table G-2. Mercury Waterbody Characteristics Used for Baseline and Floor/Standard

Site	Waterbody	Air Temp. (K)	Wind-speed (m/s)	WS Area Impervious to Fallout (km^2)	Area, Including Impervious Area (km^2)	Current Velocity (m/s)	Type	WB Depth (m)	WB Area (m^2)	Sediment Area (m^2)	Erosivity Factor, R (yr^{-1})	Topo-graphic Factor, LS (unitless)	Cover Mgmt Factor, C (unitless)	Support Practice Factor, Ps (unitless)	Average Annual Runoff, Ro (cm/yr)	Average Annual Precip-itation, P (cm/yr)	Average Annual Evapo-trans, Ev (cm/yr)	Dilution Outflow (m^3/yr)	Hydrologic Region TSS (g/m^3)	Resus-pension Velocity, vrs (m/yr)
711	Brechtel Lake	294	4.13	4.96E-02	6.71E-01	NA	Lake	4.000	1.41E+05	1.41E+05	550	6.93E-02	1.00E-02	1.00E+00	25.4	154	107.7	1.70E+05	3.80E+01	3.70E-01
711	Mississippi River	294	4.13	5.67E+00	7.66E+01	2.228	River	6.687	6.55E+07	6.55E+07	550	8.65E-02	3.49E-02	9.36E-01	25.4	154	107.7	4.18E+11	1.63E+02	1.59E+00
806	Wolf Lake	283	4.61	7.62E+00	1.21E+01	NA	Lake	4.000	3.51E+06	3.51E+06	155	5.94E-01	1.25E-01	1.00E+00	12.7	90	62.9	1.54E+06	6.00E+00	5.84E-02
806	Lake George	283	4.61	1.02E+00	1.63E+00	NA	Lake	4.000	5.29E+05	5.29E+05	155	5.94E-01	3.65E-01	1.00E+00	12.7	90	62.9	2.06E+05	6.00E+00	5.84E-02
806	Little Calumet River	283	4.61	3.34E+02	5.29E+02	0.550	River	0.340	5.61E+05	5.61E+05	155	2.82E-01	4.64E-02	9.18E-01	12.7	90	62.9	6.62E+07	6.80E+01	6.62E-01
806	Grand Calumet River	283	4.61	6.13E+01	9.73E+01	0.490	River	0.230	1.75E+05	1.75E+05	155	5.94E-01	7.03E-02	9.90E-01	12.7	90	62.9	3.15E+07	2.10E+01	2.04E-01
915	Genesee River	282	5.66	2.00E+02	3.00E+02	0.732	River	0.512	1.08E+06	1.08E+06	75	6.87E-01	4.94E-02	7.66E-01	19.1	81	56.5	2.52E+09	2.10E+01	2.04E-01
915	Irondequoit Bay	282	5.66	1.67E+02	2.51E+02	NA	Lake	4.000	6.88E+06	6.88E+06	75	9.61E-01	3.93E-02	8.62E-01	19.1	81	56.5	4.80E+07	6.00E+00	5.84E-02
915	Highland Reservoir	282	5.66	1.52E-02	2.29E-02	NA	Lake	4.000	2.29E+04	2.29E+04	75	2.66E+00	1.00E-02	1.00E+00	19.1	81	56.5	4.36E+03	6.00E+00	5.84E-02
A32	Armand Bayou	294	4.10	1.38E+01	1.28E+02	0.320	River	0.165	8.10E+04	8.10E+04	400	6.93E-02	6.95E-02	6.73E-01	12.7	119	83.4	1.08E+08	7.20E+01	7.01E-01
A43	Twelvemile Creek	282	6.17	3.88E+01	6.93E+01	0.213	River	0.091	7.23E+04	7.23E+04	80	4.80E-01	9.71E-03	9.98E-01	21.6	97	67.8	4.10E+07	2.10E+01	2.04E-01
A43	Bergholtz Creek	282	6.17	2.66E+01	4.75E+01	0.458	River	0.171	7.57E+04	7.57E+04	80	5.50E-01	1.83E-02	1.00E+00	21.6	97	67.8	1.34E+07	2.10E+01	2.04E-01
A43	Cayuga Creek	282	6.17	2.07E+01	3.70E+01	0.387	River	0.250	1.37E+05	1.37E+05	80	4.04E-01	2.38E-02	1.00E+00	21.6	97	67.8	1.72E+08	2.10E+01	2.04E-01
A43	Niagara River	282	6.17	4.11E+02	7.34E+02	0.771	River	0.875	2.17E+06	2.17E+06	80	4.45E-01	2.97E-02	9.34E-01	21.6	97	67.8	8.06E+08	2.10E+01	2.04E-01
A50	Carpenters Bayou	294	4.13	8.35E+00	5.84E+01	0.274	River	0.143	1.44E+05	1.44E+05	450	8.64E-02	3.62E-02	8.04E-01	15.2	119	83.4	7.45E+07	7.20E+01	7.01E-01
A50	Highlands Reservoir	294	4.13	7.45E-01	5.21E+00	NA	Lake	4.000	1.89E+06	1.89E+06	450	6.93E-02	8.00E-02	5.00E-01	15.2	119	83.4	7.92E+05	7.00E+01	6.81E-01
A50	Buffalo Bayou	294	4.13	3.11E+01	2.18E+02	0.646	River	1.195	1.84E+06	1.84E+06	450	7.10E-02	3.32E-02	8.79E-01	15.2	119	83.4	3.43E+09	7.20E+01	7.01E-01
A50	San Jacinto River	294	4.13	1.27E+01	8.89E+01	0.561	River	0.351	7.56E+05	7.56E+05	450	8.54E-02	3.56E-02	8.32E-01	15.2	119	83.4	2.33E+09	7.20E+01	7.01E-01
A62	Caney Creek	294	4.12	2.82E+01	1.96E+02	0.265	River	0.140	3.95E+05	3.95E+05	425	1.91E-01	1.13E-02	9.96E-01	12.7	119	83.4	1.33E+08	7.20E+01	7.01E-01
A62	E & W Fork Crystal Cr.	294	4.12	1.41E+01	9.77E+01	0.780	River	0.375	3.41E+05	3.41E+05	425	3.05E-01	3.79E-02	9.89E-01	12.7	119	83.4	1.10E+08	7.20E+01	7.01E-01
A62	Stewarts Creek	294	4.12	8.11E+00	5.63E+01	0.216	River	0.094	1.05E+05	1.05E+05	425	3.51E-01	1.41E-02	9.89E-01	12.7	119	83.4	4.31E+07	7.20E+01	7.01E-01
A62	Lewis Creek Reservoir	294	4.12	1.42E+00	9.84E+00	NA	Lake	4.000	1.75E+06	1.75E+06	425	4.36E-01	5.34E-03	9.98E-01	12.7	119	83.4	1.25E+06	7.00E+01	6.81E-01
B20	Cuyahoga River	283	5.12	1.61E+02	3.82E+02	0.730	River	0.820	8.47E+05	8.47E+05	120	1.04E+00	3.18E-02	9.31E-01	12.7	94	65.9	6.56E+08	2.10E+01	2.04E-01
B20	Upper and Lower Shaker Lake	283	5.12	5.35E+00	1.27E+01	NA	Lake	4.000	9.43E+04	9.43E+04	120	7.77E-01	1.00E-02	1.00E+00	12.7	94	65.9	1.62E+06	6.00E+00	5.84E-02
B20	Euclid Creek	283	5.12	2.27E+01	5.40E+01	0.490	River	0.230	1.11E+05	1.11E+05	120	8.74E-01	1.96E-02	9.26E-01	12.7	94	65.9	3.15E+07	2.10E+01	2.04E-01
B20	Fairmont Reservoir	283	5.12	1.36E-01	3.24E-01	NA	Lake	4.000	2.77E+04	2.77E+04	120	9.70E-01	1.00E-02	1.00E+00	12.7	94	65.9	4.12E+04	6.00E+00	5.84E-02
HAN	Fabius River	287	5.10	1.16E+00	2.32E+02	0.700	River	0.670	1.42E+06	1.42E+06	200	9.04E-01	7.77E-02	5.41E-01	12.7	94	65.5	3.41E+08	6.80E+01	6.62E-01
HAN	Spring Lake	287	5.10	1.00E-03	2.01E-01	NA	Lake	4.000	2.73E+04	2.73E+04	200	1.19E+00	9.61E-03	1.00E+00	12.7	94	65.5	2.29E+04	3.80E+01	3.70E-01
HAN	Mississippi River	287	5.10	4.34E+00	8.67E+02	1.310	River	5.570	1.42E+07	1.42E+07	200	8.87E-01	6.87E-02	6.11E-01	12.7	94	65.5	7.03E+10	6.80E+01	6.62E-01
KIN	North Fork Holston River	287	4.10	1.11E+02	3.16E+02	0.700	River	0.670	1.07E+06	1.07E+06	160	4.43E+00	2.74E-02	8.59E-01	22.9	105	73.4	3.41E+08	1.50E+01	1.46E-01
KIN	Kingsport Reservoir	287	4.10	4.73E-01	1.34E+00	NA	Lake	4.000	2.17E+05	2.17E+05	160	5.19E+00	5.00E-03	1.00E+00	22.9	105	73.4	3.08E+05	6.00E+00	5.84E-02
KIN	South Fork Holston River	287	4.10	1.68E+02	4.76E+02	0.820	River	1.250	1.77E+06	1.77E+06	160	2.53E+00	5.10E-02	7.43E-01	22.9	105	73.4	1.61E+09	1.50E+01	1.46E-01
KIN	Reedy Creek	287	4.10	4.14E+01	1.17E+02	0.490	River	0.230	2.03E+05	2.03E+05	160	2.95E+00	3.25E-02	8.66E-01	22.9	105	73.4	3.15E+07	1.50E+01	1.46E-01
MCI	Hals Lake	293	4.61	5.15E+00	1.32E+02	NA	Lake	4.000	1.12E+06	1.12E+06	410	7.40E-01	7.10E-03	9.86E-01	25.4	167	116.6	3.35E+07	6.00E+00	5.84E-02
MCI	Hellcat Lake	293	4.61	3.27E-01	8.38E+00	NA	Lake	4.000	2.24E+05	2.24E+05	410	1.22E-01	5.14E-03	1.00E+00	25.4	167	116.6	2.13E+06	6.00E+00	5.84E-02
MCI	Alabama River	293	4.61	8.35E+00	2.14E+02	1.100	River	3.510	8.63E+06	8.63E+06	410	1.40E-01	8.09E-03	9.79E-01	25.4	167	116.6	2.08E+10	2.40E+01	2.34E-01
MCI	Tombigbee River	293	4.61	2.86E+01	7.33E+02	1.070	River	3.150	8.03E+06	8.03E+06	410	2.95E-01	1.92E-02	9.60E-01	25.4	167	116.6	1.64E+10	2.40E+01	2.34E-01
MID	Tittabawassee River	281	5.12	1.28E+02	3.65E+02	0.820	River	1.250	6.20E+06	6.20E+06	75	1.19E-01	4.89E-02	7.73E-01	6.4	78	54.3	1.61E+09	2.10E+01	2.04E-01
MID	Sturgeon Creek	281	5.12	5.09E+01	1.45E+02	0.550	River	0.340	2.40E+05	2.40E+05	75	1.18E-01	4.19E-02	7.92E-01	6.4	78	54.3	6.62E+07	2.10E+01	2.04E-01
MID	Kawkawlin River	281	5.12	9.13E+01	2.59E+02	0.550	River	0.670	3.88E+05	3.88E+05	75	1.22E-01	7.22E-02	5.86E-01	6.4	78	54.3	6.62E+07	2.10E+01	2.04E-01
MID	Chippewa River	281	5.12	3.55E+01	1.01E+02	0.700	River	0.670	5.68E+05	5.68E+05	75	1.22E-01	4.10E-02	8.41E-01	6.4	78	54.3	3.41E+08	2.10E+01	2.04E-01

Table G-2. Mercury Waterbody Characteristics Used for Baseline and Floor/Standard

Site	Waterbody	Air Temp. (K)	Wind-speed (m/s)	WS Area Impervious to Fallout (km^2)	Area, Including Impervious Area (km^2)	Current Velocity (m/s)	Type	WB Depth (m)	WB Area (m^2)	Sediment Area (m^2)	Erosivity Factor, R (yr^{-1})	Topo-graphic Factor, LS (unitless)	Cover Mgmt Factor, C (unitless)	Support Practice Factor, Ps (unitless)	Average Annual Runoff, Ro (cm/yr)	Average Annual Precip-itation, P (cm/yr)	Average Annual Evapo-trans, Ev (cm/yr)	Dilution Outflow (m^3/yr)	Hydrologic Region TSS (g/m^3)	Resus-pension Velocity, vrs (m/yr)
STG	Bayou Plaquemine	293	4.10	7.06E-01	9.54E+00	0.460	River	0.170	5.71E+04	5.71E+04	500	9.52E-02	6.15E-02	6.64E-01	22.9	146	102.2	1.34E+07	1.63E+02	1.59E+00
STG	Manchac Bayou	293	4.10	2.70E+01	3.64E+02	0.250	River	0.253	3.07E+05	3.07E+05	500	2.77E-01	4.98E-02	7.81E-01	22.9	146	102.2	1.19E+08	1.63E+02	1.59E+00
STG	Bayou Fountain	293	4.10	7.72E+00	1.04E+02	0.238	River	0.287	3.16E+05	3.16E+05	500	2.41E-01	6.83E-02	7.27E-01	22.9	146	102.2	5.25E+07	1.63E+02	1.59E+00
STG	Mississippi River	293	4.10	8.67E+00	1.17E+02	2.228	River	6.642	7.29E+07	7.29E+07	500	1.70E-01	6.42E-02	8.93E-01	22.9	146	102.2	4.17E+11	1.63E+02	1.59E+00
340	Sunfish Creek	286	3.60	9.85E+00	1.33E+02	0.247	River	0.098	1.51E+05	1.51E+05	150	6.68E+00	3.34E-02	8.21E-01	17.8	105	73.6	1.17E+08	2.70E+01	2.63E-01
340	Proctor Creek	286	3.60	4.17E+00	5.63E+01	0.560	River	0.330	1.48E+05	1.48E+05	150	2.56E+00	2.04E-02	8.98E-01	17.8	105	73.6	6.34E+07	2.70E+01	2.63E-01
340	Fish Creek	286	3.60	2.01E+01	2.72E+02	0.326	River	0.521	6.50E+05	6.50E+05	150	2.99E+00	2.45E-02	8.70E-01	17.8	105	73.6	2.01E+08	2.70E+01	2.63E-01
340	Ohio River	286	3.60	8.00E+01	1.08E+03	0.817	River	3.097	1.32E+07	1.32E+07	150	3.94E+00	2.56E-02	8.82E-01	17.8	105	73.6	3.49E+10	2.70E+01	2.63E-01
342	Kalamazoo River	282	5.66	2.54E+02	5.16E+02	0.521	River	0.927	2.47E+06	2.47E+06	150	4.85E-01	6.62E-02	6.38E-01	12.7	78	54.4	1.01E+09	2.10E+01	2.04E-01
342	East Lake	282	5.66	4.25E+00	8.64E+00	NA	Lake	4.000	4.84E+05	4.84E+05	150	3.18E-01	8.00E-02	5.00E-01	12.7	78	54.4	1.10E+06	6.00E+00	5.84E-02
342	Portage Creek	282	5.66	7.08E+01	1.44E+02	0.539	River	0.291	3.06E+05	3.06E+05	150	4.83E-01	5.43E-02	7.35E-01	12.7	78	54.4	4.83E+07	2.10E+01	2.04E-01
342	Portage River	282	5.66	2.07E+02	4.20E+02	0.256	River	0.277	3.77E+05	3.77E+05	150	5.31E-01	7.30E-02	5.48E-01	12.7	78	54.4	6.38E+07	2.10E+01	2.04E-01
453	Lake Spivey	290	4.61	1.53E+01	2.91E+01	NA	Lake	4.000	1.90E+06	1.90E+06	300	1.80E+00	6.60E-02	9.20E-01	24.1	127	88.6	7.02E+06	6.00E+00	5.84E-02
453	Jester Creek	290	4.61	1.55E+01	2.94E+01	0.460	River	0.180	5.65E+04	5.65E+04	300	1.59E+00	8.21E-02	9.89E-01	24.1	127	88.6	3.15E+07	2.40E+01	2.34E-01
453	Flint River	290	4.61	1.48E+02	2.82E+02	0.580	River	0.400	4.09E+05	4.09E+05	300	1.35E+00	6.33E-02	9.12E-01	24.1	127	88.6	1.20E+08	2.40E+01	2.34E-01
468	Wissahickon Creek	286	4.63	8.51E+01	1.62E+02	0.580	River	0.370	3.83E+05	3.83E+05	180	7.66E-01	2.97E-02	8.91E-01	21.6	105	73.6	8.58E+07	2.70E+01	2.63E-01
468	Tacony Creek	286	4.63	4.10E+01	7.80E+01	7.050	River	0.216	1.17E+05	1.17E+05	180	1.23E+00	1.14E-02	1.00E+00	21.6	105	73.6	2.37E+07	2.70E+01	2.63E-01
468	Schuylkill	286	4.63	3.10E+02	5.88E+02	0.756	River	0.579	1.45E+06	1.45E+06	180	1.04E+00	4.58E-02	8.17E-01	21.6	105	73.6	2.80E+09	2.70E+01	2.63E-01
468	Pickering Creek Reservoir	286	4.63	1.23E+01	2.34E+01	NA	Lake	4.000	5.33E+05	5.33E+05	180	1.51E+00	5.37E-02	7.36E-01	21.6	105	73.6	5.05E+06	6.00E+00	5.84E-02
701	Wabash River	285	4.63	3.96E+00	7.93E+02	0.914	River	0.850	3.78E+06	3.78E+06	200	5.31E-01	7.51E-02	5.88E-01	15.2	102	71.5	9.21E+09	2.70E+01	2.63E-01
701	Sugar Creek	285	4.63	2.33E-01	4.67E+01	0.536	River	0.213	2.25E+05	2.25E+05	200	1.00E+00	4.51E-02	7.33E-01	15.2	102	71.5	6.26E+08	2.70E+01	2.63E-01
701	Big Raccoon Creek	285	4.63	1.84E+00	3.68E+02	0.479	River	0.354	7.67E+05	7.67E+05	200	1.49E+00	5.31E-02	6.81E-01	15.2	102	71.5	4.70E+08	2.70E+01	2.63E-01
704	Garvey Reservoir	290	4.13	8.19E-02	1.17E-01	NA	Lake	4.000	1.17E+05	1.17E+05	50	4.50E-01	1.00E-02	1.00E+00	1.3	29	20.1	1.52E+03	9.00E+00	8.76E-02
704	Legg Lake	290	4.13	9.50E-02	1.36E-01	NA	Lake	4.000	1.36E+05	1.36E+05	50	1.83E-01	4.98E-02	7.16E-01	1.3	29	20.1	1.76E+03	9.00E+00	8.76E-02
704	Silver Lake Res.	290	4.13	8.68E-01	1.24E+00	NA	Lake	4.000	2.97E+05	2.97E+05	50	7.09E+00	2.27E-01	1.00E+00	1.3	29	20.1	1.61E+04	9.00E+00	8.76E-02
708	Grindle Creek	289	4.10	2.29E+01	2.10E+02	0.550	River	0.340	5.06E+05	5.06E+05	300	1.85E-01	3.68E-02	7.89E-01	14.0	107	74.7	6.62E+07	2.40E+01	2.34E-01
708	Parker Creek	289	4.10	2.92E+00	2.68E+01	0.460	River	0.180	6.38E+04	6.38E+04	300	1.79E-01	8.68E-02	7.53E-01	14.0	107	74.7	1.26E+07	2.40E+01	2.34E-01
708	Tranters Creek	289	4.10	2.42E+01	2.22E+02	0.700	River	0.670	1.04E+06	1.04E+06	300	1.85E-01	3.83E-02	7.84E-01	14.0	107	74.7	3.41E+08	2.40E+01	2.34E-01
725	Passaic River	286	6.20	7.50E-01	1.79E+00	0.567	River	0.518	1.06E+08	1.06E+08	175	8.97E-01	2.63E-02	1.00E+00	25.4	110	76.7	1.25E+09	2.70E+01	2.63E-01
725	Silver Lake Reservoir	286	6.20	6.61E-02	1.57E-01	NA	Lake	4.000	3.83E+05	3.83E+05	175	5.94E-01	1.00E-02	1.00E+00	25.4	110	76.7	4.00E+04	6.00E+00	5.84E-02
725	Reservoir No. 2	286	6.20	1.48E-02	3.52E-02	NA	Lake	4.000	1.05E+05	1.05E+05	175	1.48E+00	1.00E-02	1.00E+00	25.4	110	76.7	8.94E+03	6.00E+00	5.84E-02
725	Rahway River	286	6.20	3.08E-01	7.33E-01	0.372	River	0.460	1.39E+08	1.39E+08	175	9.62E-01	1.55E-02	1.00E+00	25.4	110	76.7	1.54E+08	2.70E+01	2.63E-01
824	Newton Lake	286	4.63	4.19E+00	1.19E+01	NA	Lake	4.000	3.91E+05	3.91E+05	185	4.02E-01	1.00E-02	1.00E+00	22.9	105	73.6	2.73E+06	6.00E+00	5.84E-02
824	Big Timber Creek	286	4.63	4.73E+01	1.34E+02	0.201	River	0.201	5.13E+04	5.13E+04	185	3.40E-01	4.43E-02	9.00E-01	22.9	105	73.6	8.10E+07	2.70E+01	2.63E-01
824	Darby Creek	286	4.63	5.01E+01	1.42E+02	0.296	River	0.158	1.45E+05	1.45E+05	185	8.82E-01	2.59E-02	1.00E+00	22.9	105	73.6	8.80E+07	2.70E+01	2.63E-01
824	Schuylkill River	286	4.63	3.25E+01	9.24E+01	0.756	River	0.579	5.53E+05	5.53E+05	185	6.76E-01	3.90E-02	1.00E+00	22.9	105	73.6	2.80E+09	2.70E+01	2.63E-01
904	Pascagoula River	293	4.60	1.05E+01	4.93E+01	1.049	River	4.572	9.20E+05	9.20E+05	550	1.62E-01	1.92E-02	9.14E-01	38.1	167	116.6	1.41E+10	2.40E+01	2.34E-01
904	Escatawpa River	293	4.60	3.96E+01	1.86E+02	0.710	River	0.951	2.04E+06	2.04E+06	550	1.79E-01	3.33E-02	8.77E-01	38.1	167	116.6	2.33E+09	2.40E+01	2.34E-01
906	Mississippi River	283	5.70	2.10E+01	5.40E+02	0.924	River	2.944	1.41E+07	1.41E+07	180	7.95E-01	6.57E-02	6.59E-01	8.9	94	65.9	4.88E+10	6.80E+01	6.62E-01
906	Copperas Creek	283	5.70	3.85E+00	9.87E+01	0.311	River	0.274	2.20E+05	2.20E+05	180	1.07E+00	7.28E-02	5.49E-01	8.9	94	65.9	9.96E+07	6.80E+01	6.62E-01
906	Eliza Creek	283	5.70	3.65E+00	9.36E+01	0.320	River	0.283	2.75E+05	2.75E+05	180	1.17E+00	7.11E-02	5.62E-01	8.9	94	65.9	1.05E+08	6.80E+01	6.62E-01
906	Muscatine Slough	283	5.70	5.78E+00	1.48E+02	0.560	River	0.330	2.94E+05	2.94E+05	180	5.58E-01	7.26E-02	6.00E-01	8.9	94	65.9	6.32E+00	6.80E+01	6.62E-01
A14	New River	293	4.10	1.60E+01	2.16E+02	0.320	River	0.293	5.57E+05	5.57E+05	550	1.20E-01	3.82E-02	7.86E-01	22.9	146	102.3	1.07E+08	1.63E+02	1.59E+00
A14	Bayou Conway	293	4.10	9.91E+00	1.34E+02	0.560	River	0.330	3.01E+05	3.01E+05	550	8.81E-02	6.58E-02	7.19E-01	22.9	146	102.3	6.32E+07	1.63E+02	1.59E+00
A14	Mississippi River	293	4.10	5.33E+00	7.21E+01	2.228	River	6.657	6.07E+07	6.07E+07	550	1.33E-01	4.93E-02	8.77E-01	22.9	146	102.3	4.16E+11	1.63E+02	1.59E+00
A14	Bayou Lafourche	293	4.10	2.61E-01	3.53E+00	0.660	River	0.560	2.84E+05	2.84E+05	550	1.83E-01	3.32E-02	8.34E-01	22.9	146	102.3	2.29E+08	1.63E+02	1.59E+00

Table G-2. Mercury Waterbody Characteristics Used for Baseline and Floor/Standard

Site	Waterbody	Air Temp. (K)	Wind-speed (m/s)	WS Area Impervious to Fallout (km^2)	Area, Including Impervious Area (km^2)	Current Velocity (m/s)	Type	WB Depth (m)	WB Area (m^2)	Sediment Area (m^2)	Erosivity Factor, R (yr^{-1})	Topo-graphic Factor, LS (unitless)	Cover Mgmt Factor, C (unitless)	Support Practice Factor, Ps (unitless)	Average Annual Runoff, Ro (cm/yr)	Average Annual Precip-itation, P (cm/yr)	Average Annual Evapo-trans, Ev (cm/yr)	Dilution Outflow (m^3/yr)	Hydrologic Region TSS (g/m^3)	Resus-pension Velocity, vrs (m/yr)
A26	Big Creek	287	5.10	2.34E-01	4.67E+01	0.460	River	0.180	5.86E+04	5.86E+04	240	1.98E+00	5.66E-02	6.56E-01	15.2	107	74.7	1.26E+07	2.06E+02	2.01E+00
A26	Carter Creek	287	5.10	5.17E-01	1.03E+02	0.550	River	0.340	1.69E+05	1.69E+05	240	8.89E-01	5.45E-02	6.70E-01	15.2	107	74.7	6.62E+07	2.06E+02	2.01E+00
A26	Dota Creek	287	5.10	8.21E-01	1.64E+02	0.700	River	0.670	8.75E+05	8.75E+05	240	2.05E+00	4.81E-02	7.13E-01	15.2	107	74.7	3.41E+08	2.06E+02	2.01E+00
A31	Nottaway River	288	3.58	3.53E+01	4.70E+02	0.790	River	1.110	2.35E+06	2.35E+06	250	7.05E-01	3.53E-02	7.99E-01	17.8	109	76.4	1.29E+09	2.40E+01	2.34E-01
A31	Chowan River	288	3.58	4.50E+01	5.99E+02	0.880	River	1.650	3.45E+06	3.45E+06	250	3.91E-01	4.16E-02	8.02E-01	17.8	109	76.4	3.60E+09	2.40E+01	2.34E-01
A31	Nottaway Swamp	288	3.58	5.66E+00	7.54E+01	0.550	River	0.340	2.44E+05	2.44E+05	250	3.21E-01	3.53E-02	7.99E-01	17.8	109	76.4	6.62E+07	2.40E+01	2.34E-01
A45	Sheldon Reservoir	294	4.10	1.50E+00	5.30E+00	NA	Lake	4.000	5.30E+06	5.30E+06	300	7.08E-02	7.88E-02	5.08E-01	12.7	119	83.4	6.73E+05	7.00E+01	6.81E-01
A45	Highlands Reservoir	294	4.10	1.47E+00	5.21E+00	NA	Lake	4.000	1.89E+06	1.89E+06	300	6.93E-02	8.00E-02	5.00E-01	12.7	119	83.4	6.62E+05	7.00E+01	6.81E-01
A45	Greens Bayou	294	4.10	2.77E+01	9.79E+01	0.520	River	0.280	4.71E+05	4.71E+05	300	7.63E-02	1.29E-02	9.81E-01	12.7	119	83.4	4.73E+07	7.20E+01	7.01E-01
A45	Buffalo Bayou	294	4.10	1.10E+02	3.87E+02	0.670	River	0.600	6.06E+05	6.06E+05	300	7.36E-02	2.83E-02	8.92E-01	12.7	119	83.4	2.84E+08	7.20E+01	7.01E-01
A46	Little Muskingum River	286	3.60	1.92E+00	3.84E+02	0.640	River	0.540	4.31E+05	4.31E+05	150	5.08E+00	1.93E-02	9.05E-01	17.8	105	73.6	2.30E+08	2.70E+01	2.63E-01
A46	Ohio River	286	3.60	1.75E+00	3.49E+02	1.160	River	4.220	8.49E+06	8.49E+06	150	4.23E+00	1.80E-02	9.35E-01	17.8	105	73.6	2.52E+10	2.70E+01	2.63E-01
A46	Middle Island Creek	286	3.60	2.40E+00	4.80E+02	0.700	River	0.670	1.61E+06	1.61E+06	150	5.72E+00	1.74E-02	9.17E-01	17.8	105	73.6	3.41E+08	2.70E+01	2.63E-01
A47	Caney River	289	5.60	1.04E+02	7.21E+02	0.700	River	0.670	1.80E+06	1.80E+06	250	5.55E-01	5.62E-02	6.83E-01	6.4	99	69.2	3.41E+08	2.06E+02	2.01E+00
A47	Sand Creek	289	5.60	4.66E+01	3.23E+02	0.550	River	0.340	5.07E+05	5.07E+05	250	1.39E+00	9.97E-03	9.80E-01	6.4	99	69.2	6.62E+07	2.06E+02	2.01E+00
A47	Bar-Dew Lake	289	5.60	7.09E-01	4.92E+00	NA	Lake	4.000	1.65E+05	1.65E+05	250	1.69E+00	7.75E-03	1.00E+00	6.4	99	69.2	3.15E+05	7.00E+01	6.81E-01
A47	Lake Hudson	289	5.60	4.47E+00	3.10E+01	NA	Lake	4.000	1.13E+06	1.13E+06	250	1.28E+00	1.02E-02	9.87E-01	6.4	99	69.2	1.98E+06	7.00E+01	6.81E-01
A55	Mohawk River	282	5.14	7.94E+01	7.29E+02	0.768	River	0.771	2.71E+06	2.71E+06	125	8.29E-01	4.17E-02	8.29E-01	25.4	91	63.6	5.49E+09	2.70E+01	2.63E-01
A55	Acplause Kill River	282	5.14	1.62E+01	1.49E+02	0.296	River	0.183	1.70E+05	1.70E+05	125	1.04E+00	3.41E-02	8.16E-01	25.4	91	63.6	8.89E+07	2.70E+01	2.63E-01
A55	Stony Creek Reservoir	282	5.14	2.98E+00	2.73E+01	NA	Lake	4.000	1.72E+06	1.72E+06	125	9.00E-01	3.42E-02	8.70E-01	25.4	91	63.6	6.94E+06	6.00E+00	5.84E-02
A55	Watervliet Reservoir	282	5.14	2.63E+01	2.42E+02	NA	Lake	4.000	1.60E+06	1.60E+06	125	7.57E-01	4.34E-02	8.08E-01	25.4	91	63.6	6.14E+07	6.00E+00	5.84E-02
B18	Gulf Intercoastal Waterway	293	4.10	4.61E+01	3.20E+02	0.436	River	0.567	1.46E+06	1.46E+06	500	7.98E-02	2.90E-02	8.60E-01	21.6	146	102.3	6.50E+08	1.63E+02	1.59E+00
B18	Bayou La Butte	293	4.10	7.00E+00	4.86E+01	0.560	River	0.330	9.79E+04	9.79E+04	500	8.89E-02	6.95E-02	6.33E-01	21.6	146	102.3	6.34E+07	1.63E+02	1.59E+00
B18	Mississippi River	293	4.10	1.58E+01	1.10E+02	2.228	River	6.642	6.51E+07	6.51E+07	500	1.43E-01	8.46E-02	8.63E-01	21.6	146	102.3	4.17E+11	1.63E+02	1.59E+00
B18	Bayou Manchac	293	4.10	3.90E+01	2.71E+02	0.201	River	0.226	1.74E+05	1.74E+05	500	1.37E-01	5.32E-02	7.38E-01	21.6	146	102.3	3.69E+07	1.63E+02	1.59E+00
B23	Hillbrandt Bayou	294	4.60	3.28E+01	1.16E+02	0.347	River	0.390	3.26E+05	3.26E+05	430	7.46E-02	5.87E-02	6.48E-01	14.0	141	98.4	1.31E+08	7.20E+01	7.01E-01
B23	Cow Bayou	294	4.60	2.89E+01	1.02E+02	0.421	River	0.277	3.80E+05	3.80E+05	430	1.15E-01	3.99E-02	8.72E-01	14.0	141	98.4	2.12E+08	7.20E+01	7.01E-01
B23	Neches River	294	4.60	2.81E+01	9.92E+01	0.844	River	1.375	3.56E+06	3.56E+06	430	8.23E-02	2.67E-02	9.38E-01	14.0	141	98.4	7.27E+09	7.20E+01	7.01E-01
B23	Port Arthur Reservoir	294	4.60	2.11E-01	7.45E-01	NA	Lake	4.000	5.47E+05	5.47E+05	430	8.44E-02	1.00E-02	1.00E+00	14.0	141	98.4	1.04E+05	7.00E+01	6.81E-01
B31	Wassahickon Creek	284	5.15	4.40E+01	1.56E+02	0.280	River	0.204	2.12E+05	2.12E+05	175	7.42E-01	3.05E-02	8.87E-01	25.4	112	78.6	7.78E+07	2.70E+01	2.63E-01
B31	Neshaminy Creek	284	5.15	4.58E+01	1.62E+02	0.497	River	0.232	2.22E+05	2.22E+05	175	5.17E-01	6.72E-02	6.97E-01	25.4	112	78.6	3.36E+08	2.70E+01	2.63E-01
B31	Peace Valley Reservoir	284	5.15	4.94E+00	1.75E+01	NA	Lake	4.000	1.49E+06	1.49E+06	175	5.04E-01	1.25E-01	5.84E-01	25.4	112	78.6	4.44E+06	6.00E+00	5.84E-02
B31	Sckuylkill River	284	5.15	2.07E+02	7.30E+02	0.741	River	0.719	1.66E+06	1.66E+06	175	9.87E-01	5.45E-02	7.30E-01	25.4	112	78.6	2.63E+09	2.70E+01	2.63E-01
B32	Cedar Bayou	294	4.13	7.58E+01	2.39E+02	0.494	River	0.655	1.75E+06	1.75E+06	450	8.92E-02	6.18E-02	6.27E-01	15.2	119	83.4	3.31E+08	7.20E+01	7.01E-01
B32	Cary Bayou	294	4.13	4.32E+00	1.36E+01	0.380	River	0.090	1.36E+04	1.36E+04	450	8.04E-02	8.48E-02	6.71E-01	15.2	119	83.4	2.77E+06	7.20E+01	7.01E-01
B32	Goose Creek	294	4.13	2.12E+01	6.70E+01	0.427	River	0.135	2.36E+04	2.36E+04	450	7.95E-02	6.28E-02	6.28E-01	15.2	119	83.4	7.66E+06	7.20E+01	7.01E-01
B37	Arkansas River	287	5.10	1.52E+02	4.31E+02	0.841	River	1.149	7.11E+06	7.11E+06	240	1.74E-01	4.19E-02	8.00E-01	15.2	107	74.7	3.80E+10	2.06E+02	2.01E+00
B37	Plum Bayou	287	5.10	7.35E+01	2.08E+02	0.560	River	0.330	7.34E+05	7.34E+05	240	7.37E-02	7.60E-02	5.29E-01	15.2	107	74.7	6.34E+07	2.06E+02	2.01E+00
B37	Yellow Lake	287	5.10	2.95E+00	8.36E+00	NA	Lake	4.000	1.76E+06	1.76E+06	240	9.51E-02	2.47E-02	9.35E-01	15.2	107	74.7	1.27E+06	7.00E+01	6.81E-01
B37	Lake Pine Bluff	287	5.10	3.90E+01	1.10E+02	NA	Lake	4.000	1.76E+06	1.76E+06	240	1.95E-01	1.51E-02	9.82E-01	15.2	107	74.7	1.68E+07	7.00E+01	6.81E-01

Table G-2. Mercury Waterbody Characteristics Used for Baseline and Floor/Standard

Site	Waterbody	Air Temp. (K)	Wind-speed (m/s)	WS Area Impervious to Fallout (km^2)	Area, Including Impervious Area (km^2)	Current Velocity (m/s)	Type	WB Depth (m)	WB Area (m^2)	Sediment Area (m^2)	Erosivity Factor, R (yr^{-1})	Topo-graphic Factor, LS (unitless)	Cover Mgmt Factor, C (unitless)	Support Practice Factor, Ps (unitless)	Average Annual Runoff, Ro (cm/yr)	Average Annual Precip-itation, P (cm/yr)	Average Annual Evapo-trans, Ev (cm/yr)	Dilution Outflow (m^3/yr)	Hydrologic Region TSS (g/m^3)	Resus-pension Velocity, vrs (m/yr)
B44	Sheldon Reservoir	294	4.13	1.46E+00	5.17E+00	NA	Lake	4.000	5.17E+06	5.17E+06	450	7.01E-02	7.85E-02	5.10E-01	14.0	119	83.4	7.24E+05	7.00E+01	6.81E-01
B44	Greens Bayou	294	4.13	2.77E+01	9.79E+01	0.415	River	0.408	4.07E+05	4.07E+05	450	7.63E-02	1.29E-02	9.81E-01	14.0	119	83.4	2.04E+08	7.20E+01	7.01E-01
B44	Buffalo Bayou	294	4.13	9.58E+01	3.38E+02	0.646	River	1.195	2.50E+06	2.50E+06	450	7.37E-02	2.98E-02	8.86E-01	14.0	119	83.4	3.43E+09	7.20E+01	7.01E-01
B44	Hunting Bayou	294	4.13	1.38E+01	4.86E+01	0.481	River	0.199	1.15E+05	1.15E+05	450	7.35E-02	1.82E-02	9.32E-01	14.0	119	83.4	1.94E+07	7.20E+01	7.01E-01
TOO	Rush Lake	284	4.62	6.23E+01	3.48E+02	NA	Lake	4.000	1.13E+06	1.13E+06	20	2.41E+00	2.19E-02	9.36E-01	1.3	40	27.7	4.52E+06	1.00E+00	9.73E-03
TOO	Box Elder Wash	284	4.62	2.31E+01	1.29E+02	0.300	River	0.040	2.92E+04	2.92E+04	20	2.62E+00	1.52E-02	9.66E-01	1.3	40	27.7	3.15E+05	1.30E+01	1.27E-01
TOO	Blue Lakes	284	4.62	1.94E-01	1.08E+00	NA	Lake	4.000	2.45E+05	2.45E+05	20	1.16E-01	1.00E-02	1.00E+00	1.3	40	27.7	1.41E+04	1.00E+00	9.73E-03
TOO	Soldier Creek	284	4.62	6.91E+00	3.86E+01	0.460	River	0.170	8.04E+04	8.04E+04	20	7.74E+00	9.58E-03	9.80E-01	1.3	40	27.7	1.32E+07	1.30E+01	1.27E-01

Table G-3. Site-Specific Inputs Used for Baseline

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
209	Lawsons Fork Creek	1.55E-14	3.01E-11	1.15E-09	3.10E-11	4.38E-10	1.82E-14
209	Tyger River	2.70E-14	7.96E-11	2.74E-09	8.14E-11	1.46E-09	2.85E-14
209	Fair Forest Creek	2.97E-14	4.51E-11	2.34E-09	4.51E-11	8.21E-10	3.09E-14
209	Middle Tyger River	1.66E-14	5.40E-11	1.62E-09	4.16E-11	6.04E-10	1.39E-14
214	Fish Ponds	8.93E-13	1.89E-09	7.14E-08	1.89E-09	3.26E-08	8.93E-13
214	Lake Clause	9.56E-13	3.97E-09	9.45E-08	3.45E-09	4.37E-08	8.61E-13
214	University Lake/ City Park Lake	4.71E-13	1.37E-09	4.44E-08	1.37E-09	2.30E-08	4.62E-13
214	Comite River	4.39E-13	1.86E-09	4.54E-08	1.74E-09	2.53E-08	4.01E-13
221	Highlands Reservoir	1.04E-11	2.93E-08	1.67E-08	2.08E-08	3.86E-10	9.71E-12
221	Sheldon Reservoir	2.60E-11	3.05E-08	4.20E-08	3.05E-08	6.25E-10	2.60E-11
221	San Jacinto River / Houston Lake	2.72E-11	4.52E-08	4.41E-08	5.01E-08	9.96E-10	2.86E-11
324	Shades Creek	2.86E-13	4.37E-10	3.43E-08	4.37E-10	1.28E-08	2.65E-13
324	Valley Creek	8.42E-13	1.01E-09	1.49E-07	6.55E-10	3.75E-08	6.73E-13
324	Bayview Lake	7.74E-13	1.50E-09	1.66E-07	1.31E-09	3.60E-08	4.94E-13
324	Cahaba River	1.36E-13	3.03E-10	1.60E-08	2.86E-10	5.22E-09	1.12E-13
325	Big Hill Creek	1.07E-11	6.24E-10	4.77E-06	7.25E-10	4.78E-07	1.15E-11
325	Potato Creek	1.92E-11	6.75E-10	8.31E-06	1.06E-09	7.52E-07	3.23E-11
325	Claymore Creek	3.06E-11	2.28E-09	1.55E-05	2.83E-09	4.35E-06	3.37E-11
325	Verdigris River	3.53E-12	3.71E-10	1.59E-06	7.42E-10	4.26E-07	6.32E-12
331	Rocky River	4.40E-13	1.37E-09	6.21E-08	1.50E-09	6.39E-08	5.91E-13
331	East Branch Black River	9.75E-13	3.43E-09	2.26E-07	2.06E-09	5.86E-08	4.24E-13
331	Wyleswood Lake	7.15E-13	1.86E-09	1.14E-07	1.86E-09	9.09E-08	7.15E-13
331	Baldwin Lake	2.16E-13	7.99E-10	2.94E-08	1.30E-09	5.18E-08	5.35E-13
359	Kentucky River	1.30E-10	2.87E-07	0.00E+00	4.56E-07	0.00E+00	2.24E-10
359	Indian Creek	1.51E-10	3.26E-07	0.00E+00	3.56E-07	0.00E+00	1.80E-10
359	Indian Kentuck Creek	8.77E-11	2.22E-07	0.00E+00	1.52E-07	0.00E+00	6.12E-11
359	Ohio River	1.13E-10	2.69E-07	0.00E+00	3.87E-07	0.00E+00	1.79E-10
A15	Tonawanda Creek	1.78E-12	2.04E-09	1.70E-07	1.02E-09	1.41E-08	6.12E-13
A15	Murder Creek	7.11E-13	1.66E-09	6.33E-08	1.52E-09	2.44E-08	6.58E-13
A15	Ellicott Creek	1.14E-12	1.96E-09	1.03E-07	2.26E-09	4.01E-08	1.08E-12
A18	Taylor Bayou	3.23E-10	2.07E-06	0.00E+00	2.00E-06	0.00E+00	4.73E-10
A18	Hillebrandt Bayou	2.43E-10	8.42E-07	0.00E+00	1.08E-06	0.00E+00	3.69E-10
A18	Viterbo Reservoir	4.29E-10	1.16E-06	0.00E+00	1.40E-06	0.00E+00	5.06E-10
CAL	Tennessee River	1.84E-10	8.48E-07	6.36E-07	7.27E-07	3.23E-07	1.55E-10
CAL	Kentucky Lake	2.59E-10	1.28E-06	1.28E-06	1.80E-06	1.41E-06	3.51E-10
CAL	Barkley Lake	9.61E-11	4.85E-07	2.96E-07	5.02E-07	1.95E-07	9.96E-11
CAL	Cumberland River	1.88E-10	5.54E-07	6.19E-07	5.19E-07	4.00E-07	1.78E-10
ELD	Flat Creek	3.43E-11	1.09E-07	0.00E+00	8.49E-08	0.00E+00	4.59E-11
ELD	Salt Creek	3.05E-11	6.37E-08	0.00E+00	5.90E-08	0.00E+00	2.98E-11
ELD	Calion Lake	1.26E-11	2.60E-08	0.00E+00	2.36E-08	0.00E+00	8.95E-12
ELD	Ouachita River	1.14E-11	3.66E-08	0.00E+00	1.65E-08	0.00E+00	7.63E-12
SAU	Horseshoe Lake	4.53E-13	1.22E-09	4.76E-08	1.27E-09	2.22E-08	4.75E-13
SAU	Old Cahokia Creek	7.34E-13	2.10E-09	8.50E-08	2.05E-09	4.03E-08	6.62E-13
SAU	Mississippi River	7.82E-13	2.71E-09	1.06E-07	6.26E-09	1.64E-07	1.37E-12
202	Elk City Lake	1.29E-13	1.12E-09	1.50E-08	1.87E-09	1.53E-08	2.00E-13
202	Montgomery County State Park Lake	4.63E-13	5.18E-09	1.08E-07	4.81E-09	1.08E-07	5.80E-13
202	Verdigris River	3.17E-13	1.62E-09	5.07E-08	2.44E-09	5.96E-08	5.34E-13
203	Catalpa Creek	1.81E-12	2.38E-08	3.91E-07	1.95E-08	8.79E-08	2.17E-12
203	Gilmer Creek	2.34E-12	2.35E-08	4.56E-07	2.04E-08	7.85E-08	1.54E-12
203	N. Branch Magowah Creek	2.23E-12	1.18E-07	2.84E-06	2.09E-07	6.47E-06	1.88E-12
203	Shotbag Creek	2.12E-12	2.75E-08	5.43E-07	2.23E-08	2.02E-07	1.91E-12

Table G-3. Site-Specific Inputs Used for Baseline

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
204	Bay Creek	9.10E-13	7.49E-09	1.17E-07	8.37E-09	8.77E-08	9.99E-13
204	Little Calumet Creek	6.05E-13	4.14E-08	3.75E-07	4.45E-08	7.73E-07	6.52E-13
204	Upper and Lower Swan Lake	8.43E-13	1.94E-08	2.05E-07	1.85E-08	1.64E-07	8.76E-13
204	Mississippi River	8.94E-13	1.76E-08	2.14E-07	2.69E-08	2.86E-07	8.66E-13
302	Maumee River	1.28E-12	5.91E-09	2.46E-07	6.19E-09	6.68E-08	1.48E-12
302	Auglaize River	1.52E-12	5.21E-09	3.08E-07	3.94E-09	2.82E-08	1.45E-12
302	Six Mile Creek	3.39E-12	1.91E-08	1.02E-06	1.07E-08	1.84E-07	3.28E-12
304	Big Walnut Creek	9.68E-12	2.01E-08	7.20E-06	2.04E-08	3.28E-06	9.63E-12
304	Glenn Flint Lake	7.29E-12	1.13E-08	3.91E-06	1.39E-08	8.70E-07	7.03E-12
304	Deer Creek	1.19E-11	3.25E-08	1.18E-05	1.97E-08	2.18E-06	1.13E-11
320	Mud Devils Lake	2.03E-12	3.76E-08	9.65E-07	1.18E-07	2.51E-06	4.54E-12
320	Thunder Bay River	2.72E-12	4.43E-08	1.10E-06	7.53E-08	1.57E-06	2.94E-12
320	Long Lake	3.24E-12	3.43E-08	8.74E-07	3.43E-08	3.39E-07	3.22E-12
321	Black Warrior River	3.11E-11	6.22E-08	1.85E-05	5.28E-08	1.56E-06	3.00E-11
321	Powell Creek	2.66E-11	3.25E-08	1.28E-05	2.96E-08	5.48E-07	2.59E-11
321	Lake Demopolis	3.11E-11	6.22E-08	1.85E-05	2.82E-07	5.92E-05	4.75E-11
321	Lake Henry	3.01E-11	4.63E-08	1.49E-05	3.83E-08	8.84E-07	2.63E-11
BAT	Monocacy Creek	1.90E-12	8.50E-09	4.94E-07	1.13E-08	3.82E-07	1.31E-12
BAT	Lehigh River	9.08E-13	4.38E-09	1.85E-07	3.56E-09	3.42E-08	6.40E-13
CHA	Allen Lake	2.48E-11	2.87E-07	7.47E-06	3.02E-07	3.90E-06	2.69E-11
CHA	Santa Fe Lake	1.47E-11	4.14E-07	1.06E-05	4.69E-07	8.65E-06	1.88E-11
CHA	Neosho River	1.51E-11	1.51E-07	4.72E-06	1.46E-07	1.44E-06	2.09E-11
FOR	Walnut Bayou	2.41E-11	4.17E-07	9.89E-06	6.67E-07	1.08E-05	2.72E-11
FOR	West Flat Creek	4.80E-11	2.51E-07	1.06E-05	1.25E-07	1.19E-06	2.93E-11
FOR	Hamilton Lake	2.55E-11	6.01E-07	1.22E-05	6.30E-07	8.12E-06	2.86E-11
FRE	Salt Creek	8.86E-12	5.04E-08	2.34E-06	3.96E-08	4.78E-07	8.86E-12
FRE	Verdigris River	2.74E-11	7.36E-08	6.31E-06	6.15E-08	1.55E-06	2.02E-11
FRE	Fall River	1.07E-11	1.78E-08	1.81E-06	1.65E-08	9.64E-08	9.54E-12
HAR	Indian Field Swamp	1.72E-11	1.05E-07	4.91E-06	1.02E-07	7.53E-07	1.77E-11
HAR	Walnut Branch	1.77E-11	8.27E-08	4.77E-06	6.50E-08	4.47E-07	1.47E-11
HAR	Huttos Lake	4.18E-11	3.04E-07	1.65E-05	3.20E-07	7.56E-06	4.38E-11
HOL	Huttos Lake	1.57E-11	2.92E-08	1.22E-05	2.95E-08	4.08E-06	1.56E-11
HOL	Lake Merkel	7.81E-12	5.34E-09	4.33E-06	5.56E-09	2.12E-07	8.21E-12
TEX	Armstrong Creek	1.86E-11	4.71E-09	9.19E-06	2.80E-09	4.11E-07	1.83E-11
TEX	Massey Lake	4.72E-12	2.02E-09	2.40E-06	1.23E-09	6.38E-08	2.21E-12
TEX	Mountain Creek	1.43E-11	6.50E-09	8.63E-06	7.62E-09	4.37E-06	2.17E-11
TEX	Waxahachie Creek	1.22E-11	2.30E-09	4.97E-06	2.13E-09	3.30E-07	7.57E-12
WAM	Connoquenessing Creek	4.50E-11	5.84E-08	3.24E-05	6.01E-08	5.95E-06	4.97E-11
WAM	Hereford Manor Lake	3.29E-11	3.94E-08	2.15E-05	4.20E-08	2.92E-06	3.56E-11
WAM	Beaver River	2.70E-11	6.49E-08	2.36E-05	1.90E-07	4.21E-05	3.29E-11
WAM	Slippery Rock Creek	4.62E-11	5.15E-08	3.14E-05	1.05E-07	1.42E-05	7.07E-11
ARV	James River	2.09E-13	4.98E-10	5.94E-08	5.70E-10	1.52E-08	2.60E-13
ARV	Sports Lake	2.21E-13	4.18E-10	5.84E-08	1.77E-10	1.93E-09	1.32E-13
ARV	Holman Creek	8.15E-13	6.27E-10	2.15E-07	7.31E-10	1.80E-08	9.43E-13
ARV	Rivanna River	2.34E-13	2.17E-10	5.98E-08	1.93E-10	1.81E-09	2.21E-13
BRO	Bluelick Creek	1.40E-11	6.44E-08	6.17E-06	2.44E-07	1.35E-05	3.13E-11
BRO	McNeely Lake	1.42E-11	1.80E-08	3.79E-06	2.18E-08	2.37E-07	1.66E-11
BRO	Silver Lake	8.06E-12	1.85E-08	2.20E-06	1.85E-08	1.59E-07	8.21E-12
BRO	Salt River	6.34E-12	1.18E-08	1.77E-06	2.88E-08	4.33E-07	1.59E-11
CAS	Cascade Creek	4.93E-12	1.32E-08	1.58E-06	8.26E-09	1.60E-07	2.20E-12
CAS	Smith River	8.62E-13	3.13E-09	2.28E-07	4.31E-09	4.10E-08	1.31E-12
CAS	Dan River	2.20E-12	3.66E-09	5.70E-07	5.03E-09	5.25E-08	2.92E-12

Table G-3. Site-Specific Inputs Used for Baseline

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
COH	Troy Reservoir	2.55E-11	1.58E-08	9.38E-06	1.84E-08	4.48E-07	3.32E-11
COH	Hudson River	2.87E-11	3.90E-08	1.08E-05	7.01E-08	1.67E-06	4.08E-11
COH	Mohawk River	3.32E-11	4.49E-08	1.30E-05	6.05E-08	1.86E-06	5.96E-11
COH	Tomahannock Reservoir	5.33E-12	7.20E-09	1.92E-06	7.20E-09	4.12E-08	5.41E-12
NOR	Rocky River	4.80E-13	1.20E-09	1.11E-07	1.65E-09	2.41E-08	5.91E-13
NOR	Long Lake/Creek	2.94E-13	6.31E-10	5.96E-08	7.69E-10	4.06E-09	4.44E-13
NOR	Lake Tillery	3.61E-13	4.15E-10	7.42E-08	3.69E-10	1.66E-09	2.66E-13
334	Mississippi River	8.33E-14	2.24E-10	1.68E-08	3.94E-10	2.64E-08	1.22E-13
334	Vermilion River	4.47E-14	1.56E-10	7.39E-09	1.49E-10	9.52E-09	6.68E-14
334	Colby Lake	1.05E-13	2.04E-10	1.72E-08	2.04E-10	1.42E-08	1.05E-13
334	Lake Isabelle	1.51E-13	2.92E-10	3.07E-08	2.78E-10	2.68E-08	1.55E-13
463	Blue River	4.47E-12	9.79E-09	0.00E+00	2.54E-08	0.00E+00	1.04E-11
463	Rock Creek	1.98E-11	3.37E-08	0.00E+00	3.39E-08	0.00E+00	2.31E-11
463	Shoal Creek	5.76E-12	7.03E-09	0.00E+00	7.17E-09	0.00E+00	5.26E-12
463	Missouri River	4.91E-12	8.83E-09	0.00E+00	1.12E-08	0.00E+00	5.58E-12
464	Ottawa River	1.10E-14	8.58E-11	1.92E-09	1.38E-10	2.37E-09	1.35E-14
464	Twin Lakes Reservoir	2.77E-14	1.27E-10	4.39E-09	1.20E-10	2.70E-09	2.68E-14
464	Metzger/Ferguson Reservoir	1.85E-14	1.16E-10	2.58E-09	1.16E-10	1.67E-09	1.85E-14
504	Pennsauken Creek	8.99E-11	1.13E-07	0.00E+00	1.07E-07	0.00E+00	8.40E-11
504	Darby Creek	8.09E-11	3.91E-07	0.00E+00	6.34E-07	0.00E+00	1.22E-10
504	Cooper River Lake	9.03E-11	1.13E-07	0.00E+00	1.78E-07	0.00E+00	1.48E-10
504	Schuylkill River	1.67E-10	4.57E-07	0.00E+00	8.72E-07	0.00E+00	2.68E-10
600	Lake Jackson	8.10E-12	3.30E-10	4.27E-06	3.30E-10	8.41E-08	8.14E-12
600	Oyster Creek	6.08E-12	3.30E-10	3.24E-06	3.19E-10	8.04E-08	6.29E-12
600	Brazos River	7.70E-12	6.16E-10	4.49E-06	1.29E-09	1.42E-06	9.10E-12
711	Brechtel Lake	1.47E-13	8.25E-10	2.22E-10	8.25E-10	1.76E-11	1.47E-13
711	Mississippi River	2.20E-13	1.74E-09	4.60E-10	1.75E-09	1.78E-10	2.20E-13
806	Wolf Lake	1.76E-11	7.88E-08	0.00E+00	8.52E-08	0.00E+00	1.83E-11
806	Lake George	2.17E-11	8.12E-08	0.00E+00	7.64E-08	0.00E+00	2.09E-11
806	Little Calumet River	8.48E-12	2.71E-08	0.00E+00	3.50E-08	0.00E+00	1.09E-11
806	Grand Calumet River	4.45E-11	8.68E-08	0.00E+00	4.22E-08	0.00E+00	2.32E-11
915	Genesee River	9.58E-13	7.38E-09	0.00E+00	2.00E-08	0.00E+00	2.17E-12
915	Irondequoit Bay	1.45E-12	4.67E-09	0.00E+00	8.13E-09	0.00E+00	3.59E-12
915	Highland Reservoir	8.71E-13	6.48E-09	0.00E+00	6.48E-09	0.00E+00	8.71E-13
A32	Armand Bayou	7.70E-12	2.50E-08	0.00E+00	3.91E-08	0.00E+00	9.46E-12
A43	Twelvemile Creek	1.17E-11	4.20E-08	0.00E+00	2.87E-08	0.00E+00	8.45E-12
A43	Bergholtz Creek	2.09E-11	6.53E-08	0.00E+00	7.38E-08	0.00E+00	2.41E-11
A43	Cayuga Creek	4.16E-11	1.31E-07	0.00E+00	1.03E-07	0.00E+00	3.24E-11
A43	Niagara River	9.40E-12	5.28E-08	0.00E+00	5.52E-08	0.00E+00	9.69E-12
A50	Carpenters Bayou	5.39E-13	3.74E-11	2.26E-07	4.46E-11	1.02E-08	6.55E-13
A50	Highlands Reservoir	2.73E-13	1.51E-11	1.13E-07	1.59E-11	1.99E-09	2.68E-13
A50	Buffalo Bayou	4.71E-13	4.30E-11	2.03E-07	5.01E-11	1.59E-08	7.00E-13
A50	San Jacinto River	3.51E-13	1.99E-11	1.46E-07	2.07E-11	5.05E-09	4.34E-13
A62	Caney Creek	7.58E-12	9.42E-08	0.00E+00	1.27E-07	0.00E+00	9.99E-12
A62	E & W Fork Crystal Cr.	9.89E-12	3.07E-07	0.00E+00	7.51E-07	0.00E+00	2.64E-11
A62	Stewarts Creek	1.77E-11	9.69E-08	0.00E+00	9.69E-08	0.00E+00	1.55E-11
A62	Lewis Creek Reservoir	5.46E-12	2.69E-08	0.00E+00	2.69E-08	0.00E+00	5.44E-12
B20	Cuyahoga River	1.99E-12	7.50E-09	0.00E+00	7.50E-09	0.00E+00	2.09E-12
B20	Upper and Lower Shaker Lake	3.90E-12	8.95E-09	0.00E+00	3.31E-08	0.00E+00	1.77E-11
B20	Euclid Creek	3.30E-12	6.60E-09	0.00E+00	7.39E-09	0.00E+00	3.62E-12
B20	Fairmont Reservoir	1.80E-11	2.64E-08	0.00E+00	2.64E-08	0.00E+00	1.70E-11
HAN	Fabius River	1.00E-11	2.38E-08	4.66E-08	2.38E-08	2.57E-08	9.90E-12
HAN	Spring Lake	1.10E-11	3.70E-08	5.45E-08	3.86E-08	3.22E-08	1.04E-11
HAN	Mississippi River	1.42E-11	4.22E-08	8.47E-08	1.27E-07	2.24E-07	3.69E-11

Table G-3. Site-Specific Inputs Used for Baseline

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
KIN	North Fork Holston River	3.16E-12	6.48E-09	7.18E-09	9.59E-09	1.07E-09	5.83E-12
KIN	Kingsport Reservoir	7.40E-12	7.82E-09	1.60E-08	6.71E-09	4.17E-10	5.68E-12
KIN	South Fork Holston River	1.44E-12	3.58E-09	3.12E-09	8.80E-09	9.09E-10	3.09E-12
KIN	Reedy Creek	2.61E-12	6.47E-09	6.15E-09	1.40E-08	1.87E-09	8.02E-12
MCI	Hals Lake	3.69E-13	2.06E-09	4.25E-08	3.33E-09	6.32E-08	7.38E-13
MCI	Hellcat Lake	2.93E-12	1.83E-08	7.50E-07	3.06E-08	7.98E-07	3.15E-12
MCI	Alabama River	2.24E-13	1.04E-09	2.00E-08	1.38E-09	1.45E-08	3.04E-13
MCI	Tombigbee River	4.84E-13	2.23E-09	6.10E-08	5.16E-09	1.28E-07	9.05E-13
MID	Tittabawassee River	6.22E-12	2.84E-08	1.48E-08	2.89E-08	3.15E-09	6.00E-12
MID	Sturgeon Creek	3.76E-12	1.89E-08	7.85E-09	1.40E-08	6.67E-10	2.77E-12
MID	Kawkawlin River	7.50E-12	1.94E-08	1.55E-08	1.53E-08	5.31E-10	5.01E-12
MID	Chippewa River	3.63E-12	1.76E-08	7.77E-09	2.43E-08	2.10E-09	4.96E-12
STG	Bayou Plaquemine	3.79E-11	2.30E-08	1.71E-05	2.30E-08	1.06E-06	3.79E-11
STG	Manchac Bayou	6.78E-11	4.62E-08	3.87E-05	1.78E-08	1.18E-06	3.10E-11
STG	Bayou Fountain	3.42E-11	1.95E-08	1.57E-05	1.85E-08	1.14E-06	3.27E-11
STG	Mississippi River	7.14E-11	4.44E-08	3.92E-05	4.93E-08	1.11E-05	7.85E-11
340	Sunfish Creek	2.48E-12	2.86E-09	4.71E-09	2.66E-09	9.39E-11	2.65E-12
340	Proctor Creek	5.10E-12	9.12E-09	1.02E-08	1.05E-08	1.14E-09	4.77E-12
340	Fish Creek	2.48E-12	2.86E-09	4.71E-09	2.66E-09	9.39E-11	2.65E-12
340	Ohio River	2.81E-12	4.56E-09	5.57E-09	1.03E-08	1.49E-09	4.03E-12
342	Kalamazoo River	3.08E-14	4.42E-11	4.48E-09	1.38E-09	5.10E-09	6.00E-14
342	East Lake	1.17E-14	1.73E-11	1.31E-09	1.73E-11	5.27E-10	1.17E-14
342	Portage Creek	3.83E-14	5.74E-11	6.89E-09	5.25E-10	3.38E-09	3.99E-14
342	Portage River	2.40E-14	3.73E-11	2.78E-09	2.56E-11	5.71E-10	1.90E-14
453	Lake Spivey	1.18E-12	1.25E-09	3.25E-09	1.40E-09	2.72E-11	1.18E-12
453	Jester Creek	5.62E-12	6.78E-09	1.60E-08	9.89E-09	1.02E-09	7.31E-12
453	Flint River	1.24E-12	3.06E-09	3.56E-09	3.84E-09	2.80E-10	1.76E-12
468	Wissahickon Creek	2.05E-14	8.99E-13	1.80E-08	1.35E-12	4.58E-10	3.00E-14
468	Tacony Creek	1.45E-14	6.57E-13	1.25E-08	5.18E-13	9.90E-11	1.21E-14
468	Schuylkill	2.42E-14	2.21E-12	2.23E-08	2.56E-12	2.41E-09	4.32E-14
468	Pickering Creek Reservoir	5.56E-15	1.38E-12	5.08E-09	1.38E-12	3.51E-10	5.78E-15
701	Wabash River	5.82E-13	6.93E-11	2.67E-07	1.90E-09	1.18E-06	2.00E-13
701	Sugar Creek	3.25E-13	3.59E-11	1.36E-07	4.69E-10	3.42E-07	3.80E-14
701	Big Raccoon Creek	5.42E-13	6.06E-11	2.28E-07	9.14E-10	7.18E-07	1.00E-13
704	Garvey Reservoir	1.07E-12	2.37E-11	9.90E-07	2.37E-11	1.21E-08	1.08E-12
704	Legg Lake	9.09E-12	3.96E-11	8.29E-06	3.96E-11	2.03E-08	8.96E-12
704	Silver Lake Res.	3.47E-13	1.98E-11	3.18E-07	1.98E-11	2.16E-09	3.40E-13
708	Grindle Creek	2.35E-12	1.31E-10	1.29E-06	1.22E-10	3.26E-08	2.42E-12
708	Parker Creek	1.90E-11	8.88E-10	1.11E-05	9.79E-10	1.24E-06	2.49E-11
708	Tranters Creek	9.27E-13	5.19E-11	5.00E-07	4.05E-11	4.58E-09	7.36E-13
725	Passaic River	2.60E-16	9.34E-13	3.63E-11	1.16E-12	4.22E-11	3.46E-16
725	Silver Lake Reservoir	1.89E-15	1.57E-12	5.63E-10	1.55E-12	4.59E-10	1.87E-15
725	Reservoir No. 2	4.92E-16	1.13E-12	7.20E-11	1.13E-12	5.36E-11	4.90E-16
725	Rahway River	1.28E-16	1.01E-12	1.84E-11	1.28E-12	1.68E-11	1.45E-16
824	Newton Lake	8.57E-16	1.40E-12	8.38E-11	1.68E-12	5.48E-11	1.05E-15
824	Big Timber Creek	4.97E-16	1.43E-12	4.85E-11	1.36E-12	2.35E-11	4.24E-16
824	Darby Creek	1.23E-15	7.52E-13	1.12E-10	8.60E-13	6.05E-11	1.26E-15
824	Schuylkill River	1.16E-15	9.32E-13	1.05E-10	1.25E-12	6.61E-11	1.77E-15
904	Pascagoula River	3.35E-13	1.70E-09	3.73E-08	1.42E-08	2.63E-08	3.21E-13
904	Escatawpa River	3.60E-13	2.06E-09	4.35E-08	1.34E-07	4.03E-08	3.45E-13
906	Mississippi River	2.03E-12	3.45E-09	0.00E+00	5.39E-09	0.00E+00	3.29E-12
906	Copperas Creek	1.18E-12	1.56E-09	0.00E+00	1.70E-09	0.00E+00	1.77E-12
906	Eliza Creek	6.28E-13	1.04E-09	0.00E+00	9.45E-10	0.00E+00	6.14E-13
906	Muscatine Slough	1.57E-12	4.39E-09	0.00E+00	4.21E-09	0.00E+00	1.37E-12

Table G-3. Site-Specific Inputs Used for Baseline

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
A14	New River	9.18E-16	7.56E-14	4.90E-10	5.91E-14	1.11E-11	4.63E-16
A14	Bayou Conway	7.50E-16	7.32E-14	3.91E-10	6.48E-14	1.47E-11	5.85E-16
A14	Mississippi River	7.09E-16	7.32E-14	3.66E-10	6.80E-14	1.45E-11	6.45E-16
A14	Bayou Lafourche	3.63E-16	4.32E-14	1.85E-10	4.60E-14	6.08E-12	3.86E-16
A26	Big Creek	1.13E-11	1.46E-08	5.09E-09	7.12E-09	2.09E-09	3.51E-12
A26	Carter Creek	6.65E-13	2.09E-09	1.79E-10	1.91E-09	9.07E-11	4.82E-13
A26	Dota Creek	1.43E-12	3.48E-09	4.04E-10	3.21E-09	1.90E-10	1.24E-12
A31	Nottaway River	7.71E-13	1.14E-10	5.07E-07	1.25E-10	7.07E-08	9.05E-13
A31	Chowan River	5.65E-13	4.21E-11	3.39E-07	4.36E-11	1.25E-08	5.79E-13
A31	Nottaway Swamp	2.22E-12	1.73E-10	1.43E-06	3.37E-10	3.54E-07	4.12E-12
A45	Sheldon Reservoir	1.73E-13	1.90E-10	1.05E-08	1.90E-10	4.47E-09	1.74E-13
A45	Highlands Reservoir	4.66E-14	6.98E-11	2.82E-09	5.71E-11	6.59E-10	4.52E-14
A45	Greens Bayou	1.87E-13	2.28E-10	1.16E-08	3.42E-10	6.16E-09	2.22E-13
A45	Buffalo Bayou	2.70E-13	4.63E-10	2.17E-08	5.90E-10	1.42E-08	4.40E-13
A46	Little Muskingum River	3.09E-12	6.89E-09	0.00E+00	6.72E-09	0.00E+00	2.79E-12
A46	Ohio River	9.99E-12	1.56E-08	0.00E+00	2.17E-08	0.00E+00	1.08E-11
A46	Middle Island Creek	4.00E-12	9.75E-09	0.00E+00	1.11E-08	0.00E+00	3.93E-12
A47	Caney River	3.35E-14	4.25E-11	6.01E-11	5.67E-11	9.49E-12	4.06E-14
A47	Sand Creek	6.09E-14	8.51E-11	1.13E-10	1.03E-10	7.35E-12	5.57E-14
A47	Bar-Dew Lake	9.61E-14	7.76E-11	1.72E-10	7.09E-11	2.50E-12	9.68E-14
A47	Lake Hudson	5.80E-14	6.34E-11	1.04E-10	9.34E-11	9.59E-12	1.29E-13
A55	Mohawk River	4.68E-14	8.33E-11	1.01E-10	1.73E-10	3.21E-11	8.61E-14
A55	Acplause Kill River	4.33E-14	5.25E-11	8.91E-11	4.61E-11	1.46E-11	4.12E-14
A55	Stony Creek Reservoir	1.53E-14	2.56E-11	3.11E-11	2.43E-11	9.36E-13	1.55E-14
A55	Watervliet Reservoir	2.35E-14	8.71E-11	5.05E-11	4.36E-11	1.50E-12	1.35E-14
B18	Gulf Intercoastal Waterway	6.25E-14	2.76E-10	2.24E-11	2.46E-10	4.77E-12	6.04E-14
B18	Bayou La Butte	3.68E-13	1.76E-09	2.02E-10	1.50E-09	8.37E-11	3.98E-13
B18	Mississippi River	9.22E-14	4.12E-10	3.77E-11	4.12E-10	1.38E-11	9.30E-14
B18	Bayou Manchac	5.35E-14	2.50E-10	2.04E-11	2.13E-10	3.40E-12	3.98E-14
B23	Hillbrandt Bayou	3.27E-14	1.80E-10	2.68E-09	1.76E-10	9.67E-10	2.73E-14
B23	Cow Bayou	4.98E-14	1.20E-10	3.46E-09	1.23E-10	1.03E-09	4.71E-14
B23	Neches River	4.90E-14	1.55E-10	3.83E-09	1.65E-10	1.67E-09	4.86E-14
B23	Port Arthur Reservoir	1.08E-13	4.54E-10	9.67E-09	4.58E-10	4.71E-09	1.09E-13
B31	Wassahickon Creek	1.01E-12	8.03E-10	3.61E-07	2.56E-09	1.55E-07	1.90E-12
B31	Neshaminy Creek	4.09E-13	5.00E-10	1.41E-07	3.94E-10	4.74E-09	3.39E-13
B31	Peace Valley Reservoir	2.03E-13	2.88E-10	6.84E-08	3.03E-10	2.87E-09	2.14E-13
B31	Sckuylkill River	3.30E-13	1.06E-09	1.32E-07	6.97E-10	7.58E-09	1.97E-13
B32	Cedar Bayou	3.92E-13	6.15E-11	2.85E-07	8.96E-11	5.23E-08	6.71E-13
B32	Cary Bayou	9.94E-13	1.01E-10	6.69E-07	9.40E-11	4.65E-08	1.02E-12
B32	Goose Creek	3.35E-13	4.39E-11	2.20E-07	5.01E-11	1.41E-08	3.15E-13
B37	Arkansas River	7.80E-14	1.54E-10	1.98E-10	1.18E-10	7.53E-12	7.22E-14
B37	Plum Bayou	2.33E-14	5.90E-11	5.66E-11	4.72E-11	9.33E-13	1.71E-14
B37	Yellow Lake	3.02E-13	5.69E-10	7.89E-10	9.67E-10	2.22E-11	5.99E-13
B37	Lake Pine Bluff	4.47E-14	1.62E-10	1.16E-10	9.11E-11	4.54E-12	3.51E-14
B44	Sheldon Reservoir	2.14E-14	1.42E-11	1.21E-08	1.42E-11	3.97E-09	2.14E-14
B44	Greens Bayou	3.46E-14	2.32E-11	2.09E-08	3.15E-11	1.25E-08	5.17E-14
B44	Buffalo Bayou	6.04E-14	4.96E-11	4.44E-08	4.06E-11	2.35E-08	7.27E-14
B44	Hunting Bayou	2.80E-14	2.51E-11	1.74E-08	2.77E-11	7.66E-09	3.13E-14
TOO	Rush Lake	2.31E-13	2.83E-09	2.06E-10	6.83E-09	2.11E-11	5.43E-13
TOO	Box Elder Wash	4.62E-13	1.38E-08	4.35E-10	3.82E-09	1.16E-11	2.96E-13
TOO	Blue Lakes	3.69E-14	1.52E-09	3.59E-11	1.50E-09	4.44E-12	3.72E-14
TOO	Soldier Creek	1.83E-13	2.35E-09	1.63E-10	2.42E-09	7.37E-12	1.94E-13

Table G-4. Site-Specific Inputs Used for Floor/Standard

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
209	Lawsons Fork Creek	1.55E-14	3.01E-11	1.15E-09	3.10E-11	4.38E-10	1.82E-14
209	Tyger River	2.70E-14	7.96E-11	2.74E-09	8.14E-11	1.46E-09	2.85E-14
209	Fair Forest Creek	2.97E-14	4.51E-11	2.34E-09	4.51E-11	8.21E-10	3.09E-14
209	Middle Tyger River	1.66E-14	5.40E-11	1.62E-09	4.16E-11	6.04E-10	1.39E-14
214	Fish Ponds	8.93E-13	1.89E-09	7.14E-08	1.89E-09	3.26E-08	8.93E-13
214	Lake Clause	9.56E-13	3.97E-09	9.45E-08	3.45E-09	4.37E-08	8.61E-13
214	University Lake/ City Park Lake	4.71E-13	1.37E-09	4.44E-08	1.37E-09	2.30E-08	4.62E-13
214	Comite River	4.39E-13	1.86E-09	4.54E-08	1.74E-09	2.53E-08	4.01E-13
221	Highlands Reservoir	1.04E-11	2.93E-08	1.67E-08	2.08E-08	3.86E-10	9.71E-12
221	Sheldon Reservoir	2.60E-11	3.05E-08	4.20E-08	3.05E-08	6.25E-10	2.60E-11
221	San Jacinto River / Houston Lake	2.72E-11	4.52E-08	4.41E-08	5.01E-08	9.96E-10	2.86E-11
324	Shades Creek	2.07E-13	3.17E-10	2.48E-08	3.17E-10	9.25E-09	1.92E-13
324	Valley Creek	6.10E-13	7.31E-10	1.08E-07	4.75E-10	2.72E-08	4.87E-13
324	Bayview Lake	5.61E-13	1.08E-09	1.20E-07	9.50E-10	2.61E-08	3.58E-13
324	Cahaba River	9.86E-14	2.19E-10	1.16E-08	2.07E-10	3.78E-09	8.15E-14
325	Big Hill Creek	1.07E-11	6.24E-10	4.77E-06	7.25E-10	4.78E-07	1.15E-11
325	Potato Creek	1.92E-11	6.75E-10	8.31E-06	1.06E-09	7.52E-07	3.23E-11
325	Claymore Creek	3.06E-11	2.28E-09	1.55E-05	2.83E-09	4.35E-06	3.37E-11
325	Verdigris River	3.53E-12	3.71E-10	1.59E-06	7.42E-10	4.26E-07	6.32E-12
331	Rocky River	4.40E-13	1.37E-09	6.21E-08	1.50E-09	6.39E-08	5.91E-13
331	East Branch Black River	9.75E-13	3.43E-09	2.26E-07	2.06E-09	5.86E-08	4.24E-13
331	Wyleswood Lake	7.15E-13	1.86E-09	1.14E-07	1.86E-09	9.09E-08	7.15E-13
331	Baldwin Lake	2.16E-13	7.99E-10	2.94E-08	1.30E-09	5.18E-08	5.35E-13
359	Kentucky River	8.49E-12	1.87E-08	0.00E+00	2.98E-08	0.00E+00	1.46E-11
359	Indian Creek	9.89E-12	2.13E-08	0.00E+00	2.33E-08	0.00E+00	1.17E-11
359	Indian Kentuck Creek	5.73E-12	1.45E-08	0.00E+00	9.93E-09	0.00E+00	4.00E-12
359	Ohio River	7.41E-12	1.76E-08	0.00E+00	2.53E-08	0.00E+00	1.17E-11
A15	Tonawanda Creek	1.92E-13	2.21E-10	1.84E-08	1.10E-10	1.52E-09	6.61E-14
A15	Murder Creek	7.68E-14	1.79E-10	6.84E-09	1.64E-10	2.64E-09	7.11E-14
A15	Ellicott Creek	1.23E-13	2.12E-10	1.11E-08	2.45E-10	4.34E-09	1.17E-13
A18	Taylor Bayou	3.49E-11	2.24E-07	0.00E+00	2.17E-07	0.00E+00	5.11E-11
A18	Hillebrandt Bayou	2.62E-11	9.10E-08	0.00E+00	1.16E-07	0.00E+00	3.99E-11
A18	Viterbo Reservoir	4.64E-11	1.26E-07	0.00E+00	1.51E-07	0.00E+00	5.47E-11
CAL	Tennessee River	1.21E-11	5.57E-08	4.17E-08	4.77E-08	2.10E-08	1.02E-11
CAL	Kentucky Lake	1.70E-11	8.41E-08	8.37E-08	1.18E-07	9.22E-08	2.31E-11
CAL	Barkley Lake	6.31E-12	3.18E-08	1.94E-08	3.30E-08	1.27E-08	6.54E-12
CAL	Cumberland River	1.24E-11	3.64E-08	4.06E-08	3.41E-08	2.61E-08	1.17E-11
ELD	Flat Creek	3.43E-11	1.09E-07	0.00E+00	8.49E-08	0.00E+00	4.59E-11
ELD	Salt Creek	3.05E-11	6.37E-08	0.00E+00	5.90E-08	0.00E+00	2.98E-11
ELD	Calion Lake	1.26E-11	2.60E-08	0.00E+00	2.36E-08	0.00E+00	8.95E-12
ELD	Ouachita River	1.14E-11	3.66E-08	0.00E+00	1.65E-08	0.00E+00	7.63E-12
SAU	Horseshoe Lake	4.53E-13	1.22E-09	4.76E-08	1.27E-09	2.22E-08	4.75E-13
SAU	Old Cahokia Creek	7.34E-13	2.10E-09	8.50E-08	2.05E-09	4.03E-08	6.62E-13
SAU	Mississippi River	7.82E-13	2.71E-09	1.06E-07	6.26E-09	1.64E-07	1.37E-12
202	Elk City Lake	1.29E-13	1.12E-09	1.50E-08	1.87E-09	1.53E-08	2.00E-13
202	Montgomery County State Park Lake	4.63E-13	5.18E-09	1.08E-07	4.81E-09	1.08E-07	5.80E-13
202	Verdigris River	3.17E-13	1.62E-09	5.07E-08	2.44E-09	5.96E-08	5.34E-13
203	Catalpa Creek	1.81E-12	2.38E-08	3.91E-07	1.95E-08	8.79E-08	2.17E-12
203	Gilmer Creek	2.34E-12	2.35E-08	4.56E-07	2.04E-08	7.85E-08	1.54E-12
203	N. Branch Magowah Creek	2.23E-12	1.18E-07	2.84E-06	2.09E-07	6.47E-06	1.88E-12
203	Shotbag Creek	2.12E-12	2.75E-08	5.43E-07	2.23E-08	2.02E-07	1.91E-12

Table G-4. Site-Specific Inputs Used for Floor/Standard

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
204	Bay Creek	9.10E-13	7.49E-09	1.17E-07	8.37E-09	8.77E-08	9.99E-13
204	Little Calumet Creek	6.05E-13	4.14E-08	3.75E-07	4.45E-08	7.73E-07	6.52E-13
204	Upper and Lower Swan Lake	8.43E-13	1.94E-08	2.05E-07	1.85E-08	1.64E-07	8.76E-13
204	Mississippi River	8.94E-13	1.76E-08	2.14E-07	2.69E-08	2.86E-07	8.66E-13
302	Maumee River	1.28E-12	5.91E-09	2.46E-07	6.19E-09	6.68E-08	1.48E-12
302	Auglaize River	1.52E-12	5.21E-09	3.08E-07	3.94E-09	2.82E-08	1.45E-12
302	Six Mile Creek	3.39E-12	1.91E-08	1.02E-06	1.07E-08	1.84E-07	3.28E-12
304	Big Walnut Creek	9.68E-12	2.01E-08	7.20E-06	2.04E-08	3.28E-06	9.63E-12
304	Glenn Flint Lake	7.29E-12	1.13E-08	3.91E-06	1.39E-08	8.70E-07	7.03E-12
304	Deer Creek	1.19E-11	3.25E-08	1.18E-05	1.97E-08	2.18E-06	1.13E-11
320	Mud Devils Lake	2.03E-12	3.76E-08	9.65E-07	1.18E-07	2.51E-06	4.54E-12
320	Thunder Bay River	2.72E-12	4.43E-08	1.10E-06	7.53E-08	1.57E-06	2.94E-12
320	Long Lake	3.24E-12	3.43E-08	8.74E-07	3.43E-08	3.39E-07	3.22E-12
321	Black Warrior River	2.72E-11	5.43E-08	1.61E-05	4.61E-08	1.37E-06	2.63E-11
321	Powell Creek	2.33E-11	2.84E-08	1.12E-05	2.59E-08	4.79E-07	2.27E-11
321	Lake Demopolis	2.72E-11	5.43E-08	1.61E-05	2.46E-07	5.18E-05	4.16E-11
321	Lake Henry	2.63E-11	4.04E-08	1.30E-05	3.34E-08	7.73E-07	2.30E-11
BAT	Monocacy Creek	1.90E-12	8.50E-09	4.94E-07	1.13E-08	3.82E-07	1.31E-12
BAT	Lehigh River	9.08E-13	4.38E-09	1.85E-07	3.56E-09	3.42E-08	6.40E-13
CHA	Allen Lake	2.48E-11	2.87E-07	7.47E-06	3.02E-07	3.90E-06	2.69E-11
CHA	Santa Fe Lake	1.47E-11	4.14E-07	1.06E-05	4.69E-07	8.65E-06	1.88E-11
CHA	Neosho River	1.51E-11	1.51E-07	4.72E-06	1.46E-07	1.44E-06	2.09E-11
FOR	Walnut Bayou	1.77E-11	3.06E-07	7.19E-06	4.89E-07	7.87E-06	1.99E-11
FOR	West Flat Creek	3.52E-11	1.84E-07	7.74E-06	9.17E-08	9.48E-07	2.15E-11
FOR	Hamilton Lake	1.87E-11	4.40E-07	8.89E-06	4.62E-07	5.96E-06	2.10E-11
FRE	Salt Creek	8.86E-12	5.04E-08	2.34E-06	3.96E-08	4.78E-07	8.86E-12
FRE	Verdigris River	2.74E-11	7.36E-08	6.31E-06	6.15E-08	1.55E-06	2.02E-11
FRE	Fall River	1.07E-11	1.78E-08	1.81E-06	1.65E-08	9.64E-08	9.54E-12
HAR	Indian Field Swamp	1.57E-11	9.58E-08	4.50E-06	9.23E-08	6.93E-07	1.61E-11
HAR	Walnut Branch	1.61E-11	7.51E-08	4.37E-06	5.90E-08	4.12E-07	1.34E-11
HAR	Huttos Lake	3.80E-11	2.76E-07	1.51E-05	2.90E-07	6.96E-06	3.98E-11
HOL	Huttos Lake	1.57E-11	2.92E-08	1.22E-05	2.95E-08	4.08E-06	1.56E-11
HOL	Lake Merkel	7.81E-12	5.34E-09	4.33E-06	5.56E-09	2.12E-07	8.21E-12
TEX	Armstrong Creek	1.86E-11	4.71E-09	9.19E-06	2.80E-09	4.11E-07	1.83E-11
TEX	Massey Lake	4.72E-12	2.02E-09	2.40E-06	1.23E-09	6.38E-08	2.21E-12
TEX	Mountain Creek	1.43E-11	6.50E-09	8.63E-06	7.62E-09	4.37E-06	2.17E-11
TEX	Waxahachie Creek	1.22E-11	2.30E-09	4.97E-06	2.13E-09	3.30E-07	7.57E-12
WAM	Connoquenessing Creek	2.15E-11	4.25E-08	1.47E-05	4.37E-08	3.02E-06	2.37E-11
WAM	Hereford Manor Lake	1.61E-11	2.88E-08	9.80E-06	3.07E-08	1.55E-06	1.74E-11
WAM	Beaver River	1.28E-11	4.73E-08	1.07E-05	1.38E-07	1.95E-05	1.54E-11
WAM	Slippery Rock Creek	2.23E-11	3.76E-08	1.43E-05	7.63E-08	6.96E-06	3.33E-11
ARV	James River	2.09E-13	4.98E-10	5.94E-08	5.70E-10	1.52E-08	2.60E-13
ARV	Sports Lake	2.21E-13	4.18E-10	5.84E-08	1.77E-10	1.93E-09	1.32E-13
ARV	Holman Creek	8.15E-13	6.27E-10	2.15E-07	7.31E-10	1.80E-08	9.43E-13
ARV	Rivanna River	2.34E-13	2.17E-10	5.98E-08	1.93E-10	1.81E-09	2.21E-13
BRO	Bluelick Creek	1.40E-11	6.44E-08	6.17E-06	2.44E-07	1.35E-05	3.13E-11
BRO	McNeely Lake	1.42E-11	1.80E-08	3.79E-06	2.18E-08	2.37E-07	1.66E-11
BRO	Silver Lake	8.06E-12	1.85E-08	2.20E-06	1.85E-08	1.59E-07	8.21E-12
BRO	Salt River	6.34E-12	1.18E-08	1.77E-06	2.88E-08	4.33E-07	1.59E-11
CAS	Cascade Creek	4.93E-12	1.32E-08	1.58E-06	8.26E-09	1.60E-07	2.20E-12
CAS	Smith River	8.62E-13	3.13E-09	2.28E-07	4.31E-09	4.10E-08	1.31E-12
CAS	Dan River	2.20E-12	3.66E-09	5.70E-07	5.03E-09	5.25E-08	2.92E-12

Table G-4. Site-Specific Inputs Used for Floor/Standard

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
COH	Troy Reservoir	9.12E-12	5.64E-09	3.35E-06	6.58E-09	1.60E-07	1.19E-11
COH	Hudson River	1.03E-11	1.40E-08	3.85E-06	2.51E-08	5.98E-07	1.46E-11
COH	Mohawk River	1.19E-11	1.60E-08	4.64E-06	2.17E-08	6.65E-07	2.13E-11
COH	Tomahannock Reservoir	1.91E-12	2.57E-09	6.86E-07	2.57E-09	1.47E-08	1.94E-12
NOR	Rocky River	4.80E-13	1.20E-09	1.11E-07	1.65E-09	2.41E-08	5.91E-13
NOR	Long Lake/Creek	2.94E-13	6.31E-10	5.96E-08	7.69E-10	4.06E-09	4.44E-13
NOR	Lake Tillery	3.61E-13	4.15E-10	7.42E-08	3.69E-10	1.66E-09	2.66E-13
334	Mississippi River	8.33E-14	2.24E-10	1.68E-08	3.94E-10	2.64E-08	1.22E-13
334	Vermilion River	4.47E-14	1.56E-10	7.39E-09	1.49E-10	9.52E-09	6.68E-14
334	Colby Lake	1.05E-13	2.04E-10	1.72E-08	2.04E-10	1.42E-08	1.05E-13
334	Lake Isabelle	1.51E-13	2.92E-10	3.07E-08	2.78E-10	2.68E-08	1.55E-13
463	Blue River	4.47E-12	9.79E-09	0.00E+00	2.54E-08	0.00E+00	1.04E-11
463	Rock Creek	1.98E-11	3.37E-08	0.00E+00	3.39E-08	0.00E+00	2.31E-11
463	Shoal Creek	5.76E-12	7.03E-09	0.00E+00	7.17E-09	0.00E+00	5.26E-12
463	Missouri River	4.91E-12	8.83E-09	0.00E+00	1.12E-08	0.00E+00	5.58E-12
464	Ottawa River	1.10E-14	8.58E-11	1.92E-09	1.38E-10	2.37E-09	1.35E-14
464	Twin Lakes Reservoir	2.77E-14	1.27E-10	4.39E-09	1.20E-10	2.70E-09	2.68E-14
464	Metzger/Ferguson Reservoir	1.85E-14	1.16E-10	2.58E-09	1.16E-10	1.67E-09	1.85E-14
504	Pennsauken Creek	6.15E-12	7.71E-09	0.00E+00	7.31E-09	0.00E+00	5.75E-12
504	Darby Creek	5.54E-12	2.68E-08	0.00E+00	4.34E-08	0.00E+00	8.36E-12
504	Cooper River Lake	6.18E-12	7.71E-09	0.00E+00	1.22E-08	0.00E+00	1.01E-11
504	Schuylkill River	1.14E-11	3.13E-08	0.00E+00	5.97E-08	0.00E+00	1.83E-11
600	Lake Jackson	8.10E-12	3.30E-10	4.27E-06	3.30E-10	8.41E-08	8.14E-12
600	Oyster Creek	6.08E-12	3.30E-10	3.24E-06	3.19E-10	8.04E-08	6.29E-12
600	Brazos River	7.70E-12	6.16E-10	4.49E-06	1.29E-09	1.42E-06	9.10E-12
711	Brechtel Lake	1.47E-13	8.25E-10	2.22E-10	8.25E-10	1.76E-11	1.47E-13
711	Mississippi River	2.20E-13	1.74E-09	4.60E-10	1.75E-09	1.78E-10	2.20E-13
806	Wolf Lake	9.32E-12	4.18E-08	0.00E+00	4.51E-08	0.00E+00	9.72E-12
806	Lake George	1.15E-11	4.30E-08	0.00E+00	4.05E-08	0.00E+00	1.11E-11
806	Little Calumet River	4.49E-12	1.43E-08	0.00E+00	1.86E-08	0.00E+00	5.78E-12
806	Grand Calumet River	2.36E-11	4.60E-08	0.00E+00	2.24E-08	0.00E+00	1.23E-11
915	Genesee River	9.58E-13	7.38E-09	0.00E+00	2.00E-08	0.00E+00	2.17E-12
915	Irondequoit Bay	1.45E-12	4.67E-09	0.00E+00	8.13E-09	0.00E+00	3.59E-12
915	Highland Reservoir	8.71E-13	6.48E-09	0.00E+00	6.48E-09	0.00E+00	8.71E-13
A32	Armand Bayou	7.70E-12	2.50E-08	0.00E+00	3.91E-08	0.00E+00	9.46E-12
A43	Twelvemile Creek	6.14E-12	2.21E-08	0.00E+00	1.51E-08	0.00E+00	4.45E-12
A43	Bergholtz Creek	1.10E-11	3.44E-08	0.00E+00	3.89E-08	0.00E+00	1.27E-11
A43	Cayuga Creek	2.19E-11	6.91E-08	0.00E+00	5.40E-08	0.00E+00	1.71E-11
A43	Niagara River	4.95E-12	2.78E-08	0.00E+00	2.90E-08	0.00E+00	5.10E-12
A50	Carpenters Bayou	5.39E-13	3.74E-11	2.26E-07	4.46E-11	1.02E-08	6.55E-13
A50	Highlands Reservoir	2.73E-13	1.51E-11	1.13E-07	1.59E-11	1.99E-09	2.68E-13
A50	Buffalo Bayou	4.71E-13	4.30E-11	2.03E-07	5.01E-11	1.59E-08	7.00E-13
A50	San Jacinto River	3.51E-13	1.99E-11	1.46E-07	2.07E-11	5.05E-09	4.34E-13
A62	Caney Creek	3.98E-12	4.95E-08	0.00E+00	6.65E-08	0.00E+00	5.25E-12
A62	E & W Fork Crystal Cr.	5.19E-12	1.61E-07	0.00E+00	3.95E-07	0.00E+00	1.39E-11
A62	Stewarts Creek	9.32E-12	5.09E-08	0.00E+00	5.09E-08	0.00E+00	8.14E-12
A62	Lewis Creek Reservoir	2.87E-12	1.41E-08	0.00E+00	1.41E-08	0.00E+00	2.86E-12
B20	Cuyahoga River	1.99E-12	7.50E-09	0.00E+00	7.50E-09	0.00E+00	2.09E-12
B20	Upper and Lower Shaker Lake	3.90E-12	8.95E-09	0.00E+00	3.31E-08	0.00E+00	1.77E-11
B20	Euclid Creek	3.30E-12	6.60E-09	0.00E+00	7.39E-09	0.00E+00	3.62E-12
B20	Fairmont Reservoir	1.80E-11	2.64E-08	0.00E+00	2.64E-08	0.00E+00	1.70E-11
HAN	Fabius River	5.43E-12	1.29E-08	4.08E-08	1.29E-08	2.53E-08	5.36E-12
HAN	Spring Lake	5.94E-12	2.01E-08	4.81E-08	2.09E-08	3.15E-08	5.63E-12
HAN	Mississippi River	7.69E-12	2.29E-08	7.56E-08	6.91E-08	2.15E-07	1.98E-11

Table G-4. Site-Specific Inputs Used for Floor/Standard

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
KIN	North Fork Holston River	3.16E-12	6.48E-09	7.18E-09	9.59E-09	1.07E-09	5.83E-12
KIN	Kingsport Reservoir	7.40E-12	7.82E-09	1.60E-08	6.71E-09	4.17E-10	5.68E-12
KIN	South Fork Holston River	1.44E-12	3.58E-09	3.12E-09	8.80E-09	9.09E-10	3.09E-12
KIN	Reedy Creek	2.61E-12	6.47E-09	6.15E-09	1.40E-08	1.87E-09	8.02E-12
MCI	Hals Lake	3.69E-13	2.06E-09	4.25E-08	3.33E-09	6.32E-08	7.38E-13
MCI	Hellcat Lake	2.93E-12	1.83E-08	7.50E-07	3.06E-08	7.98E-07	3.15E-12
MCI	Alabama River	2.24E-13	1.04E-09	2.00E-08	1.38E-09	1.45E-08	3.04E-13
MCI	Tombigbee River	4.84E-13	2.23E-09	6.10E-08	5.16E-09	1.28E-07	9.05E-13
MID	Tittabawassee River	6.22E-12	2.84E-08	1.48E-08	2.89E-08	3.15E-09	6.00E-12
MID	Sturgeon Creek	3.76E-12	1.89E-08	7.85E-09	1.40E-08	6.67E-10	2.77E-12
MID	Kawkawlin River	7.50E-12	1.94E-08	1.55E-08	1.53E-08	5.31E-10	5.01E-12
MID	Chippewa River	3.63E-12	1.76E-08	7.77E-09	2.43E-08	2.10E-09	4.96E-12
STG	Bayou Plaquemine	1.64E-11	1.64E-08	6.88E-06	1.64E-08	4.25E-07	1.64E-11
STG	Manchac Bayou	2.93E-11	3.30E-08	1.56E-05	1.27E-08	4.75E-07	1.34E-11
STG	Bayou Fountain	1.48E-11	1.39E-08	6.32E-06	1.32E-08	4.59E-07	1.41E-11
STG	Mississippi River	3.09E-11	3.17E-08	1.58E-05	3.52E-08	4.47E-06	3.40E-11
340	Sunfish Creek	2.48E-12	2.86E-09	4.71E-09	2.66E-09	9.39E-11	2.65E-12
340	Proctor Creek	5.10E-12	9.12E-09	1.02E-08	1.05E-08	1.14E-09	4.77E-12
340	Fish Creek	2.48E-12	2.86E-09	4.71E-09	2.66E-09	9.39E-11	2.65E-12
340	Ohio River	2.81E-12	4.56E-09	5.57E-09	1.03E-08	1.49E-09	4.03E-12
342	Kalamazoo River	3.08E-14	4.42E-11	4.48E-09	1.38E-09	5.10E-09	6.00E-14
342	East Lake	1.17E-14	1.73E-11	1.31E-09	1.73E-11	5.27E-10	1.17E-14
342	Portage Creek	3.83E-14	5.74E-11	6.89E-09	5.25E-10	3.38E-09	3.99E-14
342	Portage River	2.40E-14	3.73E-11	2.78E-09	2.56E-11	5.71E-10	1.90E-14
453	Lake Spivey	1.18E-12	1.25E-09	3.25E-09	1.40E-09	2.72E-11	1.18E-12
453	Jester Creek	5.62E-12	6.78E-09	1.60E-08	9.89E-09	1.02E-09	7.31E-12
453	Flint River	1.24E-12	3.06E-09	3.56E-09	3.84E-09	2.80E-10	1.76E-12
468	Wissahickon Creek	2.05E-14	8.99E-13	1.80E-08	1.35E-12	4.58E-10	3.00E-14
468	Tacony Creek	1.45E-14	6.57E-13	1.25E-08	5.18E-13	9.90E-11	1.21E-14
468	Schuylkill	2.42E-14	2.21E-12	2.23E-08	2.56E-12	2.41E-09	4.32E-14
468	Pickering Creek Reservoir	5.56E-15	1.38E-12	5.08E-09	1.38E-12	3.51E-10	5.78E-15
701	Wabash River	5.82E-13	6.93E-11	2.67E-07	1.90E-09	1.18E-06	2.00E-13
701	Sugar Creek	3.25E-13	3.59E-11	1.36E-07	4.69E-10	3.42E-07	3.80E-14
701	Big Raccoon Creek	5.42E-13	6.06E-11	2.28E-07	9.14E-10	7.18E-07	1.00E-13
704	Garvey Reservoir	1.07E-12	2.37E-11	9.90E-07	2.37E-11	1.21E-08	1.08E-12
704	Legg Lake	9.09E-12	3.96E-11	8.29E-06	3.96E-11	2.03E-08	8.96E-12
704	Silver Lake Res.	3.47E-13	1.98E-11	3.18E-07	1.98E-11	2.16E-09	3.40E-13
708	Grindle Creek	2.35E-12	1.31E-10	1.29E-06	1.22E-10	3.26E-08	2.42E-12
708	Parker Creek	1.90E-11	8.88E-10	1.11E-05	9.79E-10	1.24E-06	2.49E-11
708	Tranters Creek	9.27E-13	5.19E-11	5.00E-07	4.05E-11	4.58E-09	7.36E-13
725	Passaic River	2.60E-16	9.34E-13	3.63E-11	1.16E-12	4.22E-11	3.46E-16
725	Silver Lake Reservoir	1.89E-15	1.57E-12	5.63E-10	1.55E-12	4.59E-10	1.87E-15
725	Reservoir No. 2	4.92E-16	1.13E-12	7.20E-11	1.13E-12	5.36E-11	4.90E-16
725	Rahway River	1.28E-16	1.01E-12	1.84E-11	1.28E-12	1.68E-11	1.45E-16
824	Newton Lake	8.57E-16	1.40E-12	8.38E-11	1.68E-12	5.48E-11	1.05E-15
824	Big Timber Creek	4.97E-16	1.43E-12	4.85E-11	1.36E-12	2.35E-11	4.24E-16
824	Darby Creek	1.23E-15	7.52E-13	1.12E-10	8.60E-13	6.05E-11	1.26E-15
824	Schuylkill River	1.16E-15	9.32E-13	1.05E-10	1.25E-12	6.61E-11	1.77E-15
904	Pascagoula River	1.76E-13	8.90E-10	1.97E-08	7.44E-09	1.39E-08	1.68E-13
904	Escatawpa River	1.88E-13	1.08E-09	2.29E-08	7.04E-08	2.13E-08	1.81E-13
906	Mississippi River	2.03E-12	3.45E-09	0.00E+00	5.39E-09	0.00E+00	3.29E-12
906	Copperas Creek	1.18E-12	1.56E-09	0.00E+00	1.70E-09	0.00E+00	1.77E-12
906	Eliza Creek	6.28E-13	1.04E-09	0.00E+00	9.45E-10	0.00E+00	6.14E-13
906	Muscatine Slough	1.57E-12	4.39E-09	0.00E+00	4.21E-09	0.00E+00	1.37E-12

Table G-4. Site-Specific Inputs Used for Floor/Standard

Site	Waterbody	Watershed Air Conc. (g/m^3)	Elemental Mercury Watershed Deposition Load (g/m^2-yr)	Divalent Mercury Watershed Deposition Load (g/m^2-yr)	Elemental Mercury Waterbody Deposition Load (g/m^2-yr)	Divalent Mercury Waterbody Deposition Load (g/m^2-yr)	Waterbody Air Conc. (g/m^3)
A14	New River	9.18E-16	7.56E-14	4.90E-10	5.91E-14	1.11E-11	4.63E-16
A14	Bayou Conway	7.50E-16	7.32E-14	3.91E-10	6.48E-14	1.47E-11	5.85E-16
A14	Mississippi River	7.09E-16	7.32E-14	3.66E-10	6.80E-14	1.45E-11	6.45E-16
A14	Bayou Lafourche	3.63E-16	4.32E-14	1.85E-10	4.60E-14	6.08E-12	3.86E-16
A26	Big Creek	1.13E-11	1.46E-08	5.09E-09	7.12E-09	2.09E-09	3.51E-12
A26	Carter Creek	6.65E-13	2.09E-09	1.79E-10	1.91E-09	9.07E-11	4.82E-13
A26	Dota Creek	1.43E-12	3.48E-09	4.04E-10	3.21E-09	1.90E-10	1.24E-12
A31	Nottaway River	7.71E-13	1.14E-10	5.07E-07	1.25E-10	7.07E-08	9.05E-13
A31	Chowan River	5.65E-13	4.21E-11	3.39E-07	4.36E-11	1.25E-08	5.79E-13
A31	Nottaway Swamp	2.22E-12	1.73E-10	1.43E-06	3.37E-10	3.54E-07	4.12E-12
A45	Sheldon Reservoir	1.73E-13	1.90E-10	1.05E-08	1.90E-10	4.47E-09	1.74E-13
A45	Highlands Reservoir	4.66E-14	6.98E-11	2.82E-09	5.71E-11	6.59E-10	4.52E-14
A45	Greens Bayou	1.87E-13	2.28E-10	1.16E-08	3.42E-10	6.16E-09	2.22E-13
A45	Buffalo Bayou	2.70E-13	4.63E-10	2.17E-08	5.90E-10	1.42E-08	4.40E-13
A46	Little Muskingum River	3.09E-12	6.89E-09	0.00E+00	6.72E-09	0.00E+00	2.79E-12
A46	Ohio River	9.99E-12	1.56E-08	0.00E+00	2.17E-08	0.00E+00	1.08E-11
A46	Middle Island Creek	4.00E-12	9.75E-09	0.00E+00	1.11E-08	0.00E+00	3.93E-12
A47	Caney River	3.35E-14	4.25E-11	6.01E-11	5.67E-11	9.49E-12	4.06E-14
A47	Sand Creek	6.09E-14	8.51E-11	1.13E-10	1.03E-10	7.35E-12	5.57E-14
A47	Bar-Dew Lake	9.61E-14	7.76E-11	1.72E-10	7.09E-11	2.50E-12	9.68E-14
A47	Lake Hudson	5.80E-14	6.34E-11	1.04E-10	9.34E-11	9.59E-12	1.29E-13
A55	Mohawk River	4.68E-14	8.33E-11	1.01E-10	1.73E-10	3.21E-11	8.61E-14
A55	Acplause Kill River	4.33E-14	5.25E-11	8.91E-11	4.61E-11	1.46E-11	4.12E-14
A55	Stony Creek Reservoir	1.53E-14	2.56E-11	3.11E-11	2.43E-11	9.36E-13	1.55E-14
A55	Watervliet Reservoir	2.35E-14	8.71E-11	5.05E-11	4.36E-11	1.50E-12	1.35E-14
B18	Gulf Intercoastal Waterway	6.25E-14	2.76E-10	2.24E-11	2.46E-10	4.77E-12	6.04E-14
B18	Bayou La Butte	3.68E-13	1.76E-09	2.02E-10	1.50E-09	8.37E-11	3.98E-13
B18	Mississippi River	9.22E-14	4.12E-10	3.77E-11	4.12E-10	1.38E-11	9.30E-14
B18	Bayou Manchac	5.35E-14	2.50E-10	2.04E-11	2.13E-10	3.40E-12	3.98E-14
B23	Hillbrandt Bayou	1.72E-14	9.41E-11	1.42E-09	9.23E-11	5.10E-10	1.43E-14
B23	Cow Bayou	2.61E-14	6.27E-11	1.82E-09	6.46E-11	5.41E-10	2.47E-14
B23	Neches River	2.57E-14	8.12E-11	2.02E-09	8.67E-11	8.82E-10	2.55E-14
B23	Port Arthur Reservoir	5.67E-14	2.38E-10	5.10E-09	2.40E-10	2.48E-09	5.74E-14
B31	Wassahickon Creek	5.30E-13	4.22E-10	1.90E-07	1.35E-09	8.13E-08	9.99E-13
B31	Neshaminy Creek	2.15E-13	2.63E-10	7.38E-08	2.07E-10	2.49E-09	1.78E-13
B31	Peace Valley Reservoir	1.06E-13	1.51E-10	3.59E-08	1.59E-10	1.51E-09	1.12E-13
B31	Sckuylkill River	1.73E-13	5.57E-10	6.94E-08	3.66E-10	3.98E-09	1.04E-13
B32	Cedar Bayou	3.92E-13	6.15E-11	2.85E-07	8.96E-11	5.23E-08	6.71E-13
B32	Cary Bayou	9.94E-13	1.01E-10	6.69E-07	9.40E-11	4.65E-08	1.02E-12
B32	Goose Creek	3.35E-13	4.39E-11	2.20E-07	5.01E-11	1.41E-08	3.15E-13
B37	Arkansas River	7.80E-14	1.54E-10	1.98E-10	1.18E-10	7.53E-12	7.22E-14
B37	Plum Bayou	2.33E-14	5.90E-11	5.66E-11	4.72E-11	9.33E-13	1.71E-14
B37	Yellow Lake	3.02E-13	5.69E-10	7.89E-10	9.67E-10	2.22E-11	5.99E-13
B37	Lake Pine Bluff	4.47E-14	1.62E-10	1.16E-10	9.11E-11	4.54E-12	3.51E-14
B44	Sheldon Reservoir	2.14E-14	1.42E-11	1.21E-08	1.42E-11	3.97E-09	2.14E-14
B44	Greens Bayou	3.46E-14	2.32E-11	2.09E-08	3.15E-11	1.25E-08	5.17E-14
B44	Buffalo Bayou	6.04E-14	4.96E-11	4.44E-08	4.06E-11	2.35E-08	7.27E-14
B44	Hunting Bayou	2.80E-14	2.51E-11	1.74E-08	2.77E-11	7.66E-09	3.13E-14
TOO	Rush Lake	2.31E-13	2.83E-09	2.06E-10	6.83E-09	2.11E-11	5.43E-13
TOO	Box Elder Wash	4.62E-13	1.38E-08	4.35E-10	3.82E-09	1.16E-11	2.96E-13
TOO	Blue Lakes	3.69E-14	1.52E-09	3.59E-11	1.50E-09	4.44E-12	3.72E-14
TOO	Soldier Creek	1.83E-13	2.35E-09	1.63E-10	2.42E-09	7.37E-12	1.94E-13

Table G-5. Mercury Waterbody Intermediate Values Used for Baseline and Floor/Standard

Site	Waterbody	Sediment Delivery Ratio to Waterbody, Sdel (unitless)	Sediment Loss Rate, Xe (kg/km^2-yr)	Sediment Burial Velocity, vb (m/yr)	Conc. of Biotic Solids, Sbio (g/m^3)	Conc. of Abiotic Solids, S_w (g/m^3)	Elemental Mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Elemental Mercury Water Column Vol. Loss Constant, kwv (yr^{-1})	Methyl-mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Methyl-mercury Water Column Vol. Loss Constant, kwv (yr^{-1})
209	Lawsons Fork Creek	1.13E-01	8.30E+05	2.60E-01	2.76E+00	5.06E+01	8.04E+02	2.97E+03	7.97E-01	2.94E+00
209	Tyger River	4.94E-02	1.04E+06	4.34E-02	2.65E+00	2.83E+01	8.62E+02	2.25E+03	7.97E-01	2.08E+00
209	Fair Forest Creek	1.07E-01	7.64E+05	4.86E-01	2.71E+00	7.38E+01	1.01E+03	5.02E+03	7.98E-01	3.97E+00
209	Middle Tyger River	1.30E-01	1.19E+06	1.50E-01	1.50E+00	3.94E+01	1.02E+03	4.59E+03	7.98E-01	3.58E+00
214	Fish Ponds	2.17E-01	1.23E+05	7.50E-03	8.55E+00	3.80E+01	1.59E+02	3.98E+01	8.21E+00	2.05E+00
214	Lake Clause	1.78E-01	1.34E+05	1.63E-02	7.56E+00	3.90E+01	1.59E+02	3.98E+01	8.21E+00	2.05E+00
214	University Lake/ City Park Lake	3.01E-01	2.24E+05	9.04E-03	8.52E+00	3.82E+01	1.59E+02	3.98E+01	8.21E+00	2.05E+00
214	Comite River	5.18E-02	2.69E+05	0.00E+00	8.01E-01	6.72E+01	9.91E+02	2.86E+03	7.98E-01	2.30E+00
221	Highlands Reservoir	2.03E-01	6.30E+04	7.35E-03	8.54E+00	7.00E+01	1.58E+02	3.96E+01	8.15E+00	2.04E+00
221	Sheldon Reservoir	2.02E-01	6.36E+04	7.34E-03	8.55E+00	7.00E+01	1.58E+02	3.96E+01	8.15E+00	2.04E+00
221	San Jacinto River / Houston Lake	1.19E-01	5.51E+04	0.00E+00	4.69E+00	6.07E+01	1.05E+03	2.99E+03	7.98E-01	2.27E+00
324	Shades Creek	1.13E-01	8.32E+05	5.99E-02	2.18E+00	3.00E+01	1.13E+03	5.31E+03	7.98E-01	3.74E+00
324	Valley Creek	5.06E-02	1.20E+06	5.49E-02	2.70E+00	2.95E+01	8.68E+02	1.98E+03	7.97E-01	1.82E+00
324	Bayview Lake	1.13E-01	7.08E+05	5.42E-02	7.09E+00	1.10E+01	1.39E+02	3.48E+01	7.24E+00	1.81E+00
324	Cahaba River	1.14E-01	1.04E+06	7.51E-03	1.80E+00	2.47E+01	8.10E+02	1.76E+03	7.97E-01	1.73E+00
325	Big Hill Creek	1.18E-01	2.67E+05	0.00E+00	2.46E+00	1.60E+02	1.34E+03	2.20E+04	7.98E-01	1.31E+01
325	Potato Creek	1.33E-01	2.31E+05	0.00E+00	1.57E+00	1.81E+02	1.69E+03	7.06E+04	7.98E-01	3.32E+01
325	Claymore Creek	1.37E-01	2.09E+05	0.00E+00	2.17E+00	1.40E+02	1.08E+03	3.32E+03	7.98E-01	2.45E+00
325	Verdigris River	4.49E-02	2.53E+05	0.00E+00	1.11E+00	1.00E+02	1.46E+03	7.75E+03	7.98E-01	4.22E+00
331	Rocky River	5.17E-02	1.90E+05	0.00E+00	3.46E+00	1.92E+01	9.13E+02	1.69E+03	7.98E-01	1.48E+00
331	East Branch Black River	1.07E-01	1.75E+05	1.56E-02	2.42E+00	2.25E+01	9.53E+02	2.03E+03	7.98E-01	1.70E+00
331	Wyleswood Lake	5.09E-01	1.81E+05	9.32E-03	8.55E+00	6.21E+00	1.97E+02	4.93E+01	1.06E+01	2.64E+00
331	Baldwin Lake	1.39E-01	1.24E+05	5.30E-02	6.76E+00	1.09E+01	1.97E+02	4.93E+01	1.06E+01	2.64E+00
359	Kentucky River	4.95E-02	1.07E+06	0.00E+00	2.82E-01	6.80E+00	8.19E+02	8.56E+02	7.97E-01	8.33E-01
359	Indian Creek	1.18E-01	1.15E+06	3.90E-01	6.20E-01	6.71E+01	1.71E+03	2.16E+04	7.98E-01	1.01E+01
359	Indian Kentuck Creek	1.18E-01	1.20E+06	1.18E+00	2.73E+00	1.48E+02	1.00E+03	7.31E+03	7.98E-01	5.82E+00
359	Ohio River	4.90E-02	1.09E+06	0.00E+00	2.03E-01	3.79E+00	4.16E+02	8.05E+01	7.97E-01	1.54E-01
A15	Tonawanda Creek	4.99E-02	7.37E+04	0.00E+00	2.96E+00	1.63E+01	1.01E+03	3.25E+03	7.98E-01	2.57E+00
A15	Murder Creek	1.19E-01	9.60E+04	2.77E-02	2.26E+00	2.37E+01	1.48E+03	2.56E+04	7.98E-01	1.38E+01
A15	Ellicott Creek	5.30E-02	1.97E+05	0.00E+00	3.11E+00	2.00E+01	1.09E+03	5.25E+03	7.98E-01	3.85E+00
A18	Taylor Bayou	5.06E-02	1.74E+05	0.00E+00	2.00E+00	5.28E+01	9.53E+02	2.03E+03	7.98E-01	1.70E+00
A18	Hillebrandt Bayou	1.09E-01	1.71E+05	3.05E-01	5.57E+00	1.03E+02	1.30E+03	7.20E+03	7.98E-01	4.43E+00
A18	Viterbo Reservoir	2.12E-01	1.85E+05	9.27E-03	8.49E+00	7.02E+01	1.78E+02	4.45E+01	9.14E+00	2.29E+00
CAL	Tennessee River	4.87E-02	6.05E+05	0.00E+00	1.05E-01	1.30E+00	7.91E+02	4.36E+02	7.97E-01	4.40E-01
CAL	Kentucky Lake	1.15E-01	2.22E+06	1.51E-02	8.52E+00	6.80E+00	1.79E+02	4.48E+01	9.53E+00	2.38E+00

Table G-5. Mercury Waterbody Intermediate Values Used for Baseline and Floor/Standard

Site	Waterbody	Sediment Delivery Ratio to Waterbody, Sdel (unitless)	Sediment Loss Rate, Xe (kg/km^2-yr)	Sediment Burial Velocity, vb (m/yr)	Conc. of Biotic Solids, Sbio (g/m^3)	Conc. of Abiotic Solids, S_w (g/m^3)	Elemental Mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Elemental Mercury Water Column Vol. Loss Constant, kwv (yr^{-1})	Methyl-mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Methyl-mercury Water Column Vol. Loss Constant, kwv (yr^{-1})
CAL	Barkley Lake	1.19E-01	8.71E+05	1.09E-02	8.52E+00	6.37E+00	1.79E+02	4.48E+01	9.53E+00	2.38E+00
CAL	Cumberland River	5.21E-02	1.14E+06	0.00E+00	2.27E-01	4.39E+00	9.73E+02	1.04E+03	7.98E-01	8.52E-01
ELD	Flat Creek	1.21E-01	1.99E+05	0.00E+00	1.96E+00	1.13E+02	1.05E+03	3.10E+03	7.98E-01	2.35E+00
ELD	Salt Creek	1.32E-01	9.13E+04	0.00E+00	6.91E+00	1.53E+02	1.45E+03	8.63E+03	7.98E-01	4.76E+00
ELD	Calion Lake	1.31E-01	9.97E+04	7.96E-03	8.19E+00	3.81E+01	1.78E+02	4.45E+01	9.22E+00	2.30E+00
ELD	Ouachita River	5.12E-02	1.07E+05	0.00E+00	4.97E-01	4.52E+01	6.28E+02	3.81E+02	7.97E-01	4.83E-01
SAU	Horseshoe Lake	1.68E-01	1.03E+05	7.43E-03	8.54E+00	3.80E+01	1.98E+02	4.95E+01	1.05E+01	2.62E+00
SAU	Old Cahokia Creek	3.03E-01	8.42E+05	0.00E+00	1.45E+00	4.63E+01	1.30E+03	7.20E+03	7.98E-01	4.43E+00
SAU	Mississippi River	4.45E-02	4.61E+05	0.00E+00	6.57E-02	3.18E+00	3.37E+02	2.82E+01	7.96E-01	6.67E-02
202	Elk City Lake	1.20E-01	1.92E+05	8.91E-03	8.52E+00	7.02E+01	2.36E+02	5.89E+01	1.24E+01	3.11E+00
202	Montgomery County State Park Lake	1.80E-01	3.10E+05	2.97E-02	8.36E+00	7.23E+01	2.36E+02	5.89E+01	1.24E+01	3.11E+00
202	Verdigris River	4.56E-02	2.19E+05	0.00E+00	1.73E+00	1.25E+02	6.93E+02	5.54E+02	7.97E-01	6.38E-01
203	Catalpa Creek	5.27E-02	3.46E+05	5.38E-02	3.54E+00	2.93E+01	1.01E+03	2.49E+03	7.98E-01	1.97E+00
203	Gilmer Creek	1.17E-01	3.17E+05	4.09E-01	5.46E+00	6.56E+01	1.32E+03	7.74E+03	7.98E-01	4.67E+00
203	N. Branch Magowah Creek	1.36E-01	3.24E+05	4.71E-03	2.13E+00	2.44E+01	1.08E+03	3.32E+03	7.98E-01	2.45E+00
203	Shotbag Creek	1.24E-01	3.78E+05	1.02E-01	2.32E+00	3.43E+01	1.08E+03	3.32E+03	7.98E-01	2.45E+00
204	Bay Creek	1.17E-01	8.10E+05	9.39E-02	1.94E+00	7.76E+01	1.00E+03	2.51E+03	7.98E-01	1.99E+00
204	Little Calumet Creek	1.69E-01	9.81E+05	0.00E+00	1.21E+00	6.11E+01	1.05E+03	3.10E+03	7.98E-01	2.35E+00
204	Upper and Lower Swan Lake	2.02E-01	1.06E+05	9.72E-03	8.47E+00	3.83E+01	1.98E+02	4.95E+01	1.07E+01	2.67E+00
204	Mississippi River	4.54E-02	8.52E+05	0.00E+00	1.29E-01	6.22E+00	4.06E+02	5.95E+01	7.97E-01	1.17E-01
302	Maumee River	4.91E-02	7.47E+04	0.00E+00	6.53E-02	9.97E-01	7.20E+02	6.49E+02	7.97E-01	7.18E-01
302	Auglaize River	4.75E-02	6.57E+04	0.00E+00	1.83E-02	3.11E-01	6.93E+02	5.54E+02	7.97E-01	6.38E-01
302	Six Mile Creek	1.27E-01	9.99E+04	0.00E+00	8.59E-02	1.57E+00	1.05E+03	3.10E+03	7.98E-01	2.35E+00
304	Big Walnut Creek	5.02E-02	1.24E+06	7.44E-02	5.23E+00	3.42E+01	1.38E+03	1.03E+04	7.98E-01	5.95E+00
304	Glenn Flint Lake	1.34E-01	5.98E+05	3.68E-02	8.24E+00	9.06E+00	1.79E+02	4.47E+01	9.53E+00	2.38E+00
304	Deer Creek	1.08E-01	1.04E+06	1.51E-01	8.38E+00	4.17E+01	1.36E+03	1.35E+04	7.98E-01	7.90E+00
320	Mud Devils Lake	1.23E-01	3.81E+04	8.06E-03	8.36E+00	6.09E+00	1.58E+02	3.96E+01	8.63E+00	2.16E+00
320	Thunder Bay River	5.12E-02	1.05E+05	0.00E+00	4.43E+00	1.78E+01	8.67E+02	1.85E+03	7.97E-01	1.70E+00
320	Long Lake	1.28E-01	5.26E+04	7.51E-03	8.53E+00	6.02E+00	1.58E+02	3.96E+01	8.63E+00	2.16E+00
321	Black Warrior River	5.01E-02	3.63E+05	0.00E+00	5.61E-01	8.14E+00	5.86E+02	2.87E+02	7.97E-01	3.91E-01
321	Powell Creek	1.15E-01	7.00E+05	3.56E-02	8.03E-01	2.77E+01	8.62E+02	1.29E+03	7.97E-01	1.19E+00
321	Lake Demopolis	5.01E-02	3.63E+05	9.17E-03	8.38E+00	6.21E+00	1.39E+02	3.46E+01	7.18E+00	1.80E+00
321	Lake Henry	1.96E-01	8.55E+05	1.21E-01	7.62E+00	1.77E+01	1.39E+02	3.46E+01	7.18E+00	1.80E+00
BAT	Monocacy Creek	1.17E-01	8.75E+05	1.29E-01	8.41E+00	3.95E+01	1.12E+03	3.87E+03	7.98E-01	2.75E+00
BAT	Lehigh River	4.61E-02	9.61E+05	0.00E+00	3.05E+00	2.43E+01	9.05E+02	1.25E+03	7.98E-01	1.10E+00

Table G-5. Mercury Waterbody Intermediate Values Used for Baseline and Floor/Standard

Site	Waterbody	Sediment Delivery Ratio to Waterbody, Sdel (unitless)	Sediment Loss Rate, Xe (kg/km^2-yr)	Sediment Burial Velocity, vb (m/yr)	Conc. of Biotic Solids, Sbio (g/m^3)	Conc. of Abiotic Solids, S_w (g/m^3)	Elemental Mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Elemental Mercury Water Column Vol. Loss Constant, kwv (yr^{-1})	Methyl-mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Methyl-mercury Water Column Vol. Loss Constant, kwv (yr^{-1})
CHA	Allen Lake	3.26E-01	7.03E+04	1.06E-02	8.44E+00	7.03E+01	1.99E+02	4.97E+01	1.05E+01	2.63E+00
CHA	Santa Fe Lake	1.88E-01	1.71E+05	1.80E-02	8.31E+00	7.11E+01	1.99E+02	4.97E+01	1.05E+01	2.63E+00
CHA	Neosho River	4.56E-02	2.06E+05	0.00E+00	5.39E-01	6.23E+01	1.36E+03	7.08E+03	7.98E-01	4.15E+00
FOR	Walnut Bayou	5.14E-02	1.11E+05	0.00E+00	5.09E+00	1.81E+02	1.05E+03	3.10E+03	7.98E-01	2.35E+00
FOR	West Flat Creek	1.33E-01	1.42E+05	0.00E+00	4.48E+00	1.85E+02	1.45E+03	1.12E+04	7.98E-01	6.14E+00
FOR	Hamilton Lake	1.99E-01	4.69E+04	4.79E-03	8.16E+00	6.98E+01	1.78E+02	4.45E+01	1.08E+01	2.70E+00
FRE	Salt Creek	1.31E-01	1.73E+05	0.00E+00	1.06E+00	1.15E+02	1.67E+03	4.21E+04	7.98E-01	2.01E+01
FRE	Verdigris River	4.93E-02	1.73E+05	0.00E+00	9.57E-01	9.04E+01	2.31E+03	4.22E+04	7.98E-01	1.45E+01
FRE	Fall River	5.02E-02	2.65E+05	0.00E+00	1.21E+00	1.07E+02	2.36E+03	5.15E+04	7.98E-01	1.75E+01
HAR	Indian Field Swamp	3.39E-01	1.76E+05	0.00E+00	4.93E+00	2.05E+01	1.09E+03	7.45E+03	7.98E-01	5.46E+00
HAR	Walnut Branch	3.98E-01	7.22E+04	0.00E+00	7.40E-01	8.77E+00	8.64E+02	1.32E+03	7.97E-01	1.21E+00
HAR	Huttos Lake	3.43E-01	2.16E+05	1.09E-02	8.53E+00	6.37E+00	1.60E+02	3.99E+01	8.27E+00	2.07E+00
HOL	Huttos Lake	3.43E-01	2.34E+05	1.12E-02	8.53E+00	6.40E+00	1.59E+02	3.98E+01	8.26E+00	2.07E+00
HOL	Lake Merkel	1.91E-01	1.01E+05	2.86E-02	7.78E+00	8.26E+00	1.59E+02	3.98E+01	8.26E+00	2.07E+00
TEX	Armstrong Creek	1.26E-01	3.87E+05	2.99E-01	3.90E+00	1.02E+02	1.32E+03	7.58E+03	7.98E-01	4.59E+00
TEX	Massey Lake	1.78E-01	3.97E+05	5.81E-02	8.46E+00	7.52E+01	2.19E+02	5.47E+01	1.13E+01	2.83E+00
TEX	Mountain Creek	5.15E-02	5.00E+05	6.14E-01	3.74E+00	1.35E+02	1.26E+03	1.88E+04	7.98E-01	1.19E+01
TEX	Waxahachie Creek	1.14E-01	3.73E+05	6.57E-01	6.24E+00	1.39E+02	8.90E+02	8.85E+03	7.97E-01	7.93E+00
WAM	Connoquenessing Creek	5.24E-02	8.42E+05	0.00E+00	1.35E+00	2.51E+01	8.40E+02	1.17E+03	7.97E-01	1.11E+00
WAM	Hereford Manor Lake	2.17E-01	8.62E+05	3.93E-02	8.36E+00	9.30E+00	1.98E+02	4.96E+01	1.06E+01	2.65E+00
WAM	Beaver River	4.90E-02	5.75E+05	0.00E+00	3.44E-01	8.42E+00	6.52E+02	4.76E+02	7.97E-01	5.81E-01
WAM	Slippery Rock Creek	1.14E-01	7.56E+05	0.00E+00	1.55E+00	1.96E+01	6.50E+02	5.70E+02	7.97E-01	6.99E-01
ARV	James River	4.53E-02	5.88E+05	0.00E+00	8.76E-01	1.51E+01	6.28E+02	3.81E+02	7.97E-01	4.83E-01
ARV	Sports Lake	1.29E-01	9.15E+05	2.99E-01	6.51E+00	3.61E+01	1.39E+02	3.48E+01	7.33E+00	1.83E+00
ARV	Holman Creek	1.82E-01	3.76E+05	1.16E-01	2.39E+00	3.88E+01	1.30E+03	7.20E+03	7.98E-01	4.43E+00
ARV	Rivanna River	1.09E-01	5.60E+05	2.90E-02	2.93E+00	2.98E+01	8.62E+02	1.29E+03	7.97E-01	1.19E+00
BRO	Bluelick Creek	1.70E-01	2.50E+06	1.31E+00	3.38E+00	1.62E+02	1.30E+03	7.20E+03	7.98E-01	4.43E+00
BRO	McNeely Lake	1.81E-01	9.25E+05	8.53E-02	7.98E+00	1.41E+01	2.16E+02	5.41E+01	1.13E+01	2.83E+00
BRO	Silver Lake	4.74E-01	3.49E+04	7.79E-03	8.52E+00	6.05E+00	2.16E+02	5.41E+01	1.13E+01	2.83E+00
BRO	Salt River	4.65E-02	1.26E+06	1.14E-02	2.21E+00	2.80E+01	7.20E+02	6.49E+02	7.97E-01	7.18E-01
CAS	Cascade Creek	1.19E-01	6.43E+05	1.61E-01	4.27E+00	4.02E+01	7.48E+02	1.03E+03	7.97E-01	1.10E+00
CAS	Smith River	1.07E-01	5.11E+05	0.00E+00	2.12E+00	2.33E+01	7.52E+02	1.43E+03	7.97E-01	1.51E+00
CAS	Dan River	1.98E-01	7.22E+05	0.00E+00	2.04E+00	1.55E+01	1.04E+03	3.16E+03	7.98E-01	2.42E+00
COH	Troy Reservoir	3.02E-01	7.71E+05	3.01E-02	8.35E+00	8.36E+00	1.39E+02	3.48E+01	7.34E+00	1.84E+00
COH	Hudson River	4.59E-02	3.38E+05	0.00E+00	9.02E-01	1.16E+01	6.69E+02	4.21E+02	7.97E-01	5.01E-01

Table G-5. Mercury Waterbody Intermediate Values Used for Baseline and Floor/Standard

Site	Waterbody	Sediment Delivery Ratio to Waterbody, Sdel (unitless)	Sediment Loss Rate, Xe (kg/km^2-yr)	Sediment Burial Velocity, vb (m/yr)	Conc. of Biotic Solids, Sbio (g/m^3)	Conc. of Abiotic Solids, S_w (g/m^3)	Elemental Mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Elemental Mercury Water Column Vol. Loss Constant, kwv (yr^{-1})	Methyl-mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Methyl-mercury Water Column Vol. Loss Constant, kwv (yr^{-1})
COH	Mohawk River	5.31E-02	2.27E+05	0.00E+00	2.49E+00	1.88E+01	9.36E+02	1.56E+03	7.98E-01	1.33E+00
COH	Tomahannock Reservoir	1.24E-01	5.89E+05	1.29E-02	8.39E+00	6.59E+00	1.39E+02	3.48E+01	7.34E+00	1.84E+00
NOR	Rocky River	4.58E-02	1.09E+06	8.14E-02	1.72E+00	3.23E+01	7.57E+02	7.89E+02	7.97E-01	8.31E-01
NOR	Long Lake/Creek	1.39E-01	9.10E+05	9.21E-02	7.85E+00	1.48E+01	1.58E+02	3.96E+01	8.29E+00	2.07E+00
NOR	Lake Tillery	1.10E-01	1.70E+06	3.38E-02	8.40E+00	8.74E+00	1.58E+02	3.96E+01	8.29E+00	2.07E+00
334	Mississippi River	4.60E-02	4.84E+05	0.00E+00	1.68E+00	4.08E+01	6.60E+02	3.85E+02	7.97E-01	4.65E-01
334	Vermilion River	5.04E-02	2.38E+05	4.54E-03	8.39E+00	6.77E+01	8.81E+02	3.52E+03	7.97E-01	3.19E+00
334	Colby Lake	3.73E-01	4.78E+05	9.58E-03	8.56E+00	3.82E+01	2.40E+02	5.99E+01	1.30E+01	3.26E+00
334	Lake Isabelle	3.25E-01	3.21E+04	7.73E-03	8.54E+00	3.80E+01	2.40E+02	5.99E+01	1.30E+01	3.26E+00
463	Blue River	1.09E-01	2.64E+05	5.95E-02	1.06E+01	1.25E+02	6.16E+02	1.15E+03	7.97E-01	1.49E+00
463	Rock Creek	1.68E-01	2.19E+05	0.00E+00	3.11E+00	9.74E+01	1.33E+03	7.82E+03	7.98E-01	4.69E+00
463	Shoal Creek	1.13E-01	5.49E+05	7.31E-01	1.01E+01	1.94E+02	6.16E+02	4.49E+03	7.97E-01	5.82E+00
463	Missouri River	4.58E-02	5.34E+05	1.73E-02	1.03E+01	1.21E+02	6.36E+02	3.28E+02	7.97E-01	4.11E-01
464	Ottawa River	5.08E-02	2.33E+05	0.00E+00	4.76E+00	2.06E+01	4.39E+02	2.97E+02	7.97E-01	5.39E-01
464	Twin Lakes Reservoir	3.76E-01	1.23E+06	3.73E-02	8.49E+00	9.08E+00	1.98E+02	4.96E+01	1.06E+01	2.65E+00
464	Metzger/Ferguson Reservoir	3.13E-01	2.64E+05	7.99E-03	8.55E+00	6.07E+00	1.98E+02	4.96E+01	1.06E+01	2.65E+00
504	Pennsauken Creek	1.34E-01	1.92E+05	0.00E+00	2.11E+00	2.23E+01	8.05E+02	3.52E+03	7.97E-01	3.48E+00
504	Darby Creek	1.12E-01	3.60E+05	5.60E-02	1.74E+00	3.27E+01	1.13E+03	7.13E+03	7.98E-01	5.05E+00
504	Cooper River Lake	1.31E-01	7.42E+04	1.12E-02	7.02E+00	6.55E+00	1.79E+02	4.47E+01	9.49E+00	2.37E+00
504	Schuylkill River	1.12E-01	3.66E+05	0.00E+00	2.60E-01	5.50E+00	9.55E+02	1.65E+03	7.98E-01	1.38E+00
600	Lake Jackson	3.06E-01	1.02E+06	1.19E-02	8.56E+00	7.05E+01	2.40E+02	5.99E+01	1.23E+01	3.07E+00
600	Oyster Creek	1.29E-01	5.34E+04	0.00E+00	2.90E+00	5.29E+01	1.11E+03	4.24E+03	7.98E-01	3.04E+00
600	Brazos River	1.20E-01	7.20E+04	0.00E+00	6.36E-01	2.38E+01	5.92E+02	3.56E+02	7.97E-01	4.79E-01
711	Brechtel Lake	3.55E-01	2.89E+04	7.24E-03	8.47E+00	3.80E+01	1.60E+02	3.99E+01	8.20E+00	2.05E+00
711	Mississippi River	1.24E-01	1.18E+05	0.00E+00	1.53E-01	1.67E+01	5.02E+02	7.51E+01	7.97E-01	1.19E-01
806	Wolf Lake	1.82E-01	8.69E+05	9.96E-03	8.53E+00	6.27E+00	1.78E+02	4.45E+01	9.57E+00	2.39E+00
806	Lake George	3.18E-01	2.55E+06	1.95E-02	8.53E+00	7.26E+00	1.78E+02	4.45E+01	9.57E+00	2.39E+00
806	Little Calumet River	4.87E-02	1.41E+05	0.00E+00	5.13E+00	6.14E+01	1.05E+03	3.10E+03	7.98E-01	2.35E+00
806	Grand Calumet River	1.20E-01	4.86E+05	9.11E-02	3.91E+00	3.01E+01	1.19E+03	5.19E+03	7.98E-01	3.47E+00
915	Genesee River	5.23E-02	1.48E+05	0.00E+00	4.16E-01	5.25E+00	9.96E+02	1.94E+03	7.98E-01	1.56E+00
915	Irondequoit Bay	1.07E-01	1.85E+05	9.51E-03	8.08E+00	6.27E+00	2.19E+02	5.47E+01	1.18E+01	2.95E+00
915	Highland Reservoir	5.99E-01	1.51E+05	7.71E-03	8.55E+00	6.04E+00	2.19E+02	5.47E+01	1.18E+01	2.95E+00
A32	Armand Bayou	1.16E-01	9.82E+04	0.00E+00	7.13E-01	3.33E+01	1.14E+03	6.94E+03	7.98E-01	4.83E+00
A43	Twelvemile Creek	1.26E-01	2.82E+04	0.00E+00	1.56E+00	1.30E+01	1.25E+03	1.37E+04	7.98E-01	8.77E+00
A43	Bergholtz Creek	1.32E-01	6.09E+04	0.00E+00	3.97E+00	1.93E+01	1.32E+03	7.74E+03	7.98E-01	4.67E+00

Table G-5. Mercury Waterbody Intermediate Values Used for Baseline and Floor/Standard

Site	Waterbody	Sediment Delivery Ratio to Waterbody, Sdel (unitless)	Sediment Loss Rate, Xe (kg/km^2-yr)	Sediment Burial Velocity, vb (m/yr)	Conc. of Biotic Solids, Sbio (g/m^3)	Conc. of Abiotic Solids, S_w (g/m^3)	Elemental Mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Elemental Mercury Water Column Vol. Loss Constant, kwv (yr^{-1})	Methyl-mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Methyl-mercury Water Column Vol. Loss Constant, kwv (yr^{-1})
A43	Cayuga Creek	1.36E-01	5.84E+04	0.00E+00	7.49E-01	8.18E+00	1.03E+03	4.13E+03	7.98E-01	3.19E+00
A43	Niagara River	4.68E-02	7.49E+04	0.00E+00	2.20E+00	1.44E+01	7.96E+02	9.10E+02	7.97E-01	9.11E-01
A50	Carpenters Bayou	1.28E-01	8.58E+04	0.00E+00	1.69E+00	4.52E+01	1.14E+03	7.96E+03	7.98E-01	5.58E+00
A50	Highlands Reservoir	2.03E-01	9.45E+04	7.52E-03	8.53E+00	7.00E+01	1.60E+02	3.99E+01	8.20E+00	2.05E+00
A50	Buffalo Bayou	1.09E-01	7.07E+04	0.00E+00	5.14E-01	2.06E+01	6.32E+02	5.29E+02	7.97E-01	6.67E-01
A50	San Jacinto River	1.22E-01	8.63E+04	0.00E+00	3.17E-01	1.41E+01	1.05E+03	2.99E+03	7.98E-01	2.27E+00
A62	Caney Creek	1.10E-01	6.93E+04	0.00E+00	2.43E+00	5.23E+01	1.13E+03	8.07E+03	7.98E-01	5.69E+00
A62	E & W Fork Crystal Cr.	1.20E-01	3.68E+05	0.00E+00	2.50E+00	6.02E+01	1.18E+03	3.15E+03	7.98E-01	2.13E+00
A62	Stewarts Creek	1.29E-01	1.57E+05	0.00E+00	2.06E+00	5.42E+01	1.23E+03	1.31E+04	7.98E-01	8.44E+00
A62	Lewis Creek Reservoir	1.87E-01	7.49E+04	7.52E-03	8.51E+00	7.00E+01	1.59E+02	3.98E+01	8.19E+00	2.05E+00
B20	Cuyahoga River	5.07E-02	2.80E+05	0.00E+00	1.17E+00	1.27E+01	8.00E+02	9.75E+02	7.97E-01	9.72E-01
B20	Upper and Lower Shaker Lake	1.81E-01	7.07E+04	1.80E-02	7.46E+00	7.20E+00	1.98E+02	4.95E+01	1.06E+01	2.65E+00
B20	Euclid Creek	1.30E-01	1.44E+05	0.00E+00	2.78E+00	2.03E+01	1.19E+03	5.19E+03	7.98E-01	3.47E+00
B20	Fairmont Reservoir	3.89E-01	8.82E+04	1.02E-02	8.45E+00	6.31E+00	1.98E+02	4.95E+01	1.06E+01	2.65E+00
HAN	Fabius River	1.08E-01	5.76E+05	0.00E+00	3.12E+00	6.16E+01	8.62E+02	1.29E+03	7.97E-01	1.19E+00
HAN	Spring Lake	4.56E-01	1.73E+05	1.46E-02	8.50E+00	3.88E+01	1.97E+02	4.93E+01	1.04E+01	2.61E+00
HAN	Mississippi River	4.58E-02	5.64E+05	0.00E+00	1.97E-01	9.02E+00	4.25E+02	7.63E+01	7.97E-01	1.43E-01
KIN	North Fork Holston River	5.20E-02	1.27E+06	7.38E-02	2.51E+00	2.24E+01	8.62E+02	1.29E+03	7.97E-01	1.19E+00
KIN	Kingsport Reservoir	3.26E-01	3.15E+05	1.26E-02	8.46E+00	6.55E+00	1.58E+02	3.96E+01	8.38E+00	2.09E+00
KIN	South Fork Holston River	4.94E-02	1.16E+06	0.00E+00	1.01E+00	1.28E+01	6.93E+02	5.54E+02	7.97E-01	6.38E-01
KIN	Reedy Creek	1.18E-01	1.01E+06	4.66E-01	4.33E+00	6.26E+01	1.19E+03	5.19E+03	7.98E-01	3.47E+00
MCI	Hals Lake	1.16E-01	1.61E+05	3.04E-02	6.82E+00	8.54E+00	1.78E+02	4.45E+01	9.18E+00	2.29E+00
MCI	Hellcat Lake	1.91E-01	1.95E+04	7.72E-03	7.92E+00	6.10E+00	1.78E+02	4.45E+01	9.18E+00	2.29E+00
MCI	Alabama River	1.09E-01	3.44E+04	0.00E+00	3.97E-01	5.61E+00	4.88E+02	1.39E+02	7.97E-01	2.27E-01
MCI	Tombigbee River	4.68E-02	1.69E+05	0.00E+00	4.66E-01	6.58E+00	5.07E+02	1.61E+02	7.97E-01	2.53E-01
MID	Tittabawassee River	5.10E-02	2.55E+04	0.00E+00	2.89E+00	1.55E+01	6.93E+02	5.54E+02	7.97E-01	6.38E-01
MID	Sturgeon Creek	1.15E-01	2.22E+04	0.00E+00	2.83E+00	1.62E+01	1.05E+03	3.10E+03	7.98E-01	2.35E+00
MID	Kawkawlin River	5.33E-02	2.94E+04	0.00E+00	3.99E+00	1.78E+01	7.70E+02	1.15E+03	7.97E-01	1.19E+00
MID	Chippewa River	1.20E-01	2.40E+04	0.00E+00	1.47E+00	1.18E+01	8.62E+02	1.29E+03	7.97E-01	1.19E+00
STG	Bayou Plaquemine	1.88E-01	1.47E+05	0.00E+00	3.23E+00	1.28E+02	1.33E+03	7.82E+03	7.98E-01	4.69E+00
STG	Manchac Bayou	5.10E-02	4.07E+05	0.00E+00	2.15E+00	1.27E+02	8.40E+02	3.32E+03	7.97E-01	3.15E+00
STG	Bayou Fountain	1.19E-01	4.54E+05	0.00E+00	4.13E+00	1.51E+02	7.74E+02	2.70E+03	7.97E-01	2.78E+00
STG	Mississippi River	1.18E-01	3.69E+05	0.00E+00	1.70E-01	1.84E+01	5.04E+02	7.59E+01	7.97E-01	1.20E-01
340	Sunfish Creek	1.16E-01	2.08E+06	1.14E+00	1.17E+00	1.44E+02	1.29E+03	1.31E+04	7.98E-01	8.14E+00
340	Proctor Creek	1.29E-01	5.31E+05	1.07E-01	1.98E+00	3.79E+01	1.08E+03	3.26E+03	7.98E-01	2.42E+00

Table G-5. Mercury Waterbody Intermediate Values Used for Baseline and Floor/Standard

Site	Waterbody	Sediment Delivery Ratio to Waterbody, Sdel (unitless)	Sediment Loss Rate, Xe (kg/km^2-yr)	Sediment Burial Velocity, vb (m/yr)	Conc. of Biotic Solids, Sbio (g/m^3)	Conc. of Abiotic Solids, S_w (g/m^3)	Elemental Mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Elemental Mercury Water Column Vol. Loss Constant, kwv (yr^{-1})	Methyl-mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Methyl-mercury Water Column Vol. Loss Constant, kwv (yr^{-1})
340	Fish Creek	5.29E-02	7.23E+05	6.22E-02	2.57E+00	3.32E+01	6.78E+02	1.30E+03	7.97E-01	1.53E+00
340	Ohio River	4.46E-02	1.01E+06	0.00E+00	3.63E-01	6.85E+00	4.49E+02	1.45E+02	7.97E-01	2.57E-01
342	Kalamazoo River	4.89E-02	2.33E+05	0.00E+00	2.04E+00	1.45E+01	6.44E+02	6.95E+02	7.97E-01	8.60E-01
342	East Lake	1.90E-01	1.45E+05	1.03E-02	8.40E+00	6.32E+00	2.19E+02	5.47E+01	1.18E+01	2.95E+00
342	Portage Creek	1.15E-01	2.19E+05	3.26E-02	4.27E+00	2.40E+01	1.12E+03	3.85E+03	7.98E-01	2.74E+00
342	Portage River	5.01E-02	2.41E+05	3.87E-02	4.08E+00	2.47E+01	8.14E+02	2.94E+03	7.97E-01	2.88E+00
453	Lake Spivey	1.40E-01	2.48E+06	4.03E-02	8.30E+00	9.42E+00	1.78E+02	4.45E+01	9.30E+00	2.32E+00
453	Jester Creek	1.40E-01	2.93E+06	6.64E-01	1.58E+00	9.22E+01	1.30E+03	7.20E+03	7.98E-01	4.43E+00
453	Flint River	5.27E-02	1.78E+06	2.25E-01	2.70E+00	4.70E+01	1.00E+03	2.51E+03	7.98E-01	1.99E+00
468	Wissahickon Creek	1.13E-01	2.77E+05	4.40E-03	3.32E+00	2.72E+01	1.04E+03	2.81E+03	7.98E-01	2.16E+00
468	Tacony Creek	1.24E-01	1.91E+05	2.35E-02	3.61E+00	2.92E+01	3.63E+03	1.68E+04	7.98E-01	3.69E+00
468	Schuylkill	4.81E-02	5.32E+05	0.00E+00	4.99E-01	9.28E+00	9.55E+02	1.65E+03	7.98E-01	1.38E+00
468	Pickering Creek Reservoir	1.68E-01	8.13E+05	4.33E-02	7.92E+00	9.76E+00	1.79E+02	4.47E+01	9.49E+00	2.37E+00
701	Wabash River	4.63E-02	3.55E+05	0.00E+00	3.97E-01	7.31E+00	8.73E+02	1.03E+03	7.97E-01	9.38E-01
701	Sugar Creek	1.32E-01	5.02E+05	0.00E+00	3.49E-01	9.50E+00	1.29E+03	6.04E+03	7.98E-01	3.75E+00
701	Big Raccoon Creek	5.10E-02	8.16E+05	2.44E-02	1.45E+00	2.95E+01	9.71E+02	2.74E+03	7.98E-01	2.25E+00
704	Garvey Reservoir	4.88E-01	1.70E+04	7.36E-03	8.56E+00	9.00E+00	1.60E+02	3.99E+01	8.31E+00	2.08E+00
704	Legg Lake	4.79E-01	2.47E+04	7.38E-03	8.56E+00	9.00E+00	1.60E+02	3.99E+01	8.31E+00	2.08E+00
704	Silver Lake Res.	3.29E-01	6.10E+06	4.08E-02	8.56E+00	1.24E+01	1.60E+02	3.99E+01	8.31E+00	2.08E+00
708	Grindle Creek	1.09E-01	1.22E+05	2.40E-02	4.82E+00	2.61E+01	1.05E+03	3.10E+03	7.98E-01	2.35E+00
708	Parker Creek	1.41E-01	2.66E+05	1.00E-01	3.67E+00	3.40E+01	1.30E+03	7.20E+03	7.98E-01	4.43E+00
708	Tranters Creek	1.09E-01	1.26E+05	0.00E+00	2.46E+00	1.90E+01	8.62E+02	1.29E+03	7.97E-01	1.19E+00
725	Passaic River	3.14E-01	3.13E+05	5.62E-03	1.11E+01	2.66E+01	8.80E+02	1.70E+03	7.97E-01	1.54E+00
725	Silver Lake Reservoir	4.71E-01	7.87E+04	7.44E-03	8.55E+00	6.01E+00	2.40E+02	5.99E+01	1.27E+01	3.18E+00
725	Reservoir No. 2	5.67E-01	1.96E+05	7.61E-03	8.56E+00	6.03E+00	2.40E+02	5.99E+01	1.27E+01	3.18E+00
725	Rahway River	3.51E-01	1.97E+05	1.09E-02	1.26E+01	2.70E+01	7.65E+02	1.66E+03	7.97E-01	1.73E+00
824	Newton Lake	1.83E-01	5.64E+04	9.00E-03	8.08E+00	6.22E+00	1.79E+02	4.48E+01	9.49E+00	2.37E+00
824	Big Timber Creek	1.16E-01	1.90E+05	0.00E+00	6.04E-01	2.47E+01	8.44E+02	4.20E+03	7.97E-01	3.96E+00
824	Darby Creek	1.15E-01	3.20E+05	5.12E-02	1.46E+00	3.22E+01	1.12E+03	7.09E+03	7.98E-01	5.03E+00
824	Schuylkill River	1.21E-01	3.70E+05	0.00E+00	1.95E-01	4.25E+00	9.55E+02	1.65E+03	7.98E-01	1.38E+00
904	Pascagoula River	1.31E-01	1.19E+05	0.00E+00	6.46E-02	1.13E+00	4.20E+02	9.18E+01	7.97E-01	1.74E-01
904	Escatawpa River	1.11E-01	2.18E+05	0.00E+00	8.15E-01	1.03E+01	7.37E+02	7.74E+02	7.97E-01	8.38E-01
906	Mississippi River	4.86E-02	4.69E+05	0.00E+00	2.80E-01	1.20E+01	4.88E+02	1.66E+02	7.97E-01	2.71E-01
906	Copperas Creek	1.20E-01	5.82E+05	0.00E+00	1.89E+00	6.74E+01	8.95E+02	3.27E+03	7.97E-01	2.91E+00
906	Eliza Creek	1.21E-01	6.38E+05	0.00E+00	2.18E+00	6.73E+01	8.94E+02	3.16E+03	7.97E-01	2.82E+00

Table G-5. Mercury Waterbody Intermediate Values Used for Baseline and Floor/Standard

Site	Waterbody	Sediment Delivery Ratio to Waterbody, Sdel (unitless)	Sediment Loss Rate, Xe (kg/km^2-yr)	Sediment Burial Velocity, vb (m/yr)	Conc. of Biotic Solids, Sbio (g/m^3)	Conc. of Abiotic Solids, S_w (g/m^3)	Elemental Mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Elemental Mercury Water Column Vol. Loss Constant, kwv (yr^{-1})	Methyl-mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Methyl-mercury Water Column Vol. Loss Constant, kwv (yr^{-1})
906	Muscatine Slough	1.14E-01	3.31E+05	2.56E-01	1.31E+01	9.31E+01	1.08E+03	3.26E+03	7.98E-01	2.42E+00
A14	New River	1.09E-01	1.51E+05	0.00E+00	3.71E+00	1.35E+02	8.80E+02	3.00E+03	7.97E-01	2.72E+00
A14	Bayou Conway	1.16E-01	1.74E+05	0.00E+00	3.49E+00	1.35E+02	1.08E+03	3.26E+03	7.98E-01	2.42E+00
A14	Mississippi River	1.25E-01	2.40E+05	0.00E+00	1.43E-01	1.57E+01	5.03E+02	7.56E+01	7.97E-01	1.20E-01
A14	Bayou Lafourche	2.13E-01	2.11E+05	0.00E+00	1.13E+00	7.78E+01	9.11E+02	1.63E+03	7.98E-01	1.42E+00
A26	Big Creek	1.32E-01	1.34E+06	9.88E-01	3.45E+00	3.07E+02	1.30E+03	7.20E+03	7.98E-01	4.43E+00
A26	Carter Creek	1.20E-01	5.90E+05	0.00E+00	2.13E+00	1.72E+02	1.05E+03	3.10E+03	7.98E-01	2.35E+00
A26	Dota Creek	1.13E-01	1.28E+06	0.00E+00	2.13E+00	1.58E+02	8.62E+02	1.29E+03	7.97E-01	1.19E+00
A31	Nottaway River	4.94E-02	3.77E+05	0.00E+00	1.58E+00	1.64E+01	7.20E+02	6.49E+02	7.97E-01	7.18E-01
A31	Chowan River	4.80E-02	2.47E+05	0.00E+00	8.80E-01	1.09E+01	6.28E+02	3.81E+02	7.97E-01	4.83E-01
A31	Nottaway Swamp	1.24E-01	1.72E+05	0.00E+00	2.87E+00	2.36E+01	1.05E+03	3.10E+03	7.98E-01	2.35E+00
A45	Sheldon Reservoir	2.02E-01	6.44E+04	7.33E-03	8.55E+00	7.00E+01	1.58E+02	3.96E+01	8.14E+00	2.04E+00
A45	Highlands Reservoir	2.03E-01	6.30E+04	7.32E-03	8.54E+00	7.00E+01	1.58E+02	3.96E+01	8.14E+00	2.04E+00
A45	Greens Bayou	1.20E-01	2.19E+04	0.00E+00	5.66E+00	6.38E+01	1.12E+03	4.01E+03	7.98E-01	2.85E+00
A45	Buffalo Bayou	5.07E-02	4.23E+04	0.00E+00	1.83E+00	4.47E+01	8.89E+02	1.48E+03	7.97E-01	1.33E+00
A46	Little Muskingum River	5.07E-02	1.01E+06	2.39E-01	1.63E+00	5.14E+01	9.13E+02	1.69E+03	7.98E-01	1.48E+00
A46	Ohio River	5.13E-02	8.10E+05	0.00E+00	3.25E-01	5.80E+00	4.58E+02	1.09E+02	7.97E-01	1.89E-01
A46	Middle Island Creek	4.93E-02	1.04E+06	1.01E-01	3.42E+00	3.71E+01	8.62E+02	1.29E+03	7.97E-01	1.19E+00
A47	Caney River	4.69E-02	4.04E+05	0.00E+00	3.71E+00	1.71E+02	8.62E+02	1.29E+03	7.97E-01	1.19E+00
A47	Sand Creek	5.18E-02	2.58E+05	0.00E+00	4.82E+00	1.83E+02	1.05E+03	3.10E+03	7.98E-01	2.35E+00
A47	Bar-Dew Lake	2.04E-01	2.48E+05	2.26E-02	8.42E+00	7.16E+01	2.16E+02	5.41E+01	1.13E+01	2.83E+00
A47	Lake Hudson	1.39E-01	2.45E+05	1.62E-02	8.44E+00	7.09E+01	2.16E+02	5.41E+01	1.13E+01	2.83E+00
A55	Mohawk River	4.68E-02	2.72E+05	0.00E+00	4.75E-01	8.26E+00	8.43E+02	1.09E+03	7.97E-01	1.03E+00
A55	Acplause Kill River	1.14E-01	2.75E+05	8.13E-02	1.67E+00	3.53E+01	1.05E+03	5.76E+03	7.98E-01	4.36E+00
A55	Stony Creek Reservoir	1.41E-01	2.54E+05	1.35E-02	8.28E+00	6.66E+00	1.99E+02	4.97E+01	1.07E+01	2.67E+00
A55	Watervliet Reservoir	1.07E-01	2.51E+05	4.83E-02	6.45E+00	1.04E+01	1.99E+02	4.97E+01	1.07E+01	2.67E+00
B18	Gulf Intercoastal Waterway	5.19E-02	7.55E+04	0.00E+00	1.91E+00	1.02E+02	7.47E+02	1.32E+03	7.97E-01	1.41E+00
B18	Bayou La Butte	1.31E-01	1.48E+05	0.00E+00	1.38E+00	9.24E+01	1.08E+03	3.26E+03	7.98E-01	2.42E+00
B18	Mississippi River	1.19E-01	3.96E+05	0.00E+00	1.52E-01	1.67E+01	5.04E+02	7.59E+01	7.97E-01	1.20E-01
B18	Bayou Manchac	5.30E-02	2.04E+05	0.00E+00	3.48E+00	1.42E+02	7.99E+02	3.54E+03	7.97E-01	3.53E+00
B23	Hillbrandt Bayou	1.18E-01	9.25E+04	0.00E+00	2.09E+00	4.89E+01	8.00E+02	2.05E+03	7.97E-01	2.04E+00
B23	Cow Bayou	1.20E-01	1.31E+05	0.00E+00	1.57E+00	4.31E+01	1.02E+03	3.70E+03	7.98E-01	2.88E+00
B23	Neches River	1.20E-01	6.71E+04	0.00E+00	4.70E-01	1.90E+01	6.72E+02	4.88E+02	7.97E-01	5.80E-01
B23	Port Arthur Reservoir	3.51E-01	2.75E+04	7.27E-03	8.55E+00	7.00E+01	1.78E+02	4.45E+01	9.14E+00	2.29E+00
B31	Wassahickon Creek	1.14E-01	2.66E+05	5.43E-02	2.26E+00	3.25E+01	9.78E+02	4.79E+03	7.98E-01	3.91E+00

Table G-5. Mercury Waterbody Intermediate Values Used for Baseline and Floor/Standard

Site	Waterbody	Sediment Delivery Ratio to Waterbody, Sdel (unitless)	Sediment Loss Rate, Xe (kg/km^2-yr)	Sediment Burial Velocity, vb (m/yr)	Conc. of Biotic Solids, Sbio (g/m^3)	Conc. of Abiotic Solids, S_w (g/m^3)	Elemental Mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Elemental Mercury Water Column Vol. Loss Constant, kwv (yr^{-1})	Methyl-mercury Water Column Vol. Mass Transfer Coeff., Kv (m/yr)	Methyl-mercury Water Column Vol. Loss Constant, kwv (yr^{-1})
B31	Neshaminy Creek	1.13E-01	3.21E+05	0.00E+00	6.31E-01	1.72E+01	1.20E+03	5.17E+03	7.98E-01	3.44E+00
B31	Peace Valley Reservoir	1.74E-01	4.90E+05	1.64E-02	8.35E+00	6.95E+00	1.99E+02	4.98E+01	1.06E+01	2.65E+00
B31	Sckuylkill River	4.68E-02	5.21E+05	0.00E+00	6.00E-01	1.18E+01	8.56E+02	1.19E+03	7.97E-01	1.11E+00
B32	Cedar Bayou	1.08E-01	1.18E+05	0.00E+00	3.71E+00	5.85E+01	7.40E+02	1.13E+03	7.97E-01	1.22E+00
B32	Cary Bayou	1.80E-01	1.56E+05	4.99E-02	3.61E+00	7.69E+01	1.62E+03	1.80E+04	7.98E-01	8.86E+00
B32	Goose Creek	1.26E-01	1.07E+05	2.72E-02	2.50E+00	7.46E+01	1.42E+03	1.05E+04	7.98E-01	5.91E+00
B37	Arkansas River	5.00E-02	1.06E+05	0.00E+00	1.84E-01	2.48E+01	7.30E+02	6.35E+02	7.97E-01	6.94E-01
B37	Plum Bayou	1.09E-01	5.39E+04	0.00E+00	6.13E+00	1.86E+02	1.08E+03	3.26E+03	7.98E-01	2.42E+00
B37	Yellow Lake	1.91E-01	3.99E+04	6.92E-03	8.51E+00	7.00E+01	1.97E+02	4.93E+01	1.04E+01	2.61E+00
B37	Lake Pine Bluff	1.19E-01	5.27E+04	1.26E-03	7.92E+00	6.94E+01	1.97E+02	4.93E+01	1.04E+01	2.61E+00
B44	Sheldon Reservoir	2.03E-01	9.57E+04	7.38E-03	8.55E+00	7.00E+01	1.60E+02	3.99E+01	8.20E+00	2.05E+00
B44	Greens Bayou	1.20E-01	3.28E+04	0.00E+00	1.73E+00	4.33E+01	8.51E+02	2.09E+03	7.97E-01	1.95E+00
B44	Buffalo Bayou	5.15E-02	6.63E+04	0.00E+00	6.86E-01	2.52E+01	6.32E+02	5.29E+02	7.97E-01	6.67E-01
B44	Hunting Bayou	1.31E-01	4.26E+04	0.00E+00	4.09E+00	6.03E+01	1.26E+03	6.35E+03	7.98E-01	4.01E+00
TOO	Rush Lake	5.13E-02	7.48E+04	1.99E-02	8.28E+00	2.32E+00	1.79E+02	4.46E+01	9.53E+00	2.38E+00
TOO	Box Elder Wash	1.16E-01	5.84E+04	3.32E-01	1.19E+01	4.61E+01	2.06E+03	5.15E+04	7.98E-01	1.99E+01
TOO	Blue Lakes	3.35E-01	1.76E+03	7.36E-03	8.56E+00	1.00E+00	1.79E+02	4.46E+01	9.53E+00	2.38E+00
TOO	Soldier Creek	1.35E-01	1.10E+05	4.37E-02	4.18E+00	1.72E+01	1.33E+03	7.82E+03	7.98E-01	4.69E+00

Table G-6. Mercury Media Concentrations, Baseline

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
209	Lawsons Fork Creek	1.42E-06	3.65E-10	5.68E-11	5.51E-06	1.57E-11	1.98E-12	1.40E-06	5.41E-11	2.85E-08	7.11E-13	1.14E-06	4.83E-06
209	Tyger River	3.77E-06	6.27E-10	1.46E-10	1.44E-05	4.40E-11	3.31E-12	3.69E-06	1.41E-10	7.54E-08	1.50E-12	2.40E-06	1.02E-05
209	Fair Forest Creek	2.95E-06	1.12E-09	1.30E-10	1.25E-05	3.33E-11	4.63E-12	2.89E-06	1.23E-10	5.91E-08	1.64E-12	2.62E-06	1.11E-05
209	Middle Tyger River	1.74E-06	2.93E-10	5.70E-11	5.59E-06	1.81E-11	1.42E-12	1.71E-06	5.49E-11	3.49E-08	7.61E-13	1.22E-06	5.17E-06
214	Fish Ponds	1.04E-04	2.88E-09	5.96E-10	4.18E-05	9.35E-10	1.91E-10	1.02E-04	3.90E-10	2.09E-06	1.61E-11	2.58E-05	1.09E-04
214	Lake Clause	1.41E-04	4.16E-08	8.59E-09	6.14E-04	1.38E-09	2.60E-09	1.38E-04	5.80E-09	2.82E-06	1.83E-10	2.93E-04	1.25E-03
214	University Lake/ City Park Lake	5.86E-05	3.54E-09	7.25E-10	5.13E-05	5.21E-10	2.27E-10	5.74E-05	4.78E-10	1.17E-06	1.98E-11	3.17E-05	1.35E-04
214	Comite River	6.96E-05	7.04E-09	9.95E-10	3.63E-05	8.08E-10	1.18E-10	6.82E-05	8.71E-10	1.39E-06	6.05E-12	9.68E-06	4.11E-05
221	Highlands Reservoir	6.81E-05	1.09E-09	3.96E-10	8.05E-06	6.33E-10	3.20E-10	6.67E-05	7.28E-11	1.36E-06	3.33E-12	5.32E-06	2.26E-05
221	San Jacinto River / Houston Lake	1.34E-04	6.95E-10	2.44E-10	5.52E-06	1.48E-09	1.81E-10	1.32E-04	6.25E-11	2.69E-06	1.98E-13	3.17E-07	1.35E-06
221	Sheldon Reservoir	1.07E-04	1.10E-09	4.40E-10	7.68E-06	9.98E-10	3.68E-10	1.05E-04	6.89E-11	2.14E-06	3.16E-12	5.06E-06	2.15E-05
324	Shades Creek	4.17E-05	1.57E-08	3.58E-09	3.55E-04	5.13E-10	5.41E-11	4.09E-05	3.51E-09	8.34E-07	1.71E-11	2.73E-05	1.16E-04
324	Valley Creek	1.95E-04	9.73E-08	2.19E-08	2.18E-03	2.53E-09	2.77E-10	1.92E-04	2.15E-08	3.91E-06	8.48E-11	1.36E-04	5.77E-04
324	Cahaba River	1.84E-05	4.62E-09	1.23E-09	1.21E-04	2.25E-10	2.83E-11	1.80E-05	1.19E-09	3.68E-07	6.27E-12	1.00E-05	4.27E-05
324	Bayview Lake	2.08E-04	6.98E-08	2.29E-08	1.96E-03	2.56E-09	4.56E-09	2.04E-04	1.81E-08	4.16E-06	2.72E-10	4.35E-04	1.85E-03
325	Verdigris River	2.36E-03	8.42E-08	7.53E-09	3.65E-04	2.09E-08	4.12E-11	2.31E-03	7.39E-09	4.72E-05	9.57E-11	1.53E-04	6.51E-04
325	Big Hill Creek	6.71E-03	1.57E-06	8.97E-08	6.97E-03	5.26E-08	2.42E-10	6.58E-03	8.81E-08	1.34E-04	1.34E-09	2.14E-03	9.11E-03
325	Potato Creek	1.17E-02	6.94E-06	3.57E-07	3.14E-02	8.72E-08	5.92E-10	1.15E-02	3.51E-07	2.34E-04	5.44E-09	8.70E-03	3.70E-02
325	Claymore Creek	2.20E-02	1.34E-06	8.77E-08	5.92E-03	1.62E-07	9.32E-10	2.16E-02	8.55E-08	4.41E-04	1.28E-09	2.04E-03	8.67E-03
331	Rocky River	9.47E-05	1.08E-08	3.01E-09	2.80E-04	9.01E-10	4.47E-11	9.28E-05	2.94E-09	1.89E-06	2.21E-11	3.54E-05	1.50E-04
331	East Branch Black River	3.34E-04	4.68E-08	1.26E-08	1.26E-03	3.13E-09	1.50E-10	3.27E-04	1.23E-08	6.68E-06	1.24E-10	1.98E-04	8.42E-04
331	Wyleswood Lake	1.39E-04	5.17E-09	1.70E-09	1.62E-04	8.41E-10	2.68E-10	1.37E-04	1.39E-09	2.79E-06	4.53E-11	7.26E-05	3.08E-04
331	Baldwin Lake	4.42E-05	7.15E-09	2.33E-09	2.07E-04	3.69E-10	3.79E-10	4.33E-05	1.91E-09	8.84E-07	3.65E-11	5.84E-05	2.48E-04
359	Ohio River	3.58E-04	2.67E-10	2.66E-10	7.73E-08	4.17E-09	2.66E-10	3.51E-04	0.00E+00	7.16E-06	0.00E+00	0.00E+00	0.00E+00
359	Kentucky River	3.82E-04	1.62E-09	1.61E-09	6.39E-07	4.42E-09	1.61E-09	3.74E-04	0.00E+00	7.63E-06	0.00E+00	0.00E+00	0.00E+00
359	Indian Creek	3.54E-04	1.29E-08	1.21E-08	1.26E-05	3.80E-09	1.21E-08	3.47E-04	0.00E+00	7.08E-06	0.00E+00	0.00E+00	0.00E+00
359	Indian Kentuck Creek	2.37E-04	2.09E-08	1.81E-08	1.85E-05	2.54E-09	1.81E-08	2.33E-04	0.00E+00	4.75E-06	0.00E+00	0.00E+00	0.00E+00
A15	Ellicott Creek	1.56E-04	3.70E-08	1.03E-08	9.95E-04	1.26E-09	1.20E-10	1.53E-04	1.01E-08	3.13E-06	6.01E-11	9.62E-05	4.09E-04
A15	Tonawanda Creek	2.61E-04	2.81E-08	8.76E-09	6.97E-04	2.16E-09	8.33E-11	2.56E-04	8.64E-09	5.22E-06	4.07E-11	6.51E-05	2.77E-04
A15	Murder Creek	9.64E-05	3.16E-08	8.37E-09	8.31E-04	7.39E-10	1.48E-10	9.45E-05	8.17E-09	1.93E-06	5.48E-11	8.76E-05	3.72E-04
A18	Taylor Bayou	3.09E-03	1.04E-08	9.82E-09	7.67E-06	3.33E-08	9.82E-09	3.03E-03	0.00E+00	6.19E-05	0.00E+00	0.00E+00	0.00E+00
A18	Hillebrandt Bayou	1.22E-03	8.34E-09	7.52E-09	7.74E-06	1.28E-08	7.52E-09	1.20E-03	0.00E+00	2.45E-05	0.00E+00	0.00E+00	0.00E+00
A18	Viterbo Reservoir	1.60E-03	1.05E-08	9.71E-09	1.01E-05	1.33E-08	9.71E-09	1.57E-03	0.00E+00	3.20E-05	0.00E+00	0.00E+00	0.00E+00
CAL	Tennessee River	2.10E-03	2.24E-09	2.07E-09	1.08E-05	2.22E-08	9.00E-10	2.06E-03	1.15E-09	4.20E-05	1.36E-11	2.18E-05	9.25E-05
CAL	Kentucky Lake	2.14E-03	9.37E-08	3.95E-08	2.48E-03	2.11E-08	1.75E-08	2.10E-03	2.13E-08	4.28E-05	6.46E-10	1.03E-03	4.39E-03
CAL	Barkley Lake	9.14E-04	1.98E-08	9.19E-09	4.96E-04	8.85E-09	4.84E-09	8.96E-04	4.21E-09	1.83E-05	1.37E-10	2.19E-04	9.31E-04
CAL	Cumberland River	1.54E-03	2.94E-09	2.22E-09	2.46E-05	1.58E-08	7.40E-10	1.51E-03	1.46E-09	3.07E-05	1.90E-11	3.04E-05	1.29E-04
ELD	Flat Creek	1.56E-04	7.14E-09	6.40E-09	4.59E-06	1.54E-09	6.40E-09	1.53E-04	0.00E+00	3.11E-06	0.00E+00	0.00E+00	0.00E+00
ELD	Salt Creek	9.44E-05	2.42E-09	2.08E-09	2.00E-06	9.00E-10	2.08E-09	9.25E-05	0.00E+00	1.89E-06	0.00E+00	0.00E+00	0.00E+00
ELD	Calion Lake	3.83E-05	6.92E-10	6.62E-10	7.12E-07	3.66E-10	6.62E-10	3.76E-05	0.00E+00	7.67E-07	0.00E+00	0.00E+00	0.00E+00
ELD	Ouachita River	5.52E-05	4.13E-10	3.95E-10	1.19E-07	5.88E-10	3.95E-10	5.41E-05	0.00E+00	1.10E-06	0.00E+00	0.00E+00	0.00E+00
SAU	Mississippi River	1.57E-04	1.83E-10	1.39E-10	6.37E-07	1.61E-09	4.78E-12	1.54E-04	1.34E-10	3.14E-06	2.25E-13	3.60E-07	1.53E-06
SAU	Horseshoe Lake	7.13E-05	5.02E-09	9.81E-10	7.38E-05	5.92E-10	2.64E-10	6.99E-05	6.90E-10	1.43E-06	2.79E-11	4.46E-05	1.90E-04
SAU	Old Cahokia Creek	7.27E-05	1.21E-08	2.10E-09	1.39E-04	5.31E-10	6.57E-11	7.13E-05	2.02E-09	1.45E-06	1.27E-11	2.04E-05	8.66E-05

Table G-6. Mercury Media Concentrations, Baseline

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
202	Verdigris River	7.81E-05	3.47E-09	2.86E-10	1.51E-05	6.91E-10	3.93E-11	7.65E-05	2.45E-10	1.56E-06	2.04E-12	3.27E-06	1.39E-05
202	Elk City Lake	2.33E-05	2.00E-09	2.87E-10	1.97E-05	1.82E-10	9.42E-11	2.28E-05	1.85E-10	4.65E-07	8.28E-12	1.32E-05	5.63E-05
202	Montgomery County State Park Lal	1.49E-04	3.50E-08	4.86E-09	3.39E-04	1.05E-09	1.53E-09	1.46E-04	3.21E-09	2.99E-06	1.23E-10	1.97E-04	8.37E-04
203	Catalpa Creek	6.04E-04	6.48E-08	1.40E-08	1.40E-03	7.69E-09	1.43E-10	5.92E-04	1.36E-08	1.21E-05	3.02E-10	4.83E-04	2.05E-03
203	Gilmer Creek	6.65E-04	1.62E-07	1.87E-08	1.87E-03	8.11E-09	1.73E-10	6.52E-04	1.82E-08	1.33E-05	4.04E-10	6.46E-04	2.74E-03
203	N. Branch Magowah Creek	4.02E-03	3.11E-07	8.05E-08	8.08E-03	4.57E-08	4.47E-10	3.94E-03	7.87E-08	8.03E-05	1.39E-09	2.22E-03	9.43E-03
203	Shotbag Creek	7.71E-04	8.85E-08	1.81E-08	1.81E-03	9.13E-09	1.25E-10	7.55E-04	1.76E-08	1.54E-05	3.53E-10	5.65E-04	2.40E-03
204	Mississippi River	3.20E-04	3.77E-10	2.32E-10	2.06E-06	3.19E-09	9.58E-12	3.13E-04	2.19E-10	6.40E-06	3.30E-12	5.27E-06	2.24E-05
204	Bay Creek	1.50E-04	3.74E-08	4.20E-09	4.08E-04	1.33E-09	1.26E-10	1.47E-04	4.01E-09	2.99E-06	6.64E-11	1.06E-04	4.52E-04
204	Little Calumet Creek	4.23E-04	6.77E-08	9.45E-09	8.25E-04	3.44E-09	2.87E-10	4.14E-04	9.01E-09	8.45E-06	1.49E-10	2.39E-04	1.02E-03
204	Upper and Lower Swan Lake	3.24E-04	2.12E-08	4.19E-09	3.10E-04	2.43E-09	1.17E-09	3.18E-04	2.90E-09	6.48E-06	1.19E-10	1.91E-04	8.12E-04
302	Maumee River	3.83E-04	1.67E-10	1.51E-10	7.37E-07	3.46E-09	3.19E-12	3.75E-04	1.46E-10	7.66E-06	1.88E-12	3.01E-06	1.28E-05
302	Auglaize River	4.77E-04	2.05E-10	1.98E-10	3.34E-07	4.37E-09	2.61E-12	4.67E-04	1.93E-10	9.53E-06	2.55E-12	4.08E-06	1.73E-05
302	Six Mile Creek	1.54E-03	2.83E-09	2.41E-09	1.84E-05	1.24E-08	2.27E-11	1.51E-03	2.35E-09	3.07E-05	3.57E-11	5.72E-05	2.43E-04
304	Big Walnut Creek	9.39E-03	1.59E-06	2.89E-07	2.93E-02	9.81E-08	6.22E-10	9.21E-03	2.85E-07	1.88E-04	3.64E-09	5.83E-03	2.48E-02
304	Deer Creek	1.35E-02	2.89E-06	4.21E-07	4.29E-02	1.37E-07	8.73E-10	1.33E-02	4.14E-07	2.71E-04	5.96E-09	9.54E-03	4.05E-02
304	Glenn Flint Lake	4.87E-03	4.57E-07	1.44E-07	1.30E-02	4.47E-08	2.45E-08	4.77E-03	1.16E-07	9.74E-05	3.06E-09	4.89E-03	2.08E-02
320	Mud Devils Lake	1.52E-03	2.01E-07	6.94E-08	6.33E-03	1.57E-08	1.36E-08	1.49E-03	5.41E-08	3.04E-05	1.69E-09	2.71E-03	1.15E-02
320	Thunder Bay River	1.74E-03	9.09E-08	2.52E-08	2.18E-03	1.94E-08	6.06E-10	1.70E-03	2.45E-08	3.47E-05	7.92E-11	1.27E-04	5.39E-04
320	Long Lake	1.37E-03	3.13E-08	1.08E-08	9.75E-04	1.39E-08	2.22E-09	1.34E-03	8.29E-09	2.74E-05	2.72E-10	4.36E-04	1.85E-03
321	Black Warrior River (most inclusiv	2.70E-02	2.15E-07	1.12E-07	3.81E-03	3.53E-07	8.76E-10	2.65E-02	1.09E-07	5.40E-04	1.50E-09	2.40E-03	1.02E-02
321	Powell Creek	1.59E-02	1.70E-06	4.35E-07	4.34E-02	1.95E-07	2.30E-09	1.55E-02	4.26E-07	3.17E-04	6.74E-09	1.08E-02	4.58E-02
321	Lake Demopolis	2.70E-02	2.58E-06	8.89E-07	8.05E-02	3.53E-07	1.78E-07	2.65E-02	6.90E-07	5.40E-04	2.16E-08	3.46E-02	1.47E-01
321	Lake Henry	1.51E-02	2.02E-06	5.59E-07	4.55E-02	1.57E-07	1.24E-07	1.47E-02	4.26E-07	3.01E-04	9.05E-09	1.45E-02	6.15E-02
BAT	Lehigh River	2.57E-04	1.54E-08	3.82E-09	3.47E-04	2.58E-09	4.58E-11	2.52E-04	3.72E-09	5.14E-06	5.25E-11	8.41E-05	3.57E-04
BAT	Monocacy Creek	5.91E-04	1.11E-07	1.68E-08	1.70E-03	5.33E-09	1.23E-10	5.79E-04	1.64E-08	1.18E-05	2.56E-10	4.10E-04	1.74E-03
CHA	Allen Lake	1.12E-02	1.59E-06	2.34E-07	1.55E-02	7.86E-08	8.17E-08	1.09E-02	1.46E-07	2.23E-04	6.41E-09	1.03E-02	4.36E-02
CHA	Neosho River	7.28E-03	2.93E-07	4.31E-08	1.19E-03	7.34E-08	3.85E-09	7.13E-03	3.90E-08	1.46E-04	2.66E-10	4.26E-04	1.81E-03
CHA	Sante Fe Lake	1.54E-02	3.74E-06	5.49E-07	3.64E-02	1.21E-07	1.91E-07	1.51E-02	3.44E-07	3.09E-04	1.38E-08	2.21E-02	9.39E-02
FOR	Walnut Bayou	1.55E-02	3.69E-06	1.95E-07	1.61E-02	1.44E-07	1.24E-08	1.52E-02	1.80E-07	3.11E-04	2.92E-09	4.68E-03	1.99E-02
FOR	West Flat Creek	1.58E-02	6.06E-06	3.02E-07	2.67E-02	1.31E-07	5.91E-09	1.55E-02	2.91E-07	3.15E-04	4.94E-09	7.90E-03	3.36E-02
FOR	Hamilton Lake	1.91E-02	1.88E-06	2.88E-07	1.85E-02	1.42E-07	1.06E-07	1.87E-02	1.74E-07	3.82E-04	7.93E-09	1.27E-02	5.39E-02
FRE	Fall River	2.70E-03	1.58E-07	1.34E-08	6.89E-04	2.27E-08	1.93E-10	2.65E-03	1.30E-08	5.40E-05	1.64E-10	2.62E-04	1.11E-03
FRE	Salt Creek	3.44E-03	5.51E-07	4.45E-08	2.42E-03	2.57E-08	1.25E-09	3.37E-03	4.27E-08	6.88E-05	6.09E-10	9.74E-04	4.14E-03
FRE	Verdigris River	9.57E-03	2.09E-07	2.08E-08	8.97E-04	8.10E-08	4.45E-10	9.37E-03	2.02E-08	1.91E-04	2.23E-10	3.56E-04	1.52E-03
HAR	Indian Field Swamp	6.54E-03	1.60E-08	4.06E-09	3.49E-04	5.48E-08	1.47E-10	6.41E-03	3.88E-09	1.31E-04	2.95E-11	4.72E-05	2.00E-04
HAR	Walnut Branch	6.87E-03	9.99E-10	5.19E-10	1.74E-05	5.36E-08	5.31E-11	6.73E-03	4.62E-10	1.37E-04	4.36E-12	6.97E-06	2.96E-05
HAR	Huttos Lake	2.11E-02	7.40E-07	2.49E-07	2.28E-02	1.76E-07	4.68E-08	2.07E-02	1.96E-07	4.22E-04	6.55E-09	1.05E-02	4.46E-02
HOL	Huttos Lake	1.51E-02	5.15E-07	1.72E-07	1.59E-02	1.26E-07	3.13E-08	1.48E-02	1.36E-07	3.02E-04	4.61E-09	7.37E-03	3.13E-02
HOL	Lake Merkel	6.30E-03	5.84E-07	1.93E-07	1.74E-02	5.94E-08	3.34E-08	6.17E-03	1.56E-07	1.26E-04	4.20E-09	6.71E-03	2.85E-02
TEX	Armstrong Creek	1.24E-02	4.91E-06	4.09E-07	4.09E-02	1.02E-07	1.80E-09	1.21E-02	4.01E-07	2.47E-04	6.08E-09	9.73E-03	4.14E-02
TEX	Waxahachie Creek	6.80E-03	3.87E-06	2.41E-07	2.41E-02	5.89E-08	1.35E-09	6.67E-03	2.36E-07	1.36E-04	3.60E-09	5.76E-03	2.45E-02
TEX	Massey Lake	3.06E-03	7.82E-07	1.07E-07	7.34E-03	2.33E-08	3.47E-08	3.00E-03	6.98E-08	6.12E-05	2.45E-09	3.92E-03	1.67E-02
TEX	Mountain Creek	1.24E-02	7.32E-06	4.82E-07	4.82E-02	1.12E-07	1.72E-09	1.21E-02	4.74E-07	2.47E-04	6.61E-09	1.06E-02	4.49E-02

Table G-6. Mercury Media Concentrations, Baseline

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
WAM	Beaver River	3.37E-02	1.05E-06	5.49E-07	1.72E-02	3.27E-07	2.76E-09	3.30E-02	5.42E-07	6.73E-04	4.34E-09	6.94E-03	2.95E-02
WAM	Connoquenessing Creek	4.42E-02	6.71E-06	1.78E-06	1.66E-01	4.16E-07	1.20E-08	4.33E-02	1.76E-06	8.83E-04	1.56E-08	2.50E-02	1.06E-01
WAM	Slippery Rock Creek	3.84E-02	1.97E-06	6.03E-07	4.41E-02	3.48E-07	5.87E-09	3.76E-02	5.91E-07	7.68E-04	6.07E-09	9.72E-03	4.13E-02
WAM	Hereford Manor Lake	2.08E-02	2.23E-06	6.87E-07	6.29E-02	1.52E-07	1.09E-07	2.04E-02	5.64E-07	4.16E-04	1.40E-08	2.24E-02	9.50E-02
ARV	James River	8.55E-05	2.40E-09	8.99E-10	5.00E-05	1.15E-09	1.06E-11	8.38E-05	8.75E-10	1.71E-06	1.39E-11	2.23E-05	9.47E-05
ARV	Rivanna River	7.82E-05	8.67E-09	1.91E-09	1.91E-04	9.69E-10	1.63E-11	7.67E-05	1.86E-09	1.56E-06	2.77E-11	4.43E-05	1.88E-04
ARV	Sports Lake	6.66E-05	1.25E-08	2.63E-09	2.02E-04	7.66E-10	6.46E-10	6.53E-05	1.94E-09	1.33E-06	3.94E-11	6.31E-05	2.68E-04
ARV	Holman Creek	2.76E-04	4.14E-08	7.72E-09	7.75E-04	2.92E-09	2.27E-11	2.71E-04	7.58E-09	5.52E-06	1.24E-10	1.99E-04	8.45E-04
BRO	Bluelick Creek (includes Clear Run	3.82E-03	2.40E-06	1.37E-07	1.34E-02	2.96E-08	3.15E-09	3.74E-03	1.32E-07	7.63E-05	1.95E-09	3.13E-03	1.33E-02
BRO	Salt River (includes Floyd's Fork)	2.34E-03	3.44E-07	8.20E-08	8.13E-03	2.21E-08	1.36E-09	2.29E-03	7.98E-08	4.68E-05	8.41E-10	1.35E-03	5.72E-03
BRO	McNeely Lake	3.84E-03	5.14E-07	1.44E-07	1.28E-02	2.90E-08	2.30E-08	3.76E-03	1.19E-07	7.68E-05	2.46E-09	3.93E-03	1.67E-02
BRO	Silver Lake	3.24E-03	5.07E-08	1.67E-08	1.61E-03	1.91E-08	2.44E-09	3.17E-03	1.38E-08	6.47E-05	4.63E-10	7.40E-04	3.15E-03
CAS	Cascade Creek	2.00E-03	3.81E-07	6.56E-08	6.52E-03	1.77E-08	1.12E-09	1.96E-03	6.35E-08	4.00E-05	9.56E-10	1.53E-03	6.50E-03
CAS	Dan River	6.12E-04	1.03E-09	3.56E-10	2.27E-05	4.63E-09	1.15E-11	6.00E-04	3.41E-10	1.22E-05	4.10E-12	6.55E-06	2.79E-05
CAS	Smith River	3.07E-04	2.75E-08	7.38E-09	7.17E-04	2.84E-09	7.72E-11	3.01E-04	7.20E-09	6.13E-06	9.68E-11	1.55E-04	6.58E-04
COH	Hudson River	1.59E-02	3.51E-07	1.51E-07	6.51E-03	2.11E-07	1.70E-09	1.56E-02	1.49E-07	3.17E-04	3.24E-10	5.18E-04	2.20E-03
COH	Mohawk River	1.93E-02	3.28E-07	9.75E-08	6.92E-03	2.41E-07	8.93E-10	1.89E-02	9.65E-08	3.86E-04	1.88E-10	3.00E-04	1.28E-03
COH	Tomahannock Reservoir	2.44E-03	3.13E-07	1.07E-07	9.61E-03	2.85E-08	2.16E-08	2.39E-03	8.31E-08	4.87E-05	2.43E-09	3.88E-03	1.65E-02
COH	Troy Reservoir	8.23E-03	1.32E-06	4.35E-07	3.79E-02	7.94E-08	9.01E-08	8.06E-03	3.37E-07	1.65E-04	7.95E-09	1.27E-02	5.41E-02
NOR	Rocky River (includes Bear Creek	1.51E-04	1.62E-08	3.56E-09	3.54E-04	1.83E-09	3.96E-11	1.48E-04	3.46E-09	3.02E-06	6.76E-11	1.08E-04	4.60E-04
NOR	Lake Tillery	7.21E-05	5.17E-09	1.65E-09	1.46E-04	8.08E-10	3.12E-10	7.06E-05	1.30E-09	1.44E-06	3.80E-11	6.09E-05	2.59E-04
NOR	Long Lake/Creek	6.69E-05	7.01E-09	2.01E-09	1.70E-04	6.76E-10	4.00E-10	6.55E-05	1.57E-09	1.34E-06	3.83E-11	6.12E-05	2.60E-04
334	Mississippi River	2.46E-05	1.79E-10	3.43E-11	1.98E-06	2.09E-10	1.49E-12	2.41E-05	3.25E-11	4.92E-07	3.12E-13	4.99E-07	2.12E-06
334	Vermilion River	1.12E-05	3.54E-09	3.78E-10	3.78E-05	9.13E-11	4.55E-12	1.10E-05	3.70E-10	2.24E-07	3.29E-12	5.27E-06	2.24E-05
334	Colby Lake	1.71E-05	1.13E-09	2.10E-10	1.67E-05	9.62E-11	4.77E-11	1.68E-05	1.56E-10	3.43E-07	6.37E-12	1.02E-05	4.33E-05
334	Lake Isabelle	4.61E-05	1.97E-09	3.69E-10	2.93E-05	2.75E-10	8.32E-11	4.51E-05	2.74E-10	9.21E-07	1.12E-11	1.79E-05	7.60E-05
463	Blue River	1.39E-05	3.43E-09	3.02E-09	3.09E-06	1.19E-10	3.02E-09	1.36E-05	0.00E+00	2.78E-07	0.00E+00	0.00E+00	0.00E+00
463	Rock Creek	4.67E-05	4.66E-09	4.24E-09	3.56E-06	3.55E-10	4.24E-09	4.58E-05	0.00E+00	9.34E-07	0.00E+00	0.00E+00	0.00E+00
463	Missouri River	1.27E-05	6.51E-10	5.76E-10	5.90E-07	1.17E-10	5.76E-10	1.24E-05	0.00E+00	2.53E-07	0.00E+00	0.00E+00	0.00E+00
463	Shoal Creek	9.15E-06	1.12E-08	9.26E-09	9.40E-06	7.74E-11	9.26E-09	8.97E-06	0.00E+00	1.83E-07	0.00E+00	0.00E+00	0.00E+00
464	Ottawa River	2.98E-06	1.98E-09	5.17E-10	4.96E-05	2.85E-11	3.18E-11	2.92E-06	4.84E-10	5.96E-08	1.16E-12	1.85E-06	7.87E-06
464	Twin Lakes Reservoir	2.60E-06	3.71E-10	1.16E-10	1.05E-05	1.71E-11	2.08E-11	2.55E-06	9.35E-11	5.20E-08	2.13E-12	3.41E-06	1.45E-05
464	Metzger/Ferguson Reservoir	3.33E-06	1.08E-10	3.63E-11	3.42E-06	2.37E-11	6.18E-12	3.26E-06	2.91E-11	6.65E-08	9.44E-13	1.51E-06	6.42E-06
504	Schuylkill River	6.27E-04	1.18E-08	1.18E-08	4.12E-06	6.28E-09	1.18E-08	6.15E-04	0.00E+00	1.25E-05	0.00E+00	0.00E+00	0.00E+00
504	Pennsauken Creek	1.61E-04	1.98E-08	1.93E-08	1.83E-05	1.48E-09	1.93E-08	1.58E-04	0.00E+00	3.22E-06	0.00E+00	0.00E+00	0.00E+00
504	Darby Creek	5.38E-04	1.21E-07	1.17E-07	1.28E-04	5.38E-09	1.17E-07	5.28E-04	0.00E+00	1.08E-05	0.00E+00	0.00E+00	0.00E+00
504	Cooper River Lake	1.68E-04	3.27E-08	3.22E-08	4.37E-05	1.57E-09	3.22E-08	1.65E-04	0.00E+00	3.36E-06	0.00E+00	0.00E+00	0.00E+00
600	Brazos River	6.72E-03	1.40E-08	4.03E-09	1.33E-04	5.35E-08	4.12E-11	6.59E-03	3.97E-09	1.34E-04	1.35E-11	2.17E-05	9.21E-05
600	Lake Jackson	3.19E-03	2.34E-07	3.23E-08	2.31E-03	2.06E-08	9.64E-09	3.13E-03	2.17E-08	6.39E-05	1.00E-09	1.61E-03	6.83E-03
600	Oyster Creek	4.87E-03	1.29E-07	1.88E-08	1.39E-03	3.76E-08	8.72E-11	4.77E-03	1.86E-08	9.74E-05	5.75E-11	9.20E-05	3.91E-04
711	Mississippi River	3.23E-06	3.72E-13	3.42E-13	1.93E-10	3.47E-11	3.27E-13	3.17E-06	1.45E-14	6.47E-08	6.22E-17	9.95E-11	4.23E-10
711	Brechtel Lake	1.56E-06	1.55E-11	8.97E-12	1.21E-07	1.29E-11	7.88E-12	1.52E-06	1.05E-12	3.11E-08	4.56E-14	7.29E-08	3.10E-07

Table G-6. Mercury Media Concentrations, Baseline

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
806	Wolf Lake	8.12E-05	1.51E-09	1.49E-09	2.03E-06	6.95E-10	1.49E-09	7.96E-05	0.00E+00	1.62E-06	0.00E+00	0.00E+00	0.00E+00
806	Lake George	2.97E-05	1.39E-09	1.37E-09	1.81E-06	2.28E-10	1.37E-09	2.91E-05	0.00E+00	5.94E-07	0.00E+00	0.00E+00	0.00E+00
806	Little Calumet River	4.07E-05	1.46E-08	1.37E-08	1.31E-05	4.29E-10	1.37E-08	3.99E-05	0.00E+00	8.15E-07	0.00E+00	0.00E+00	0.00E+00
806	Grand Calumet River	1.14E-04	2.28E-08	2.20E-08	2.42E-05	1.09E-09	2.20E-08	1.12E-04	0.00E+00	2.28E-06	0.00E+00	0.00E+00	0.00E+00
915	Genesee River	1.11E-05	4.18E-10	4.16E-10	1.80E-07	9.62E-11	4.16E-10	1.09E-05	0.00E+00	2.22E-07	0.00E+00	0.00E+00	0.00E+00
915	Irondequoit Bay	6.78E-06	5.56E-10	5.48E-10	7.47E-07	5.83E-11	5.48E-10	6.65E-06	0.00E+00	1.36E-07	0.00E+00	0.00E+00	0.00E+00
915	Highland Reservoir	7.82E-06	5.28E-11	5.20E-11	7.14E-08	4.03E-11	5.20E-11	7.66E-06	0.00E+00	1.56E-07	0.00E+00	0.00E+00	0.00E+00
A32	Armand Bayou	3.71E-05	1.78E-09	1.72E-09	8.86E-07	4.11E-10	1.72E-09	3.63E-05	0.00E+00	7.41E-07	0.00E+00	0.00E+00	0.00E+00
A43	Twelvemile Creek	6.36E-05	1.26E-08	1.24E-08	9.70E-06	4.76E-10	1.24E-08	6.23E-05	0.00E+00	1.27E-06	0.00E+00	0.00E+00	0.00E+00
A43	Niagara River	8.01E-05	8.74E-09	8.60E-09	7.29E-06	6.84E-10	8.60E-09	7.85E-05	0.00E+00	1.60E-06	0.00E+00	0.00E+00	0.00E+00
A43	Bergholtz Creek	9.77E-05	1.57E-08	1.54E-08	1.66E-05	7.17E-10	1.54E-08	9.58E-05	0.00E+00	1.95E-06	0.00E+00	0.00E+00	0.00E+00
A43	Cayuga Creek	1.97E-04	8.83E-09	8.75E-09	4.95E-06	1.42E-09	8.75E-09	1.93E-04	0.00E+00	3.93E-06	0.00E+00	0.00E+00	0.00E+00
A50	San Jacinto River	2.17E-04	1.04E-09	4.20E-10	8.24E-06	2.35E-09	8.21E-13	2.12E-04	4.16E-10	4.34E-06	2.73E-12	4.37E-06	1.86E-05
A50	Carpenters Bayou	3.35E-04	3.32E-08	5.68E-09	3.58E-04	3.55E-09	1.22E-11	3.29E-04	5.63E-09	6.71E-06	3.57E-11	5.72E-05	2.43E-04
A50	Highlands Reservoir	1.64E-04	4.41E-09	6.86E-10	4.28E-05	1.52E-09	2.66E-10	1.60E-04	4.01E-10	3.27E-06	1.87E-11	2.99E-05	1.27E-04
A50	Buffalo Bayou	3.04E-04	2.28E-09	7.22E-10	2.07E-05	3.46E-09	4.10E-12	2.98E-04	7.14E-10	6.09E-06	4.16E-12	6.65E-06	2.83E-05
A62	Caney Creek	1.41E-04	4.88E-09	4.63E-09	3.59E-06	1.60E-09	4.63E-09	1.39E-04	0.00E+00	2.83E-06	0.00E+00	0.00E+00	0.00E+00
A62	E & W Fork Crystal Cr.	4.18E-04	9.43E-09	8.87E-09	7.84E-06	4.55E-09	8.87E-09	4.09E-04	0.00E+00	8.35E-06	0.00E+00	0.00E+00	0.00E+00
A62	Stewarts Creek	1.40E-04	4.87E-09	4.61E-09	3.69E-06	1.48E-09	4.61E-09	1.38E-04	0.00E+00	2.81E-06	0.00E+00	0.00E+00	0.00E+00
A62	Lewis Creek Reservoir	3.97E-05	3.47E-10	3.22E-10	3.36E-07	3.81E-10	3.22E-10	3.89E-05	0.00E+00	7.93E-07	0.00E+00	0.00E+00	0.00E+00
B20	Cuyahoga River	1.11E-05	9.18E-10	9.06E-10	6.94E-07	1.06E-10	9.06E-10	1.08E-05	0.00E+00	2.21E-07	0.00E+00	0.00E+00	0.00E+00
B20	Upper and Lower Shaker Lake	1.32E-05	2.59E-09	2.55E-09	3.39E-06	1.05E-10	2.55E-09	1.30E-05	0.00E+00	2.65E-07	0.00E+00	0.00E+00	0.00E+00
B20	Euclid Creek	9.62E-06	9.46E-10	9.25E-10	1.03E-06	8.25E-11	9.25E-10	9.43E-06	0.00E+00	1.92E-07	0.00E+00	0.00E+00	0.00E+00
B20	Fairmont Reservoir	3.68E-05	8.51E-10	8.39E-10	1.14E-06	2.39E-10	8.39E-10	3.61E-05	0.00E+00	7.37E-07	0.00E+00	0.00E+00	0.00E+00
HAN	Mississippi River	1.81E-04	2.04E-10	1.22E-10	1.15E-06	1.84E-09	3.65E-11	1.78E-04	8.45E-11	3.63E-06	1.31E-12	2.10E-06	8.94E-06
HAN	Fabius River	9.14E-05	7.89E-09	1.08E-09	9.15E-05	8.62E-10	7.98E-11	8.96E-05	9.84E-10	1.83E-06	1.68E-11	2.69E-05	1.14E-04
HAN	Spring Lake	1.14E-04	5.84E-09	1.31E-09	8.17E-05	7.29E-10	5.12E-10	1.12E-04	7.63E-10	2.28E-06	3.13E-11	5.02E-05	2.13E-04
KIN	South Fork Holston River	8.82E-06	6.85E-10	4.07E-10	1.63E-05	1.03E-10	2.21E-10	8.65E-06	1.85E-10	1.76E-07	1.07E-12	1.71E-06	7.27E-06
KIN	North Fork Holston River	1.76E-05	2.94E-09	1.21E-09	6.37E-05	2.00E-10	5.91E-10	1.73E-05	6.19E-10	3.52E-07	3.76E-12	6.02E-06	2.56E-05
KIN	Reedy Creek	1.43E-05	4.75E-09	1.44E-09	4.69E-05	1.54E-10	9.82E-10	1.40E-05	4.51E-10	2.86E-07	3.72E-12	5.96E-06	2.53E-05
KIN	Kingsport Reservoir	2.80E-05	1.61E-09	6.48E-10	4.45E-05	2.36E-10	2.54E-10	2.75E-05	3.82E-10	5.60E-07	1.17E-11	1.88E-05	7.98E-05
MCI	Tombigbee River	9.45E-05	2.85E-10	1.66E-10	4.42E-06	1.05E-09	6.79E-12	9.26E-05	1.57E-10	1.89E-06	2.28E-12	3.65E-06	1.55E-05
MCI	Hals Lake	6.47E-05	6.15E-09	2.12E-09	1.91E-04	6.55E-10	3.52E-10	6.34E-05	1.73E-09	1.29E-06	4.44E-11	7.10E-05	3.02E-04
MCI	Hellcat Lake	1.16E-03	6.67E-08	2.30E-08	2.16E-03	1.01E-08	3.78E-09	1.14E-03	1.86E-08	2.32E-05	6.11E-10	9.77E-04	4.15E-03
MCI	Alabama River	3.17E-05	1.98E-11	1.25E-11	2.72E-07	3.30E-10	1.07E-12	3.11E-05	1.13E-11	6.35E-07	1.49E-13	2.38E-07	1.01E-06
MID	Tittabawassee River (plus Sanford	6.60E-05	1.87E-09	1.04E-09	2.97E-05	6.25E-10	6.64E-10	6.47E-05	3.80E-10	1.32E-06	4.07E-13	6.51E-07	2.77E-06
MID	Sturgeon Creek	4.08E-05	9.25E-09	4.97E-09	1.57E-04	3.67E-10	3.03E-09	4.00E-05	1.93E-09	8.16E-07	2.16E-12	3.45E-06	1.47E-05
MID	Kawkawlin River	5.33E-05	2.65E-08	1.09E-08	5.35E-04	4.95E-10	4.90E-09	5.22E-05	6.00E-09	1.07E-06	7.37E-12	1.18E-05	5.01E-05
MID	Chippewa River (most inclusive da	3.86E-05	1.62E-09	1.11E-09	1.99E-05	3.41E-10	7.76E-10	3.78E-05	3.37E-10	7.72E-07	3.34E-13	5.34E-07	2.27E-06
STG	Mississippi River	5.35E-02	4.62E-09	1.63E-09	1.80E-05	5.89E-07	4.37E-11	5.24E-02	1.57E-09	1.07E-03	1.43E-11	2.28E-05	9.69E-05
STG	Bayou Plaquemine	2.43E-02	2.27E-06	1.58E-07	1.24E-02	2.33E-07	1.05E-09	2.38E-02	1.55E-07	4.85E-04	2.17E-09	3.47E-03	1.47E-02
STG	Manchac Bayou	5.61E-02	1.91E-05	1.37E-06	1.05E-01	6.57E-07	1.52E-08	5.49E-02	1.33E-06	1.12E-03	1.86E-08	2.98E-02	1.27E-01
STG	Bayou Fountain	2.08E-02	8.54E-06	5.10E-07	4.69E-02	2.28E-07	7.77E-09	2.04E-02	4.95E-07	4.16E-04	7.29E-09	1.17E-02	4.96E-02

Table G-6. Mercury Media Concentrations, Baseline

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
340	Sunfish Creek	6.52E-06	1.18E-09	3.21E-10	2.24E-05	7.81E-11	9.96E-11	6.39E-06	2.19E-10	1.30E-07	2.87E-12	4.59E-06	1.95E-05
340	Ohio River	1.38E-05	5.72E-11	3.87E-11	6.29E-07	1.85E-10	1.44E-11	1.35E-05	2.39E-11	2.76E-07	3.43E-13	5.49E-07	2.33E-06
340	Proctor Creek	2.48E-05	2.31E-09	5.97E-10	4.11E-05	2.83E-10	1.90E-10	2.43E-05	4.01E-10	4.95E-07	5.89E-12	9.42E-06	4.00E-05
340	Fish Creek	1.34E-05	1.97E-09	3.69E-10	2.93E-05	1.67E-10	8.32E-11	1.32E-05	2.74E-10	2.69E-07	1.12E-11	1.79E-05	7.60E-05
342	Kalamazoo River	6.72E-06	1.21E-09	4.27E-10	2.97E-05	6.01E-11	8.60E-12	6.59E-06	4.17E-10	1.34E-07	6.17E-13	9.87E-07	4.19E-06
342	East Lake	1.89E-06	3.66E-10	1.20E-10	1.16E-05	1.35E-11	1.71E-11	1.86E-06	1.00E-10	3.79E-08	2.95E-12	4.73E-06	2.01E-05
342	Portage Creek	9.96E-06	8.20E-09	1.94E-09	1.96E-04	8.30E-11	1.60E-11	9.76E-06	1.92E-09	1.99E-07	4.31E-12	6.90E-06	2.93E-05
342	Portage River	4.18E-06	6.78E-09	1.60E-09	1.60E-04	3.69E-11	2.59E-11	4.09E-06	1.57E-09	8.35E-08	2.53E-12	4.05E-06	1.72E-05
453	Lake Spivey	3.14E-06	5.06E-10	2.03E-10	1.25E-05	2.90E-11	8.95E-11	3.08E-06	1.11E-10	6.29E-08	2.30E-12	3.68E-06	1.56E-05
453	Jester Creek	1.43E-05	8.24E-09	1.66E-09	6.92E-05	1.32E-10	9.77E-10	1.40E-05	6.75E-10	2.85E-07	4.98E-12	7.96E-06	3.38E-05
453	Flint River	7.95E-06	3.86E-09	1.32E-09	4.88E-05	8.30E-11	8.46E-10	7.79E-06	4.73E-10	1.59E-07	2.17E-12	3.47E-06	1.48E-05
468	Schuylkill	3.19E-05	2.72E-09	1.34E-09	4.67E-05	3.41E-10	1.77E-12	3.13E-05	1.34E-09	6.38E-07	2.98E-12	4.76E-06	2.02E-05
468	Wissahickon Creek	2.53E-05	1.93E-08	4.40E-09	4.44E-04	2.52E-10	1.57E-11	2.48E-05	4.37E-09	5.06E-07	1.09E-11	1.74E-05	7.41E-05
468	Tacony Creek	1.80E-05	2.00E-08	4.30E-09	4.36E-04	1.72E-10	3.22E-12	1.77E-05	4.29E-09	3.61E-07	9.42E-12	1.51E-05	6.40E-05
468	Pickering Creek Reservoir	5.51E-06	1.47E-09	4.64E-10	4.19E-05	4.93E-11	7.71E-11	5.40E-06	3.80E-10	1.10E-07	6.95E-12	1.11E-05	4.73E-05
701	Wabash River	3.92E-04	2.32E-09	1.28E-09	3.50E-05	4.24E-09	2.98E-12	3.84E-04	1.25E-09	7.83E-06	2.27E-11	3.64E-05	1.55E-04
701	Sugar Creek	1.75E-04	2.75E-09	1.36E-09	4.81E-05	1.62E-09	9.38E-13	1.72E-04	1.34E-09	3.51E-06	2.48E-11	3.97E-05	1.69E-04
701	Big Raccoon Creek	3.12E-04	3.03E-08	7.17E-09	7.17E-04	3.24E-09	2.20E-11	3.06E-04	7.02E-09	6.25E-06	1.29E-10	2.06E-04	8.74E-04
704	Silver Lake Res.	5.02E-05	1.51E-08	4.46E-09	3.80E-04	4.25E-10	9.21E-10	4.92E-05	3.47E-09	1.00E-06	7.12E-11	1.14E-04	4.84E-04
704	Garvey Reservoir	1.49E-03	2.84E-08	8.95E-09	7.93E-04	1.10E-08	1.73E-09	1.46E-03	6.98E-09	2.97E-05	2.37E-10	3.79E-04	1.61E-03
704	Legg Lake	1.23E-02	2.36E-07	7.43E-08	6.59E-03	9.24E-08	1.43E-08	1.21E-02	5.80E-08	2.47E-04	1.97E-09	3.15E-03	1.34E-02
708	Grindle Creek	1.90E-03	5.10E-07	1.12E-07	1.13E-02	2.13E-08	4.21E-10	1.86E-03	1.11E-07	3.81E-05	7.70E-10	1.23E-03	5.23E-03
708	Tranters Creek	7.38E-04	5.37E-08	1.59E-08	1.28E-03	8.31E-09	8.71E-11	7.23E-04	1.57E-08	1.48E-05	1.14E-10	1.83E-04	7.76E-04
708	Parker Creek	1.54E-02	3.36E-06	6.53E-07	6.59E-02	1.54E-07	1.30E-09	1.51E-02	6.45E-07	3.08E-04	6.91E-09	1.11E-02	4.70E-02
725	Passaic River	4.41E-08	2.07E-12	3.57E-13	3.66E-08	2.73E-13	5.74E-15	4.32E-08	3.50E-13	8.82E-10	9.05E-16	1.45E-09	6.15E-09
725	Silver Lake Reservoir	7.80E-07	2.06E-11	6.66E-12	6.60E-07	4.22E-12	8.61E-13	7.65E-07	5.62E-12	1.56E-08	1.81E-13	2.89E-07	1.23E-06
725	Reservoir No. 2	8.38E-08	2.41E-12	7.84E-13	7.71E-08	4.17E-13	1.06E-13	8.21E-08	6.57E-13	1.68E-09	2.11E-14	3.37E-08	1.43E-07
725	Rahway River	2.47E-08	1.05E-12	1.72E-13	1.76E-08	1.45E-13	3.88E-15	2.42E-08	1.67E-13	4.93E-10	4.97E-16	7.94E-10	3.38E-09
824	Newton Lake	1.27E-07	2.71E-11	9.25E-12	8.72E-07	1.09E-12	1.52E-12	1.24E-07	7.52E-12	2.54E-09	2.18E-13	3.49E-07	1.48E-06
824	Big Timber Creek	7.21E-08	3.41E-11	9.88E-12	8.57E-07	7.10E-13	5.47E-13	7.06E-08	9.30E-12	1.44E-09	3.68E-14	5.89E-08	2.50E-07
824	Darby Creek	1.56E-07	7.18E-11	1.60E-11	1.60E-06	1.54E-12	1.72E-13	1.53E-07	1.58E-11	3.12E-09	7.72E-14	1.24E-07	5.25E-07
824	Schuylkill River	1.43E-07	1.66E-12	1.13E-12	1.80E-08	1.38E-12	1.08E-14	1.41E-07	1.12E-12	2.87E-09	6.20E-15	9.92E-09	4.22E-08
904	Pascagoula River	5.71E-05	3.97E-11	3.55E-11	1.64E-07	5.49E-10	2.20E-12	5.60E-05	3.30E-11	1.14E-06	2.46E-13	3.94E-07	1.67E-06
904	Escatawpa River	6.52E-05	1.18E-09	5.87E-10	2.15E-05	6.73E-10	9.43E-11	6.39E-05	4.89E-10	1.30E-06	3.75E-12	6.00E-06	2.55E-05
906	Mississippi River	4.97E-06	4.08E-12	4.03E-12	9.59E-10	4.45E-11	4.03E-12	4.87E-06	0.00E+00	9.94E-08	0.00E+00	0.00E+00	0.00E+00
906	Copperas Creek	1.99E-06	2.72E-11	2.54E-11	2.63E-08	1.62E-11	2.54E-11	1.95E-06	0.00E+00	3.97E-08	0.00E+00	0.00E+00	0.00E+00
906	Eliza Creek	1.30E-06	1.39E-11	1.30E-11	1.34E-08	1.06E-11	1.30E-11	1.27E-06	0.00E+00	2.60E-08	0.00E+00	0.00E+00	0.00E+00
906	Muscatine Slough	6.08E-06	9.70E-11	8.77E-11	9.06E-08	5.07E-11	8.77E-11	5.96E-06	0.00E+00	1.22E-07	0.00E+00	0.00E+00	0.00E+00
A14	Mississippi River	5.17E-07	1.47E-14	5.76E-15	5.38E-11	5.55E-12	1.98E-16	5.07E-07	5.49E-15	1.03E-08	7.12E-17	1.14E-10	4.84E-10
A14	New River	7.17E-07	1.43E-10	9.43E-12	7.77E-07	8.17E-12	1.14E-13	7.03E-07	9.19E-12	1.43E-08	1.20E-13	1.92E-07	8.15E-07
A14	Bayou Lafourche	2.50E-07	7.05E-13	7.94E-14	3.73E-09	2.27E-12	1.40E-15	2.45E-07	7.68E-14	5.00E-09	1.17E-15	1.87E-09	7.96E-09
A14	Bayou Conway	5.67E-07	1.31E-10	8.71E-12	7.19E-07	6.30E-12	9.90E-14	5.56E-07	8.50E-12	1.13E-08	1.14E-13	1.83E-07	7.77E-07
A26	Big Creek (includes Sulfur Spring C	1.95E-05	4.85E-09	2.12E-10	1.48E-05	1.68E-10	6.48E-11	1.91E-05	1.44E-10	3.89E-07	2.73E-12	4.37E-06	1.86E-05
A26	Carter Creek	2.88E-06	8.44E-11	1.12E-11	3.48E-07	2.60E-11	7.13E-12	2.82E-06	4.00E-12	5.76E-08	7.79E-14	1.25E-07	5.30E-07
A26	Dota Creek	4.13E-06	9.92E-11	1.35E-11	4.06E-07	3.82E-11	8.37E-12	4.05E-06	5.08E-12	8.26E-08	9.41E-14	1.51E-07	6.40E-07

Table G-6. Mercury Media Concentrations, Baseline

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
A31	Nottaway River	7.39E-04	2.84E-08	9.62E-09	6.63E-04	9.58E-09	7.27E-11	7.24E-04	9.45E-09	1.48E-05	1.06E-10	1.69E-04	7.19E-04
A31	Chowan River	5.03E-04	7.19E-09	3.17E-09	1.46E-04	6.61E-09	2.13E-11	4.93E-04	3.12E-09	1.01E-05	3.39E-11	5.43E-05	2.31E-04
A31	Nottaway Swamp (a creek)	2.06E-03	2.66E-07	6.75E-08	6.75E-03	2.42E-08	2.11E-10	2.02E-03	6.66E-08	4.13E-05	7.05E-10	1.13E-03	4.80E-03
A45	Sheldon Reservoir	1.57E-05	5.22E-10	8.32E-11	5.04E-06	1.47E-10	3.38E-11	1.54E-05	4.73E-11	3.15E-07	2.13E-12	3.40E-06	1.45E-05
A45	Highlands Reservoir	4.28E-06	2.08E-10	3.32E-11	2.01E-06	3.98E-11	1.35E-11	4.19E-06	1.89E-11	8.55E-08	8.52E-13	1.36E-06	5.80E-06
A45	Buffalo Bayou	3.37E-05	8.72E-09	1.55E-09	9.27E-05	3.98E-10	7.26E-11	3.30E-05	1.48E-09	6.74E-07	2.51E-12	4.02E-06	1.71E-05
A45	Greens Bayou	1.79E-05	7.07E-09	8.44E-10	7.46E-05	1.96E-10	1.63E-11	1.76E-05	8.26E-10	3.59E-07	1.63E-12	2.60E-06	1.11E-05
A46	Ohio River	2.15E-05	1.24E-11	1.23E-11	4.46E-09	2.72E-10	1.23E-11	2.11E-05	0.00E+00	4.31E-07	0.00E+00	0.00E+00	0.00E+00
A46	Middle Island Creek	1.29E-05	3.72E-11	3.58E-11	3.86E-08	1.66E-10	3.58E-11	1.26E-05	0.00E+00	2.58E-07	0.00E+00	0.00E+00	0.00E+00
A46	Little Muskingum River	9.33E-06	3.53E-11	3.35E-11	3.54E-08	1.18E-10	3.35E-11	9.14E-06	0.00E+00	1.87E-07	0.00E+00	0.00E+00	0.00E+00
A47	Caney River	1.49E-07	3.00E-11	3.92E-12	1.22E-07	1.41E-12	2.48E-12	1.46E-07	1.43E-12	2.99E-09	9.64E-15	1.54E-08	6.55E-08
A47	Sand Creek	2.93E-07	1.15E-10	1.21E-11	4.78E-07	2.64E-12	6.81E-12	2.87E-07	5.25E-12	5.86E-09	2.92E-14	4.67E-08	1.99E-07
A47	Lake Hudson	2.34E-07	3.44E-11	6.56E-12	3.18E-07	1.85E-12	3.45E-12	2.29E-07	2.98E-12	4.67E-09	1.24E-13	1.98E-07	8.40E-07
A47	Bar-Dew Lake	3.34E-07	5.95E-11	1.02E-11	5.59E-07	2.39E-12	4.75E-12	3.27E-07	5.26E-12	6.68E-09	2.09E-13	3.34E-07	1.42E-06
A55	Mohawk River	2.73E-07	3.23E-12	2.16E-12	3.63E-08	2.69E-12	9.98E-13	2.68E-07	1.15E-12	5.47E-09	1.18E-14	1.89E-08	8.03E-08
A55	Acplause Kill River	2.00E-07	3.12E-11	8.99E-12	5.77E-07	1.80E-12	3.29E-12	1.96E-07	5.64E-12	3.99E-09	6.82E-14	1.09E-07	4.64E-07
A55	Stony Creek Reservoir	7.89E-08	3.04E-12	1.26E-12	8.33E-08	6.48E-13	5.18E-13	7.74E-08	7.18E-13	1.58E-09	2.25E-14	3.60E-08	1.53E-07
A55	Watervliet Reservoir	1.96E-07	1.68E-11	9.58E-12	3.25E-07	1.81E-12	6.59E-12	1.92E-07	2.93E-12	3.92E-09	5.87E-14	9.39E-08	3.99E-07
B18	Mississippi River	6.07E-07	1.03E-13	9.78E-14	3.21E-11	6.67E-12	9.59E-14	5.95E-07	1.91E-15	1.21E-08	1.32E-17	2.12E-11	9.01E-11
B18	Gulf Intercoastal Waterway	4.51E-07	9.95E-12	7.53E-12	1.46E-08	5.26E-12	7.37E-12	4.42E-07	1.56E-13	9.03E-09	9.26E-16	1.48E-09	6.30E-09
B18	Bayou La Butte	2.85E-06	1.13E-10	7.57E-11	2.28E-07	2.99E-11	7.24E-11	2.79E-06	3.23E-12	5.70E-08	2.90E-14	4.64E-08	1.97E-07
B18	Bayou Manchac	4.02E-07	9.04E-11	5.60E-11	2.04E-07	4.64E-12	5.42E-11	3.94E-07	1.77E-12	8.04E-09	1.30E-14	2.09E-08	8.87E-08
B23	Neches River	5.96E-06	1.76E-11	6.25E-12	1.51E-07	5.96E-11	5.69E-13	5.84E-06	5.67E-12	1.19E-07	1.48E-14	2.37E-08	1.01E-07
B23	Port Arthur Reservoir	1.51E-05	5.85E-10	9.12E-11	5.67E-06	1.15E-10	3.56E-11	1.48E-05	5.32E-11	3.01E-07	2.39E-12	3.82E-06	1.62E-05
B23	Hillbrandt Bayou	4.18E-06	7.78E-10	1.36E-10	8.28E-06	4.22E-11	1.57E-11	4.10E-06	1.20E-10	8.37E-08	3.68E-13	5.89E-07	2.50E-06
B23	Cow Bayou	5.32E-06	5.63E-10	1.05E-10	5.96E-06	5.33E-11	6.12E-12	5.22E-06	9.85E-11	1.06E-07	3.60E-13	5.76E-07	2.45E-06
B31	Wassahickon Creek	5.11E-04	2.21E-07	4.71E-08	4.73E-03	4.64E-09	2.28E-10	5.00E-04	4.66E-08	1.02E-05	2.64E-10	4.22E-04	1.80E-03
B31	Sckuylkill River	1.91E-04	1.33E-08	5.82E-09	2.55E-04	1.89E-09	6.58E-11	1.87E-04	5.73E-09	3.82E-06	3.08E-11	4.93E-05	2.10E-04
B31	Neshaminy Creek	1.96E-04	2.67E-08	9.40E-09	6.01E-04	1.78E-09	4.62E-11	1.92E-04	9.30E-09	3.92E-06	5.94E-11	9.51E-05	4.04E-04
B31	Peace Valley Reservoir	8.41E-05	7.99E-09	2.61E-09	2.47E-04	6.78E-10	3.96E-10	8.24E-05	2.15E-09	1.68E-06	6.17E-11	9.87E-05	4.19E-04
B32	Cedar Bayou	4.21E-04	7.34E-08	9.79E-09	7.92E-04	4.81E-09	1.45E-10	4.13E-04	9.61E-09	8.43E-06	2.85E-11	4.56E-05	1.94E-04
B32	Cary Bayou	9.49E-04	1.10E-06	1.17E-07	1.17E-02	9.26E-09	1.78E-10	9.30E-04	1.16E-07	1.90E-05	5.12E-10	8.19E-04	3.48E-03
B32	Goose Creek	3.25E-04	6.47E-07	7.23E-08	7.25E-03	3.47E-09	1.66E-10	3.19E-04	7.20E-08	6.51E-06	2.23E-10	3.58E-04	1.52E-03
B37	Arkansas River	5.31E-07	1.43E-12	8.17E-13	2.96E-09	5.18E-12	5.79E-13	5.21E-07	2.37E-13	1.06E-08	4.34E-16	6.94E-10	2.95E-09
B37	Plum Bayou (includes Black Bayou	1.74E-07	7.48E-11	8.47E-12	3.04E-07	1.63E-12	5.16E-12	1.71E-07	3.30E-12	3.49E-09	6.87E-15	1.10E-08	4.67E-08
B37	Yellow Lake	2.03E-06	1.04E-10	2.51E-11	9.15E-07	1.60E-11	1.63E-11	1.99E-06	8.48E-12	4.07E-08	3.79E-13	6.06E-07	2.57E-06
B37	Lake Pine Bluff	4.19E-07	1.56E-10	3.79E-11	1.39E-06	3.80E-12	2.44E-11	4.11E-07	1.30E-11	8.38E-09	5.21E-13	8.33E-07	3.54E-06
B44	Sheldon Reservoir	1.76E-05	5.36E-10	8.35E-11	5.20E-06	1.63E-10	3.25E-11	1.73E-05	4.88E-11	3.53E-07	2.20E-12	3.52E-06	1.50E-05
B44	Greens Bayou	3.16E-05	3.02E-09	5.35E-10	3.22E-05	3.44E-10	3.80E-12	3.10E-05	5.30E-10	6.33E-07	1.10E-12	1.76E-06	7.47E-06
B44	Buffalo Bayou	6.74E-05	1.32E-09	3.63E-10	1.26E-05	7.85E-10	3.19E-12	6.61E-05	3.59E-10	1.35E-06	7.13E-13	1.14E-06	4.85E-06
B44	Hunting Bayou	2.62E-05	1.32E-08	1.69E-09	1.43E-04	2.74E-10	7.27E-12	2.57E-05	1.68E-09	5.24E-07	3.95E-12	6.32E-06	2.69E-05
TOO	Soldier Creek	3.70E-06	2.10E-10	1.56E-10	2.18E-06	3.39E-11	1.37E-10	3.63E-06	1.97E-11	7.41E-08	7.54E-14	1.21E-07	5.13E-07
TOO	Box Elder Wash	2.15E-05	6.70E-09	5.36E-09	2.08E-05	2.11E-10	5.21E-09	2.11E-05	1.48E-10	4.31E-07	3.59E-13	5.75E-07	2.44E-06
TOO	Blue Lakes	2.38E-06	1.62E-11	1.55E-11	7.37E-08	1.79E-11	1.52E-11	2.33E-06	2.87E-13	4.76E-08	8.13E-15	1.30E-08	5.53E-08
TOO	Rush Lake	4.61E-06	1.05E-09	9.44E-10	8.21E-06	4.77E-11	8.91E-10	4.52E-06	5.16E-11	9.23E-08	9.63E-13	1.54E-06	6.55E-06

Table G-7. Mercury Media Concentrations, Floor/Standard

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
209	Lawsons Fork Creek	1.42E-06	3.65E-10	5.68E-11	5.51E-06	1.57E-11	1.98E-12	1.40E-06	5.41E-11	2.85E-08	7.11E-13	1.14E-06	4.83E-06
209	Tyger River	3.77E-06	6.27E-10	1.46E-10	1.44E-05	4.40E-11	3.31E-12	3.69E-06	1.41E-10	7.54E-08	1.50E-12	2.40E-06	1.02E-05
209	Fair Forest Creek	2.95E-06	1.12E-09	1.30E-10	1.25E-05	3.33E-11	4.63E-12	2.89E-06	1.23E-10	5.91E-08	1.64E-12	2.62E-06	1.11E-05
209	Middle Tyger River	1.74E-06	2.93E-10	5.70E-11	5.59E-06	1.81E-11	1.42E-12	1.71E-06	5.49E-11	3.49E-08	7.61E-13	1.22E-06	5.17E-06
214	Fish Ponds	1.04E-04	2.88E-09	5.96E-10	4.18E-05	9.35E-10	1.91E-10	1.02E-04	3.90E-10	2.09E-06	1.61E-11	2.58E-05	1.09E-04
214	Lake Clause	1.41E-04	4.16E-08	8.59E-09	6.14E-04	1.38E-09	2.60E-09	1.38E-04	5.80E-09	2.82E-06	1.83E-10	2.93E-04	1.25E-03
214	University Lake/ City Park Lake	5.86E-05	3.54E-09	7.25E-10	5.13E-05	5.21E-10	2.27E-10	5.74E-05	4.78E-10	1.17E-06	1.98E-11	3.17E-05	1.35E-04
214	Comite River	6.96E-05	7.04E-09	9.95E-10	3.63E-05	8.08E-10	1.18E-10	6.82E-05	8.71E-10	1.39E-06	6.05E-12	9.68E-06	4.11E-05
221	Highlands Reservoir	6.81E-05	1.09E-09	3.96E-10	8.05E-06	6.33E-10	3.20E-10	6.67E-05	7.28E-11	1.36E-06	3.33E-12	5.32E-06	2.26E-05
221	San Jacinto River / Houston Lake	1.34E-04	6.95E-10	2.44E-10	5.52E-06	1.48E-09	1.81E-10	1.32E-04	6.25E-11	2.69E-06	1.98E-13	3.17E-07	1.35E-06
221	Sheldon Reservoir	1.07E-04	1.10E-09	4.40E-10	7.68E-06	9.98E-10	3.68E-10	1.05E-04	6.89E-11	2.14E-06	3.16E-12	5.06E-06	2.15E-05
324	Shades Creek	3.02E-05	1.14E-08	2.59E-09	2.57E-04	3.72E-10	3.92E-11	2.96E-05	2.54E-09	6.04E-07	1.24E-11	1.98E-05	8.41E-05
324	Valley Creek	1.41E-04	7.05E-08	1.58E-08	1.58E-03	1.83E-09	2.00E-10	1.39E-04	1.56E-08	2.83E-06	6.14E-11	9.83E-05	4.18E-04
324	Cahaba River	1.33E-05	3.34E-09	8.88E-10	8.75E-05	1.63E-10	2.05E-11	1.30E-05	8.63E-10	2.66E-07	4.54E-12	7.27E-06	3.09E-05
324	Bayview Lake	1.51E-04	5.05E-08	1.66E-08	1.42E-03	1.85E-09	3.30E-09	1.48E-04	1.31E-08	3.01E-06	1.97E-10	3.15E-04	1.34E-03
325	Verdigris River	2.36E-03	8.42E-08	7.53E-09	3.65E-04	2.09E-08	4.12E-11	2.31E-03	7.39E-09	4.72E-05	9.57E-11	1.53E-04	6.51E-04
325	Big Hill Creek	6.71E-03	1.57E-06	8.97E-08	6.97E-03	5.26E-08	2.42E-10	6.58E-03	8.81E-08	1.34E-04	1.34E-09	2.14E-03	9.11E-03
325	Potato Creek	1.17E-02	6.94E-06	3.57E-07	3.14E-02	8.72E-08	5.92E-10	1.15E-02	3.51E-07	2.34E-04	5.44E-09	8.70E-03	3.70E-02
325	Claymore Creek	2.20E-02	1.34E-06	8.77E-08	5.92E-03	1.62E-07	9.32E-10	2.16E-02	8.55E-08	4.41E-04	1.28E-09	2.04E-03	8.67E-03
331	Rocky River	9.47E-05	1.08E-08	3.01E-09	2.80E-04	9.01E-10	4.47E-11	9.28E-05	2.94E-09	1.89E-06	2.21E-11	3.54E-05	1.50E-04
331	East Branch Black River	3.34E-04	4.68E-08	1.26E-08	1.26E-03	3.13E-09	1.50E-10	3.27E-04	1.23E-08	6.68E-06	1.24E-10	1.98E-04	8.42E-04
331	Wyleswood Lake	1.39E-04	5.17E-09	1.70E-09	1.62E-04	8.41E-10	2.68E-10	1.37E-04	1.39E-09	2.79E-06	4.53E-11	7.26E-05	3.08E-04
331	Baldwin Lake	4.42E-05	7.15E-09	2.33E-09	2.07E-04	3.69E-10	3.79E-10	4.33E-05	1.91E-09	8.84E-07	3.65E-11	5.84E-05	2.48E-04
359	Ohio River	3.59E-04	1.75E-11	1.74E-11	5.05E-09	4.18E-09	1.74E-11	3.52E-04	0.00E+00	7.18E-06	0.00E+00	0.00E+00	0.00E+00
359	Kentucky River	3.82E-04	1.06E-10	1.05E-10	4.17E-08	4.43E-09	1.05E-10	3.75E-04	0.00E+00	7.65E-06	0.00E+00	0.00E+00	0.00E+00
359	Indian Creek	3.55E-04	8.42E-10	7.89E-10	8.24E-07	3.80E-09	7.89E-10	3.48E-04	0.00E+00	7.09E-06	0.00E+00	0.00E+00	0.00E+00
359	Indian Kentuck Creek	2.38E-04	1.36E-09	1.18E-09	1.21E-06	2.55E-09	1.18E-09	2.33E-04	0.00E+00	4.76E-06	0.00E+00	0.00E+00	0.00E+00
A15	Ellicott Creek	1.69E-05	4.00E-09	1.11E-09	1.08E-04	1.36E-10	1.30E-11	1.66E-05	1.09E-09	3.38E-07	6.50E-12	1.04E-05	4.42E-05
A15	Tonawanda Creek	2.82E-05	3.04E-09	9.48E-10	7.53E-05	2.34E-10	9.00E-12	2.77E-05	9.34E-10	5.65E-07	4.40E-12	7.04E-06	2.99E-05
A15	Murder Creek	1.04E-05	3.42E-09	9.05E-10	8.99E-05	7.99E-11	1.60E-11	1.02E-05	8.83E-10	2.08E-07	5.92E-12	9.47E-06	4.03E-05
A18	Taylor Bayou	3.34E-04	1.12E-09	1.06E-09	8.30E-07	3.60E-09	1.06E-09	3.28E-04	0.00E+00	6.69E-06	0.00E+00	0.00E+00	0.00E+00
A18	Hillebrandt Bayou	1.32E-04	9.02E-10	8.13E-10	8.37E-07	1.38E-09	8.13E-10	1.30E-04	0.00E+00	2.65E-06	0.00E+00	0.00E+00	0.00E+00
A18	Viterbo Reservoir	1.73E-04	1.13E-09	1.05E-09	1.09E-06	1.44E-09	1.05E-09	1.69E-04	0.00E+00	3.46E-06	0.00E+00	0.00E+00	0.00E+00
CAL	Tennessee River	1.38E-04	1.47E-10	1.35E-10	7.09E-07	1.46E-09	5.91E-11	1.35E-04	7.54E-11	2.76E-06	8.91E-13	1.43E-06	6.06E-06
CAL	Kentucky Lake	1.40E-04	6.13E-09	2.58E-09	1.62E-04	1.38E-09	1.15E-09	1.38E-04	1.39E-09	2.81E-06	4.23E-11	6.76E-05	2.87E-04
CAL	Barkley Lake	6.00E-05	1.30E-09	6.02E-10	3.24E-05	5.80E-10	3.18E-10	5.88E-05	2.76E-10	1.20E-06	8.96E-12	1.43E-05	6.09E-05
CAL	Cumberland River	1.01E-04	1.92E-10	1.45E-10	1.61E-06	1.03E-09	4.86E-11	9.88E-05	9.55E-11	2.02E-06	1.24E-12	1.99E-06	8.47E-06
ELD	Flat Creek	1.56E-04	7.14E-09	6.40E-09	4.59E-06	1.54E-09	6.40E-09	1.53E-04	0.00E+00	3.11E-06	0.00E+00	0.00E+00	0.00E+00
ELD	Salt Creek	9.44E-05	2.42E-09	2.08E-09	2.00E-06	9.00E-10	2.08E-09	9.25E-05	0.00E+00	1.89E-06	0.00E+00	0.00E+00	0.00E+00
ELD	Calion Lake	3.83E-05	6.92E-10	6.62E-10	7.12E-07	3.66E-10	6.62E-10	3.76E-05	0.00E+00	7.67E-07	0.00E+00	0.00E+00	0.00E+00
ELD	Ouachita River	5.52E-05	4.13E-10	3.95E-10	1.19E-07	5.88E-10	3.95E-10	5.41E-05	0.00E+00	1.10E-06	0.00E+00	0.00E+00	0.00E+00
SAU	Mississippi River	1.57E-04	1.83E-10	1.39E-10	6.37E-07	1.61E-09	4.78E-12	1.54E-04	1.34E-10	3.14E-06	2.25E-13	3.60E-07	1.53E-06
SAU	Horseshoe Lake	7.13E-05	5.02E-09	9.81E-10	7.38E-05	5.92E-10	2.64E-10	6.99E-05	6.90E-10	1.43E-06	2.79E-11	4.46E-05	1.90E-04
SAU	Old Cahokia Creek	7.27E-05	1.21E-08	2.10E-09	1.39E-04	5.31E-10	6.57E-11	7.13E-05	2.02E-09	1.45E-06	1.27E-11	2.04E-05	8.66E-05

Table G-7. Mercury Media Concentrations, Floor/Standard

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
202	Verdigris River	7.81E-05	3.47E-09	2.86E-10	1.51E-05	6.91E-10	3.93E-11	7.65E-05	2.45E-10	1.56E-06	2.04E-12	3.27E-06	1.39E-05
202	Elk City Lake	2.33E-05	2.00E-09	2.87E-10	1.97E-05	1.82E-10	9.42E-11	2.28E-05	1.85E-10	4.65E-07	8.28E-12	1.32E-05	5.63E-05
202	Montgomery County State Park Lal	1.49E-04	3.50E-08	4.86E-09	3.39E-04	1.05E-09	1.53E-09	1.46E-04	3.21E-09	2.99E-06	1.23E-10	1.97E-04	8.37E-04
203	Catalpa Creek	6.04E-04	6.48E-08	1.40E-08	1.40E-03	7.69E-09	1.43E-10	5.92E-04	1.36E-08	1.21E-05	3.02E-10	4.83E-04	2.05E-03
203	Gilmer Creek	6.65E-04	1.62E-07	1.87E-08	1.87E-03	8.11E-09	1.73E-10	6.52E-04	1.82E-08	1.33E-05	4.04E-10	6.46E-04	2.74E-03
203	N. Branch Magowah Creek	4.02E-03	3.11E-07	8.05E-08	8.08E-03	4.57E-08	4.47E-10	3.94E-03	7.87E-08	8.03E-05	1.39E-09	2.22E-03	9.43E-03
203	Shotbag Creek	7.71E-04	8.85E-08	1.81E-08	1.81E-03	9.13E-09	1.25E-10	7.55E-04	1.76E-08	1.54E-05	3.53E-10	5.65E-04	2.40E-03
204	Mississippi River	3.20E-04	3.77E-10	2.32E-10	2.06E-06	3.19E-09	9.58E-12	3.13E-04	2.19E-10	6.40E-06	3.30E-12	5.27E-06	2.24E-05
204	Bay Creek	1.50E-04	3.74E-08	4.20E-09	4.08E-04	1.33E-09	1.26E-10	1.47E-04	4.01E-09	2.99E-06	6.64E-11	1.06E-04	4.52E-04
204	Little Calumet Creek	4.23E-04	6.77E-08	9.45E-09	8.25E-04	3.44E-09	2.87E-10	4.14E-04	9.01E-09	8.45E-06	1.49E-10	2.39E-04	1.02E-03
204	Upper and Lower Swan Lake	3.24E-04	2.12E-08	4.19E-09	3.10E-04	2.43E-09	1.17E-09	3.18E-04	2.90E-09	6.48E-06	1.19E-10	1.91E-04	8.12E-04
302	Maumee River	3.83E-04	1.67E-10	1.51E-10	7.37E-07	3.46E-09	3.19E-12	3.75E-04	1.46E-10	7.66E-06	1.88E-12	3.01E-06	1.28E-05
302	Auglaize River	4.77E-04	2.05E-10	1.98E-10	3.34E-07	4.37E-09	2.61E-12	4.67E-04	1.93E-10	9.53E-06	2.55E-12	4.08E-06	1.73E-05
302	Six Mile Creek	1.54E-03	2.83E-09	2.41E-09	1.84E-05	1.24E-08	2.27E-11	1.51E-03	2.35E-09	3.07E-05	3.57E-11	5.72E-05	2.43E-04
304	Big Walnut Creek	9.39E-03	1.59E-06	2.89E-07	2.93E-02	9.81E-08	6.22E-10	9.21E-03	2.85E-07	1.88E-04	3.64E-09	5.83E-03	2.48E-02
304	Deer Creek	1.35E-02	2.89E-06	4.21E-07	4.29E-02	1.37E-07	8.73E-10	1.33E-02	4.14E-07	2.71E-04	5.96E-09	9.54E-03	4.05E-02
304	Glenn Flint Lake	4.87E-03	4.57E-07	1.44E-07	1.30E-02	4.47E-08	2.45E-08	4.77E-03	1.16E-07	9.74E-05	3.06E-09	4.89E-03	2.08E-02
320	Mud Devils Lake	1.52E-03	2.01E-07	6.94E-08	6.33E-03	1.57E-08	1.36E-08	1.49E-03	5.41E-08	3.04E-05	1.69E-09	2.71E-03	1.15E-02
320	Thunder Bay River	1.74E-03	9.09E-08	2.52E-08	2.18E-03	1.94E-08	6.06E-10	1.70E-03	2.45E-08	3.47E-05	7.92E-11	1.27E-04	5.39E-04
320	Long Lake	1.37E-03	3.13E-08	1.08E-08	9.75E-04	1.39E-08	2.22E-09	1.34E-03	8.29E-09	2.74E-05	2.72E-10	4.36E-04	1.85E-03
321	Black Warrior River (most inclusiv	2.36E-02	1.88E-07	9.78E-08	3.33E-03	3.09E-07	7.66E-10	2.31E-02	9.57E-08	4.72E-04	1.31E-09	2.10E-03	8.92E-03
321	Powell Creek	1.39E-02	1.49E-06	3.80E-07	3.80E-02	1.70E-07	2.01E-09	1.36E-02	3.73E-07	2.77E-04	5.90E-09	9.43E-03	4.01E-02
321	Lake Demopolis	2.36E-02	2.26E-06	7.78E-07	7.05E-02	3.09E-07	1.56E-07	2.31E-02	6.04E-07	4.72E-04	1.89E-08	3.03E-02	1.29E-01
321	Lake Henry	1.32E-02	1.76E-06	4.89E-07	3.98E-02	1.37E-07	1.09E-07	1.29E-02	3.72E-07	2.63E-04	7.91E-09	1.27E-02	5.38E-02
BAT	Lehigh River	2.57E-04	1.54E-08	3.82E-09	3.47E-04	2.58E-09	4.58E-11	2.52E-04	3.72E-09	5.14E-06	5.25E-11	8.41E-05	3.57E-04
BAT	Monocacy Creek	5.91E-04	1.11E-07	1.68E-08	1.70E-03	5.33E-09	1.23E-10	5.79E-04	1.64E-08	1.18E-05	2.56E-10	4.10E-04	1.74E-03
CHA	Allen Lake	1.12E-02	1.59E-06	2.34E-07	1.55E-02	7.86E-08	8.17E-08	1.09E-02	1.46E-07	2.23E-04	6.41E-09	1.03E-02	4.36E-02
CHA	Neosho River	7.28E-03	2.93E-07	4.31E-08	1.19E-03	7.34E-08	3.85E-09	7.13E-03	3.90E-08	1.46E-04	2.66E-10	4.26E-04	1.81E-03
CHA	Sante Fe Lake	1.54E-02	3.74E-06	5.49E-07	3.64E-02	1.21E-07	1.91E-07	1.51E-02	3.44E-07	3.09E-04	1.38E-08	2.21E-02	9.39E-02
FOR	Walnut Bayou	1.13E-02	2.68E-06	1.42E-07	1.17E-02	1.05E-07	9.04E-09	1.11E-02	1.31E-07	2.26E-04	2.12E-09	3.40E-03	1.44E-02
FOR	West Flat Creek	1.15E-02	4.43E-06	2.20E-07	1.95E-02	9.57E-08	4.33E-09	1.13E-02	2.12E-07	2.30E-04	3.61E-09	5.77E-03	2.45E-02
FOR	Hamilton Lake	1.39E-02	1.37E-06	2.10E-07	1.35E-02	1.04E-07	7.74E-08	1.36E-02	1.27E-07	2.78E-04	5.79E-09	9.26E-03	3.93E-02
FRE	Fall River	2.70E-03	1.58E-07	1.34E-08	6.89E-04	2.27E-08	1.93E-10	2.65E-03	1.30E-08	5.40E-05	1.64E-10	2.62E-04	1.11E-03
FRE	Salt Creek	3.44E-03	5.51E-07	4.45E-08	2.42E-03	2.57E-08	1.25E-09	3.37E-03	4.27E-08	6.88E-05	6.09E-10	9.74E-04	4.14E-03
FRE	Verdigris River	9.57E-03	2.09E-07	2.08E-08	8.97E-04	8.10E-08	4.45E-10	9.37E-03	2.02E-08	1.91E-04	2.23E-10	3.56E-04	1.52E-03
HAR	Indian Field Swamp	6.00E-03	1.47E-08	3.73E-09	3.21E-04	5.02E-08	1.33E-10	5.88E-03	3.57E-09	1.20E-04	2.70E-11	4.33E-05	1.84E-04
HAR	Walnut Branch	6.29E-03	9.17E-10	4.76E-10	1.59E-05	4.91E-08	4.82E-11	6.17E-03	4.24E-10	1.26E-04	3.99E-12	6.39E-06	2.72E-05
HAR	Huttos Lake	1.93E-02	6.79E-07	2.28E-07	2.09E-02	1.61E-07	4.30E-08	1.90E-02	1.80E-07	3.87E-04	6.01E-09	9.62E-03	4.09E-02
HOL	Huttos Lake	1.51E-02	5.15E-07	1.72E-07	1.59E-02	1.26E-07	3.13E-08	1.48E-02	1.36E-07	3.02E-04	4.61E-09	7.37E-03	3.13E-02
HOL	Lake Merkel	6.30E-03	5.84E-07	1.93E-07	1.74E-02	5.94E-08	3.34E-08	6.17E-03	1.56E-07	1.26E-04	4.20E-09	6.71E-03	2.85E-02
TEX	Armstrong Creek	1.24E-02	4.91E-06	4.09E-07	4.09E-02	1.02E-07	1.80E-09	1.21E-02	4.01E-07	2.47E-04	6.08E-09	9.73E-03	4.14E-02
TEX	Waxahachie Creek	6.80E-03	3.87E-06	2.41E-07	2.41E-02	5.89E-08	1.35E-09	6.67E-03	2.36E-07	1.36E-04	3.60E-09	5.76E-03	2.45E-02
TEX	Massey Lake	3.06E-03	7.82E-07	1.07E-07	7.34E-03	2.33E-08	3.47E-08	3.00E-03	6.98E-08	6.12E-05	2.45E-09	3.92E-03	1.67E-02
TEX	Mountain Creek	1.24E-02	7.32E-06	4.82E-07	4.82E-02	1.12E-07	1.72E-09	1.21E-02	4.74E-07	2.47E-04	6.61E-09	1.06E-02	4.49E-02

Table G-7. Mercury Media Concentrations, Floor/Standard

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
WAM	Beaver River	1.53E-02	4.75E-07	2.49E-07	7.79E-03	1.48E-07	1.67E-09	1.50E-02	2.46E-07	3.06E-04	1.97E-09	3.15E-03	1.34E-02
WAM	Connoquenessing Creek	2.01E-02	3.05E-06	8.11E-07	7.53E-02	1.89E-07	6.23E-09	1.97E-02	7.98E-07	4.02E-04	7.09E-09	1.14E-02	4.82E-02
WAM	Slippery Rock Creek	1.75E-02	8.95E-07	2.75E-07	2.00E-02	1.58E-07	2.86E-09	1.71E-02	2.69E-07	3.49E-04	2.76E-09	4.42E-03	1.88E-02
WAM	Hereford Manor Lake	9.48E-03	1.02E-06	3.14E-07	2.87E-02	6.94E-08	5.02E-08	9.29E-03	2.57E-07	1.90E-04	6.37E-09	1.02E-02	4.33E-02
ARV	James River	8.55E-05	2.40E-09	8.99E-10	5.00E-05	1.15E-09	1.06E-11	8.38E-05	8.75E-10	1.71E-06	1.39E-11	2.23E-05	9.47E-05
ARV	Rivanna River	7.82E-05	8.67E-09	1.91E-09	1.91E-04	9.69E-10	1.63E-11	7.67E-05	1.86E-09	1.56E-06	2.77E-11	4.43E-05	1.88E-04
ARV	Sports Lake	6.66E-05	1.25E-08	2.63E-09	2.02E-04	7.66E-10	6.46E-10	6.53E-05	1.94E-09	1.33E-06	3.94E-11	6.31E-05	2.68E-04
ARV	Holman Creek	2.76E-04	4.14E-08	7.72E-09	7.75E-04	2.92E-09	2.27E-11	2.71E-04	7.58E-09	5.52E-06	1.24E-10	1.99E-04	8.45E-04
BRO	Bluelick Creek (includes Clear Run	3.82E-03	2.40E-06	1.37E-07	1.34E-02	2.96E-08	3.15E-09	3.74E-03	1.32E-07	7.63E-05	1.95E-09	3.13E-03	1.33E-02
BRO	Salt River (includes Floyd's Fork)	2.34E-03	3.44E-07	8.20E-08	8.13E-03	2.21E-08	1.36E-09	2.29E-03	7.98E-08	4.68E-05	8.41E-10	1.35E-03	5.72E-03
BRO	McNeely Lake	3.84E-03	5.14E-07	1.44E-07	1.28E-02	2.90E-08	2.30E-08	3.76E-03	1.19E-07	7.68E-05	2.46E-09	3.93E-03	1.67E-02
BRO	Silver Lake	3.24E-03	5.07E-08	1.67E-08	1.61E-03	1.91E-08	2.44E-09	3.17E-03	1.38E-08	6.47E-05	4.63E-10	7.40E-04	3.15E-03
CAS	Cascade Creek	2.00E-03	3.81E-07	6.56E-08	6.52E-03	1.77E-08	1.12E-09	1.96E-03	6.35E-08	4.00E-05	9.56E-10	1.53E-03	6.50E-03
CAS	Dan River	6.12E-04	1.03E-09	3.56E-10	2.27E-05	4.63E-09	1.15E-11	6.00E-04	3.41E-10	1.22E-05	4.10E-12	6.55E-06	2.79E-05
CAS	Smith River	3.07E-04	2.75E-08	7.38E-09	7.17E-04	2.84E-09	7.72E-11	3.01E-04	7.20E-09	6.13E-06	9.68E-11	1.55E-04	6.58E-04
COH	Hudson River	5.68E-03	1.26E-07	5.40E-08	2.33E-03	7.56E-08	6.07E-10	5.56E-03	5.32E-08	1.14E-04	1.16E-10	1.85E-04	7.88E-04
COH	Mohawk River	6.90E-03	1.17E-07	3.49E-08	2.47E-03	8.62E-08	3.20E-10	6.76E-03	3.45E-08	1.38E-04	6.72E-11	1.07E-04	4.57E-04
COH	Tomahannock Reservoir	8.71E-04	1.12E-07	3.83E-08	3.44E-03	1.02E-08	7.71E-09	8.54E-04	2.97E-08	1.74E-05	8.68E-10	1.39E-03	5.90E-03
COH	Troy Reservoir	2.94E-03	4.72E-07	1.56E-07	1.36E-02	2.84E-08	3.22E-08	2.88E-03	1.20E-07	5.88E-05	2.84E-09	4.55E-03	1.93E-02
NOR	Rocky River (includes Bear Creek	1.51E-04	1.62E-08	3.56E-09	3.54E-04	1.83E-09	3.96E-11	1.48E-04	3.46E-09	3.02E-06	6.76E-11	1.08E-04	4.60E-04
NOR	Lake Tillery	7.21E-05	5.17E-09	1.65E-09	1.46E-04	8.08E-10	3.12E-10	7.06E-05	1.30E-09	1.44E-06	3.80E-11	6.09E-05	2.59E-04
NOR	Long Lake/Creek	6.69E-05	7.01E-09	2.01E-09	1.70E-04	6.76E-10	4.00E-10	6.55E-05	1.57E-09	1.34E-06	3.83E-11	6.12E-05	2.60E-04
334	Mississippi River	2.46E-05	1.79E-10	3.43E-11	1.98E-06	2.09E-10	1.49E-12	2.41E-05	3.25E-11	4.92E-07	3.12E-13	4.99E-07	2.12E-06
334	Vermilion River	1.12E-05	3.54E-09	3.78E-10	3.78E-05	9.13E-11	4.55E-12	1.10E-05	3.70E-10	2.24E-07	3.29E-12	5.27E-06	2.24E-05
334	Colby Lake	1.71E-05	1.13E-09	2.10E-10	1.67E-05	9.62E-11	4.77E-11	1.68E-05	1.56E-10	3.43E-07	6.37E-12	1.02E-05	4.33E-05
334	Lake Isabelle	4.61E-05	1.97E-09	3.69E-10	2.93E-05	2.75E-10	8.32E-11	4.51E-05	2.74E-10	9.21E-07	1.12E-11	1.79E-05	7.60E-05
463	Blue River	1.39E-05	3.43E-09	3.02E-09	3.09E-06	1.19E-10	3.02E-09	1.36E-05	0.00E+00	2.78E-07	0.00E+00	0.00E+00	0.00E+00
463	Rock Creek	4.67E-05	4.66E-09	4.24E-09	3.56E-06	3.55E-10	4.24E-09	4.58E-05	0.00E+00	9.34E-07	0.00E+00	0.00E+00	0.00E+00
463	Missouri River	1.27E-05	6.51E-10	5.76E-10	5.90E-07	1.17E-10	5.76E-10	1.24E-05	0.00E+00	2.53E-07	0.00E+00	0.00E+00	0.00E+00
463	Shoal Creek	9.15E-06	1.12E-08	9.26E-09	9.40E-06	7.74E-11	9.26E-09	8.97E-06	0.00E+00	1.83E-07	0.00E+00	0.00E+00	0.00E+00
464	Ottawa River	2.98E-06	1.98E-09	5.17E-10	4.96E-05	2.85E-11	3.18E-11	2.92E-06	4.84E-10	5.96E-08	1.16E-12	1.85E-06	7.87E-06
464	Twin Lakes Reservoir	2.60E-06	3.71E-10	1.16E-10	1.05E-05	1.71E-11	2.08E-11	2.55E-06	9.35E-11	5.20E-08	2.13E-12	3.41E-06	1.45E-05
464	Metzger/Ferguson Reservoir	3.33E-06	1.08E-10	3.63E-11	3.42E-06	2.37E-11	6.18E-12	3.26E-06	2.91E-11	6.65E-08	9.44E-13	1.51E-06	6.42E-06
504	Schuylkill River	4.29E-05	8.10E-10	8.05E-10	2.82E-07	4.30E-10	8.05E-10	4.21E-05	0.00E+00	8.59E-07	0.00E+00	0.00E+00	0.00E+00
504	Pennsauken Creek	1.10E-05	1.36E-09	1.32E-09	1.25E-06	1.02E-10	1.32E-09	1.08E-05	0.00E+00	2.20E-07	0.00E+00	0.00E+00	0.00E+00
504	Darby Creek	3.68E-05	8.30E-09	8.02E-09	8.74E-06	3.68E-10	8.02E-09	3.61E-05	0.00E+00	7.37E-07	0.00E+00	0.00E+00	0.00E+00
504	Cooper River Lake	1.15E-05	2.24E-09	2.21E-09	2.99E-06	1.07E-10	2.21E-09	1.13E-05	0.00E+00	2.30E-07	0.00E+00	0.00E+00	0.00E+00
600	Brazos River	6.72E-03	1.40E-08	4.03E-09	1.33E-04	5.35E-08	4.12E-11	6.59E-03	3.97E-09	1.34E-04	1.35E-11	2.17E-05	9.21E-05
600	Lake Jackson	3.19E-03	2.34E-07	3.23E-08	2.31E-03	2.06E-08	9.64E-09	3.13E-03	2.17E-08	6.39E-05	1.00E-09	1.61E-03	6.83E-03
600	Oyster Creek	4.87E-03	1.29E-07	1.88E-08	1.39E-03	3.76E-08	8.72E-11	4.77E-03	1.86E-08	9.74E-05	5.75E-11	9.20E-05	3.91E-04
711	Mississippi River	3.23E-06	3.72E-13	3.42E-13	1.93E-10	3.47E-11	3.27E-13	3.17E-06	1.45E-14	6.47E-08	6.22E-17	9.95E-11	4.23E-10
711	Brechtel Lake	1.56E-06	1.55E-11	8.97E-12	1.21E-07	1.29E-11	7.88E-12	1.52E-06	1.05E-12	3.11E-08	4.56E-14	7.29E-08	3.10E-07

Table G-7. Mercury Media Concentrations, Floor/Standard

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
806	Wolf Lake	4.30E-05	8.02E-10	7.90E-10	1.08E-06	3.68E-10	7.90E-10	4.22E-05	0.00E+00	8.60E-07	0.00E+00	0.00E+00	0.00E+00
806	Lake George	1.57E-05	7.36E-10	7.24E-10	9.59E-07	1.21E-10	7.24E-10	1.54E-05	0.00E+00	3.15E-07	0.00E+00	0.00E+00	0.00E+00
806	Little Calumet River	2.16E-05	7.75E-09	7.27E-09	6.94E-06	2.27E-10	7.27E-09	2.12E-05	0.00E+00	4.32E-07	0.00E+00	0.00E+00	0.00E+00
806	Grand Calumet River	6.04E-05	1.21E-08	1.17E-08	1.28E-05	5.79E-10	1.17E-08	5.91E-05	0.00E+00	1.21E-06	0.00E+00	0.00E+00	0.00E+00
915	Genesee River	1.11E-05	4.18E-10	4.16E-10	1.80E-07	9.62E-11	4.16E-10	1.09E-05	0.00E+00	2.22E-07	0.00E+00	0.00E+00	0.00E+00
915	Irondequoit Bay	6.78E-06	5.56E-10	5.48E-10	7.47E-07	5.83E-11	5.48E-10	6.65E-06	0.00E+00	1.36E-07	0.00E+00	0.00E+00	0.00E+00
915	Highland Reservoir	7.82E-06	5.28E-11	5.20E-11	7.14E-08	4.03E-11	5.20E-11	7.66E-06	0.00E+00	1.56E-07	0.00E+00	0.00E+00	0.00E+00
A32	Armand Bayou	3.71E-05	1.78E-09	1.72E-09	8.86E-07	4.11E-10	1.72E-09	3.63E-05	0.00E+00	7.41E-07	0.00E+00	0.00E+00	0.00E+00
A43	Twelvemile Creek	3.35E-05	6.63E-09	6.53E-09	5.11E-06	2.51E-10	6.53E-09	3.28E-05	0.00E+00	6.70E-07	0.00E+00	0.00E+00	0.00E+00
A43	Niagara River	4.22E-05	4.60E-09	4.53E-09	3.84E-06	3.60E-10	4.53E-09	4.14E-05	0.00E+00	8.44E-07	0.00E+00	0.00E+00	0.00E+00
A43	Bergholtz Creek	5.14E-05	8.29E-09	8.10E-09	8.72E-06	3.78E-10	8.10E-09	5.04E-05	0.00E+00	1.03E-06	0.00E+00	0.00E+00	0.00E+00
A43	Cayuga Creek	1.04E-04	4.65E-09	4.61E-09	2.61E-06	7.49E-10	4.61E-09	1.01E-04	0.00E+00	2.07E-06	0.00E+00	0.00E+00	0.00E+00
A50	San Jacinto River	2.17E-04	1.04E-09	4.20E-10	8.24E-06	2.35E-09	8.21E-13	2.12E-04	4.16E-10	4.34E-06	2.73E-12	4.37E-06	1.86E-05
A50	Carpenters Bayou	3.35E-04	3.32E-08	5.68E-09	3.58E-04	3.55E-09	1.22E-11	3.29E-04	5.63E-09	6.71E-06	3.57E-11	5.72E-05	2.43E-04
A50	Highlands Reservoir	1.64E-04	4.41E-09	6.86E-10	4.28E-05	1.52E-09	2.66E-10	1.60E-04	4.01E-10	3.27E-06	1.87E-11	2.99E-05	1.27E-04
A50	Buffalo Bayou	3.04E-04	2.28E-09	7.22E-10	2.07E-05	3.46E-09	4.10E-12	2.98E-04	7.14E-10	6.09E-06	4.16E-12	6.65E-06	2.83E-05
A62	Caney Creek	7.43E-05	2.57E-09	2.43E-09	1.89E-06	8.40E-10	2.43E-09	7.28E-05	0.00E+00	1.49E-06	0.00E+00	0.00E+00	0.00E+00
A62	E & W Fork Crystal Cr.	2.19E-04	4.95E-09	4.66E-09	4.12E-06	2.39E-09	4.66E-09	2.15E-04	0.00E+00	4.39E-06	0.00E+00	0.00E+00	0.00E+00
A62	Stewarts Creek	7.38E-05	2.56E-09	2.42E-09	1.94E-06	7.80E-10	2.42E-09	7.23E-05	0.00E+00	1.48E-06	0.00E+00	0.00E+00	0.00E+00
A62	Lewis Creek Reservoir	2.08E-05	1.82E-10	1.69E-10	1.76E-07	2.00E-10	1.69E-10	2.04E-05	0.00E+00	4.17E-07	0.00E+00	0.00E+00	0.00E+00
B20	Cuyahoga River	1.11E-05	9.18E-10	9.06E-10	6.94E-07	1.06E-10	9.06E-10	1.08E-05	0.00E+00	2.21E-07	0.00E+00	0.00E+00	0.00E+00
B20	Upper and Lower Shaker Lake	1.32E-05	2.59E-09	2.55E-09	3.39E-06	1.05E-10	2.55E-09	1.30E-05	0.00E+00	2.65E-07	0.00E+00	0.00E+00	0.00E+00
B20	Euclid Creek	9.62E-06	9.46E-10	9.25E-10	1.03E-06	8.25E-11	9.25E-10	9.43E-06	0.00E+00	1.92E-07	0.00E+00	0.00E+00	0.00E+00
B20	Fairmont Reservoir	3.68E-05	8.51E-10	8.39E-10	1.14E-06	2.39E-10	8.39E-10	3.61E-05	0.00E+00	7.37E-07	0.00E+00	0.00E+00	0.00E+00
HAN	Mississippi River	1.41E-04	1.72E-10	9.81E-11	1.05E-06	1.43E-09	1.99E-11	1.38E-04	7.70E-11	2.82E-06	1.17E-12	1.88E-06	7.97E-06
HAN	Fabius River	6.99E-05	6.91E-09	9.27E-10	8.04E-05	6.59E-10	4.76E-11	6.85E-05	8.64E-10	1.40E-06	1.47E-11	2.36E-05	1.00E-04
HAN	Spring Lake	8.47E-05	5.18E-09	1.09E-09	7.37E-05	5.42E-10	3.77E-10	8.30E-05	6.88E-10	1.69E-06	2.82E-11	4.51E-05	1.92E-04
KIN	South Fork Holston River	8.82E-06	6.85E-10	4.07E-10	1.63E-05	1.03E-10	2.21E-10	8.65E-06	1.85E-10	1.76E-07	1.07E-12	1.71E-06	7.27E-06
KIN	North Fork Holston River	1.76E-05	2.94E-09	1.21E-09	6.37E-05	2.00E-10	5.91E-10	1.73E-05	6.19E-10	3.52E-07	3.76E-12	6.02E-06	2.56E-05
KIN	Reedy Creek	1.43E-05	4.75E-09	1.44E-09	4.69E-05	1.54E-10	9.82E-10	1.40E-05	4.51E-10	2.86E-07	3.72E-12	5.96E-06	2.53E-05
KIN	Kingsport Reservoir	2.80E-05	1.61E-09	6.48E-10	4.45E-05	2.36E-10	2.54E-10	2.75E-05	3.82E-10	5.60E-07	1.17E-11	1.88E-05	7.98E-05
MCI	Tombigbee River	9.45E-05	2.85E-10	1.66E-10	4.42E-06	1.05E-09	6.79E-12	9.26E-05	1.57E-10	1.89E-06	2.28E-12	3.65E-06	1.55E-05
MCI	Hals Lake	6.47E-05	6.15E-09	2.12E-09	1.91E-04	6.55E-10	3.52E-10	6.34E-05	1.73E-09	1.29E-06	4.44E-11	7.10E-05	3.02E-04
MCI	Hellcat Lake	1.16E-03	6.67E-08	2.30E-08	2.16E-03	1.01E-08	3.78E-09	1.14E-03	1.86E-08	2.32E-05	6.11E-10	9.77E-04	4.15E-03
MCI	Alabama River	3.17E-05	1.98E-11	1.25E-11	2.72E-07	3.30E-10	1.07E-12	3.11E-05	1.13E-11	6.35E-07	1.49E-13	2.38E-07	1.01E-06
MID	Tittabawassee River (plus Sanford	6.60E-05	1.87E-09	1.04E-09	2.97E-05	6.25E-10	6.64E-10	6.47E-05	3.80E-10	1.32E-06	4.07E-13	6.51E-07	2.77E-06
MID	Sturgeon Creek	4.08E-05	9.25E-09	4.97E-09	1.57E-04	3.67E-10	3.03E-09	4.00E-05	1.93E-09	8.16E-07	2.16E-12	3.45E-06	1.47E-05
MID	Kawkawlin River	5.33E-05	2.65E-08	1.09E-08	5.35E-04	4.95E-10	4.90E-09	5.22E-05	6.00E-09	1.07E-06	7.37E-12	1.18E-05	5.01E-05
MID	Chippewa River (most inclusive da	3.86E-05	1.62E-09	1.11E-09	1.99E-05	3.41E-10	7.76E-10	3.78E-05	3.37E-10	7.72E-07	3.34E-13	5.34E-07	2.27E-06
STG	Mississippi River	2.15E-02	1.86E-09	6.60E-10	7.26E-06	2.37E-07	2.09E-11	2.11E-02	6.34E-10	4.31E-04	5.74E-12	9.18E-06	3.90E-05
STG	Bayou Plaquemine	9.78E-03	9.14E-07	6.37E-08	4.98E-03	9.38E-08	4.85E-10	9.58E-03	6.24E-08	1.96E-04	8.73E-10	1.40E-03	5.94E-03
STG	Manchac Bayou	2.26E-02	7.69E-06	5.51E-07	4.24E-02	2.65E-07	7.13E-09	2.21E-02	5.37E-07	4.52E-04	7.49E-09	1.20E-02	5.09E-02
STG	Bayou Fountain	8.38E-03	3.44E-06	2.06E-07	1.89E-02	9.18E-08	3.29E-09	8.22E-03	1.99E-07	1.68E-04	2.94E-09	4.70E-03	2.00E-02

Table G-7. Mercury Media Concentrations, Floor/Standard

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
340	Sunfish Creek	6.52E-06	1.18E-09	3.21E-10	2.24E-05	7.81E-11	9.96E-11	6.39E-06	2.19E-10	1.30E-07	2.87E-12	4.59E-06	1.95E-05
340	Ohio River	1.38E-05	5.72E-11	3.87E-11	6.29E-07	1.85E-10	1.44E-11	1.35E-05	2.39E-11	2.76E-07	3.43E-13	5.49E-07	2.33E-06
340	Proctor Creek	2.48E-05	2.31E-09	5.97E-10	4.11E-05	2.83E-10	1.90E-10	2.43E-05	4.01E-10	4.95E-07	5.89E-12	9.42E-06	4.00E-05
340	Fish Creek	1.34E-05	1.97E-09	3.69E-10	2.93E-05	1.67E-10	8.32E-11	1.32E-05	2.74E-10	2.69E-07	1.12E-11	1.79E-05	7.60E-05
342	Kalamazoo River	6.72E-06	1.21E-09	4.27E-10	2.97E-05	6.01E-11	8.60E-12	6.59E-06	4.17E-10	1.34E-07	6.17E-13	9.87E-07	4.19E-06
342	East Lake	1.89E-06	3.66E-10	1.20E-10	1.16E-05	1.35E-11	1.71E-11	1.86E-06	1.00E-10	3.79E-08	2.95E-12	4.73E-06	2.01E-05
342	Portage Creek	9.96E-06	8.20E-09	1.94E-09	1.96E-04	8.30E-11	1.60E-11	9.76E-06	1.92E-09	1.99E-07	4.31E-12	6.90E-06	2.93E-05
342	Portage River	4.18E-06	6.78E-09	1.60E-09	1.60E-04	3.69E-11	2.59E-11	4.09E-06	1.57E-09	8.35E-08	2.53E-12	4.05E-06	1.72E-05
453	Lake Spivey	3.14E-06	5.06E-10	2.03E-10	1.25E-05	2.90E-11	8.95E-11	3.08E-06	1.11E-10	6.29E-08	2.30E-12	3.68E-06	1.56E-05
453	Jester Creek	1.43E-05	8.24E-09	1.66E-09	6.92E-05	1.32E-10	9.77E-10	1.40E-05	6.75E-10	2.85E-07	4.98E-12	7.96E-06	3.38E-05
453	Flint River	7.95E-06	3.86E-09	1.32E-09	4.88E-05	8.30E-11	8.46E-10	7.79E-06	4.73E-10	1.59E-07	2.17E-12	3.47E-06	1.48E-05
468	Schuylkill	3.19E-05	2.72E-09	1.34E-09	4.67E-05	3.41E-10	1.77E-12	3.13E-05	1.34E-09	6.38E-07	2.98E-12	4.76E-06	2.02E-05
468	Wissahickon Creek	2.53E-05	1.93E-08	4.40E-09	4.44E-04	2.52E-10	1.57E-11	2.48E-05	4.37E-09	5.06E-07	1.09E-11	1.74E-05	7.41E-05
468	Tacony Creek	1.80E-05	2.00E-08	4.30E-09	4.36E-04	1.72E-10	3.22E-12	1.77E-05	4.29E-09	3.61E-07	9.42E-12	1.51E-05	6.40E-05
468	Pickering Creek Reservoir	5.51E-06	1.47E-09	4.64E-10	4.19E-05	4.93E-11	7.71E-11	5.40E-06	3.80E-10	1.10E-07	6.95E-12	1.11E-05	4.73E-05
701	Wabash River	3.92E-04	2.32E-09	1.28E-09	3.50E-05	4.24E-09	2.98E-12	3.84E-04	1.25E-09	7.83E-06	2.27E-11	3.64E-05	1.55E-04
701	Sugar Creek	1.75E-04	2.75E-09	1.36E-09	4.81E-05	1.62E-09	9.38E-13	1.72E-04	1.34E-09	3.51E-06	2.48E-11	3.97E-05	1.69E-04
701	Big Raccoon Creek	3.12E-04	3.03E-08	7.17E-09	7.17E-04	3.24E-09	2.20E-11	3.06E-04	7.02E-09	6.25E-06	1.29E-10	2.06E-04	8.74E-04
704	Silver Lake Res.	5.02E-05	1.51E-08	4.46E-09	3.80E-04	4.25E-10	9.21E-10	4.92E-05	3.47E-09	1.00E-06	7.12E-11	1.14E-04	4.84E-04
704	Garvey Reservoir	1.49E-03	2.84E-08	8.95E-09	7.93E-04	1.10E-08	1.73E-09	1.46E-03	6.98E-09	2.97E-05	2.37E-10	3.79E-04	1.61E-03
704	Legg Lake	1.23E-02	2.36E-07	7.43E-08	6.59E-03	9.24E-08	1.43E-08	1.21E-02	5.80E-08	2.47E-04	1.97E-09	3.15E-03	1.34E-02
708	Grindle Creek	1.90E-03	5.10E-07	1.12E-07	1.13E-02	2.13E-08	4.21E-10	1.86E-03	1.11E-07	3.81E-05	7.70E-10	1.23E-03	5.23E-03
708	Tranters Creek	7.38E-04	5.37E-08	1.59E-08	1.28E-03	8.31E-09	8.71E-11	7.23E-04	1.57E-08	1.48E-05	1.14E-10	1.83E-04	7.76E-04
708	Parker Creek	1.54E-02	3.36E-06	6.53E-07	6.59E-02	1.54E-07	1.30E-09	1.51E-02	6.45E-07	3.08E-04	6.91E-09	1.11E-02	4.70E-02
725	Passaic River	4.41E-08	2.07E-12	3.57E-13	3.66E-08	2.73E-13	5.74E-15	4.32E-08	3.50E-13	8.82E-10	9.05E-16	1.45E-09	6.15E-09
725	Silver Lake Reservoir	7.80E-07	2.06E-11	6.66E-12	6.60E-07	4.22E-12	8.61E-13	7.65E-07	5.62E-12	1.56E-08	1.81E-13	2.89E-07	1.23E-06
725	Reservoir No. 2	8.38E-08	2.41E-12	7.84E-13	7.71E-08	4.17E-13	1.06E-13	8.21E-08	6.57E-13	1.68E-09	2.11E-14	3.37E-08	1.43E-07
725	Rahway River	2.47E-08	1.05E-12	1.72E-13	1.76E-08	1.45E-13	3.88E-15	2.42E-08	1.67E-13	4.93E-10	4.97E-16	7.94E-10	3.38E-09
824	Newton Lake	1.27E-07	2.71E-11	9.25E-12	8.72E-07	1.09E-12	1.52E-12	1.24E-07	7.52E-12	2.54E-09	2.18E-13	3.49E-07	1.48E-06
824	Big Timber Creek	7.21E-08	3.41E-11	9.88E-12	8.57E-07	7.10E-13	5.47E-13	7.06E-08	9.30E-12	1.44E-09	3.68E-14	5.89E-08	2.50E-07
824	Darby Creek	1.56E-07	7.18E-11	1.60E-11	1.60E-06	1.54E-12	1.72E-13	1.53E-07	1.58E-11	3.12E-09	7.72E-14	1.24E-07	5.25E-07
824	Schuylkill River	1.43E-07	1.66E-12	1.13E-12	1.80E-08	1.38E-12	1.08E-14	1.41E-07	1.12E-12	2.87E-09	6.20E-15	9.92E-09	4.22E-08
904	Pascagoula River	3.01E-05	2.09E-11	1.87E-11	8.67E-08	2.89E-10	1.15E-12	2.95E-05	1.74E-11	6.03E-07	1.30E-13	2.08E-07	8.83E-07
904	Escatawpa River	3.44E-05	6.19E-10	3.09E-10	1.13E-05	3.55E-10	4.94E-11	3.37E-05	2.58E-10	6.87E-07	1.98E-12	3.16E-06	1.34E-05
906	Mississippi River	4.97E-06	4.08E-12	4.03E-12	9.59E-10	4.45E-11	4.03E-12	4.87E-06	0.00E+00	9.94E-08	0.00E+00	0.00E+00	0.00E+00
906	Copperas Creek	1.99E-06	2.72E-11	2.54E-11	2.63E-08	1.62E-11	2.54E-11	1.95E-06	0.00E+00	3.97E-08	0.00E+00	0.00E+00	0.00E+00
906	Eliza Creek	1.30E-06	1.39E-11	1.30E-11	1.34E-08	1.06E-11	1.30E-11	1.27E-06	0.00E+00	2.60E-08	0.00E+00	0.00E+00	0.00E+00
906	Muscatine Slough	6.08E-06	9.70E-11	8.77E-11	9.06E-08	5.07E-11	8.77E-11	5.96E-06	0.00E+00	1.22E-07	0.00E+00	0.00E+00	0.00E+00
A14	Mississippi River	5.17E-07	1.47E-14	5.76E-15	5.38E-11	5.55E-12	1.98E-16	5.07E-07	5.49E-15	1.03E-08	7.12E-17	1.14E-10	4.84E-10
A14	New River	7.17E-07	1.43E-10	9.43E-12	7.77E-07	8.17E-12	1.14E-13	7.03E-07	9.19E-12	1.43E-08	1.20E-13	1.92E-07	8.15E-07
A14	Bayou Lafourche	2.50E-07	7.05E-13	7.94E-14	3.73E-09	2.27E-12	1.40E-15	2.45E-07	7.68E-14	5.00E-09	1.17E-15	1.87E-09	7.96E-09
A14	Bayou Conway	5.67E-07	1.31E-10	8.71E-12	7.19E-07	6.30E-12	9.90E-14	5.56E-07	8.50E-12	1.13E-08	1.14E-13	1.83E-07	7.77E-07
A26	Big Creek (includes Sulfur Spring C	1.95E-05	4.85E-09	2.12E-10	1.48E-05	1.68E-10	6.48E-11	1.91E-05	1.44E-10	3.89E-07	2.73E-12	4.37E-06	1.86E-05
A26	Carter Creek	2.88E-06	8.44E-11	1.12E-11	3.48E-07	2.60E-11	7.13E-12	2.82E-06	4.00E-12	5.76E-08	7.79E-14	1.25E-07	5.30E-07
A26	Dota Creek	4.13E-06	9.92E-11	1.35E-11	4.06E-07	3.82E-11	8.37E-12	4.05E-06	5.08E-12	8.26E-08	9.41E-14	1.51E-07	6.40E-07

Table G-7. Mercury Media Concentrations, Floor/Standard

Site	Waterbody	Total Mercury				Elemental Mercury		Divalent Mercury		Methylmercury			
		Watershed Soil (mg/kg)	Total Water (mg/L)	Dissolved Water (mg/L)	Sorbed Sediment (mg/kg)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Watershed Soil (mg/kg)	Dissolved Water (mg/L)	Fish TL3 (mg/kg)	Fish TL4 (mg/kg)
A31	Nottaway River	7.39E-04	2.84E-08	9.62E-09	6.63E-04	9.58E-09	7.27E-11	7.24E-04	9.45E-09	1.48E-05	1.06E-10	1.69E-04	7.19E-04
A31	Chowan River	5.03E-04	7.19E-09	3.17E-09	1.46E-04	6.61E-09	2.13E-11	4.93E-04	3.12E-09	1.01E-05	3.39E-11	5.43E-05	2.31E-04
A31	Nottaway Swamp (a creek)	2.06E-03	2.66E-07	6.75E-08	6.75E-03	2.42E-08	2.11E-10	2.02E-03	6.66E-08	4.13E-05	7.05E-10	1.13E-03	4.80E-03
A45	Sheldon Reservoir	1.57E-05	5.22E-10	8.32E-11	5.04E-06	1.47E-10	3.38E-11	1.54E-05	4.73E-11	3.15E-07	2.13E-12	3.40E-06	1.45E-05
A45	Highlands Reservoir	4.28E-06	2.08E-10	3.32E-11	2.01E-06	3.98E-11	1.35E-11	4.19E-06	1.89E-11	8.55E-08	8.52E-13	1.36E-06	5.80E-06
A45	Buffalo Bayou	3.37E-05	8.72E-09	1.55E-09	9.27E-05	3.98E-10	7.26E-11	3.30E-05	1.48E-09	6.74E-07	2.51E-12	4.02E-06	1.71E-05
A45	Greens Bayou	1.79E-05	7.07E-09	8.44E-10	7.46E-05	1.96E-10	1.63E-11	1.76E-05	8.26E-10	3.59E-07	1.63E-12	2.60E-06	1.11E-05
A46	Ohio River	2.15E-05	1.24E-11	1.23E-11	4.46E-09	2.72E-10	1.23E-11	2.11E-05	0.00E+00	4.31E-07	0.00E+00	0.00E+00	0.00E+00
A46	Middle Island Creek	1.29E-05	3.72E-11	3.58E-11	3.86E-08	1.66E-10	3.58E-11	1.26E-05	0.00E+00	2.58E-07	0.00E+00	0.00E+00	0.00E+00
A46	Little Muskingum River	9.33E-06	3.53E-11	3.35E-11	3.54E-08	1.18E-10	3.35E-11	9.14E-06	0.00E+00	1.87E-07	0.00E+00	0.00E+00	0.00E+00
A47	Caney River	1.49E-07	3.00E-11	3.92E-12	1.22E-07	1.41E-12	2.48E-12	1.46E-07	1.43E-12	2.99E-09	9.64E-15	1.54E-08	6.55E-08
A47	Sand Creek	2.93E-07	1.15E-10	1.21E-11	4.78E-07	2.64E-12	6.81E-12	2.87E-07	5.25E-12	5.86E-09	2.92E-14	4.67E-08	1.99E-07
A47	Lake Hudson	2.34E-07	3.44E-11	6.56E-12	3.18E-07	1.85E-12	3.45E-12	2.29E-07	2.98E-12	4.67E-09	1.24E-13	1.98E-07	8.40E-07
A47	Bar-Dew Lake	3.34E-07	5.95E-11	1.02E-11	5.59E-07	2.39E-12	4.75E-12	3.27E-07	5.26E-12	6.68E-09	2.09E-13	3.34E-07	1.42E-06
A55	Mohawk River	2.73E-07	3.23E-12	2.16E-12	3.63E-08	2.69E-12	9.98E-13	2.68E-07	1.15E-12	5.47E-09	1.18E-14	1.89E-08	8.03E-08
A55	Acplause Kill River	2.00E-07	3.12E-11	8.99E-12	5.77E-07	1.80E-12	3.29E-12	1.96E-07	5.64E-12	3.99E-09	6.82E-14	1.09E-07	4.64E-07
A55	Stony Creek Reservoir	7.89E-08	3.04E-12	1.26E-12	8.33E-08	6.48E-13	5.18E-13	7.74E-08	7.18E-13	1.58E-09	2.25E-14	3.60E-08	1.53E-07
A55	Watervliet Reservoir	1.96E-07	1.68E-11	9.58E-12	3.25E-07	1.81E-12	6.59E-12	1.92E-07	2.93E-12	3.92E-09	5.87E-14	9.39E-08	3.99E-07
B18	Mississippi River	6.07E-07	1.03E-13	9.78E-14	3.21E-11	6.67E-12	9.59E-14	5.95E-07	1.91E-15	1.21E-08	1.32E-17	2.12E-11	9.01E-11
B18	Gulf Intercoastal Waterway	4.51E-07	9.95E-12	7.53E-12	1.46E-08	5.26E-12	7.37E-12	4.42E-07	1.56E-13	9.03E-09	9.26E-16	1.48E-09	6.30E-09
B18	Bayou La Butte	2.85E-06	1.13E-10	7.57E-11	2.28E-07	2.99E-11	7.24E-11	2.79E-06	3.23E-12	5.70E-08	2.90E-14	4.64E-08	1.97E-07
B18	Bayou Manchac	4.02E-07	9.04E-11	5.60E-11	2.04E-07	4.64E-12	5.42E-11	3.94E-07	1.77E-12	8.04E-09	1.30E-14	2.09E-08	8.87E-08
B23	Neches River	3.14E-06	9.29E-12	3.30E-12	7.98E-08	3.14E-11	2.98E-13	3.08E-06	2.99E-12	6.28E-08	7.81E-15	1.25E-08	5.31E-08
B23	Port Arthur Reservoir	7.94E-06	3.08E-10	4.81E-11	2.99E-06	6.07E-11	1.88E-11	7.78E-06	2.81E-11	1.59E-07	1.26E-12	2.01E-06	8.56E-06
B23	Hillbrandt Bayou	2.21E-06	4.10E-10	7.18E-11	4.37E-06	2.22E-11	8.22E-12	2.16E-06	6.34E-11	4.41E-08	1.94E-13	3.10E-07	1.32E-06
B23	Cow Bayou	2.81E-06	2.97E-10	5.53E-11	3.14E-06	2.81E-11	3.21E-12	2.75E-06	5.19E-11	5.61E-08	1.90E-13	3.04E-07	1.29E-06
B31	Wassahickon Creek	2.68E-04	1.16E-07	2.47E-08	2.48E-03	2.44E-09	1.20E-10	2.63E-04	2.45E-08	5.36E-06	1.39E-10	2.22E-04	9.43E-04
B31	Sckuylkill River	1.00E-04	7.00E-09	3.06E-09	1.34E-04	9.93E-10	3.46E-11	9.83E-05	3.01E-09	2.01E-06	1.62E-11	2.59E-05	1.10E-04
B31	Neshaminy Creek	1.03E-04	1.40E-08	4.94E-09	3.16E-04	9.37E-10	2.43E-11	1.01E-04	4.88E-09	2.06E-06	3.12E-11	4.99E-05	2.12E-04
B31	Peace Valley Reservoir	4.42E-05	4.20E-09	1.37E-09	1.30E-04	3.56E-10	2.08E-10	4.33E-05	1.13E-09	8.84E-07	3.24E-11	5.18E-05	2.20E-04
B32	Cedar Bayou	4.21E-04	7.34E-08	9.79E-09	7.92E-04	4.81E-09	1.45E-10	4.13E-04	9.61E-09	8.43E-06	2.85E-11	4.56E-05	1.94E-04
B32	Cary Bayou	9.49E-04	1.10E-06	1.17E-07	1.17E-02	9.26E-09	1.78E-10	9.30E-04	1.16E-07	1.90E-05	5.12E-10	8.19E-04	3.48E-03
B32	Goose Creek	3.25E-04	6.47E-07	7.23E-08	7.25E-03	3.47E-09	1.66E-10	3.19E-04	7.20E-08	6.51E-06	2.23E-10	3.58E-04	1.52E-03
B37	Arkansas River	5.31E-07	1.43E-12	8.17E-13	2.96E-09	5.18E-12	5.79E-13	5.21E-07	2.37E-13	1.06E-08	4.34E-16	6.94E-10	2.95E-09
B37	Plum Bayou (includes Black Bayou	1.74E-07	7.48E-11	8.47E-12	3.04E-07	1.63E-12	5.16E-12	1.71E-07	3.30E-12	3.49E-09	6.87E-15	1.10E-08	4.67E-08
B37	Yellow Lake	2.03E-06	1.04E-10	2.51E-11	9.15E-07	1.60E-11	1.63E-11	1.99E-06	8.48E-12	4.07E-08	3.79E-13	6.06E-07	2.57E-06
B37	Lake Pine Bluff	4.19E-07	1.56E-10	3.79E-11	1.39E-06	3.80E-12	2.44E-11	4.11E-07	1.30E-11	8.38E-09	5.21E-13	8.33E-07	3.54E-06
B44	Sheldon Reservoir	1.76E-05	5.36E-10	8.35E-11	5.20E-06	1.63E-10	3.25E-11	1.73E-05	4.88E-11	3.53E-07	2.20E-12	3.52E-06	1.50E-05
B44	Greens Bayou	3.16E-05	3.02E-09	5.35E-10	3.22E-05	3.44E-10	3.80E-12	3.10E-05	5.30E-10	6.33E-07	1.10E-12	1.76E-06	7.47E-06
B44	Buffalo Bayou	6.74E-05	1.32E-09	3.63E-10	1.26E-05	7.85E-10	3.19E-12	6.61E-05	3.59E-10	1.35E-06	7.13E-13	1.14E-06	4.85E-06
B44	Hunting Bayou	2.62E-05	1.32E-08	1.69E-09	1.43E-04	2.74E-10	7.27E-12	2.57E-05	1.68E-09	5.24E-07	3.95E-12	6.32E-06	2.69E-05
TOO	Soldier Creek	3.70E-06	2.10E-10	1.56E-10	2.18E-06	3.39E-11	1.37E-10	3.63E-06	1.97E-11	7.41E-08	7.54E-14	1.21E-07	5.13E-07
TOO	Box Elder Wash	2.15E-05	6.70E-09	5.36E-09	2.08E-05	2.11E-10	5.21E-09	2.11E-05	1.48E-10	4.31E-07	3.59E-13	5.75E-07	2.44E-06
TOO	Blue Lakes	2.38E-06	1.62E-11	1.55E-11	7.37E-08	1.79E-11	1.52E-11	2.33E-06	2.87E-13	4.76E-08	8.13E-15	1.30E-08	5.53E-08
TOO	Rush Lake	4.61E-06	1.05E-09	9.44E-10	8.21E-06	4.77E-11	8.91E-10	4.52E-06	5.16E-11	9.23E-08	9.63E-13	1.54E-06	6.55E-06

Appendix H

Concentrations of Selected Constituents in Modeled Media

Table H-A1. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: Cement Kilns

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	3E-12	*(3E-12, 5E-12)*	5E-12	*(5E-12, 7E-12)*	7E-12	*(7E-12, 1E-11)*	1E-11	*(1E-11, 2E-11)*	3E-11	*(3E-11, 4E-11)*	6E-11	*(5E-11, 8E-11)*	1E-10	*(9E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	3E-10	*(2E-10, 4E-10)*
1,2,3,7,8-PeCDD	9E-12	*(9E-12, 1E-11)*	1E-11	*(1E-11, 2E-11)*	2E-11	*(2E-11, 2E-11)*	2E-11	*(2E-11, 4E-11)*	5E-11	*(4E-11, 8E-11)*	2E-10	*(1E-10, 2E-10)*	5E-10	*(3E-10, 6E-10)*	7E-10	*(5E-10, 8E-10)*	1E-09	*(1E-09, 2E-09)*
1,2,3,7,8,9-HxCDD	*	*	4E-12	*(3E-12, 6E-12)*	6E-12	*(5E-12, 6E-12)*	9E-12	*(7E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	1E-10	*(5E-11, 2E-10)*	3E-10	*(2E-10, 4E-10)*	6E-10	*(3E-10, 7E-10)*	1E-09	*(9E-10, 2E-09)*
1,2,3,4,7,8-HxCDD	5E-12	*(5E-12, 7E-12)*	7E-12	*(7E-12, 1E-11)*	1E-11	*(1E-11, 1E-11)*	2E-11	*(1E-11, 2E-11)*	3E-11	*(2E-11, 5E-11)*	1E-10	*(8E-11, 2E-10)*	4E-10	*(2E-10, 5E-10)*	6E-10	*(4E-10, 9E-10)*	1E-09	*(1E-09, 2E-09)*
1,2,3,6,7,8-HxCDD	*	*	4E-12	*(4E-12, 8E-12)*	6E-12	*(5E-12, 1E-11)*	1E-11	*(1E-11, 2E-11)*	4E-11	*(3E-11, 6E-11)*	2E-10	*(1E-10, 2E-10)*	4E-10	*(3E-10, 4E-10)*	5E-10	*(4E-10, 6E-10)*	1E-09	*(1E-09, 1E-09)*
1,2,3,6,7,8,9-HpCDD	*	*	4E-12	*(2E-12, 7E-12)*	6E-12	*(4E-12, 1E-11)*	1E-11	*(1E-11, 2E-11)*	4E-11	*(3E-11, 5E-11)*	1E-10	*(8E-11, 2E-10)*	4E-10	*(3E-10, 5E-10)*	5E-10	*(5E-10, 7E-10)*	1E-09	*(1E-09, 2E-09)*
1,2,3,4,5,7,8,9-OCDD	*	*	4E-12	*(3E-12, 4E-12)*	4E-12	*(4E-12, 6E-12)*	1E-11	*(6E-12, 1E-11)*	3E-11	*(2E-11, 3E-11)*	7E-11	*(4E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*	4E-10	*(3E-10, 5E-10)*	1E-09	*(8E-10, 1E-09)*
2,3,7,8-TCDF	2E-12	*(2E-12, 3E-12)*	3E-12	*(3E-12, 5E-12)*	5E-12	*(4E-12, 9E-12)*	9E-12	*(9E-12, 1E-11)*	2E-11	*(2E-11, 7E-11)*	2E-10	*(1E-10, 2E-10)*	5E-10	*(3E-10, 8E-10)*	9E-10	*(5E-10, 1E-09)*	2E-09	*
1,2,3,7,8-PeCDF	4E-12	*(4E-12, 5E-12)*	5E-12	*(5E-12, 6E-12)*	6E-12	*(6E-12, 1E-11)*	2E-11	*(1E-11, 2E-11)*	4E-11	*(3E-11, 1E-10)*	3E-10	*(2E-10, 5E-10)*	1E-09	*(5E-10, 2E-09)*	2E-09	*(9E-10, 2E-09)*	3E-09	*(2E-09, 4E-09)*
2,3,4,7,8-PeCDF	1E-11	*(1E-11, 2E-11)*	6E-11	*(2E-11, 8E-11)*	8E-11	*(6E-11, 9E-11)*	1E-10	*(9E-11, 2E-10)*	4E-10	*(2E-10, 5E-10)*	1E-09	*(8E-10, 2E-09)*	3E-09	*(2E-09, 4E-09)*	5E-09	*(4E-09, 5E-09)*	9E-09	*(8E-09, 1E-08)*
1,2,3,6,7,8-HxCDF	1E-12	*(1E-12, 2E-12)*	2E-12	*(2E-12, 2E-12)*	2E-12	*(2E-12, 4E-12)*	6E-12	*(5E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	6E-11	*(5E-11, 9E-11)*	2E-10	*(1E-10, 2E-10)*	3E-10	*(2E-10, 3E-10)*	7E-10	*
2,3,4,6,7,8-HxCDF	1E-12	*(1E-12, 1E-12)*	2E-12	*(1E-12, 2E-12)*	2E-12	*(2E-12, 3E-12)*	3E-12	*(3E-12, 1E-11)*	2E-11	*(1E-11, 4E-11)*	6E-11	*(5E-11, 8E-11)*	2E-10	*(1E-10, 2E-10)*	3E-10	*(2E-10, 4E-10)*	7E-10	*
1,2,3,4,7,8-HxCDF	2E-12	*(2E-12, 3E-12)*	4E-12	*(3E-12, 4E-12)*	4E-12	*(4E-12, 6E-12)*	8E-12	*(6E-12, 1E-11)*	4E-11	*(2E-11, 6E-11)*	1E-10	*(1E-10, 2E-10)*	3E-10	*(2E-10, 5E-10)*	6E-10	*(4E-10, 6E-10)*	1E-09	*
1,2,3,7,8,9-HxCDF	3E-13	*(3E-13, 3E-13)*	3E-13	*(3E-13, 6E-13)*	3E-13	*(3E-13, 3E-12)*	3E-12	*(6E-13, 5E-12)*	7E-12	*(5E-12, 1E-11)*	1E-11	*(1E-11, 2E-11)*	4E-11	*(3E-11, 4E-11)*	5E-11	*(4E-11, 6E-11)*	1E-10	*
1,2,3,4,6,7,8-HpCDF	*	*	3E-13	*	4E-13	*(3E-13, 2E-12)*	2E-12	*(6E-13, 3E-12)*	6E-12	*(4E-12, 9E-12)*	2E-11	*(1E-11, 2E-11)*	4E-11	*(3E-11, 5E-11)*	6E-11	*(4E-11, 9E-11)*	1E-10	*(1E-10, 2E-10)*
1,2,3,4,7,8,9-HpCDF	1E-13	*(1E-13, 1E-13)*	1E-13	*(1E-13, 3E-13)*	2E-13	*(2E-13, 1E-12)*	1E-12	*(3E-13, 2E-12)*	3E-12	*(2E-12, 3E-12)*	6E-12	*(4E-12, 8E-12)*	1E-11	*(9E-12, 2E-11)*	2E-11	*(2E-11, 2E-11)*	6E-11	*
1,2,3,4,6,7,8,9-OCDF	*	*	7E-14	*	9E-14	*(7E-14, 7E-13)*	7E-13	*(2E-13, 1E-12)*	2E-12	*(1E-12, 4E-12)*	1E-11	*(5E-12, 2E-11)*	3E-11	*(2E-11, 9E-11)*	1E-10	*(3E-11, 2E-10)*	2E-10	*(2E-10, 4E-10)*
2,3,7,8-TCDD-TEQ	2E-11	*(2E-11, 3E-11)*	6E-11	*(3E-11, 8E-11)*	8E-11	*(7E-11, 1E-10)*	1E-10	*(1E-10, 2E-10)*	3E-10	*(2E-10, 5E-10)*	1E-09	*(6E-10, 1E-09)*	2E-09	*(2E-09, 3E-09)*	3E-09	*(3E-09, 4E-09)*	7E-09	*(6E-09, 8E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A2. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors: Lightweight Aggregate Kilns[a]

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*								
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	*	*	1E-11	2E-11	3E-11	6E-11	9E-11	2E-10	3E-10
1,2,3,7,8-PeCDD	*	*	3E-11	5E-11	1E-10	2E-10	3E-10	5E-10	1E-09
1,2,3,7,8,9-HxCDD	*	1E-11	1E-11	2E-11	3E-11	6E-11	1E-10	2E-10	4E-10
1,2,3,4,7,8-HxCDD	*	1E-11	1E-11	2E-11	3E-11	6E-11	1E-10	2E-10	4E-10
1,2,3,6,7,8-HxCDD	*	2E-11	2E-11	4E-11	5E-11	9E-11	2E-10	3E-10	6E-10
1,2,3,6,7,8,9-HpCDD	*	*	7E-12	1E-11	2E-11	3E-11	9E-11	1E-10	3E-10
1,2,3,4,5,7,8,9-OCDD	*	*	7E-12	2E-11	3E-11	5E-11	1E-10	2E-10	6E-10
2,3,7,8-TCDF	*	*	4E-11	2E-09	2E-09	4E-09	7E-09	1E-08	2E-08
1,2,3,7,8-PeCDF	*	*	1E-10	5E-10	7E-10	1E-09	2E-09	4E-09	6E-09
2,3,4,7,8-PeCDF	*	*	5E-10	3E-09	5E-09	9E-09	1E-08	2E-08	4E-08
1,2,3,6,7,8-HxCDF	*	2E-11	2E-11	7E-11	1E-10	3E-10	5E-10	8E-10	2E-09
2,3,4,6,7,8-HxCDF	*	1E-11	1E-11	5E-11	8E-11	2E-10	3E-10	5E-10	1E-09
1,2,3,4,7,8-HxCDF	*	6E-11	6E-11	2E-10	3E-10	8E-10	1E-09	2E-09	6E-09
1,2,3,7,8,9-HxCDF	*	*	2E-12	5E-12	7E-12	1E-11	3E-11	4E-11	8E-11
1,2,3,4,6,7,8-HpCDF	*	9E-12	9E-12	1E-11	3E-11	5E-11	9E-11	1E-10	3E-10
1,2,3,4,7,8,9-HpCDF	*	*	2E-12	3E-12	4E-12	7E-12	1E-11	2E-11	4E-11
1,2,3,4,6,7,8,9-OCDF	*	2E-12	2E-12	2E-12	4E-12	8E-12	2E-11	4E-11	8E-11
2,3,7,8-TCDD-TEQ	*	*	3E-10	2E-09	3E-09	5E-09	8E-09	1E-08	2E-08

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

[a] Confidence intervals are not applicable since all the lightweight aggregate kilns in the population were sampled with certainty.

All concentration values <10 have been rounded to one significant digit

Table H-A3. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	7E-15	*	3E-14	*(2E-14, 8E-14)*	6E-14	*(4E-14, 2E-13)*	4E-13	*(1E-13, 1E-12)*	3E-12	*(2E-12, 5E-12)*	2E-11	*(8E-12, 2E-11)*	4E-11	*(3E-11, 5E-11)*	6E-11	*(4E-11, 1E-10)*	1E-10	*(1E-10, 2E-10)*
1,2,3,7,8-PeCDD	2E-14	*	6E-14	*(3E-14, 1E-13)*	9E-14	*(6E-14, 4E-13)*	9E-13	*(2E-13, 2E-12)*	1E-11	*(3E-12, 1E-11)*	4E-11	*(2E-11, 6E-11)*	9E-11	*(6E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	4E-10	*(3E-10, 6E-10)*
1,2,3,7,8,9-HxCDD	2E-15	*	3E-14	*(2E-14, 5E-14)*	4E-14	*(3E-14, 8E-14)*	2E-13	*(8E-14, 1E-12)*	3E-12	*(1E-12, 6E-12)*	1E-11	*(7E-12, 1E-11)*	3E-11	*(2E-11, 4E-11)*	5E-11	*(4E-11, 7E-11)*	2E-10	*(1E-10, 2E-10)*
1,2,3,4,7,8-HxCDD	*	*	*	*	2E-14	*	3E-13	*(6E-14, 1E-12)*	3E-12	*(1E-12, 7E-12)*	1E-11	*(9E-12, 2E-11)*	4E-11	*(2E-11, 5E-11)*	8E-11	*(5E-11, 1E-10)*	2E-10	*(2E-10, 3E-10)*
1,2,3,6,7,8-HxCDD	*	*	*	*	1E-14	*	2E-13	*(4E-14, 9E-13)*	3E-12	*(1E-12, 5E-12)*	1E-11	*(7E-12, 2E-11)*	3E-11	*(2E-11, 5E-11)*	7E-11	*(5E-11, 9E-11)*	2E-10	*(2E-10, 3E-10)*
1,2,3,6,7,8,9-HpCDD	2E-16	*	2E-15	*(1E-15, 5E-15)*	4E-15	*(2E-15, 5E-14)*	1E-13	*(2E-14, 7E-13)*	2E-12	*(1E-12, 5E-12)*	1E-11	*(6E-12, 1E-11)*	2E-11	*(2E-11, 3E-11)*	6E-11	*(4E-11, 6E-11)*	2E-10	*(2E-10, 3E-10)*
1,2,3,4,5,7,8,9-OCDD	5E-16	*	6E-15	*(5E-15, 2E-14)*	1E-14	*(7E-15, 2E-13)*	3E-13	*(4E-14, 2E-12)*	6E-12	*(3E-12, 1E-11)*	3E-11	*(1E-11, 3E-11)*	6E-11	*(5E-11, 8E-11)*	1E-10	*(1E-10, 2E-10)*	5E-10	*(5E-10, 5E-10)*
2,3,7,8-TCDF	2E-14	*	6E-14	*(4E-14, 9E-14)*	9E-14	*(7E-14, 2E-13)*	4E-13	*(2E-13, 9E-13)*	3E-12	*(1E-12, 6E-12)*	3E-11	*(9E-12, 1E-10)*	3E-10	*(1E-10, 3E-10)*	4E-10	*(3E-10, 6E-10)*	1E-09	*(8E-10, 2E-09)*
1,2,3,7,8-PeCDF	5E-14	*	1E-13	*(7E-14, 3E-13)*	2E-13	*(1E-13, 6E-13)*	2E-12	*(6E-13, 6E-12)*	2E-11	*(9E-12, 3E-11)*	2E-10	*(6E-11, 3E-10)*	5E-10	*(3E-10, 7E-10)*	8E-10	*(6E-10, 1E-09)*	4E-09	*(2E-09, 5E-09)*
2,3,4,7,8-PeCDF	1E-13	*	2E-13	*(1E-13, 9E-13)*	4E-13	*(2E-13, 3E-12)*	8E-12	*(2E-12, 3E-11)*	8E-11	*(4E-11, 2E-10)*	9E-10	*(3E-10, 2E-09)*	4E-09	*(2E-09, 5E-09)*	7E-09	*(5E-09, 1E-08)*	2E-08	*(1E-08, 3E-08)*
1,2,3,6,7,8-HxCDF	*	*	*	*	7E-15	*	1E-13	*(2E-14, 1E-12)*	3E-12	*(2E-12, 7E-12)*	5E-11	*(2E-11, 8E-11)*	2E-10	*(1E-10, 2E-10)*	4E-10	*(3E-10, 7E-10)*	2E-09	*(1E-09, 3E-09)*
2,3,4,6,7,8-HxCDF	3E-15	*	7E-15	*(5E-15, 3E-14)*	2E-14	*(8E-15, 1E-13)*	4E-13	*(1E-13, 2E-12)*	6E-12	*(3E-12, 1E-11)*	4E-11	*(2E-11, 8E-11)*	1E-10	*(9E-11, 2E-10)*	4E-10	*(2E-10, 5E-10)*	1E-09	*(8E-10, 2E-09)*
1,2,3,4,7,8-HxCDF	*	*	*	*	8E-15	*	3E-13	*(3E-14, 2E-12)*	6E-12	*(3E-12, 2E-11)*	1E-10	*(3E-11, 2E-10)*	6E-10	*(3E-10, 9E-10)*	1E-09	*(9E-10, 2E-09)*	5E-09	*(3E-09, 6E-09)*
1,2,3,7,8,9-HxCDF	3E-15	*	1E-14	*(6E-15, 3E-14)*	1E-14	*(1E-14, 1E-13)*	2E-13	*(8E-14, 6E-13)*	2E-12	*(8E-13, 5E-12)*	2E-11	*(9E-12, 4E-11)*	1E-10	*(4E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	6E-10	*(3E-10, 8E-10)*
1,2,3,4,6,7,8-HpCDF	*	*	3E-15	*(2E-15, 2E-14)*	6E-15	*(3E-15, 8E-14)*	3E-13	*(7E-14, 8E-13)*	3E-12	*(1E-12, 1E-11)*	4E-11	*(2E-11, 5E-11)*	2E-10	*(8E-11, 3E-10)*	5E-10	*(2E-10, 7E-10)*	2E-09	*(1E-09, 3E-09)*
1,2,3,4,7,8,9-HpCDF	9E-16	*	3E-15	*(1E-15, 8E-15)*	6E-15	*(3E-15, 6E-14)*	1E-13	*(3E-14, 4E-13)*	2E-12	*(6E-13, 4E-12)*	2E-11	*(5E-12, 2E-11)*	4E-11	*(3E-11, 6E-11)*	9E-11	*(6E-11, 1E-10)*	3E-10	*(3E-10, 4E-10)*
1,2,3,4,6,7,8,9-OCDF	3E-16	*	1E-15	*(1E-15, 5E-15)*	3E-15	*(2E-15, 5E-14)*	1E-13	*(3E-14, 4E-13)*	1E-12	*(6E-13, 3E-12)*	1E-11	*(7E-12, 2E-11)*	4E-11	*(2E-11, 5E-11)*	1E-10	*(5E-11, 2E-10)*	8E-10	*(8E-10, 8E-10)*
2,3,7,8-TCDD-TEQ	*	*	2E-13	*(1E-13, 8E-13)*	5E-13	*(2E-13, 2E-12)*	7E-12	*(2E-12, 2E-11)*	6E-11	*(3E-11, 1E-10)*	6E-10	*(2E-10, 1E-09)*	2E-09	*(2E-09, 3E-09)*	4E-09	*(3E-09, 5E-09)*	1E-08	*(8E-09, 1E-08)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A4. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	1E-13	*	2E-13	*(1E-13, 1E-11)*	5E-12	*(6E-13, 1E-11)*	2E-11	*(1E-11, 2E-11)*	3E-11	*(2E-11, 3E-11)*	6E-11	*(4E-11, 6E-11)*	9E-11	*(6E-11, 1E-10)*	3E-10	*(2E-10, 3E-10)*
1,2,3,7,8-PeCDD	*	*	1E-13	*	2E-13	*(1E-13, 9E-12)*	2E-12	*(4E-13, 4E-11)*	5E-11	*(2E-11, 7E-11)*	7E-11	*(5E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	3E-10	*(2E-10, 5E-10)*	9E-10	*(6E-10, 1E-09)*
1,2,3,7,8,9-HxCDD	*	*	5E-14	*	9E-14	*(5E-14, 4E-12)*	1E-12	*(2E-13, 8E-12)*	9E-12	*(5E-12, 9E-12)*	1E-11	*(1E-11, 2E-11)*	3E-11	*(3E-11, 8E-11)*	1E-10	*(5E-11, 2E-10)*	3E-10	*(2E-10, 4E-10)*
1,2,3,4,7,8-HxCDD	*	*	2E-13	*	3E-13	*(2E-13, 8E-12)*	3E-12	*(7E-13, 1E-11)*	1E-11	*(8E-12, 2E-11)*	2E-11	*(2E-11, 3E-11)*	8E-11	*(4E-11, 1E-10)*	1E-10	*(7E-11, 2E-10)*	4E-10	*(2E-10, 7E-10)*
1,2,3,6,7,8-HxCDD	*	*	1E-13	*	2E-13	*(9E-14, 3E-12)*	2E-12	*(4E-13, 6E-12)*	8E-12	*(5E-12, 2E-11)*	2E-11	*(1E-11, 3E-11)*	7E-11	*(3E-11, 1E-10)*	2E-10	*(7E-11, 2E-10)*	5E-10	*(2E-10, 6E-10)*
1,2,3,6,7,8,9-HpCDD	*	*	6E-14	*	1E-13	*(6E-14, 3E-12)*	2E-12	*(2E-13, 5E-12)*	7E-12	*(5E-12, 1E-11)*	1E-11	*(1E-11, 2E-11)*	4E-11	*(2E-11, 8E-11)*	1E-10	*(5E-11, 2E-10)*	3E-10	*(2E-10, 4E-10)*
1,2,3,4,5,7,8,9-OCDD	*	*	3E-13	*	5E-13	*(3E-13, 6E-12)*	8E-12	*(9E-13, 1E-11)*	2E-11	*(1E-11, 3E-11)*	3E-11	*(2E-11, 4E-11)*	1E-10	*(5E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	6E-10	*(4E-10, 7E-10)*
2,3,7,8-TCDF	*	*	9E-13	*	2E-12	*(9E-13, 1E-11)*	1E-11	*(2E-12, 1E-10)*	2E-10	*(4E-11, 2E-10)*	3E-10	*(2E-10, 3E-10)*	4E-10	*(3E-10, 6E-10)*	7E-10	*(5E-10, 1E-09)*	2E-09	*(1E-09, 3E-09)*
1,2,3,7,8-PeCDF	*	*	1E-12	*	2E-12	*(1E-12, 2E-11)*	2E-11	*(2E-12, 3E-10)*	4E-10	*(1E-10, 5E-10)*	7E-10	*(5E-10, 7E-10)*	1E-09	*(8E-10, 2E-09)*	2E-09	*(1E-09, 2E-09)*	5E-09	*(4E-09, 1E-08)*
2,3,4,7,8-PeCDF	5E-12	*(5E-12, 5E-12)*	8E-12	*(7E-12, 1E-10)*	2E-11	*(8E-12, 2E-10)*	1E-10	*(2E-11, 3E-09)*	3E-09	*(8E-10, 4E-09)*	5E-09	*(4E-09, 6E-09)*	9E-09	*(7E-09, 1E-08)*	1E-08	*(1E-08, 2E-08)*	4E-08	*(3E-08, 5E-08)*
1,2,3,6,7,8-HxCDF	*	*	1E-13	*	2E-13	*(1E-13, 1E-11)*	3E-12	*(4E-13, 8E-11)*	8E-11	*(2E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	4E-10	*(2E-10, 9E-10)*	9E-10	*(4E-10, 1E-09)*	3E-09	*(1E-09, 6E-09)*
2,3,4,6,7,8-HxCDF	*	*	2E-13	*	2E-13	*(2E-13, 2E-11)*	3E-12	*(4E-13, 4E-11)*	4E-11	*(3E-11, 1E-10)*	1E-10	*(6E-11, 2E-10)*	4E-10	*(2E-10, 5E-10)*	6E-10	*(4E-10, 7E-10)*	2E-09	*(1E-09, 3E-09)*
1,2,3,4,7,8-HxCDF	*	*	5E-13	*	7E-13	*(5E-13, 2E-11)*	9E-12	*(9E-13, 2E-10)*	2E-10	*(6E-11, 6E-10)*	7E-10	*(3E-10, 8E-10)*	1E-09	*(8E-10, 2E-09)*	2E-09	*(2E-09, 3E-09)*	9E-09	*(5E-09, 1E-08)*
1,2,3,7,8,9-HxCDF	*	*	2E-14	*	3E-14	*(2E-14, 2E-12)*	1E-12	*(7E-14, 1E-11)*	2E-11	*(4E-12, 1E-10)*	1E-10	*(2E-11, 1E-10)*	2E-10	*(1E-10, 4E-10)*	4E-10	*(1E-10, 4E-10)*	1E-09	*(4E-10, 2E-09)*
1,2,3,4,6,7,8-HpCDF	*	*	5E-14	*	9E-14	*(5E-14, 7E-12)*	1E-12	*(2E-13, 5E-11)*	5E-11	*(2E-11, 6E-11)*	8E-11	*(6E-11, 2E-10)*	3E-10	*(2E-10, 5E-10)*	7E-10	*(2E-10, 1E-09)*	3E-09	*(6E-10, 3E-09)*
1,2,3,4,7,8,9-HpCDF	*	*	1E-14	*	2E-14	*(1E-14, 2E-12)*	5E-13	*(5E-14, 2E-11)*	2E-11	*(5E-12, 2E-11)*	3E-11	*(2E-11, 3E-11)*	6E-11	*(5E-11, 8E-11)*	1E-10	*(8E-11, 1E-10)*	3E-10	*(3E-10, 5E-10)*
1,2,3,4,6,7,8,9-OCDF	*	*	5E-14	*	1E-13	*(5E-14, 7E-12)*	3E-12	*(2E-13, 1E-11)*	1E-11	*(9E-12, 1E-11)*	2E-11	*(2E-11, 2E-11)*	5E-11	*(4E-11, 5E-11)*	7E-11	*(6E-11, 1E-10)*	3E-10	*(2E-10, 3E-10)*
2,3,7,8-TCDD-TEQ	*	*	7E-12	*	9E-12	*(7E-12, 2E-10)*	8E-11	*(1E-11, 2E-09)*	2E-09	*(5E-10, 2E-09)*	3E-09	*(2E-09, 3E-09)*	5E-09	*(4E-09, 6E-09)*	8E-09	*(6E-09, 9E-09)*	2E-08	*(2E-08, 3E-08)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A5. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	4E-13	*	1E-12	*	2E-12	*(2E-12, 5E-12)*	7E-12	*(3E-12, 2E-11)*	3E-11	*(9E-12, 5E-11)*	6E-11	*(3E-11, 1E-10)*	1E-10	*(4E-11, 1E-10)*	2E-10	*(6E-11, 3E-10)*
1,2,3,7,8-PeCDD	*	*	6E-13	*	1E-12	*	5E-12	*(2E-12, 1E-11)*	2E-11	*(1E-11, 2E-11)*	5E-11	*(2E-11, 8E-11)*	1E-10	*(5E-11, 2E-10)*	2E-10	*(1E-10, 2E-10)*	3E-10	*(2E-10, 3E-10)*
1,2,3,7,8,9-HxCDD	5E-14	*(5E-14, 2E-13)*	6E-14	*(5E-14, 6E-13)*	3E-13	*(5E-14, 2E-12)*	2E-12	*(6E-13, 3E-12)*	5E-12	*(3E-12, 6E-12)*	2E-11	*(6E-12, 3E-11)*	5E-11	*(2E-11, 5E-11)*	1E-10	*(5E-11, 1E-10)*	3E-10	*(1E-10, 3E-10)*
1,2,3,4,7,8-HxCDD	*	*	*	*	*	*	5E-13	*	6E-12	*(1E-12, 7E-12)*	2E-11	*(7E-12, 4E-11)*	7E-11	*(2E-11, 8E-11)*	1E-10	*(5E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*
1,2,3,6,7,8-HxCDD	*	*	*	*	*	*	3E-13	*	4E-12	*(8E-13, 7E-12)*	2E-11	*(7E-12, 3E-11)*	5E-11	*(2E-11, 5E-11)*	1E-10	*(5E-11, 1E-10)*	3E-10	*(1E-10, 3E-10)*
1,2,3,6,7,8,9-HpCDD	*	*	1E-13	*	3E-13	*	1E-12	*(8E-13, 2E-12)*	3E-12	*(1E-12, 8E-12)*	1E-11	*(4E-12, 2E-11)*	3E-11	*(2E-11, 6E-11)*	7E-11	*(5E-11, 1E-10)*	3E-10	*(1E-10, 4E-10)*
1,2,3,4,5,7,8,9-OCDD	*	*	4E-13	*	1E-12	*	3E-12	*(3E-12, 6E-12)*	1E-11	*(4E-12, 3E-11)*	4E-11	*(1E-11, 5E-11)*	1E-10	*(5E-11, 2E-10)*	4E-10	*(2E-10, 4E-10)*	1E-09	*(5E-10, 1E-09)*
2,3,7,8-TCDF	*	*	2E-13	*	5E-13	*	7E-13	*(6E-13, 3E-12)*	3E-12	*(1E-12, 6E-12)*	8E-12	*(5E-12, 1E-11)*	3E-11	*(1E-11, 1E-10)*	3E-10	*(4E-11, 3E-10)*	7E-10	*(3E-10, 8E-10)*
1,2,3,7,8-PeCDF	*	*	1E-12	*	3E-12	*	9E-12	*(4E-12, 1E-11)*	2E-11	*(1E-11, 6E-11)*	7E-11	*(2E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*	6E-10	*(3E-10, 6E-10)*	1E-09	*(6E-10, 1E-09)*
2,3,4,7,8-PeCDF	3E-12	*(3E-12, 1E-11)*	3E-12	*(3E-12, 3E-11)*	2E-11	*(3E-12, 4E-11)*	5E-11	*(2E-11, 8E-11)*	9E-11	*(6E-11, 2E-10)*	4E-10	*(1E-10, 5E-10)*	9E-10	*(4E-10, 2E-09)*	4E-09	*(2E-09, 5E-09)*	1E-08	*(5E-09, 1E-08)*
1,2,3,6,7,8-HxCDF	*	*	*	*	*	*	1E-12	*	3E-12	*(2E-12, 7E-12)*	2E-11	*(5E-12, 3E-11)*	5E-11	*(2E-11, 3E-10)*	3E-10	*(1E-10, 7E-10)*	2E-09	*(8E-10, 2E-09)*
2,3,4,6,7,8-HxCDF	1E-13	*(1E-13, 1E-12)*	2E-13	*(2E-13, 3E-12)*	2E-12	*(2E-13, 4E-12)*	4E-12	*(3E-12, 7E-12)*	9E-12	*(5E-12, 2E-11)*	3E-11	*(1E-11, 5E-11)*	8E-11	*(4E-11, 3E-10)*	3E-10	*(1E-10, 7E-10)*	1E-09	*(7E-10, 2E-09)*
1,2,3,4,7,8-HxCDF	*	*	*	*	*	*	2E-12	*	5E-12	*(3E-12, 1E-11)*	3E-11	*(8E-12, 5E-11)*	8E-11	*(3E-11, 9E-10)*	9E-10	*(2E-10, 2E-09)*	5E-09	*(2E-09, 6E-09)*
1,2,3,7,8,9-HxCDF	1E-13	*(1E-13, 2E-13)*	1E-13	*(1E-13, 8E-13)*	4E-13	*(1E-13, 2E-12)*	2E-12	*(7E-13, 4E-12)*	7E-12	*(4E-12, 1E-11)*	2E-11	*(7E-12, 3E-11)*	5E-11	*(2E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	6E-10	*(2E-10, 7E-10)*
1,2,3,4,6,7,8-HpCDF	2E-13	*	2E-13	*(2E-13, 6E-13)*	4E-13	*(2E-13, 8E-13)*	9E-13	*(7E-13, 4E-12)*	6E-12	*(1E-12, 2E-11)*	2E-11	*(8E-12, 4E-11)*	5E-11	*(3E-11, 6E-10)*	6E-10	*(2E-10, 1E-09)*	2E-09	*(1E-09, 3E-09)*
1,2,3,4,7,8,9-HpCDF	6E-14	*(5E-14, 8E-14)*	7E-14	*(6E-14, 7E-13)*	1E-13	*(6E-14, 2E-12)*	2E-12	*(7E-13, 3E-12)*	4E-12	*(3E-12, 5E-12)*	1E-11	*(5E-12, 2E-11)*	4E-11	*(1E-11, 1E-10)*	1E-10	*(8E-11, 3E-10)*	6E-10	*(3E-10, 8E-10)*
1,2,3,4,6,7,8,9-OCDF	*	*	9E-14	*	2E-13	*	6E-13	*(5E-13, 2E-12)*	2E-12	*(9E-13, 9E-12)*	2E-11	*(4E-12, 2E-11)*	3E-11	*(2E-11, 2E-10)*	3E-10	*(8E-11, 7E-10)*	1E-09	*(8E-10, 2E-09)*
2,3,7,8-TCDD-TEQ	*	*	3E-12	*	1E-11	*	4E-11	*(2E-11, 5E-11)*	8E-11	*(5E-11, 2E-10)*	3E-10	*(1E-10, 4E-10)*	8E-10	*(4E-10, 1E-09)*	2E-09	*(1E-09, 3E-09)*	7E-09	*(3E-09, 8E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A6. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	2E-14	*(9E-15, 4E-14)*	3E-14	*(2E-14, 8E-14)*	8E-14	*(4E-14, 4E-13)*	5E-13	*(1E-13, 1E-12)*	2E-12	*(1E-12, 4E-12)*	8E-12	*(4E-12, 1E-11)*	1E-11	*(8E-12, 2E-11)*	4E-11	*(2E-11, 9E-11)*
1,2,3,7,8-PeCDD	*	*	3E-14	*(2E-14, 7E-14)*	6E-14	*(3E-14, 1E-13)*	1E-13	*(7E-14, 2E-12)*	2E-12	*(4E-13, 5E-12)*	1E-11	*(4E-12, 2E-11)*	3E-11	*(2E-11, 5E-11)*	6E-11	*(3E-11, 1E-10)*	2E-10	*(9E-11, 3E-10)*
1,2,3,7,8,9-HxCDD	*	*	1E-14	*(3E-15, 3E-14)*	3E-14	*(1E-14, 6E-14)*	6E-14	*(3E-14, 4E-13)*	8E-13	*(1E-13, 2E-12)*	6E-12	*(2E-12, 1E-11)*	2E-11	*(7E-12, 2E-11)*	3E-11	*(1E-11, 4E-11)*	7E-11	*(4E-11, 1E-10)*
1,2,3,4,7,8-HxCDD	*	*	1E-14	*(9E-15, 3E-14)*	2E-14	*(1E-14, 6E-14)*	6E-14	*(3E-14, 7E-13)*	1E-12	*(2E-13, 3E-12)*	5E-12	*(2E-12, 1E-11)*	2E-11	*(8E-12, 3E-11)*	3E-11	*(2E-11, 3E-11)*	7E-11	*(5E-11, 1E-10)*
1,2,3,6,7,8-HxCDD	*	*	7E-15	*(5E-15, 2E-14)*	1E-14	*(7E-15, 4E-14)*	4E-14	*(2E-14, 6E-13)*	1E-12	*(1E-13, 3E-12)*	5E-12	*(1E-12, 1E-11)*	2E-11	*(8E-12, 3E-11)*	3E-11	*(2E-11, 4E-11)*	9E-11	*(5E-11, 1E-10)*
1,2,3,6,7,8,9-HpCDD	*	*	8E-16	*(3E-16, 2E-15)*	2E-15	*(8E-16, 4E-15)*	4E-15	*(2E-15, 9E-14)*	1E-13	*(1E-14, 2E-12)*	4E-12	*(4E-13, 9E-12)*	1E-11	*(5E-12, 2E-11)*	2E-11	*(1E-11, 3E-11)*	7E-11	*(5E-11, 1E-10)*
1,2,3,4,5,7,8,9-OCDD	*	*	3E-15	*(7E-16, 1E-14)*	6E-15	*(3E-15, 2E-14)*	2E-14	*(9E-15, 2E-13)*	3E-13	*(4E-14, 3E-12)*	9E-12	*(1E-12, 2E-11)*	3E-11	*(1E-11, 5E-11)*	5E-11	*(3E-11, 8E-11)*	2E-10	*(1E-10, 2E-10)*
2,3,7,8-TCDF	*	*	4E-14	*(3E-14, 7E-14)*	5E-14	*(4E-14, 9E-14)*	1E-13	*(7E-14, 2E-13)*	5E-13	*(2E-13, 2E-12)*	4E-12	*(1E-12, 2E-11)*	9E-11	*(7E-12, 2E-10)*	2E-10	*(3E-11, 5E-10)*	1E-09	*(3E-10, 4E-09)*
1,2,3,7,8-PeCDF	*	*	6E-14	*(5E-14, 1E-13)*	1E-13	*(6E-14, 2E-13)*	2E-13	*(1E-13, 2E-12)*	3E-12	*(6E-13, 1E-11)*	2E-11	*(7E-12, 1E-10)*	2E-10	*(4E-11, 3E-10)*	4E-10	*(2E-10, 7E-10)*	4E-09	*(5E-10, 4E-08)*
2,3,4,7,8-PeCDF	*	*	1E-13	*(1E-13, 2E-13)*	2E-13	*(1E-13, 5E-13)*	5E-13	*(2E-13, 6E-12)*	1E-11	*(2E-12, 5E-11)*	1E-10	*(2E-11, 5E-10)*	1E-09	*(2E-10, 3E-09)*	3E-09	*(9E-10, 7E-09)*	1E-08	*(4E-09, 4E-08)*
1,2,3,6,7,8-HxCDF	*	*	5E-15	*	7E-15	*(5E-15, 2E-14)*	2E-14	*(1E-14, 4E-13)*	8E-13	*(1E-13, 4E-12)*	9E-12	*(2E-12, 4E-11)*	9E-11	*(2E-11, 1E-10)*	2E-10	*(7E-11, 3E-10)*	1E-09	*(2E-10, 2E-08)*
2,3,4,6,7,8-HxCDF	*	*	4E-15	*(3E-15, 9E-15)*	7E-15	*(4E-15, 2E-14)*	2E-14	*(9E-15, 5E-13)*	7E-13	*(8E-14, 4E-12)*	9E-12	*(2E-12, 3E-11)*	8E-11	*(2E-11, 1E-10)*	1E-10	*(5E-11, 3E-10)*	6E-10	*(2E-10, 8E-09)*
1,2,3,4,7,8-HxCDF	*	*	6E-15	*	8E-15	*(5E-15, 6E-14)*	5E-14	*(1E-14, 6E-13)*	1E-12	*(1E-13, 7E-12)*	2E-11	*(3E-12, 1E-10)*	2E-10	*(4E-11, 4E-10)*	4E-10	*(2E-10, 7E-10)*	4E-09	*(6E-10, 5E-08)*
1,2,3,7,8,9-HxCDF	*	*	5E-15	*(3E-15, 1E-14)*	1E-14	*(5E-15, 3E-14)*	3E-14	*(1E-14, 2E-13)*	4E-13	*(1E-13, 8E-13)*	2E-12	*(7E-13, 1E-11)*	4E-11	*(4E-12, 7E-11)*	8E-11	*(2E-11, 1E-10)*	3E-10	*(1E-10, 6E-10)*
1,2,3,4,6,7,8-HpCDF	*	*	2E-15	*	3E-15	*(2E-15, 1E-14)*	1E-14	*(3E-15, 3E-13)*	5E-13	*(7E-14, 3E-12)*	6E-12	*(2E-12, 3E-11)*	1E-10	*(1E-11, 3E-10)*	3E-10	*(5E-11, 4E-10)*	2E-09	*(3E-10, 2E-08)*
1,2,3,4,7,8,9-HpCDF	*	*	1E-15	*(1E-15, 3E-15)*	3E-15	*(1E-15, 6E-15)*	6E-15	*(3E-15, 1E-13)*	3E-13	*(7E-14, 6E-13)*	1E-12	*(4E-13, 7E-12)*	3E-11	*(2E-12, 5E-11)*	6E-11	*(1E-11, 1E-10)*	2E-10	*(7E-11, 3E-10)*
1,2,3,4,6,7,8,9-OCDF	*	*	8E-16	*(4E-16, 3E-15)*	1E-15	*(8E-16, 4E-15)*	4E-15	*(2E-15, 1E-13)*	3E-13	*(3E-14, 8E-13)*	1E-12	*(4E-13, 4E-12)*	2E-11	*(3E-12, 5E-11)*	7E-11	*(7E-12, 1E-10)*	3E-10	*(7E-11, 4E-10)*
2,3,7,8-TCDD-TEQ	*	*	1E-13	*	2E-13	*(1E-13, 5E-13)*	5E-13	*(2E-13, 6E-12)*	1E-11	*(2E-12, 4E-11)*	7E-11	*(2E-11, 3E-10)*	8E-10	*(2E-10, 2E-09)*	2E-09	*(6E-10, 4E-09)*	8E-09	*(2E-09, 4E-08)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A7. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: Waste Heat Boilers

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	1E-12 *	4E-12 *(2E-12, 4E-12)*	4E-12 *(4E-12, 8E-12)*	8E-12 *(5E-12, 1E-11)*	1E-11 *(1E-11, 2E-11)*	2E-11 *(2E-11, 3E-11)*	5E-11 *(4E-11, 6E-11)*	6E-11 *(6E-11, 1E-10)*	2E-10 *(2E-10, 3E-10)*	
1,2,3,7,8-PeCDD	3E-12 *	9E-12 *(5E-12, 2E-11)*	2E-11 *(9E-12, 3E-11)*	3E-11 *(2E-11, 6E-11)*	6E-11 *(5E-11, 7E-11)*	1E-10 *(8E-11, 1E-10)*	2E-10 *(2E-10, 2E-10)*	3E-10 *(3E-10, 5E-10)*	9E-10 *(8E-10, 1E-09)*	
1,2,3,7,8,9-HxCDD	1E-12 *(9E-13, 2E-12)*	2E-12 *(1E-12, 7E-12)*	4E-12 *(2E-12, 9E-12)*	9E-12 *(6E-12, 9E-12)*	1E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 4E-11)*	1E-10 *(5E-11, 1E-10)*	1E-10 *(1E-10, 1E-10)*	3E-10 *(3E-10, 3E-10)*	
1,2,3,4,7,8-HxCDD	2E-12 *	4E-12 *(2E-12, 1E-11)*	9E-12 *(4E-12, 1E-11)*	1E-11 *(1E-11, 2E-11)*	2E-11 *(2E-11, 3E-11)*	4E-11 *(3E-11, 6E-11)*	1E-10 *(7E-11, 1E-10)*	1E-10 *(1E-10, 2E-10)*	5E-10 *(3E-10, 7E-10)*	
1,2,3,6,7,8-HxCDD	1E-12 *	4E-12 *(2E-12, 1E-11)*	8E-12 *(4E-12, 2E-11)*	2E-11 *(1E-11, 2E-11)*	2E-11 *(2E-11, 2E-11)*	5E-11 *(4E-11, 6E-11)*	1E-10 *(1E-10, 1E-10)*	2E-10 *(1E-10, 2E-10)*	5E-10 *(3E-10, 6E-10)*	
1,2,3,6,7,8,9-HpCDD	2E-12 *(1E-12, 3E-12)*	2E-12 *(2E-12, 8E-12)*	4E-12 *(2E-12, 1E-11)*	1E-11 *(7E-12, 1E-11)*	1E-11 *(1E-11, 2E-11)*	4E-11 *(3E-11, 5E-11)*	1E-10 *(7E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	4E-10 *(4E-10, 4E-10)*	
1,2,3,4,5,7,8,9-OCDD	1E-12 *	3E-12 *(2E-12, 1E-11)*	5E-12 *(3E-12, 2E-11)*	2E-11 *(1E-11, 3E-11)*	3E-11 *(3E-11, 3E-11)*	8E-11 *(5E-11, 1E-10)*	4E-10 *(2E-10, 4E-10)*	5E-10 *(5E-10, 5E-10)*	2E-09 *(1E-09, 2E-09)*	
2,3,7,8-TCDF	5E-12 *(5E-12, 3E-11)*	1E-11 *(7E-12, 5E-11)*	2E-11 *(1E-11, 9E-11)*	9E-11 *(4E-11, 2E-10)*	2E-10 *(1E-10, 3E-10)*	3E-10 *(3E-10, 4E-10)*	7E-10 *(6E-10, 8E-10)*	1E-09 *(8E-10, 1E-09)*	3E-09 *(2E-09, 3E-09)*	
1,2,3,7,8-PeCDF	2E-11 *	9E-11 *(3E-11, 2E-10)*	1E-10 *(8E-11, 2E-10)*	2E-10 *(2E-10, 3E-10)*	3E-10 *(3E-10, 4E-10)*	6E-10 *(5E-10, 8E-10)*	2E-09 *(9E-10, 2E-09)*	3E-09 *(1E-09, 5E-09)*	1E-08 *(4E-09, 1E-08)*	
2,3,4,7,8-PeCDF	9E-11 *	3E-10 *(1E-10, 1E-09)*	7E-10 *(3E-10, 1E-09)*	2E-09 *(9E-10, 3E-09)*	4E-09 *(2E-09, 4E-09)*	6E-09 *(5E-09, 7E-09)*	1E-08 *(9E-09, 1E-08)*	2E-08 *(1E-08, 2E-08)*	5E-08 *(4E-08, 5E-08)*	
1,2,3,6,7,8-HxCDF	5E-12 *(4E-12, 5E-11)*	1E-11 *(6E-12, 7E-11)*	4E-11 *(1E-11, 7E-11)*	8E-11 *(7E-11, 8E-11)*	1E-10 *(8E-11, 1E-10)*	3E-10 *(2E-10, 7E-10)*	1E-09 *(7E-10, 1E-09)*	1E-09 *(8E-10, 2E-09)*	6E-09 *(2E-09, 7E-09)*	
2,3,4,6,7,8-HxCDF	5E-12 *	1E-11 *(6E-12, 4E-11)*	3E-11 *(1E-11, 4E-11)*	4E-11 *(4E-11, 5E-11)*	8E-11 *(4E-11, 1E-10)*	2E-10 *(1E-10, 4E-10)*	7E-10 *(4E-10, 7E-10)*	9E-10 *(7E-10, 2E-09)*	3E-09 *(2E-09, 3E-09)*	
1,2,3,4,7,8-HxCDF	6E-12 *(5E-12, 1E-10)*	2E-11 *(7E-12, 2E-10)*	6E-11 *(2E-11, 2E-10)*	2E-10 *(1E-10, 2E-10)*	3E-10 *(2E-10, 4E-10)*	9E-10 *(5E-10, 1E-09)*	2E-09 *(2E-09, 4E-09)*	4E-09 *(2E-09, 6E-09)*	1E-08 *(6E-09, 1E-08)*	
1,2,3,7,8,9-HxCDF	2E-12 *	6E-12 *(3E-12, 3E-11)*	1E-11 *(6E-12, 4E-11)*	4E-11 *(2E-11, 1E-10)*	1E-10 *(7E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	4E-10 *(3E-10, 4E-10)*	6E-10 *(5E-10, 7E-10)*	2E-09 *(1E-09, 2E-09)*	
1,2,3,4,6,7,8-HpCDF	2E-12 *(2E-12, 4E-11)*	7E-12 *(3E-12, 5E-11)*	2E-11 *(6E-12, 5E-11)*	5E-11 *(5E-11, 8E-11)*	1E-10 *(6E-11, 2E-10)*	5E-10 *(2E-10, 8E-10)*	1E-09 *(6E-10, 2E-09)*	2E-09 *(1E-09, 3E-09)*	5E-09 *(4E-09, 8E-09)*	
1,2,3,4,7,8,9-HpCDF	7E-13 *(7E-13, 7E-12)*	2E-12 *(8E-13, 2E-11)*	7E-12 *(2E-12, 2E-11)*	2E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 5E-11)*	8E-11 *(5E-11, 1E-10)*	3E-10 *(2E-10, 3E-10)*	3E-10 *(3E-10, 4E-10)*	9E-10 *(8E-10, 9E-10)*	
1,2,3,4,6,7,8,9-OCDF	4E-13 *(3E-13, 3E-12)*	1E-12 *(6E-13, 7E-12)*	3E-12 *(1E-12, 1E-11)*	1E-11 *(5E-12, 1E-11)*	2E-11 *(1E-11, 4E-11)*	7E-11 *(4E-11, 2E-10)*	3E-10 *(2E-10, 7E-10)*	8E-10 *(7E-10, 8E-10)*	2E-09 *(2E-09, 2E-09)*	
2,3,7,8-TCDD-TEQ	6E-11 *	2E-10 *(8E-11, 6E-10)*	5E-10 *(2E-10, 8E-10)*	9E-10 *(6E-10, 2E-09)*	2E-09 *(1E-09, 2E-09)*	3E-09 *(3E-09, 4E-09)*	6E-09 *(5E-09, 8E-09)*	1E-08 *(8E-09, 1E-08)*	3E-08 *(2E-08, 3E-08)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A8. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	6E-15 *	3E-14 *(2E-14, 8E-14)*	4E-14 *(3E-14, 1E-13)*	2E-13 *(9E-14, 7E-13)*	2E-12 *(8E-13, 3E-12)*	1E-11 *(3E-12, 2E-11)*	4E-11 *(2E-11, 6E-11)*	6E-11 *(4E-11, 1E-10)*	1E-10 *(7E-11, 2E-10)*
1,2,3,7,8-PeCDD	1E-14 *	5E-14 *(3E-14, 9E-14)*	7E-14 *(6E-14, 2E-13)*	5E-13 *(2E-13, 2E-12)*	4E-12 *(2E-12, 1E-11)*	2E-11 *(1E-11, 3E-11)*	5E-11 *(3E-11, 9E-11)*	1E-10 *(5E-11, 1E-10)*	3E-10 *(2E-10, 3E-10)*
1,2,3,7,8,9-HxCDD	2E-15 *	3E-14 *(1E-14, 4E-14)*	3E-14 *(3E-14, 7E-14)*	1E-13 *(6E-14, 6E-13)*	2E-12 *(6E-13, 4E-12)*	6E-12 *(4E-12, 9E-12)*	2E-11 *(9E-12, 3E-11)*	3E-11 *(2E-11, 4E-11)*	1E-10 *(8E-11, 2E-10)*
1,2,3,4,7,8-HxCDD	* *	* *	1E-14 *	1E-13 *(3E-14, 6E-13)*	1E-12 *(5E-13, 4E-12)*	7E-12 *(4E-12, 1E-11)*	2E-11 *(1E-11, 4E-11)*	5E-11 *(2E-11, 8E-11)*	2E-10 *(9E-11, 2E-10)*
1,2,3,6,7,8-HxCDD	* *	* *	8E-15 *	7E-14 *(2E-14, 4E-13)*	1E-12 *(3E-13, 4E-12)*	5E-12 *(3E-12, 7E-12)*	2E-11 *(7E-12, 3E-11)*	3E-11 *(1E-11, 5E-11)*	2E-10 *(7E-11, 6E-10)*
1,2,3,6,7,8,9-HpCDD	2E-16 *	2E-15 *(8E-16, 4E-15)*	2E-15 *(2E-15, 2E-14)*	5E-14 *(6E-15, 2E-13)*	1E-12 *(3E-13, 2E-12)*	5E-12 *(2E-12, 8E-12)*	1E-11 *(7E-12, 2E-11)*	2E-11 *(2E-11, 2E-11)*	1E-10 *(5E-11, 2E-10)*
1,2,3,4,5,7,8,9-OCDD	4E-16 *	6E-15 *(4E-15, 2E-14)*	9E-15 *(6E-15, 4E-14)*	2E-13 *(2E-14, 7E-13)*	3E-12 *(9E-13, 6E-12)*	1E-11 *(6E-12, 3E-11)*	4E-11 *(3E-11, 5E-11)*	8E-11 *(4E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*
2,3,7,8-TCDF	2E-14 *	4E-14 *(4E-14, 9E-14)*	7E-14 *(6E-14, 1E-13)*	2E-13 *(1E-13, 6E-13)*	1E-12 *(7E-13, 3E-12)*	6E-12 *(3E-12, 1E-11)*	3E-11 *(1E-11, 2E-10)*	2E-10 *(2E-11, 2E-10)*	4E-10 *(9E-11, 1E-09)*
1,2,3,7,8-PeCDF	5E-14 *	9E-14 *(5E-14, 2E-13)*	1E-13 *(9E-14, 5E-13)*	8E-13 *(3E-13, 4E-12)*	9E-12 *(4E-12, 1E-11)*	3E-11 *(2E-11, 7E-11)*	2E-10 *(6E-11, 6E-10)*	6E-10 *(1E-10, 7E-10)*	1E-09 *(3E-10, 4E-09)*
2,3,4,7,8-PeCDF	1E-13 *	2E-13 *(1E-13, 5E-13)*	2E-13 *(2E-13, 2E-12)*	3E-12 *(8E-13, 1E-11)*	4E-11 *(2E-11, 8E-11)*	2E-10 *(9E-11, 4E-10)*	9E-10 *(3E-10, 3E-09)*	3E-09 *(5E-10, 5E-09)*	8E-09 *(2E-09, 3E-08)*
1,2,3,6,7,8-HxCDF	* *	* *	6E-15 *	7E-14 *(1E-14, 5E-13)*	2E-12 *(3E-13, 3E-12)*	8E-12 *(3E-12, 2E-11)*	5E-11 *(2E-11, 1E-10)*	1E-10 *(3E-11, 2E-10)*	4E-10 *(1E-10, 6E-10)*
2,3,4,6,7,8-HxCDF	3E-15 *	6E-15 *(3E-15, 2E-14)*	9E-15 *(7E-15, 1E-13)*	2E-13 *(3E-14, 8E-13)*	3E-12 *(9E-13, 7E-12)*	1E-11 *(8E-12, 3E-11)*	7E-11 *(3E-11, 1E-10)*	1E-10 *(5E-11, 2E-10)*	5E-10 *(2E-10, 7E-10)*
1,2,3,4,7,8-HxCDF	* *	* *	6E-15 *	9E-14 *(1E-14, 7E-13)*	3E-12 *(6E-13, 6E-12)*	2E-11 *(7E-12, 4E-11)*	8E-11 *(3E-11, 6E-10)*	6E-10 *(7E-11, 1E-09)*	2E-09 *(4E-10, 8E-09)*
1,2,3,7,8,9-HxCDF	2E-15 *	9E-15 *(5E-15, 1E-14)*	1E-14 *(1E-14, 7E-14)*	1E-13 *(3E-14, 3E-13)*	8E-13 *(4E-13, 3E-12)*	7E-12 *(3E-12, 1E-11)*	2E-11 *(1E-11, 3E-11)*	3E-11 *(2E-11, 4E-11)*	7E-11 *(5E-11, 1E-10)*
1,2,3,4,6,7,8-HpCDF	* *	3E-15 *(2E-15, 1E-14)*	4E-15 *(3E-15, 6E-14)*	9E-14 *(2E-14, 5E-13)*	1E-12 *(5E-13, 3E-12)*	1E-11 *(3E-12, 2E-11)*	4E-11 *(2E-11, 6E-11)*	7E-11 *(4E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*
1,2,3,4,7,8,9-HpCDF	7E-16 *	2E-15 *(1E-15, 6E-15)*	3E-15 *(3E-15, 3E-14)*	7E-14 *(9E-15, 2E-13)*	6E-13 *(3E-13, 2E-12)*	5E-12 *(2E-12, 1E-11)*	2E-11 *(7E-12, 3E-11)*	3E-11 *(2E-11, 4E-11)*	8E-11 *(4E-11, 9E-11)*
1,2,3,4,6,7,8,9-OCDF	3E-16 *	1E-15 *(8E-16, 3E-15)*	2E-15 *(1E-15, 3E-14)*	5E-14 *(6E-15, 3E-13)*	6E-13 *(3E-13, 1E-12)*	6E-12 *(1E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	2E-11 *(2E-11, 3E-11)*	7E-11 *(6E-11, 1E-10)*
2,3,7,8-TCDD-TEQ	* *	2E-13 *(1E-13, 5E-13)*	2E-13 *(2E-13, 2E-12)*	3E-12 *(1E-12, 1E-11)*	3E-11 *(1E-11, 5E-11)*	1E-10 *(7E-11, 3E-10)*	7E-10 *(2E-10, 2E-09)*	2E-09 *(4E-10, 3E-09)*	5E-09 *(2E-09, 2E-08)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A9. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	*	*	2E-13	*	2E-12	*(2E-13, 2E-11)*	2E-11	*(2E-12, 2E-11)*	3E-11	*(2E-11, 3E-11)*	5E-11	*(3E-11, 7E-11)*	9E-11	*(5E-11, 9E-11)*	2E-10	*(1E-10, 3E-10)*
1,2,3,7,8-PeCDD	*	*	*	*	2E-13	*	2E-12	*(2E-13, 3E-11)*	2E-11	*(2E-12, 3E-11)*	4E-11	*(1E-11, 5E-11)*	1E-10	*(5E-11, 2E-10)*	2E-10	*(1E-10, 3E-10)*	6E-10	*(3E-10, 6E-10)*
1,2,3,7,8,9-HxCDD	*	*	*	*	6E-14	*	7E-13	*(7E-14, 5E-12)*	5E-12	*(1E-12, 7E-12)*	9E-12	*(5E-12, 1E-11)*	3E-11	*(1E-11, 1E-10)*	1E-10	*(3E-11, 2E-10)*	3E-10	*(9E-11, 4E-10)*
1,2,3,4,7,8-HxCDD	*	*	*	*	2E-13	*	2E-12	*(3E-13, 8E-12)*	8E-12	*(3E-12, 1E-11)*	1E-11	*(8E-12, 2E-11)*	4E-11	*(2E-11, 1E-10)*	1E-10	*(4E-11, 2E-10)*	3E-10	*(1E-10, 4E-10)*
1,2,3,6,7,8-HxCDD	*	*	*	*	1E-13	*	1E-12	*(1E-13, 4E-12)*	4E-12	*(2E-12, 6E-12)*	7E-12	*(5E-12, 9E-12)*	2E-11	*(1E-11, 2E-10)*	2E-10	*(2E-11, 2E-10)*	4E-10	*(7E-11, 6E-10)*
1,2,3,6,7,8,9-HpCDD	*	*	*	*	7E-14	*	1E-12	*(9E-14, 3E-12)*	3E-12	*(1E-12, 5E-12)*	6E-12	*(5E-12, 7E-12)*	2E-11	*(1E-11, 1E-10)*	1E-10	*(2E-11, 2E-10)*	3E-10	*(8E-11, 4E-10)*
1,2,3,4,5,7,8,9-OCDD	*	*	*	*	3E-13	*	6E-12	*(4E-13, 9E-12)*	1E-11	*(6E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	8E-11	*(3E-11, 1E-10)*	1E-10	*(7E-11, 2E-10)*	4E-10	*(1E-10, 4E-10)*
2,3,7,8-TCDF	*	*	*	*	1E-12	*	4E-12	*(1E-12, 1E-10)*	6E-11	*(5E-12, 2E-10)*	2E-10	*(3E-11, 2E-10)*	3E-10	*(2E-10, 4E-10)*	5E-10	*(2E-10, 5E-10)*	1E-09	*(6E-10, 1E-09)*
1,2,3,7,8-PeCDF	*	*	*	*	1E-12	*	5E-12	*(2E-12, 4E-10)*	1E-10	*(6E-12, 5E-10)*	6E-10	*(6E-11, 7E-10)*	8E-10	*(6E-10, 1E-09)*	1E-09	*(7E-10, 2E-09)*	3E-09	*(2E-09, 5E-09)*
2,3,4,7,8-PeCDF	4E-12	*(4E-12, 5E-12)*	7E-12	*(5E-12, 2E-11)*	8E-12	*(7E-12, 1E-10)*	4E-11	*(2E-11, 2E-09)*	9E-10	*(5E-11, 3E-09)*	3E-09	*(6E-10, 4E-09)*	6E-09	*(4E-09, 8E-09)*	9E-09	*(6E-09, 1E-08)*	2E-08	*(1E-08, 3E-08)*
1,2,3,6,7,8-HxCDF	*	*	*	*	1E-13	*	2E-12	*(2E-13, 8E-11)*	3E-11	*(2E-12, 1E-10)*	1E-10	*(2E-11, 2E-10)*	3E-10	*(2E-10, 4E-10)*	4E-10	*(3E-10, 5E-10)*	1E-09	*(7E-10, 2E-09)*
2,3,4,6,7,8-HxCDF	*	*	*	*	2E-13	*	1E-12	*(2E-13, 8E-11)*	3E-11	*(1E-12, 1E-10)*	2E-10	*(2E-11, 2E-10)*	3E-10	*(2E-10, 4E-10)*	5E-10	*(3E-10, 7E-10)*	1E-09	*(1E-09, 2E-09)*
1,2,3,4,7,8-HxCDF	*	*	*	*	5E-13	*	1E-12	*(7E-13, 4E-10)*	9E-11	*(2E-12, 6E-10)*	7E-10	*(6E-11, 8E-10)*	1E-09	*(7E-10, 2E-09)*	2E-09	*(1E-09, 2E-09)*	6E-09	*(3E-09, 7E-09)*
1,2,3,7,8,9-HxCDF	*	*	*	*	2E-14	*	3E-13	*(3E-14, 9E-12)*	5E-12	*(3E-13, 1E-11)*	1E-11	*(3E-12, 2E-11)*	3E-11	*(2E-11, 4E-11)*	5E-11	*(3E-11, 5E-11)*	1E-10	*(8E-11, 2E-10)*
1,2,3,4,6,7,8-HpCDF	*	*	*	*	7E-14	*	6E-13	*(8E-14, 4E-11)*	3E-11	*(8E-13, 5E-11)*	7E-11	*(1E-11, 7E-11)*	2E-10	*(7E-11, 2E-10)*	2E-10	*(2E-10, 3E-10)*	6E-10	*(5E-10, 7E-10)*
1,2,3,4,7,8,9-HpCDF	*	*	*	*	2E-14	*	2E-13	*(2E-14, 1E-11)*	6E-12	*(2E-13, 2E-11)*	2E-11	*(3E-12, 2E-11)*	4E-11	*(2E-11, 6E-11)*	6E-11	*(4E-11, 8E-11)*	2E-10	*(1E-10, 2E-10)*
1,2,3,4,6,7,8,9-OCDF	*	*	*	*	6E-14	*	4E-13	*(1E-13, 8E-12)*	9E-12	*(4E-13, 1E-11)*	2E-11	*(1E-11, 2E-11)*	4E-11	*(2E-11, 5E-11)*	6E-11	*(5E-11, 7E-11)*	2E-10	*(2E-10, 2E-10)*
2,3,7,8-TCDD-TEQ	*	*	*	*	8E-12	*	2E-11	*(9E-12, 1E-09)*	5E-10	*(3E-11, 2E-09)*	2E-09	*(4E-10, 2E-09)*	3E-09	*(2E-09, 5E-09)*	5E-09	*(3E-09, 6E-09)*	1E-08	*(8E-09, 2E-08)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A10. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	3E-13	*	9E-13	*	2E-12	*(2E-12, 4E-12)*	5E-12	*(3E-12, 2E-11)*	3E-11	*(6E-12, 5E-11)*	6E-11	*(2E-11, 1E-10)*	1E-10	*(4E-11, 1E-10)*	2E-10	*(6E-11, 3E-10)*
1,2,3,7,8-PeCDD	*	*	2E-13	*	1E-12	*	4E-12	*(2E-12, 1E-11)*	1E-11	*(1E-11, 2E-11)*	3E-11	*(2E-11, 6E-11)*	9E-11	*(3E-11, 1E-10)*	1E-10	*(4E-11, 1E-10)*	3E-10	*(1E-10, 3E-10)*
1,2,3,7,8,9-HxCDD	5E-14	*(5E-14, 2E-13)*	5E-14	*(5E-14, 6E-13)*	2E-13	*(5E-14, 2E-12)*	1E-12	*(4E-13, 3E-12)*	4E-12	*(3E-12, 6E-12)*	8E-12	*(6E-12, 2E-11)*	3E-11	*(8E-12, 4E-11)*	4E-11	*(1E-11, 5E-11)*	9E-11	*(4E-11, 1E-10)*
1,2,3,4,7,8-HxCDD	*	*	*	*	*	*	2E-13	*	5E-12	*(6E-13, 7E-12)*	1E-11	*(6E-12, 3E-11)*	4E-11	*(1E-11, 7E-11)*	7E-11	*(1E-11, 8E-11)*	2E-10	*(4E-11, 2E-10)*
1,2,3,6,7,8-HxCDD	*	*	*	*	*	*	9E-14	*	3E-12	*(4E-13, 5E-12)*	7E-12	*(4E-12, 2E-11)*	3E-11	*(7E-12, 5E-11)*	5E-11	*(8E-12, 5E-11)*	1E-10	*(3E-11, 1E-10)*
1,2,3,6,7,8,9-HpCDD	*	*	9E-14	*	2E-13	*	1E-12	*(5E-13, 1E-12)*	2E-12	*(1E-12, 7E-12)*	8E-12	*(3E-12, 1E-11)*	2E-11	*(8E-12, 2E-11)*	2E-11	*(2E-11, 3E-11)*	5E-11	*(3E-11, 6E-11)*
1,2,3,4,5,7,8,9-OCDD	*	*	3E-13	*	1E-12	*	3E-12	*(2E-12, 4E-12)*	6E-12	*(4E-12, 3E-11)*	3E-11	*(1E-11, 4E-11)*	5E-11	*(3E-11, 8E-11)*	8E-11	*(5E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*
2,3,7,8-TCDF	*	*	1E-13	*	5E-13	*	7E-13	*(6E-13, 2E-12)*	2E-12	*(8E-13, 6E-12)*	6E-12	*(2E-12, 9E-12)*	1E-11	*(6E-12, 2E-11)*	2E-11	*(7E-12, 2E-11)*	3E-11	*(2E-11, 3E-11)*
1,2,3,7,8-PeCDF	*	*	6E-13	*	3E-12	*	9E-12	*(4E-12, 1E-11)*	2E-11	*(1E-11, 6E-11)*	6E-11	*(2E-11, 8E-11)*	1E-10	*(6E-11, 1E-10)*	1E-10	*(8E-11, 2E-10)*	3E-10	*(2E-10, 3E-10)*
2,3,4,7,8-PeCDF	3E-12	*(3E-12, 1E-11)*	3E-12	*(3E-12, 2E-11)*	2E-11	*(3E-12, 4E-11)*	4E-11	*(2E-11, 6E-11)*	9E-11	*(5E-11, 2E-10)*	2E-10	*(9E-11, 4E-10)*	4E-10	*(2E-10, 9E-10)*	9E-10	*(4E-10, 9E-10)*	1E-09	*(4E-10, 1E-09)*
1,2,3,6,7,8-HxCDF	*	*	*	*	*	*	2E-13	*	3E-12	*(1E-12, 5E-12)*	8E-12	*(3E-12, 2E-11)*	3E-11	*(7E-12, 4E-11)*	4E-11	*(1E-11, 4E-11)*	9E-11	*(3E-11, 9E-11)*
2,3,4,6,7,8-HxCDF	1E-13	*(1E-13, 1E-12)*	2E-13	*(2E-13, 2E-12)*	1E-12	*(2E-13, 4E-12)*	4E-12	*(2E-12, 5E-12)*	8E-12	*(4E-12, 1E-11)*	2E-11	*(8E-12, 4E-11)*	5E-11	*(2E-11, 7E-11)*	7E-11	*(3E-11, 7E-11)*	1E-10	*(7E-11, 1E-10)*
1,2,3,4,7,8-HxCDF	*	*	*	*	*	*	3E-13	*	5E-12	*(3E-12, 8E-12)*	1E-11	*(8E-12, 4E-11)*	5E-11	*(1E-11, 8E-11)*	8E-11	*(3E-11, 8E-11)*	1E-10	*(6E-11, 1E-10)*
1,2,3,7,8,9-HxCDF	1E-13	*(1E-13, 2E-13)*	1E-13	*(1E-13, 8E-13)*	3E-13	*(1E-13, 1E-12)*	1E-12	*(5E-13, 4E-12)*	4E-12	*(3E-12, 9E-12)*	1E-11	*(7E-12, 2E-11)*	3E-11	*(1E-11, 4E-11)*	4E-11	*(2E-11, 5E-11)*	1E-10	*(4E-11, 1E-10)*
1,2,3,4,6,7,8-HpCDF	2E-13	*	2E-13	*(2E-13, 6E-13)*	4E-13	*(2E-13, 8E-13)*	8E-13	*(6E-13, 2E-12)*	3E-12	*(1E-12, 2E-11)*	2E-11	*(3E-12, 2E-11)*	4E-11	*(2E-11, 4E-11)*	4E-11	*(2E-11, 5E-11)*	9E-11	*(4E-11, 2E-10)*
1,2,3,4,7,8,9-HpCDF	5E-14	*(5E-14, 8E-14)*	6E-14	*(6E-14, 7E-13)*	1E-13	*(6E-14, 2E-12)*	2E-12	*(4E-13, 3E-12)*	3E-12	*(3E-12, 5E-12)*	7E-12	*(5E-12, 2E-11)*	2E-11	*(7E-12, 3E-11)*	3E-11	*(1E-11, 4E-11)*	8E-11	*(3E-11, 8E-11)*
1,2,3,4,6,7,8,9-OCDF	*	*	7E-14	*	2E-13	*	5E-13	*(4E-13, 1E-12)*	2E-12	*(7E-13, 8E-12)*	1E-11	*(2E-12, 2E-11)*	2E-11	*(9E-12, 2E-11)*	2E-11	*(2E-11, 3E-11)*	6E-11	*(3E-11, 7E-11)*
2,3,7,8-TCDD-TEQ	*	*	2E-12	*	1E-11	*	4E-11	*(2E-11, 5E-11)*	8E-11	*(4E-11, 1E-10)*	2E-10	*(8E-11, 3E-10)*	4E-10	*(2E-10, 7E-10)*	7E-10	*(3E-10, 7E-10)*	9E-10	*(4E-10, 1E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-A11. Cumulative Frequency Distribution of Dioxins/Furans in Beef Products for Sectors with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Beef Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	1E-14	*(5E-15, 4E-14)*	2E-14	*(1E-14, 6E-14)*	6E-14	*(3E-14, 1E-13)*	2E-13	*(8E-14, 9E-13)*	1E-12	*(4E-13, 2E-12)*	2E-12	*(1E-12, 3E-12)*	4E-12	*(2E-12, 6E-12)*	1E-11	*(6E-12, 2E-11)*
1,2,3,7,8-PeCDD	*	*	3E-14	*(1E-14, 7E-14)*	5E-14	*(3E-14, 1E-13)*	1E-13	*(6E-14, 6E-13)*	8E-13	*(2E-13, 3E-12)*	4E-12	*(2E-12, 8E-12)*	1E-11	*(4E-12, 1E-11)*	2E-11	*(6E-12, 3E-11)*	6E-11	*(3E-11, 9E-11)*
1,2,3,7,8,9-HxCDD	*	*	1E-14	*(2E-15, 3E-14)*	2E-14	*(1E-14, 4E-14)*	4E-14	*(3E-14, 1E-13)*	2E-13	*(7E-14, 2E-12)*	2E-12	*(4E-13, 8E-12)*	9E-12	*(2E-12, 2E-11)*	2E-11	*(2E-12, 3E-11)*	6E-11	*(3E-12, 9E-11)*
1,2,3,4,7,8-HxCDD	*	*	1E-14	*(6E-15, 3E-14)*	2E-14	*(1E-14, 5E-14)*	5E-14	*(3E-14, 3E-13)*	4E-13	*(7E-14, 2E-12)*	2E-12	*(8E-13, 4E-12)*	6E-12	*(2E-12, 8E-12)*	1E-11	*(3E-12, 2E-11)*	4E-11	*(1E-11, 5E-11)*
1,2,3,6,7,8-HxCDD	*	*	7E-15	*(3E-15, 2E-14)*	1E-14	*(7E-15, 3E-14)*	3E-14	*(2E-14, 2E-13)*	2E-13	*(4E-14, 1E-12)*	2E-12	*(5E-13, 5E-12)*	5E-12	*(1E-12, 1E-11)*	1E-11	*(2E-12, 1E-11)*	4E-11	*
1,2,3,6,7,8,9-HpCDD	*	*	8E-16	*(2E-16, 2E-15)*	2E-15	*(8E-16, 3E-15)*	3E-15	*(2E-15, 2E-14)*	5E-14	*(5E-15, 4E-13)*	9E-13	*(8E-14, 5E-12)*	6E-12	*(4E-13, 1E-11)*	1E-11	*(1E-12, 2E-11)*	4E-11	*(2E-12, 7E-11)*
1,2,3,4,5,7,8,9-OCDD	*	*	3E-15	*(4E-16, 7E-15)*	6E-15	*(3E-15, 1E-14)*	1E-14	*(7E-15, 3E-14)*	9E-14	*(2E-14, 1E-12)*	2E-12	*(2E-13, 1E-11)*	1E-11	*(1E-12, 3E-11)*	3E-11	*(3E-12, 4E-11)*	1E-10	*
2,3,7,8-TCDF	*	*	4E-14	*(2E-14, 5E-14)*	4E-14	*(4E-14, 9E-14)*	9E-14	*(7E-14, 2E-13)*	2E-13	*(1E-13, 1E-12)*	1E-12	*(4E-13, 4E-12)*	4E-12	*(1E-12, 7E-12)*	7E-12	*(2E-12, 1E-11)*	2E-11	*(2E-12, 3E-11)*
1,2,3,7,8-PeCDF	*	*	5E-14	*(5E-14, 1E-13)*	9E-14	*(5E-14, 2E-13)*	2E-13	*(1E-13, 6E-13)*	8E-13	*(3E-13, 6E-12)*	1E-11	*(2E-12, 2E-11)*	2E-11	*(8E-12, 3E-11)*	3E-11	*(1E-11, 5E-11)*	1E-10	*(2E-11, 1E-10)*
2,3,4,7,8-PeCDF	*	*	1E-13	*(1E-13, 2E-13)*	2E-13	*(1E-13, 4E-13)*	4E-13	*(2E-13, 2E-12)*	3E-12	*(6E-13, 2E-11)*	3E-11	*(6E-12, 1E-10)*	1E-10	*(3E-11, 2E-10)*	2E-10	*(4E-11, 3E-10)*	6E-10	*(5E-11, 8E-10)*
1,2,3,6,7,8-HxCDF	*	*	4E-15	*	7E-15	*(4E-15, 2E-14)*	2E-14	*(8E-15, 1E-13)*	2E-13	*(3E-14, 2E-12)*	3E-12	*(4E-13, 9E-12)*	1E-11	*(2E-12, 2E-11)*	2E-11	*(3E-12, 3E-11)*	7E-11	*(3E-12, 1E-10)*
2,3,4,6,7,8-HxCDF	*	*	3E-15	*(3E-15, 8E-15)*	6E-15	*(3E-15, 2E-14)*	1E-14	*(7E-15, 1E-13)*	3E-13	*(2E-14, 2E-12)*	3E-12	*(5E-13, 9E-12)*	9E-12	*(2E-12, 2E-11)*	2E-11	*(3E-12, 3E-11)*	7E-11	*(3E-12, 1E-10)*
1,2,3,4,7,8-HxCDF	*	*	5E-15	*	7E-15	*(5E-15, 2E-14)*	2E-14	*(8E-15, 1E-13)*	4E-13	*(5E-14, 4E-12)*	5E-12	*(6E-13, 2E-11)*	2E-11	*(4E-12, 5E-11)*	5E-11	*(6E-12, 7E-11)*	2E-10	*(8E-12, 2E-10)*
1,2,3,7,8,9-HxCDF	*	*	5E-15	*(2E-15, 1E-14)*	9E-15	*(5E-15, 2E-14)*	2E-14	*(1E-14, 2E-13)*	2E-13	*(3E-14, 7E-13)*	7E-13	*(3E-13, 1E-12)*	2E-12	*(7E-13, 3E-12)*	3E-12	*(1E-12, 5E-12)*	1E-11	*(5E-12, 2E-11)*
1,2,3,4,6,7,8-HpCDF	*	*	1E-15	*	3E-15	*(1E-15, 6E-15)*	6E-15	*(3E-15, 8E-14)*	2E-13	*(1E-14, 2E-12)*	2E-12	*(3E-13, 6E-12)*	7E-12	*(2E-12, 1E-11)*	1E-11	*(3E-12, 2E-11)*	5E-11	*(3E-12, 7E-11)*
1,2,3,4,7,8,9-HpCDF	*	*	1E-15	*(7E-16, 3E-15)*	2E-15	*(1E-15, 5E-15)*	5E-15	*(3E-15, 1E-13)*	1E-13	*(8E-15, 4E-13)*	5E-13	*(1E-13, 7E-13)*	1E-12	*(5E-13, 2E-12)*	2E-12	*(7E-13, 3E-12)*	7E-12	*(3E-12, 1E-11)*
1,2,3,4,6,7,8,9-OCDF	*	*	7E-16	*(3E-16, 2E-15)*	1E-15	*(7E-16, 3E-15)*	3E-15	*(2E-15, 3E-14)*	6E-14	*(4E-15, 4E-13)*	4E-13	*(1E-13, 1E-12)*	1E-12	*(4E-13, 3E-12)*	3E-12	*(7E-13, 5E-12)*	1E-11	*(2E-12, 2E-11)*
2,3,7,8-TCDD-TEQ	*	*	1E-13	*	2E-13	*(1E-13, 5E-13)*	4E-13	*(2E-13, 2E-12)*	3E-12	*(7E-13, 2E-11)*	2E-11	*(6E-12, 7E-11)*	7E-11	*(2E-11, 1E-10)*	1E-10	*(3E-11, 2E-10)*	5E-10	*(4E-11, 6E-10)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B1. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: Cement Kilns

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	3E-13 *(2E-13, 6E-13)*	1E-12 *(1E-12, 2E-12)*	2E-12 *(2E-12, 4E-12)*	5E-12 *(4E-12, 7E-12)*	1E-11 *(9E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 3E-11)*	4E-11 *(3E-11, 4E-11)*	6E-11 *(6E-11, 6E-11)*	
1,2,3,7,8-PeCDD	2E-12 *(2E-12, 2E-12)*	3E-12 *(3E-12, 5E-12)*	5E-12 *(4E-12, 6E-12)*	1E-11 *(7E-12, 2E-11)*	3E-11 *(2E-11, 4E-11)*	6E-11 *(6E-11, 7E-11)*	1E-10 *(9E-11, 1E-10)*	1E-10 *(1E-10, 2E-10)*	3E-10 *(3E-10, 3E-10)*	
1,2,3,7,8,9-HxCDD	* *	1E-12 *(1E-12, 2E-12)*	2E-12 *(2E-12, 3E-12)*	4E-12 *(3E-12, 7E-12)*	2E-11 *(9E-12, 2E-11)*	5E-11 *(4E-11, 5E-11)*	8E-11 *(8E-11, 9E-11)*	1E-10 *(1E-10, 2E-10)*	3E-10 *(2E-10, 3E-10)*	
1,2,3,4,7,8-HxCDD	1E-12 *(1E-12, 2E-12)*	2E-12 *(2E-12, 3E-12)*	3E-12 *(3E-12, 4E-12)*	6E-12 *(5E-12, 9E-12)*	2E-11 *(1E-11, 2E-11)*	5E-11 *(4E-11, 7E-11)*	1E-10 *(9E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	4E-10 *(3E-10, 4E-10)*	
1,2,3,6,7,8-HxCDD	* *	1E-12 *(1E-12, 2E-12)*	2E-12 *(2E-12, 4E-12)*	5E-12 *(4E-12, 8E-12)*	3E-11 *(1E-11, 3E-11)*	5E-11 *(5E-11, 6E-11)*	1E-10 *(9E-11, 1E-10)*	1E-10 *(1E-10, 1E-10)*	3E-10 *(3E-10, 3E-10)*	
1,2,3,6,7,8,9-HpCDD	* *	8E-13 *(4E-13, 2E-12)*	2E-12 *(1E-12, 3E-12)*	3E-12 *(3E-12, 7E-12)*	2E-11 *(1E-11, 3E-11)*	5E-11 *(4E-11, 5E-11)*	1E-10 *(7E-11, 1E-10)*	1E-10 *(1E-10, 1E-10)*	3E-10 *(2E-10, 3E-10)*	
1,2,3,4,5,7,8,9-OCDD	* *	7E-13 *(6E-13, 1E-12)*	9E-13 *(7E-13, 1E-12)*	2E-12 *(2E-12, 3E-12)*	5E-12 *(4E-12, 7E-12)*	1E-11 *(9E-12, 2E-11)*	3E-11 *(2E-11, 5E-11)*	5E-11 *(4E-11, 7E-11)*	1E-10 *(1E-10, 1E-10)*	
2,3,7,8-TCDF	6E-13 *(5E-13, 1E-12)*	2E-12 *(1E-12, 3E-12)*	3E-12 *(2E-12, 5E-12)*	7E-12 *(5E-12, 2E-11)*	5E-11 *(3E-11, 5E-11)*	9E-11 *(9E-11, 1E-10)*	3E-10 *(1E-10, 5E-10)*	5E-10 *(2E-10, 7E-10)*	9E-10 *	
1,2,3,7,8-PeCDF	8E-13 *(7E-13, 1E-12)*	2E-12 *(2E-12, 4E-12)*	4E-12 *(2E-12, 6E-12)*	8E-12 *(6E-12, 2E-11)*	7E-11 *(3E-11, 1E-10)*	3E-10 *(1E-10, 4E-10)*	7E-10 *(4E-10, 7E-10)*	7E-10 *(6E-10, 7E-10)*	1E-09 *(1E-09, 1E-09)*	
2,3,4,7,8-PeCDF	3E-12 *(3E-12, 5E-12)*	1E-11 *(6E-12, 2E-11)*	2E-11 *(2E-11, 4E-11)*	6E-11 *(5E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*	5E-10 *(3E-10, 6E-10)*	9E-10 *(8E-10, 1E-09)*	1E-09 *(1E-09, 1E-09)*	2E-09 *(2E-09, 3E-09)*	
1,2,3,6,7,8-HxCDF	3E-13 *(3E-13, 4E-13)*	6E-13 *(5E-13, 1E-12)*	1E-12 *(7E-13, 2E-12)*	3E-12 *(2E-12, 5E-12)*	8E-12 *(7E-12, 1E-11)*	2E-11 *(2E-11, 3E-11)*	6E-11 *(3E-11, 7E-11)*	8E-11 *(6E-11, 9E-11)*	2E-10 *(1E-10, 2E-10)*	
2,3,4,6,7,8-HxCDF	3E-13 *(3E-13, 4E-13)*	5E-13 *(4E-13, 7E-13)*	7E-13 *(5E-13, 1E-12)*	3E-12 *(1E-12, 6E-12)*	1E-11 *(7E-12, 1E-11)*	2E-11 *(2E-11, 3E-11)*	5E-11 *(3E-11, 7E-11)*	9E-11 *(5E-11, 9E-11)*	2E-10 *	
1,2,3,4,7,8-HxCDF	5E-13 *(5E-13, 7E-13)*	9E-13 *(8E-13, 1E-12)*	1E-12 *(1E-12, 2E-12)*	5E-12 *(2E-12, 1E-11)*	2E-11 *(1E-11, 3E-11)*	4E-11 *(3E-11, 6E-11)*	1E-10 *(7E-11, 1E-10)*	1E-10 *(1E-10, 2E-10)*	4E-10 *	
1,2,3,7,8,9-HxCDF	8E-14 *(7E-14, 9E-14)*	1E-13 *(9E-14, 8E-13)*	6E-13 *(2E-13, 1E-12)*	1E-12 *(1E-12, 2E-12)*	3E-12 *(2E-12, 3E-12)*	6E-12 *(4E-12, 8E-12)*	1E-11 *(9E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	4E-11 *(3E-11, 4E-11)*	
1,2,3,4,6,7,8-HpCDF	* *	1E-13 *(8E-14, 3E-13)*	2E-13 *(1E-13, 6E-13)*	9E-13 *(6E-13, 2E-12)*	3E-12 *(2E-12, 3E-12)*	5E-12 *(4E-12, 7E-12)*	1E-11 *(7E-12, 2E-11)*	2E-11 *(1E-11, 2E-11)*	4E-11 *(2E-11, 7E-11)*	
1,2,3,4,7,8,9-HpCDF	5E-14 *(4E-14, 5E-14)*	8E-14 *(7E-14, 5E-13)*	3E-13 *(1E-13, 6E-13)*	9E-13 *(6E-13, 1E-12)*	2E-12 *(1E-12, 2E-12)*	3E-12 *(3E-12, 4E-12)*	7E-12 *(5E-12, 9E-12)*	1E-11 *(7E-12, 1E-11)*	3E-11 *(2E-11, 3E-11)*	
1,2,3,4,6,7,8,9-OCDF	* *	3E-14 *(2E-14, 2E-13)*	2E-13 *(3E-14, 2E-13)*	3E-13 *(2E-13, 4E-13)*	1E-12 *(8E-13, 3E-12)*	6E-12 *(3E-12, 1E-11)*	2E-11 *(9E-12, 4E-11)*	4E-11 *(2E-11, 7E-11)*	9E-11 *(5E-11, 2E-10)*	
2,3,7,8-TCDD-TEQ	6E-12 *(5E-12, 6E-12)*	2E-11 *(8E-12, 2E-11)*	3E-11 *(2E-11, 4E-11)*	5E-11 *(4E-11, 9E-11)*	1E-10 *(1E-10, 3E-10)*	4E-10 *(3E-10, 5E-10)*	6E-10 *(6E-10, 7E-10)*	9E-10 *(9E-10, 1E-09)*	2E-09 *(2E-09, 2E-09)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B2. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors: Lightweight Aggregate Kilns[a]

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*								
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	*	3E-12	4E-12	5E-12	8E-12	1E-11	2E-11	4E-11	7E-11
1,2,3,7,8-PeCDD	*	8E-12	1E-11	2E-11	3E-11	5E-11	9E-11	1E-10	3E-10
1,2,3,7,8,9-HxCDD	*	4E-12	4E-12	6E-12	9E-12	2E-11	4E-11	6E-11	1E-10
1,2,3,4,7,8-HxCDD	*	4E-12	5E-12	6E-12	1E-11	2E-11	4E-11	5E-11	1E-10
1,2,3,6,7,8-HxCDD	*	5E-12	6E-12	9E-12	1E-11	2E-11	6E-11	8E-11	2E-10
1,2,3,6,7,8,9-HpCDD	*	*	*	3E-12	4E-12	8E-12	2E-11	3E-11	8E-11
1,2,3,4,5,7,8,9-OCDD	*	*	*	2E-12	5E-12	8E-12	2E-11	4E-11	9E-11
2,3,7,8-TCDF	*	2E-11	7E-10	8E-10	1E-09	3E-09	4E-09	7E-09	1E-08
1,2,3,7,8-PeCDF	*	5E-11	1E-10	2E-10	3E-10	5E-10	7E-10	1E-09	2E-09
2,3,4,7,8-PeCDF	*	2E-10	8E-10	8E-10	2E-09	3E-09	4E-09	7E-09	1E-08
1,2,3,6,7,8-HxCDF	6E-12	9E-12	2E-11	2E-11	4E-11	8E-11	2E-10	2E-10	6E-10
2,3,4,6,7,8-HxCDF	3E-12	4E-12	1E-11	1E-11	2E-11	4E-11	9E-11	1E-10	3E-10
1,2,3,4,7,8-HxCDF	2E-11	2E-11	5E-11	5E-11	1E-10	2E-10	4E-10	6E-10	2E-09
1,2,3,7,8,9-HxCDF	*	*	*	1E-12	2E-12	3E-12	9E-12	1E-11	3E-11
1,2,3,4,6,7,8-HpCDF	*	2E-12	3E-12	4E-12	7E-12	1E-11	3E-11	4E-11	8E-11
1,2,3,4,7,8,9-HpCDF	*	*	*	1E-12	2E-12	3E-12	7E-12	1E-11	2E-11
1,2,3,4,6,7,8,9-OCDF	*	4E-13	4E-13	6E-13	1E-12	2E-12	5E-12	9E-12	3E-11
2,3,7,8-TCDD-TEQ	*	1E-10	5E-10	5E-10	1E-09	2E-09	2E-09	5E-09	8E-09

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

[a] Confidence intervals are not applicable since all the lightweight aggregate kilns in the population were sampled with certainty.

All concentration values <10 have been rounded to one significant digit

Table H-B3. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	3E-15	*(3E-15, 8E-15)*	8E-15	*(5E-15, 2E-14)*	9E-15	*(8E-15, 5E-14)*	1E-13	*(3E-14, 4E-13)*	9E-13	*(5E-13, 2E-12)*	4E-12	*(3E-12, 6E-12)*	1E-11	*(6E-12, 1E-11)*	1E-11	*(1E-11, 2E-11)*	3E-11	*(3E-11, 7E-11)*
1,2,3,7,8-PeCDD	7E-15	*(7E-15, 2E-14)*	1E-14	*(1E-14, 4E-14)*	2E-14	*(1E-14, 6E-14)*	2E-13	*(4E-14, 8E-13)*	3E-12	*(1E-12, 6E-12)*	2E-11	*(7E-12, 2E-11)*	3E-11	*(2E-11, 4E-11)*	5E-11	*(3E-11, 6E-11)*	1E-10	*(8E-11, 3E-10)*
1,2,3,7,8,9-HxCDD	3E-15	*(3E-15, 9E-15)*	8E-15	*(6E-15, 2E-14)*	1E-14	*(8E-15, 2E-14)*	6E-14	*(2E-14, 5E-13)*	1E-12	*(6E-13, 2E-12)*	4E-12	*(3E-12, 5E-12)*	1E-11	*(7E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	6E-11	*(4E-11, 7E-11)*
1,2,3,4,7,8-HxCDD	*	*	*	*	4E-15	*	4E-14	*(9E-15, 4E-13)*	2E-12	*(4E-13, 3E-12)*	5E-12	*(4E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	3E-11	*(2E-11, 4E-11)*	8E-11	*(6E-11, 9E-11)*
1,2,3,6,7,8-HxCDD	*	*	*	*	2E-15	*	2E-14	*(5E-15, 4E-13)*	1E-12	*(4E-13, 2E-12)*	6E-12	*(2E-12, 6E-12)*	1E-11	*(9E-12, 2E-11)*	2E-11	*(2E-11, 3E-11)*	7E-11	*(6E-11, 8E-11)*
1,2,3,6,7,8,9-HpCDD	2E-16	*(2E-16, 5E-16)*	4E-16	*(3E-16, 1E-15)*	6E-16	*(4E-16, 2E-14)*	7E-14	*(3E-15, 3E-13)*	7E-13	*(3E-13, 2E-12)*	3E-12	*(2E-12, 4E-12)*	6E-12	*(5E-12, 7E-12)*	1E-11	*(1E-11, 2E-11)*	5E-11	*(4E-11, 7E-11)*
1,2,3,4,5,7,8,9-OCDD	5E-16	*(5E-16, 1E-15)*	1E-15	*(8E-16, 3E-15)*	2E-15	*(1E-15, 4E-14)*	1E-13	*(7E-15, 5E-13)*	1E-12	*(6E-13, 3E-12)*	5E-12	*(4E-12, 7E-12)*	1E-11	*(8E-12, 1E-11)*	2E-11	*(2E-11, 3E-11)*	7E-11	*(7E-11, 1E-10)*
2,3,7,8-TCDF	2E-14	*(2E-14, 4E-14)*	4E-14	*(2E-14, 5E-14)*	5E-14	*(4E-14, 2E-13)*	3E-13	*(1E-13, 7E-13)*	2E-12	*(7E-13, 4E-12)*	3E-11	*(6E-12, 9E-11)*	1E-10	*(7E-11, 2E-10)*	2E-10	*(1E-10, 3E-10)*	5E-10	*(4E-10, 8E-10)*
1,2,3,7,8-PeCDF	*	*	3E-14	*(2E-14, 8E-14)*	4E-14	*(3E-14, 4E-13)*	7E-13	*(1E-13, 3E-12)*	6E-12	*(4E-12, 2E-11)*	6E-11	*(2E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*	4E-10	*(2E-10, 6E-10)*	2E-09	*(6E-10, 1E-08)*
2,3,4,7,8-PeCDF	*	*	6E-14	*(3E-14, 1E-13)*	7E-14	*(6E-14, 1E-12)*	3E-12	*(3E-13, 1E-11)*	4E-11	*(1E-11, 9E-11)*	3E-10	*(1E-10, 1E-09)*	1E-09	*(8E-10, 2E-09)*	2E-09	*(1E-09, 3E-09)*	5E-09	*(4E-09, 8E-09)*
1,2,3,6,7,8-HxCDF	*	*	*	*	1E-15	*	3E-14	*(3E-15, 7E-13)*	1E-12	*(7E-13, 5E-12)*	2E-11	*(5E-12, 3E-11)*	7E-11	*(4E-11, 1E-10)*	2E-10	*(8E-11, 3E-10)*	6E-10	*(4E-10, 9E-10)*
2,3,4,6,7,8-HxCDF	8E-16	*(8E-16, 2E-15)*	2E-15	*(1E-15, 4E-15)*	3E-15	*(2E-15, 5E-14)*	1E-13	*(1E-14, 7E-13)*	2E-12	*(9E-13, 6E-12)*	1E-11	*(6E-12, 2E-11)*	4E-11	*(3E-11, 9E-11)*	1E-10	*(7E-11, 2E-10)*	4E-10	*(2E-10, 5E-10)*
1,2,3,4,7,8-HxCDF	*	*	*	*	1E-15	*	7E-14	*(3E-15, 1E-12)*	2E-12	*(1E-12, 8E-12)*	5E-11	*(9E-12, 7E-11)*	2E-10	*(8E-11, 2E-10)*	5E-10	*(2E-10, 5E-10)*	2E-09	*(1E-09, 2E-09)*
1,2,3,7,8,9-HxCDF	2E-15	*(2E-15, 4E-15)*	3E-15	*(2E-15, 8E-15)*	4E-15	*(3E-15, 3E-14)*	6E-14	*(9E-15, 2E-13)*	1E-12	*(3E-13, 3E-12)*	1E-11	*(4E-12, 3E-11)*	4E-11	*(2E-11, 4E-11)*	6E-11	*(4E-11, 7E-11)*	2E-10	*(1E-10, 3E-10)*
1,2,3,4,6,7,8-HpCDF	*	*	6E-16	*(4E-16, 2E-15)*	9E-16	*(6E-16, 4E-14)*	1E-13	*(4E-15, 3E-13)*	1E-12	*(4E-13, 5E-12)*	1E-11	*(5E-12, 2E-11)*	8E-11	*(2E-11, 1E-10)*	2E-10	*(8E-11, 3E-10)*	9E-10	*(5E-10, 1E-09)*
1,2,3,4,7,8,9-HpCDF	6E-16	*(5E-16, 1E-15)*	1E-15	*(8E-16, 3E-15)*	2E-15	*(1E-15, 2E-14)*	4E-14	*(5E-15, 2E-13)*	1E-12	*(3E-13, 2E-12)*	8E-12	*(5E-12, 1E-11)*	2E-11	*(2E-11, 4E-11)*	6E-11	*(4E-11, 9E-11)*	2E-10	*(2E-10, 3E-10)*
1,2,3,4,6,7,8,9-OCDF	2E-16	*(2E-16, 5E-16)*	4E-16	*(3E-16, 1E-15)*	8E-16	*(4E-16, 1E-14)*	3E-14	*(3E-15, 2E-13)*	6E-13	*(2E-13, 2E-12)*	4E-12	*(2E-12, 5E-12)*	1E-11	*(6E-12, 2E-11)*	3E-11	*(2E-11, 6E-11)*	2E-10	*(2E-10, 3E-10)*
2,3,7,8-TCDD-TEQ	*	*	6E-14	*(4E-14, 2E-13)*	7E-14	*(6E-14, 1E-12)*	3E-12	*(3E-13, 1E-11)*	2E-11	*(1E-11, 6E-11)*	2E-10	*(8E-11, 6E-10)*	8E-10	*(5E-10, 1E-09)*	1E-09	*(9E-10, 2E-09)*	3E-09	*(2E-09, 5E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B4. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	3E-14	*	5E-14	*	4E-13	*(5E-14, 3E-12)*	3E-12	*(5E-13, 4E-12)*	6E-12	*(4E-12, 9E-12)*	1E-11	*(8E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	8E-11	*(4E-11, 9E-11)*
1,2,3,7,8-PeCDD	*	*	2E-14	*	5E-14	*	5E-13	*(5E-14, 1E-11)*	1E-11	*(6E-13, 2E-11)*	2E-11	*(2E-11, 4E-11)*	6E-11	*(3E-11, 6E-11)*	7E-11	*(5E-11, 2E-10)*	4E-10	*(1E-10, 4E-10)*
1,2,3,7,8,9-HxCDD	*	*	1E-14	*	2E-14	*	3E-13	*(3E-14, 3E-12)*	3E-12	*(4E-13, 3E-12)*	5E-12	*(3E-12, 7E-12)*	1E-11	*(8E-12, 2E-11)*	3E-11	*(1E-11, 4E-11)*	7E-11	*(5E-11, 8E-11)*
1,2,3,4,7,8-HxCDD	*	*	4E-14	*	9E-14	*	9E-13	*(9E-14, 4E-12)*	4E-12	*(1E-12, 5E-12)*	9E-12	*(5E-12, 1E-11)*	4E-11	*(1E-11, 4E-11)*	4E-11	*(2E-11, 8E-11)*	2E-10	*(7E-11, 2E-10)*
1,2,3,6,7,8-HxCDD	*	*	2E-14	*	4E-14	*	5E-13	*(4E-14, 5E-12)*	5E-12	*(5E-13, 6E-12)*	9E-12	*(6E-12, 2E-11)*	2E-11	*(9E-12, 4E-11)*	5E-11	*(2E-11, 6E-11)*	1E-10	*(7E-11, 1E-10)*
1,2,3,6,7,8,9-HpCDD	*	*	1E-14	*	2E-14	*	3E-13	*(3E-14, 2E-12)*	3E-12	*(4E-13, 3E-12)*	4E-12	*(3E-12, 5E-12)*	1E-11	*(5E-12, 2E-11)*	2E-11	*(1E-11, 4E-11)*	6E-11	*(4E-11, 6E-11)*
1,2,3,4,5,7,8,9-OCDD	*	*	4E-14	*	6E-14	*	1E-12	*(8E-14, 3E-12)*	3E-12	*(2E-12, 5E-12)*	5E-12	*(3E-12, 7E-12)*	1E-11	*(7E-12, 2E-11)*	2E-11	*(2E-11, 2E-11)*	7E-11	*(5E-11, 1E-10)*
2,3,7,8-TCDF	*	*	3E-13	*	7E-13	*	5E-12	*(7E-13, 6E-11)*	7E-11	*(6E-12, 1E-10)*	1E-10	*(7E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*	3E-10	*(2E-10, 4E-10)*	9E-10	*(5E-10, 9E-10)*
1,2,3,7,8-PeCDF	*	*	4E-13	*	7E-13	*	5E-12	*(7E-13, 1E-10)*	1E-10	*(6E-12, 2E-10)*	2E-10	*(1E-10, 3E-10)*	5E-10	*(2E-10, 6E-10)*	6E-10	*(3E-10, 1E-09)*	3E-09	*(1E-09, 4E-09)*
2,3,4,7,8-PeCDF	1E-12	*(1E-12, 1E-12)*	2E-12	*(2E-12, 4E-11)*	5E-12	*(2E-12, 4E-11)*	4E-11	*(5E-12, 8E-10)*	1E-09	*(4E-11, 1E-09)*	1E-09	*(1E-09, 2E-09)*	2E-09	*(2E-09, 3E-09)*	4E-09	*(3E-09, 5E-09)*	1E-08	*(9E-09, 1E-08)*
1,2,3,6,7,8-HxCDF	*	*	3E-14	*	5E-14	*	7E-13	*(6E-14, 2E-11)*	2E-11	*(8E-13, 3E-11)*	5E-11	*(2E-11, 1E-10)*	2E-10	*(6E-11, 4E-10)*	4E-10	*(7E-11, 5E-10)*	2E-09	*(3E-10, 2E-09)*
2,3,4,6,7,8-HxCDF	*	*	2E-14	*	5E-14	*	6E-13	*(6E-14, 9E-12)*	9E-12	*(7E-13, 2E-11)*	3E-11	*(1E-11, 6E-11)*	1E-10	*(3E-11, 1E-10)*	1E-10	*(7E-11, 3E-10)*	7E-10	*(2E-10, 1E-09)*
1,2,3,4,7,8-HxCDF	*	*	8E-14	*	2E-13	*	2E-12	*(2E-13, 5E-11)*	5E-11	*(2E-12, 1E-10)*	2E-10	*(6E-11, 2E-10)*	4E-10	*(2E-10, 5E-10)*	5E-10	*(2E-10, 1E-09)*	2E-09	*(9E-10, 3E-09)*
1,2,3,7,8,9-HxCDF	*	*	5E-15	*	9E-15	*	1E-13	*(1E-14, 9E-12)*	1E-11	*(3E-13, 4E-11)*	4E-11	*(1E-11, 4E-11)*	6E-11	*(4E-11, 1E-10)*	1E-10	*(6E-11, 1E-10)*	4E-10	*(2E-10, 4E-10)*
1,2,3,4,6,7,8-HpCDF	*	*	1E-14	*	2E-14	*	2E-13	*(2E-14, 1E-11)*	1E-11	*(3E-13, 2E-11)*	3E-11	*(1E-11, 9E-11)*	1E-10	*(4E-11, 3E-10)*	3E-10	*(4E-11, 3E-10)*	9E-10	*(1E-10, 2E-09)*
1,2,3,4,7,8,9-HpCDF	*	*	5E-15	*	9E-15	*	1E-13	*(1E-14, 7E-12)*	8E-12	*(3E-13, 9E-12)*	1E-11	*(9E-12, 2E-11)*	4E-11	*(2E-11, 4E-11)*	4E-11	*(2E-11, 1E-10)*	3E-10	*(9E-11, 3E-10)*
1,2,3,4,6,7,8,9-OCDF	*	*	1E-14	*	3E-14	*	5E-13	*(3E-14, 3E-12)*	3E-12	*(7E-13, 3E-12)*	4E-12	*(3E-12, 5E-12)*	1E-11	*(8E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	7E-11	*(5E-11, 7E-11)*
2,3,7,8-TCDD-TEQ	*	*	1E-12	*	3E-12	*	2E-11	*(3E-12, 5E-10)*	5E-10	*(2E-11, 6E-10)*	8E-10	*(6E-10, 1E-09)*	1E-09	*(1E-09, 2E-09)*	2E-09	*(2E-09, 3E-09)*	7E-09	*(5E-09, 8E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B5. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	*	*	3E-13	*	6E-13	*(4E-13, 2E-12)*	2E-12	*(7E-13, 6E-12)*	8E-12	*(4E-12, 1E-11)*	1E-11	*(6E-12, 2E-11)*	2E-11	*(1E-11, 2E-11)*	3E-11	*
1,2,3,7,8-PeCDD	*	*	*	*	2E-13	*	3E-12	*(4E-13, 3E-12)*	5E-12	*(3E-12, 1E-11)*	1E-11	*(6E-12, 2E-11)*	3E-11	*(1E-11, 4E-11)*	4E-11	*(3E-11, 4E-11)*	7E-11	*(6E-11, 8E-11)*
1,2,3,7,8,9-HxCDD	1E-14	*(1E-14, 6E-14)*	2E-14	*(2E-14, 2E-13)*	3E-14	*(2E-14, 8E-13)*	8E-13	*(2E-13, 1E-12)*	1E-12	*(1E-12, 3E-12)*	5E-12	*(2E-12, 1E-11)*	1E-11	*(5E-12, 1E-11)*	3E-11	*(1E-11, 3E-11)*	9E-11	*(3E-11, 9E-11)*
1,2,3,4,7,8-HxCDD	*	*	*	*	*	*	4E-14	*	2E-12	*(3E-13, 3E-12)*	9E-12	*(2E-12, 1E-11)*	2E-11	*(6E-12, 2E-11)*	3E-11	*(2E-11, 3E-11)*	7E-11	*(5E-11, 8E-11)*
1,2,3,6,7,8-HxCDD	*	*	*	*	*	*	2E-14	*	1E-12	*(2E-13, 2E-12)*	6E-12	*(2E-12, 1E-11)*	1E-11	*(5E-12, 1E-11)*	3E-11	*(1E-11, 3E-11)*	6E-11	*(3E-11, 7E-11)*
1,2,3,6,7,8,9-HpCDD	*	*	*	*	8E-14	*	3E-13	*(2E-13, 6E-13)*	9E-13	*(4E-13, 2E-12)*	3E-12	*(1E-12, 4E-12)*	5E-12	*(4E-12, 1E-11)*	1E-11	*(1E-11, 3E-11)*	8E-11	*(3E-11, 9E-11)*
1,2,3,4,5,7,8,9-OCDD	*	*	*	*	2E-13	*	5E-13	*(4E-13, 2E-12)*	2E-12	*(6E-13, 6E-12)*	7E-12	*(4E-12, 1E-11)*	2E-11	*(8E-12, 3E-11)*	4E-11	*(2E-11, 7E-11)*	2E-10	*(7E-11, 2E-10)*
2,3,7,8-TCDF	*	*	*	*	2E-13	*	3E-13	*(3E-13, 2E-12)*	2E-12	*(5E-13, 3E-12)*	4E-12	*(2E-12, 6E-12)*	9E-12	*(6E-12, 1E-11)*	7E-11	*(1E-11, 1E-10)*	3E-10	*(2E-10, 4E-10)*
1,2,3,7,8-PeCDF	*	*	*	*	6E-13	*	3E-12	*(1E-12, 5E-12)*	6E-12	*(4E-12, 2E-11)*	2E-11	*(8E-12, 5E-11)*	5E-11	*(3E-11, 9E-11)*	1E-10	*(7E-11, 2E-10)*	4E-10	*(2E-10, 4E-10)*
2,3,4,7,8-PeCDF	8E-13	*(8E-13, 3E-12)*	8E-13	*(8E-13, 7E-12)*	1E-12	*(8E-13, 1E-11)*	1E-11	*(6E-12, 3E-11)*	4E-11	*(2E-11, 9E-11)*	1E-10	*(5E-11, 1E-10)*	3E-10	*(1E-10, 3E-10)*	7E-10	*(3E-10, 1E-09)*	3E-09	*(1E-09, 3E-09)*
1,2,3,6,7,8-HxCDF	*	*	*	*	*	*	6E-14	*	9E-13	*(7E-13, 5E-12)*	7E-12	*(1E-12, 1E-11)*	1E-11	*(7E-12, 3E-11)*	9E-11	*(2E-11, 2E-10)*	5E-10	*(2E-10, 6E-10)*
2,3,4,6,7,8-HxCDF	3E-14	*(3E-14, 3E-13)*	5E-14	*(3E-14, 7E-13)*	7E-14	*(4E-14, 9E-13)*	9E-13	*(6E-13, 2E-12)*	3E-12	*(1E-12, 6E-12)*	9E-12	*(3E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	8E-11	*(3E-11, 2E-10)*	4E-10	*(2E-10, 5E-10)*
1,2,3,4,7,8-HxCDF	*	*	*	*	*	*	7E-14	*	2E-12	*(7E-13, 8E-12)*	1E-11	*(2E-12, 1E-11)*	2E-11	*(1E-11, 4E-11)*	2E-10	*(3E-11, 5E-10)*	1E-09	*(6E-10, 2E-09)*
1,2,3,7,8,9-HxCDF	3E-14	*(3E-14, 6E-14)*	4E-14	*(4E-14, 2E-13)*	6E-14	*(4E-14, 8E-13)*	8E-13	*(2E-13, 1E-12)*	2E-12	*(1E-12, 6E-12)*	6E-12	*(2E-12, 1E-11)*	1E-11	*(6E-12, 3E-11)*	3E-11	*(2E-11, 6E-11)*	2E-10	*(7E-11, 2E-10)*
1,2,3,4,6,7,8-HpCDF	5E-14	*(4E-14, 1E-13)*	5E-14	*(5E-14, 2E-13)*	1E-13	*(5E-14, 2E-13)*	2E-13	*(2E-13, 2E-12)*	2E-12	*(4E-13, 5E-12)*	6E-12	*(2E-12, 9E-12)*	1E-11	*(7E-12, 3E-11)*	1E-10	*(2E-11, 3E-10)*	8E-10	*(3E-10, 9E-10)*
1,2,3,4,7,8,9-HpCDF	2E-14	*(2E-14, 4E-14)*	3E-14	*(3E-14, 3E-13)*	3E-14	*(3E-14, 1E-12)*	1E-12	*(3E-13, 1E-12)*	2E-12	*(1E-12, 4E-12)*	7E-12	*(2E-12, 1E-11)*	2E-11	*(7E-12, 4E-11)*	6E-11	*(2E-11, 1E-10)*	3E-10	*(1E-10, 4E-10)*
1,2,3,4,6,7,8,9-OCDF	*	*	*	*	3E-14	*	1E-13	*(1E-13, 1E-12)*	1E-12	*(2E-13, 3E-12)*	4E-12	*(2E-12, 4E-12)*	6E-12	*(4E-12, 2E-11)*	8E-11	*(1E-11, 2E-10)*	5E-10	*(2E-10, 6E-10)*
2,3,7,8-TCDD-TEQ	*	*	*	*	1E-12	*	1E-11	*(4E-12, 2E-11)*	3E-11	*(1E-11, 8E-11)*	9E-11	*(4E-11, 1E-10)*	2E-10	*(9E-11, 3E-10)*	4E-10	*(2E-10, 8E-10)*	2E-09	*(9E-10, 2E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B6. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	3E-15 *	4E-15 *(3E-15, 8E-15)*	5E-15 *(4E-15, 9E-15)*	9E-15 *(8E-15, 5E-14)*	1E-13 *(2E-14, 5E-13)*	6E-13 *(3E-13, 1E-12)*	1E-12 *(8E-13, 2E-12)*	2E-12 *(1E-12, 4E-12)*	8E-12 *(4E-12, 1E-11)*	
1,2,3,7,8-PeCDD	7E-15 *	8E-15 *(7E-15, 2E-14)*	1E-14 *(8E-15, 2E-14)*	2E-14 *(1E-14, 1E-13)*	4E-13 *(3E-14, 2E-12)*	3E-12 *(6E-13, 6E-12)*	8E-12 *(3E-12, 1E-11)*	1E-11 *(6E-12, 2E-11)*	4E-11 *(2E-11, 6E-11)*	
1,2,3,7,8,9-HxCDD	3E-15 *	5E-15 *(3E-15, 9E-15)*	6E-15 *(5E-15, 1E-14)*	1E-14 *(8E-15, 5E-14)*	3E-13 *(2E-14, 1E-12)*	3E-12 *(5E-13, 4E-12)*	5E-12 *(2E-12, 8E-12)*	8E-12 *(4E-12, 1E-11)*	3E-11 *(1E-11, 4E-11)*	
1,2,3,4,7,8-HxCDD	4E-15 *	4E-15 *(4E-15, 9E-15)*	6E-15 *(4E-15, 9E-15)*	9E-15 *(8E-15, 7E-14)*	2E-13 *(2E-14, 1E-12)*	2E-12 *(3E-13, 5E-12)*	7E-12 *(2E-12, 9E-12)*	1E-11 *(5E-12, 2E-11)*	2E-11 *	
1,2,3,6,7,8-HxCDD	2E-15 *	2E-15 *(2E-15, 4E-15)*	3E-15 *(2E-15, 5E-15)*	4E-15 *(4E-15, 4E-14)*	2E-13 *(8E-15, 1E-12)*	1E-12 *(3E-13, 4E-12)*	5E-12 *(2E-12, 7E-12)*	7E-12 *(3E-12, 1E-11)*	2E-11 *(1E-11, 4E-11)*	
1,2,3,6,7,8,9-HpCDD	2E-16 *	2E-16 *(2E-16, 4E-16)*	3E-16 *(2E-16, 5E-16)*	5E-16 *(4E-16, 4E-15)*	7E-14 *(9E-16, 9E-13)*	1E-12 *(9E-14, 3E-12)*	4E-12 *(1E-12, 5E-12)*	6E-12 *(2E-12, 1E-11)*	2E-11 *(6E-12, 6E-11)*	
1,2,3,4,5,7,8,9-OCDD	5E-16 *	8E-16 *(5E-16, 1E-15)*	8E-16 *(8E-16, 1E-15)*	1E-15 *(1E-15, 8E-15)*	1E-13 *(3E-15, 1E-12)*	2E-12 *(2E-13, 5E-12)*	6E-12 *(2E-12, 8E-12)*	9E-12 *(4E-12, 2E-11)*	3E-11 *(9E-12, 6E-11)*	
2,3,7,8-TCDF	2E-14 *	2E-14 *(2E-14, 4E-14)*	3E-14 *(2E-14, 5E-14)*	5E-14 *(4E-14, 3E-13)*	5E-13 *(6E-14, 2E-12)*	3E-12 *(7E-13, 4E-11)*	5E-11 *(3E-12, 7E-11)*	7E-11 *(9E-12, 4E-10)*	6E-10 *	
1,2,3,7,8-PeCDF	* *	2E-14 *	2E-14 *	3E-14 *(3E-14, 2E-13)*	2E-12 *(6E-14, 6E-12)*	9E-12 *(4E-12, 6E-11)*	7E-11 *(9E-12, 9E-11)*	1E-10 *(4E-11, 1E-09)*	2E-09 *(1E-10, 2E-09)*	
2,3,4,7,8-PeCDF	* *	3E-14 *	4E-14 *	6E-14 *(6E-14, 5E-13)*	2E-12 *(1E-13, 2E-11)*	5E-11 *(5E-12, 3E-10)*	4E-10 *(5E-11, 6E-10)*	6E-10 *(2E-10, 3E-09)*	4E-09 *(9E-10, 1E-08)*	
1,2,3,6,7,8-HxCDF	* *	1E-15 *	2E-15 *(1E-15, 2E-15)*	2E-15 *(2E-15, 3E-14)*	5E-13 *(4E-15, 2E-12)*	3E-12 *(7E-13, 3E-11)*	4E-11 *(3E-12, 5E-11)*	6E-11 *(2E-11, 4E-10)*	5E-10 *(6E-11, 6E-10)*	
2,3,4,6,7,8-HxCDF	8E-16 *	1E-15 *(8E-16, 2E-15)*	1E-15 *(1E-15, 2E-15)*	2E-15 *(2E-15, 2E-14)*	1E-13 *(4E-15, 2E-12)*	3E-12 *(3E-13, 2E-11)*	3E-11 *(3E-12, 5E-11)*	5E-11 *(1E-11, 2E-10)*	2E-10 *	
1,2,3,4,7,8-HxCDF	* *	1E-15 *	2E-15 *(1E-15, 2E-15)*	2E-15 *(2E-15, 4E-14)*	6E-13 *(5E-15, 5E-12)*	6E-12 *(1E-12, 7E-11)*	8E-11 *(9E-12, 1E-10)*	1E-10 *(4E-11, 1E-09)*	2E-09 *(1E-10, 2E-09)*	
1,2,3,7,8,9-HxCDF	2E-15 *	2E-15 *(2E-15, 4E-15)*	2E-15 *(2E-15, 4E-15)*	4E-15 *(3E-15, 5E-14)*	6E-14 *(7E-15, 2E-13)*	9E-13 *(1E-13, 1E-11)*	1E-11 *(9E-13, 2E-11)*	2E-11 *(5E-12, 4E-11)*	6E-11 *	
1,2,3,4,6,7,8-HpCDF	* *	3E-16 *	5E-16 *(3E-16, 8E-16)*	8E-16 *(6E-16, 2E-14)*	3E-13 *(1E-15, 1E-12)*	2E-12 *(5E-13, 5E-11)*	6E-11 *(3E-12, 1E-10)*	1E-10 *(1E-11, 5E-10)*	7E-10 *(1E-10, 3E-09)*	
1,2,3,4,7,8,9-HpCDF	5E-16 *	6E-16 *(5E-16, 1E-15)*	9E-16 *(6E-16, 1E-15)*	1E-15 *(1E-15, 4E-14)*	7E-14 *(3E-15, 3E-13)*	8E-13 *(1E-13, 2E-11)*	2E-11 *(8E-13, 4E-11)*	4E-11 *(4E-12, 8E-11)*	1E-10 *(4E-11, 2E-10)*	
1,2,3,4,6,7,8,9-OCDF	2E-16 *	2E-16 *(2E-16, 5E-16)*	3E-16 *(2E-16, 5E-16)*	5E-16 *(4E-16, 7E-15)*	5E-14 *(1E-15, 2E-13)*	4E-13 *(8E-14, 1E-11)*	1E-11 *(4E-13, 3E-11)*	3E-11 *(1E-12, 7E-11)*	1E-10 *(3E-11, 2E-10)*	
2,3,7,8-TCDD-TEQ	* *	3E-14 *	4E-14 *(3E-14, 7E-14)*	7E-14 *(6E-14, 5E-13)*	3E-12 *(1E-13, 2E-11)*	3E-11 *(5E-12, 2E-10)*	2E-10 *(3E-11, 4E-10)*	4E-10 *(1E-10, 2E-09)*	2E-09 *(6E-10, 9E-09)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B7. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: Waste Heat Boilers

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	3E-13 *(3E-13, 8E-13)*	7E-13 *(4E-13, 1E-12)*	9E-13 *(7E-13, 2E-12)*	2E-12 *(1E-12, 3E-12)*	3E-12 *(3E-12, 4E-12)*	5E-12 *(4E-12, 9E-12)*	1E-11 *(8E-12, 1E-11)*	1E-11 *(1E-11, 3E-11)*	8E-11 *(3E-11, 9E-11)*	
1,2,3,7,8-PeCDD	9E-13 *	3E-12 *(1E-12, 6E-12)*	5E-12 *(3E-12, 1E-11)*	9E-12 *(7E-12, 2E-11)*	2E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 5E-11)*	6E-11 *(4E-11, 6E-11)*	8E-11 *(7E-11, 2E-10)*	3E-10 *(1E-10, 4E-10)*	
1,2,3,7,8,9-HxCDD	4E-13 *(3E-13, 1E-12)*	1E-12 *(5E-13, 3E-12)*	2E-12 *(1E-12, 3E-12)*	3E-12 *(3E-12, 3E-12)*	4E-12 *(3E-12, 6E-12)*	9E-12 *(6E-12, 1E-11)*	3E-11 *(1E-11, 3E-11)*	3E-11 *(3E-11, 5E-11)*	1E-10 *(9E-11, 1E-10)*	
1,2,3,4,7,8-HxCDD	6E-13 *(5E-13, 4E-12)*	2E-12 *(8E-13, 4E-12)*	4E-12 *(2E-12, 4E-12)*	5E-12 *(4E-12, 5E-12)*	7E-12 *(5E-12, 1E-11)*	1E-11 *(9E-12, 3E-11)*	4E-11 *(2E-11, 4E-11)*	8E-11 *(4E-11, 9E-11)*	2E-10 *(8E-11, 2E-10)*	
1,2,3,6,7,8-HxCDD	4E-13 *(3E-13, 3E-12)*	2E-12 *(5E-13, 4E-12)*	3E-12 *(2E-12, 5E-12)*	5E-12 *(5E-12, 6E-12)*	6E-12 *(6E-12, 9E-12)*	2E-11 *(9E-12, 2E-11)*	3E-11 *(2E-11, 3E-11)*	6E-11 *(3E-11, 7E-11)*	2E-10 *(8E-11, 2E-10)*	
1,2,3,6,7,8,9-HpCDD	5E-13 *(4E-13, 1E-12)*	1E-12 *(6E-13, 3E-12)*	2E-12 *(1E-12, 3E-12)*	3E-12 *(3E-12, 3E-12)*	4E-12 *(3E-12, 5E-12)*	7E-12 *(5E-12, 1E-11)*	3E-11 *(1E-11, 3E-11)*	4E-11 *(3E-11, 4E-11)*	1E-10 *(9E-11, 1E-10)*	
1,2,3,4,5,7,8,9-OCDD	3E-13 *	6E-13 *(4E-13, 3E-12)*	1E-12 *(6E-13, 4E-12)*	4E-12 *(2E-12, 5E-12)*	5E-12 *(5E-12, 5E-12)*	8E-12 *(7E-12, 1E-11)*	4E-11 *(2E-11, 7E-11)*	7E-11 *(7E-11, 7E-11)*	2E-10 *(2E-10, 2E-10)*	
2,3,7,8-TCDF	4E-12 *	2E-11 *(9E-12, 3E-11)*	2E-11 *(2E-11, 5E-11)*	5E-11 *(4E-11, 1E-10)*	1E-10 *(7E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	3E-10 *(2E-10, 4E-10)*	4E-10 *(4E-10, 6E-10)*	1E-09 *(5E-10, 1E-09)*	
1,2,3,7,8-PeCDF	1E-11 *(8E-12, 4E-11)*	4E-11 *(3E-11, 7E-11)*	6E-11 *(4E-11, 9E-11)*	9E-11 *(6E-11, 1E-10)*	1E-10 *(1E-10, 2E-10)*	2E-10 *(2E-10, 5E-10)*	6E-10 *(3E-10, 1E-09)*	1E-09 *(5E-10, 2E-09)*	4E-09 *(1E-09, 4E-09)*	
2,3,4,7,8-PeCDF	4E-11 *(3E-11, 3E-10)*	2E-10 *(1E-10, 4E-10)*	3E-10 *(3E-10, 6E-10)*	6E-10 *(4E-10, 1E-09)*	1E-09 *(8E-10, 1E-09)*	2E-09 *(1E-09, 2E-09)*	3E-09 *(3E-09, 4E-09)*	5E-09 *(3E-09, 5E-09)*	1E-08 *(1E-08, 1E-08)*	
1,2,3,6,7,8-HxCDF	2E-12 *(1E-12, 2E-11)*	2E-11 *(5E-12, 2E-11)*	2E-11 *(2E-11, 2E-11)*	2E-11 *(2E-11, 3E-11)*	4E-11 *(2E-11, 9E-11)*	1E-10 *(5E-11, 3E-10)*	4E-10 *(2E-10, 5E-10)*	6E-10 *(3E-10, 9E-10)*	2E-09 *(6E-10, 3E-09)*	
2,3,4,6,7,8-HxCDF	2E-12 *	9E-12 *	9E-12 *(9E-12, 9E-12)*	1E-11 *(9E-12, 2E-11)*	3E-11 *(1E-11, 4E-11)*	8E-11 *(3E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	4E-10 *(2E-10, 5E-10)*	8E-10 *(5E-10, 1E-09)*	
1,2,3,4,7,8-HxCDF	2E-12 *	5E-11 *	5E-11 *(5E-11, 5E-11)*	5E-11 *(5E-11, 7E-11)*	8E-11 *(6E-11, 1E-10)*	3E-10 *(1E-10, 5E-10)*	6E-10 *(5E-10, 1E-09)*	2E-09 *(6E-10, 2E-09)*	4E-09 *(2E-09, 4E-09)*	
1,2,3,7,8,9-HxCDF	9E-13 *	7E-12 *(2E-12, 1E-11)*	1E-11 *(7E-12, 2E-11)*	2E-11 *(1E-11, 4E-11)*	4E-11 *(3E-11, 4E-11)*	5E-11 *(4E-11, 6E-11)*	1E-10 *(9E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	4E-10 *(3E-10, 6E-10)*	
1,2,3,4,6,7,8-HpCDF	8E-13 *	1E-11 *	1E-11 *(1E-11, 1E-11)*	1E-11 *(1E-11, 5E-11)*	5E-11 *(2E-11, 9E-11)*	2E-10 *(6E-11, 3E-10)*	3E-10 *(2E-10, 7E-10)*	9E-10 *(3E-10, 9E-10)*	2E-09 *(9E-10, 2E-09)*	
1,2,3,4,7,8,9-HpCDF	4E-13 *(3E-13, 7E-12)*	6E-12 *(1E-12, 7E-12)*	7E-12 *(6E-12, 8E-12)*	8E-12 *(8E-12, 1E-11)*	2E-11 *(9E-12, 3E-11)*	4E-11 *(2E-11, 6E-11)*	1E-10 *(7E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*	4E-10 *(4E-10, 4E-10)*	
1,2,3,4,6,7,8,9-OCDF	2E-13 *(1E-13, 2E-12)*	1E-12 *(4E-13, 3E-12)*	2E-12 *(1E-12, 3E-12)*	3E-12 *(3E-12, 4E-12)*	5E-12 *(3E-12, 1E-11)*	2E-11 *(9E-12, 5E-11)*	8E-11 *(4E-11, 2E-10)*	2E-10 *(1E-10, 2E-10)*	6E-10 *(6E-10, 6E-10)*	
2,3,7,8-TCDD-TEQ	2E-11 *(2E-11, 2E-10)*	1E-10 *(6E-11, 2E-10)*	2E-10 *(2E-10, 3E-10)*	3E-10 *(2E-10, 6E-10)*	7E-10 *(5E-10, 8E-10)*	1E-09 *(8E-10, 1E-09)*	2E-09 *(2E-09, 2E-09)*	3E-09 *(2E-09, 3E-09)*	7E-09 *(7E-09, 8E-09)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B8. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	3E-15	*(3E-15, 8E-15)*	6E-15	*(4E-15, 2E-14)*	8E-15	*(7E-15, 3E-14)*	5E-14	*(2E-14, 3E-13)*	5E-13	*(3E-13, 8E-13)*	4E-12	*(1E-12, 6E-12)*	1E-11	*(6E-12, 1E-11)*	1E-11	*(8E-12, 3E-11)*	3E-11	*(1E-11, 6E-11)*
1,2,3,7,8-PeCDD	7E-15	*(7E-15, 2E-14)*	1E-14	*(9E-15, 2E-14)*	2E-14	*(1E-14, 5E-14)*	5E-14	*(3E-14, 4E-13)*	1E-12	*(4E-13, 3E-12)*	6E-12	*(3E-12, 1E-11)*	2E-11	*(8E-12, 3E-11)*	3E-11	*(1E-11, 4E-11)*	7E-11	*(5E-11, 7E-11)*
1,2,3,7,8,9-HxCDD	3E-15	*(3E-15, 8E-15)*	8E-15	*(5E-15, 1E-14)*	9E-15	*(8E-15, 2E-14)*	3E-14	*(2E-14, 3E-13)*	7E-13	*(2E-13, 1E-12)*	2E-12	*(1E-12, 4E-12)*	7E-12	*(3E-12, 1E-11)*	1E-11	*(6E-12, 1E-11)*	4E-11	*(3E-11, 5E-11)*
1,2,3,4,7,8-HxCDD	*	*	*	*	4E-15	*	2E-14	*(8E-15, 1E-13)*	5E-13	*(8E-14, 2E-12)*	2E-12	*(1E-12, 4E-12)*	1E-11	*(4E-12, 2E-11)*	2E-11	*(7E-12, 3E-11)*	5E-11	*(3E-11, 8E-11)*
1,2,3,6,7,8-HxCDD	*	*	*	*	2E-15	*	9E-15	*(4E-15, 6E-14)*	4E-13	*(4E-14, 1E-12)*	2E-12	*(1E-12, 2E-12)*	6E-12	*(2E-12, 1E-11)*	1E-11	*(4E-12, 2E-11)*	4E-11	*(2E-11, 6E-11)*
1,2,3,6,7,8,9-HpCDD	2E-16	*(2E-16, 4E-16)*	4E-16	*(2E-16, 9E-16)*	5E-16	*(4E-16, 1E-14)*	2E-14	*(9E-16, 1E-13)*	3E-13	*(9E-14, 6E-13)*	1E-12	*(6E-13, 2E-12)*	4E-12	*(2E-12, 4E-12)*	4E-12	*(4E-12, 6E-12)*	3E-11	*(1E-11, 4E-11)*
1,2,3,4,5,7,8,9-OCDD	5E-16	*(5E-16, 1E-15)*	9E-16	*(8E-16, 2E-15)*	1E-15	*(9E-16, 4E-14)*	4E-14	*(3E-15, 3E-13)*	6E-13	*(2E-13, 2E-12)*	4E-12	*(2E-12, 6E-12)*	8E-12	*(5E-12, 1E-11)*	1E-11	*(8E-12, 2E-11)*	3E-11	*(2E-11, 1E-10)*
2,3,7,8-TCDF	2E-14	*(2E-14, 3E-14)*	3E-14	*(2E-14, 5E-14)*	4E-14	*(4E-14, 1E-13)*	2E-13	*(5E-14, 4E-13)*	7E-13	*(4E-13, 2E-12)*	3E-12	*(2E-12, 5E-12)*	8E-12	*(6E-12, 3E-11)*	4E-11	*(8E-12, 1E-10)*	2E-10	*
1,2,3,7,8-PeCDF	*	*	2E-14	*	3E-14	*(3E-14, 2E-13)*	3E-13	*(7E-14, 2E-12)*	4E-12	*(2E-12, 6E-12)*	1E-11	*(6E-12, 2E-11)*	5E-11	*(2E-11, 8E-11)*	1E-10	*(5E-11, 2E-10)*	3E-10	*(9E-11, 6E-10)*
2,3,4,7,8-PeCDF	*	*	5E-14	*	6E-14	*(5E-14, 8E-13)*	8E-13	*(1E-13, 6E-12)*	1E-11	*(5E-12, 3E-11)*	5E-11	*(3E-11, 1E-10)*	1E-10	*(1E-10, 6E-10)*	7E-10	*(1E-10, 1E-09)*	2E-09	*(6E-10, 3E-09)*
1,2,3,6,7,8-HxCDF	*	*	*	*	3E-16	*	5E-15	*(2E-15, 8E-14)*	7E-13	*(6E-14, 9E-13)*	3E-12	*(1E-12, 7E-12)*	1E-11	*(5E-12, 3E-11)*	3E-11	*(1E-11, 4E-11)*	1E-10	*(4E-11, 2E-10)*
2,3,4,6,7,8-HxCDF	8E-16	*(8E-16, 2E-15)*	1E-15	*(1E-15, 4E-15)*	2E-15	*(2E-15, 3E-14)*	4E-14	*(4E-15, 4E-13)*	9E-13	*(2E-13, 2E-12)*	4E-12	*(2E-12, 9E-12)*	1E-11	*(7E-12, 3E-11)*	3E-11	*(1E-11, 4E-11)*	1E-10	*(5E-11, 2E-10)*
1,2,3,4,7,8-HxCDF	*	*	*	*	3E-16	*	5E-15	*(2E-15, 2E-13)*	1E-12	*(1E-13, 2E-12)*	6E-12	*(2E-12, 1E-11)*	2E-11	*(8E-12, 8E-11)*	1E-10	*(2E-11, 2E-10)*	4E-10	*(9E-11, 6E-10)*
1,2,3,7,8,9-HxCDF	2E-15	*(2E-15, 3E-15)*	3E-15	*(2E-15, 5E-15)*	4E-15	*(3E-15, 9E-15)*	2E-14	*(6E-15, 1E-13)*	2E-13	*(1E-13, 1E-12)*	2E-12	*(1E-12, 5E-12)*	6E-12	*(3E-12, 1E-11)*	1E-11	*(6E-12, 1E-11)*	3E-11	*(1E-11, 7E-11)*
1,2,3,4,6,7,8-HpCDF	*	*	5E-16	*(3E-16, 2E-15)*	7E-16	*(5E-16, 1E-14)*	2E-14	*(2E-15, 2E-13)*	4E-13	*(2E-13, 1E-12)*	3E-12	*(8E-13, 5E-12)*	1E-11	*(5E-12, 1E-11)*	2E-11	*(9E-12, 2E-11)*	5E-11	*(3E-11, 7E-11)*
1,2,3,4,7,8,9-HpCDF	5E-16	*(5E-16, 1E-15)*	1E-15	*(7E-16, 3E-15)*	1E-15	*(1E-15, 7E-15)*	9E-15	*(3E-15, 1E-13)*	3E-13	*(9E-14, 1E-12)*	2E-12	*(1E-12, 7E-12)*	1E-11	*(4E-12, 1E-11)*	2E-11	*(9E-12, 2E-11)*	4E-11	*(2E-11, 4E-11)*
1,2,3,4,6,7,8,9-OCDF	2E-16	*(2E-16, 4E-16)*	3E-16	*(2E-16, 9E-16)*	5E-16	*(3E-16, 1E-14)*	1E-14	*(1E-15, 9E-14)*	2E-13	*(8E-14, 4E-13)*	2E-12	*(4E-13, 4E-12)*	4E-12	*(3E-12, 5E-12)*	6E-12	*(4E-12, 8E-12)*	2E-11	*(1E-11, 2E-11)*
2,3,7,8-TCDD-TEQ	*	*	5E-14	*(3E-14, 1E-13)*	7E-14	*(6E-14, 6E-13)*	8E-13	*(1E-13, 5E-12)*	1E-11	*(4E-12, 2E-11)*	4E-11	*(2E-11, 8E-11)*	1E-10	*(8E-11, 4E-10)*	4E-10	*(1E-10, 6E-10)*	1E-09	*(4E-10, 2E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B9. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	*	*	3E-14	*	6E-14	*(4E-14, 4E-13)*	4E-13	*(1E-13, 4E-12)*	6E-12	*(4E-13, 7E-12)*	8E-12	*(3E-12, 1E-11)*	2E-11	*(6E-12, 2E-11)*	4E-11	*(2E-11, 6E-11)*
1,2,3,7,8-PeCDD	*	*	*	*	3E-14	*	5E-14	*(4E-14, 5E-13)*	5E-13	*(9E-14, 7E-12)*	9E-12	*(5E-13, 1E-11)*	3E-11	*(3E-12, 5E-11)*	5E-11	*(1E-11, 7E-11)*	1E-10	*(7E-11, 1E-10)*
1,2,3,7,8,9-HxCDD	*	*	*	*	1E-14	*	3E-14	*(2E-14, 3E-13)*	3E-13	*(5E-14, 2E-12)*	2E-12	*(3E-13, 3E-12)*	7E-12	*(2E-12, 3E-11)*	3E-11	*(5E-12, 5E-11)*	7E-11	*(3E-11, 9E-11)*
1,2,3,4,7,8-HxCDD	*	*	*	*	5E-14	*	1E-13	*(7E-14, 9E-13)*	9E-13	*(2E-13, 3E-12)*	4E-12	*(9E-13, 4E-12)*	1E-11	*(3E-12, 3E-11)*	4E-11	*(8E-12, 6E-11)*	8E-11	*(4E-11, 9E-11)*
1,2,3,6,7,8-HxCDD	*	*	*	*	2E-14	*	4E-14	*(3E-14, 5E-13)*	5E-13	*(8E-14, 1E-12)*	2E-12	*(5E-13, 2E-12)*	5E-12	*(2E-12, 4E-11)*	4E-11	*(4E-12, 6E-11)*	9E-11	*(2E-11, 1E-10)*
1,2,3,6,7,8,9-HpCDD	*	*	*	*	1E-14	*	3E-14	*(2E-14, 3E-13)*	4E-13	*(5E-14, 1E-12)*	1E-12	*(4E-13, 1E-12)*	5E-12	*(1E-12, 2E-11)*	3E-11	*(3E-12, 4E-11)*	6E-11	*(2E-11, 8E-11)*
1,2,3,4,5,7,8,9-OCDD	*	*	*	*	4E-14	*	9E-14	*(5E-14, 1E-12)*	1E-12	*(1E-13, 2E-12)*	3E-12	*(2E-12, 5E-12)*	1E-11	*(5E-12, 2E-11)*	2E-11	*(8E-12, 2E-11)*	6E-11	*(3E-11, 7E-11)*
2,3,7,8-TCDF	*	*	*	*	4E-13	*	8E-13	*(6E-13, 5E-12)*	5E-12	*(1E-12, 3E-11)*	6E-11	*(6E-12, 9E-11)*	1E-10	*(2E-11, 2E-10)*	2E-10	*(4E-11, 2E-10)*	5E-10	*(1E-10, 6E-10)*
1,2,3,7,8-PeCDF	*	*	*	*	4E-13	*	7E-13	*(6E-13, 5E-12)*	5E-12	*(8E-13, 8E-11)*	1E-10	*(6E-12, 2E-10)*	2E-10	*(2E-11, 3E-10)*	3E-10	*(8E-11, 5E-10)*	1E-09	*(3E-10, 1E-09)*
2,3,4,7,8-PeCDF	1E-12	*(1E-12, 1E-12)*	2E-12	*(2E-12, 2E-12)*	2E-12	*(2E-12, 5E-12)*	5E-12	*(5E-12, 4E-11)*	4E-11	*(5E-12, 7E-10)*	7E-10	*(4E-11, 1E-09)*	1E-09	*(2E-10, 2E-09)*	2E-09	*(7E-10, 3E-09)*	6E-09	*(2E-09, 7E-09)*
1,2,3,6,7,8-HxCDF	*	*	*	*	3E-14	*	6E-14	*(4E-14, 7E-13)*	8E-13	*(1E-13, 2E-11)*	3E-11	*(8E-13, 4E-11)*	5E-11	*(5E-12, 9E-11)*	1E-10	*(4E-11, 1E-10)*	3E-10	*(1E-10, 4E-10)*
2,3,4,6,7,8-HxCDF	*	*	*	*	3E-14	*	6E-14	*(4E-14, 6E-13)*	7E-13	*(1E-13, 2E-11)*	3E-11	*(7E-13, 4E-11)*	7E-11	*(5E-12, 9E-11)*	1E-10	*(4E-11, 2E-10)*	3E-10	*(2E-10, 4E-10)*
1,2,3,4,7,8-HxCDF	*	*	*	*	9E-14	*	2E-13	*(1E-13, 2E-12)*	2E-12	*(2E-13, 1E-10)*	1E-10	*(2E-12, 2E-10)*	2E-10	*(1E-11, 4E-10)*	4E-10	*(1E-10, 6E-10)*	2E-09	*(3E-10, 2E-09)*
1,2,3,7,8,9-HxCDF	*	*	*	*	5E-15	*	1E-14	*(7E-15, 1E-13)*	1E-13	*(2E-14, 3E-12)*	4E-12	*(1E-13, 5E-12)*	6E-12	*(8E-13, 1E-11)*	1E-11	*(4E-12, 2E-11)*	4E-11	*(1E-11, 4E-11)*
1,2,3,4,6,7,8-HpCDF	*	*	*	*	1E-14	*	2E-14	*(2E-14, 2E-13)*	3E-13	*(5E-14, 1E-11)*	1E-11	*(3E-13, 2E-11)*	3E-11	*(3E-12, 4E-11)*	5E-11	*(2E-11, 7E-11)*	1E-10	*(7E-11, 2E-10)*
1,2,3,4,7,8,9-HpCDF	*	*	*	*	5E-15	*	1E-14	*(7E-15, 1E-13)*	1E-13	*(2E-14, 6E-12)*	8E-12	*(1E-13, 1E-11)*	1E-11	*(1E-12, 2E-11)*	2E-11	*(1E-11, 3E-11)*	8E-11	*(3E-11, 1E-10)*
1,2,3,4,6,7,8,9-OCDF	*	*	*	*	1E-14	*	3E-14	*(1E-14, 5E-13)*	6E-13	*(4E-14, 3E-12)*	3E-12	*(6E-13, 5E-12)*	8E-12	*(3E-12, 1E-11)*	1E-11	*(7E-12, 2E-11)*	5E-11	*(3E-11, 6E-11)*
2,3,7,8-TCDD-TEQ	*	*	*	*	1E-12	*	3E-12	*(2E-12, 2E-11)*	2E-11	*(3E-12, 4E-10)*	4E-10	*(2E-11, 6E-10)*	7E-10	*(1E-10, 1E-09)*	1E-09	*(4E-10, 2E-09)*	3E-09	*(1E-09, 4E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B10. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	*	*	3E-13	*	6E-13	*(4E-13, 2E-12)*	2E-12	*(7E-13, 6E-12)*	8E-12	*(2E-12, 1E-11)*	1E-11	*(6E-12, 2E-11)*	2E-11	*(9E-12, 2E-11)*	3E-11	*
1,2,3,7,8-PeCDD	*	*	*	*	2E-13	*	2E-12	*(3E-13, 3E-12)*	4E-12	*(3E-12, 6E-12)*	1E-11	*(6E-12, 2E-11)*	3E-11	*(1E-11, 4E-11)*	4E-11	*(1E-11, 4E-11)*	7E-11	*(3E-11, 7E-11)*
1,2,3,7,8,9-HxCDD	1E-14	*(1E-14, 6E-14)*	2E-14	*(2E-14, 2E-13)*	2E-14	*(2E-14, 8E-13)*	7E-13	*(1E-13, 1E-12)*	1E-12	*(9E-13, 2E-12)*	4E-12	*(2E-12, 8E-12)*	1E-11	*(3E-12, 1E-11)*	1E-11	*(5E-12, 1E-11)*	3E-11	*
1,2,3,4,7,8-HxCDD	*	*	*	*	*	*	4E-14	*	2E-12	*(2E-13, 3E-12)*	4E-12	*(2E-12, 1E-11)*	2E-11	*(4E-12, 2E-11)*	2E-11	*(5E-12, 2E-11)*	5E-11	*(2E-11, 5E-11)*
1,2,3,6,7,8-HxCDD	*	*	*	*	*	*	2E-14	*	1E-12	*(1E-13, 2E-12)*	2E-12	*(1E-12, 7E-12)*	9E-12	*(2E-12, 1E-11)*	1E-11	*(4E-12, 1E-11)*	3E-11	*(1E-11, 3E-11)*
1,2,3,6,7,8,9-HpCDD	*	*	*	*	8E-14	*	3E-13	*(1E-13, 6E-13)*	7E-13	*(3E-13, 2E-12)*	2E-12	*(8E-13, 4E-12)*	4E-12	*(2E-12, 4E-12)*	5E-12	*(4E-12, 6E-12)*	1E-11	*(6E-12, 1E-11)*
1,2,3,4,5,7,8,9-OCDD	*	*	*	*	2E-13	*	5E-13	*(3E-13, 2E-12)*	2E-12	*(6E-13, 6E-12)*	7E-12	*(2E-12, 8E-12)*	1E-11	*(7E-12, 1E-11)*	1E-11	*(8E-12, 2E-11)*	2E-11	*(2E-11, 4E-11)*
2,3,7,8-TCDF	*	*	*	*	2E-13	*	3E-13	*(3E-13, 1E-12)*	1E-12	*(4E-13, 3E-12)*	3E-12	*(2E-12, 6E-12)*	6E-12	*(3E-12, 9E-12)*	9E-12	*(6E-12, 9E-12)*	1E-11	*
1,2,3,7,8-PeCDF	*	*	*	*	6E-13	*	3E-12	*(1E-12, 4E-12)*	6E-12	*(3E-12, 2E-11)*	2E-11	*(6E-12, 3E-11)*	5E-11	*(2E-11, 5E-11)*	5E-11	*(3E-11, 5E-11)*	1E-10	*(5E-11, 1E-10)*
2,3,4,7,8-PeCDF	8E-13	*(7E-13, 3E-12)*	8E-13	*(8E-13, 7E-12)*	1E-12	*(8E-13, 1E-11)*	1E-11	*(5E-12, 3E-11)*	3E-11	*(2E-11, 5E-11)*	1E-10	*(4E-11, 1E-10)*	1E-10	*(9E-11, 3E-10)*	3E-10	*(1E-10, 3E-10)*	3E-10	*(2E-10, 3E-10)*
1,2,3,6,7,8-HxCDF	*	*	*	*	*	*	6E-14	*	9E-13	*(4E-13, 5E-12)*	5E-12	*(1E-12, 8E-12)*	1E-11	*(5E-12, 1E-11)*	1E-11	*(6E-12, 1E-11)*	3E-11	*(1E-11, 3E-11)*
2,3,4,6,7,8-HxCDF	3E-14	*(3E-14, 3E-13)*	5E-14	*(3E-14, 7E-13)*	6E-14	*(4E-14, 9E-13)*	9E-13	*(5E-13, 2E-12)*	2E-12	*(1E-12, 6E-12)*	7E-12	*(3E-12, 1E-11)*	1E-11	*(6E-12, 2E-11)*	2E-11	*(9E-12, 2E-11)*	3E-11	*(2E-11, 3E-11)*
1,2,3,4,7,8-HxCDF	*	*	*	*	*	*	6E-14	*	1E-12	*(7E-13, 8E-12)*	8E-12	*(2E-12, 1E-11)*	2E-11	*(7E-12, 2E-11)*	2E-11	*(8E-12, 2E-11)*	4E-11	*(2E-11, 4E-11)*
1,2,3,7,8,9-HxCDF	3E-14	*(3E-14, 6E-14)*	4E-14	*(4E-14, 2E-13)*	5E-14	*(4E-14, 8E-13)*	6E-13	*(1E-13, 1E-12)*	2E-12	*(1E-12, 3E-12)*	6E-12	*(2E-12, 9E-12)*	1E-11	*(5E-12, 1E-11)*	1E-11	*(6E-12, 1E-11)*	3E-11	*(1E-11, 3E-11)*
1,2,3,4,6,7,8-HpCDF	5E-14	*(4E-14, 1E-13)*	5E-14	*(5E-14, 2E-13)*	1E-13	*(5E-14, 2E-13)*	2E-13	*(1E-13, 2E-12)*	2E-12	*(3E-13, 5E-12)*	5E-12	*(2E-12, 6E-12)*	9E-12	*(5E-12, 1E-11)*	1E-11	*(6E-12, 1E-11)*	2E-11	*(9E-12, 3E-11)*
1,2,3,4,7,8,9-HpCDF	2E-14	*(2E-14, 4E-14)*	3E-14	*(3E-14, 3E-13)*	3E-14	*(3E-14, 1E-12)*	1E-12	*(1E-13, 1E-12)*	2E-12	*(1E-12, 2E-12)*	5E-12	*(2E-12, 1E-11)*	1E-11	*(4E-12, 2E-11)*	2E-11	*(6E-12, 2E-11)*	4E-11	*
1,2,3,4,6,7,8,9-OCDF	*	*	*	*	3E-14	*	1E-13	*(1E-13, 6E-13)*	8E-13	*(2E-13, 2E-12)*	4E-12	*(8E-13, 4E-12)*	5E-12	*(4E-12, 5E-12)*	6E-12	*(4E-12, 7E-12)*	1E-11	*(8E-12, 2E-11)*
2,3,7,8-TCDD-TEQ	*	*	*	*	1E-12	*	1E-11	*(4E-12, 2E-11)*	2E-11	*(1E-11, 5E-11)*	8E-11	*(3E-11, 9E-11)*	1E-10	*(8E-11, 2E-10)*	2E-10	*(9E-11, 2E-10)*	3E-10	*(2E-10, 3E-10)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-B11. Cumulative Frequency Distribution of Dioxins/Furans in Dairy Products for Sectors with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Dairy Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	3E-15 *	4E-15 *(3E-15, 8E-15)*	4E-15 *(4E-15, 8E-15)*	8E-15 *(7E-15, 2E-14)*	2E-14 *(9E-15, 3E-13)*	4E-13 *(3E-14, 5E-13)*	6E-13 *(3E-13, 8E-13)*	9E-13 *(5E-13, 1E-12)*	4E-12 *(6E-13, 5E-12)*	
1,2,3,7,8-PeCDD	7E-15 *	8E-15 *(7E-15, 1E-14)*	8E-15 *(8E-15, 2E-14)*	2E-14 *(1E-14, 4E-14)*	4E-14 *(2E-14, 6E-13)*	8E-13 *(5E-14, 2E-12)*	3E-12 *(6E-13, 4E-12)*	4E-12 *(8E-13, 7E-12)*	2E-11 *(3E-12, 2E-11)*	
1,2,3,7,8,9-HxCDD	3E-15 *	4E-15 *(3E-15, 8E-15)*	5E-15 *(4E-15, 9E-15)*	8E-15 *(8E-15, 2E-14)*	2E-14 *(1E-14, 5E-13)*	7E-13 *(3E-14, 3E-12)*	3E-12 *(5E-13, 4E-12)*	4E-12 *(7E-13, 8E-12)*	1E-11 *(9E-13, 3E-11)*	
1,2,3,4,7,8-HxCDD	3E-15 *	4E-15 *(4E-15, 8E-15)*	4E-15 *(4E-15, 9E-15)*	9E-15 *(8E-15, 2E-14)*	2E-14 *(9E-15, 4E-13)*	5E-13 *(3E-14, 1E-12)*	2E-12 *(3E-13, 2E-12)*	2E-12 *(5E-13, 5E-12)*	1E-11 *(2E-12, 2E-11)*	
1,2,3,6,7,8-HxCDD	2E-15 *	2E-15 *(2E-15, 4E-15)*	2E-15 *(2E-15, 4E-15)*	4E-15 *(3E-15, 1E-14)*	1E-14 *(5E-15, 4E-13)*	5E-13 *(1E-14, 1E-12)*	1E-12 *(3E-13, 2E-12)*	2E-12 *(5E-13, 4E-12)*	9E-12 *	
1,2,3,6,7,8,9-HpCDD	2E-16 *	2E-16 *(2E-16, 4E-16)*	2E-16 *(2E-16, 5E-16)*	4E-16 *(4E-16, 1E-15)*	1E-15 *(5E-16, 1E-13)*	2E-13 *(1E-15, 1E-12)*	1E-12 *(9E-14, 2E-12)*	2E-12 *(1E-13, 4E-12)*	5E-12 *(4E-13, 1E-11)*	
1,2,3,4,5,7,8,9-OCDD	5E-16 *	5E-16 *(5E-16, 1E-15)*	8E-16 *(5E-16, 1E-15)*	1E-15 *(9E-16, 2E-15)*	3E-15 *(1E-15, 2E-13)*	3E-13 *(4E-15, 2E-12)*	2E-12 *(2E-13, 3E-12)*	3E-12 *(2E-13, 7E-12)*	9E-12 *(5E-13, 3E-11)*	
2,3,7,8-TCDF	2E-14 *	2E-14 *(2E-14, 3E-14)*	2E-14 *(2E-14, 5E-14)*	5E-14 *(4E-14, 1E-13)*	1E-13 *(5E-14, 7E-13)*	8E-13 *(1E-13, 2E-12)*	2E-12 *(7E-13, 3E-12)*	3E-12 *(8E-13, 5E-12)*	8E-12 *(9E-13, 1E-11)*	
1,2,3,7,8-PeCDF	* *	* *	2E-14 *	3E-14 *(3E-14, 8E-14)*	8E-14 *(4E-14, 4E-12)*	4E-12 *(1E-13, 6E-12)*	6E-12 *(3E-12, 9E-12)*	1E-11 *(4E-12, 2E-11)*	3E-11 *(6E-12, 4E-11)*	
2,3,4,7,8-PeCDF	* *	* *	3E-14 *	6E-14 *(6E-14, 1E-13)*	2E-13 *(7E-14, 9E-12)*	1E-11 *(2E-13, 3E-11)*	3E-11 *(3E-12, 5E-11)*	5E-11 *(1E-11, 8E-11)*	1E-10 *	
1,2,3,6,7,8-HxCDF	* *	1E-15 *	1E-15 *	2E-15 *(2E-15, 5E-15)*	6E-15 *(2E-15, 8E-13)*	8E-13 *(7E-15, 3E-12)*	3E-12 *(7E-13, 4E-12)*	4E-12 *(8E-13, 8E-12)*	1E-11 *(1E-12, 3E-11)*	
2,3,4,6,7,8-HxCDF	8E-16 *	9E-16 *(8E-16, 2E-15)*	1E-15 *(9E-16, 2E-15)*	2E-15 *(2E-15, 4E-15)*	5E-15 *(2E-15, 5E-13)*	7E-13 *(6E-15, 2E-12)*	2E-12 *(2E-13, 3E-12)*	3E-12 *(7E-13, 7E-12)*	1E-11 *	
1,2,3,4,7,8-HxCDF	* *	1E-15 *	1E-15 *	2E-15 *(2E-15, 5E-15)*	6E-15 *(2E-15, 1E-12)*	1E-12 *(1E-14, 6E-12)*	6E-12 *(1E-12, 8E-12)*	8E-12 *(1E-12, 2E-11)*	3E-11 *	
1,2,3,7,8,9-HxCDF	2E-15 *	2E-15 *(2E-15, 3E-15)*	2E-15 *(2E-15, 4E-15)*	3E-15 *(3E-15, 8E-15)*	9E-15 *(4E-15, 1E-13)*	1E-13 *(1E-14, 3E-13)*	6E-13 *(1E-13, 1E-12)*	1E-12 *(1E-13, 2E-12)*	4E-12 *(3E-13, 8E-12)*	
1,2,3,4,6,7,8-HpCDF	* *	3E-16 *	4E-16 *	7E-16 *(5E-16, 2E-15)*	2E-15 *(8E-16, 6E-13)*	7E-13 *(3E-15, 2E-12)*	2E-12 *(5E-13, 3E-12)*	3E-12 *(7E-13, 5E-12)*	7E-12 *(8E-13, 2E-11)*	
1,2,3,4,7,8,9-HpCDF	5E-16 *	6E-16 *(5E-16, 1E-15)*	7E-16 *(6E-16, 1E-15)*	1E-15 *(1E-15, 3E-15)*	4E-15 *(1E-15, 2E-13)*	2E-13 *(4E-15, 3E-13)*	6E-13 *(1E-13, 1E-12)*	1E-12 *(2E-13, 2E-12)*	3E-12 *(3E-13, 7E-12)*	
1,2,3,4,6,7,8,9-OCDF	2E-16 *	2E-16 *(2E-16, 4E-16)*	3E-16 *(2E-16, 5E-16)*	4E-16 *(3E-16, 8E-16)*	1E-15 *(5E-16, 9E-14)*	9E-14 *(2E-15, 3E-13)*	3E-13 *(8E-14, 4E-13)*	5E-13 *(9E-14, 1E-12)*	3E-12 *(3E-13, 4E-12)*	
2,3,7,8-TCDD-TEQ	* *	3E-14 *	3E-14 *	6E-14 *(6E-14, 2E-13)*	2E-13 *(7E-14, 6E-12)*	8E-12 *(2E-13, 2E-11)*	2E-11 *(3E-12, 3E-11)*	3E-11 *(7E-12, 5E-11)*	1E-10 *	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C1. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: Cement Kilns

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	9E-13 *(8E-13, 9E-13)*	1E-12 *(9E-13, 2E-12)*	2E-12 *(1E-12, 3E-12)*	3E-12 *(2E-12, 5E-12)*	6E-12 *(6E-12, 7E-12)*	1E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 3E-11)*	3E-11 *(3E-11, 4E-11)*	8E-11 *(7E-11, 8E-11)*	
1,2,3,7,8-PeCDD	4E-12 *(3E-12, 4E-12)*	5E-12 *(4E-12, 6E-12)*	6E-12 *(5E-12, 6E-12)*	8E-12 *(6E-12, 1E-11)*	2E-11 *(1E-11, 3E-11)*	8E-11 *(5E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*	3E-10 *(2E-10, 4E-10)*	1E-09 *(6E-10, 1E-09)*	
1,2,3,7,8,9-HxCDD	2E-12 *(2E-12, 2E-12)*	2E-12 *(2E-12, 2E-12)*	2E-12 *(2E-12, 3E-12)*	3E-12 *(3E-12, 5E-12)*	8E-12 *(6E-12, 2E-11)*	7E-11 *(2E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*	3E-10 *(2E-10, 4E-10)*	1E-09 *(7E-10, 1E-09)*	
1,2,3,4,7,8-HxCDD	3E-12 *(2E-12, 3E-12)*	5E-12 *(3E-12, 5E-12)*	5E-12 *(5E-12, 5E-12)*	6E-12 *(5E-12, 7E-12)*	1E-11 *(9E-12, 2E-11)*	8E-11 *(4E-11, 1E-10)*	3E-10 *(1E-10, 4E-10)*	4E-10 *(3E-10, 5E-10)*	1E-09 *(8E-10, 1E-09)*	
1,2,3,6,7,8-HxCDD	1E-12 *(1E-12, 1E-12)*	2E-12 *(1E-12, 2E-12)*	2E-12 *(2E-12, 5E-12)*	5E-12 *(3E-12, 7E-12)*	1E-11 *(7E-12, 2E-11)*	7E-11 *(4E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	3E-10 *(2E-10, 3E-10)*	9E-10 *(6E-10, 1E-09)*	
1,2,3,6,7,8,9-HpCDD	2E-12 *(1E-12, 2E-12)*	3E-12 *(2E-12, 4E-12)*	4E-12 *(3E-12, 7E-12)*	8E-12 *(5E-12, 1E-11)*	2E-11 *(1E-11, 4E-11)*	1E-10 *(6E-11, 1E-10)*	3E-10 *(2E-10, 4E-10)*	5E-10 *(4E-10, 7E-10)*	1E-09 *(1E-09, 2E-09)*	
1,2,3,4,5,7,8,9-OCDD	* *	2E-12 *	3E-12 *(2E-12, 4E-12)*	5E-12 *(3E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	6E-11 *(3E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*	4E-10 *(3E-10, 5E-10)*	1E-09 *(8E-10, 3E-09)*	
2,3,7,8-TCDF	6E-13 *(5E-13, 7E-13)*	1E-12 *(8E-13, 1E-12)*	1E-12 *(1E-12, 1E-12)*	2E-12 *(1E-12, 2E-12)*	4E-12 *(2E-12, 1E-11)*	3E-11 *(2E-11, 4E-11)*	1E-10 *(5E-11, 2E-10)*	2E-10 *(1E-10, 3E-10)*	5E-10 *	
1,2,3,7,8-PeCDF	1E-12 *(9E-13, 1E-12)*	1E-12 *(1E-12, 2E-12)*	2E-12 *(1E-12, 3E-12)*	3E-12 *(3E-12, 4E-12)*	7E-12 *(6E-12, 2E-11)*	5E-11 *(3E-11, 8E-11)*	1E-10 *(9E-11, 2E-10)*	2E-10 *(2E-10, 3E-10)*	6E-10 *(4E-10, 6E-10)*	
2,3,4,7,8-PeCDF	5E-12 *(4E-12, 1E-11)*	1E-11 *(1E-11, 2E-11)*	2E-11 *(2E-11, 2E-11)*	2E-11 *(2E-11, 4E-11)*	7E-11 *(4E-11, 1E-10)*	4E-10 *(2E-10, 7E-10)*	9E-10 *(7E-10, 1E-09)*	1E-09 *(1E-09, 2E-09)*	3E-09 *(2E-09, 4E-09)*	
1,2,3,6,7,8-HxCDF	1E-12 *(1E-12, 1E-12)*	1E-12 *(1E-12, 2E-12)*	2E-12 *(1E-12, 3E-12)*	4E-12 *(3E-12, 6E-12)*	1E-11 *(8E-12, 2E-11)*	4E-11 *(2E-11, 6E-11)*	1E-10 *(7E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	5E-10 *(4E-10, 6E-10)*	
2,3,4,6,7,8-HxCDF	7E-13 *(7E-13, 7E-13)*	7E-13 *(7E-13, 9E-13)*	9E-13 *(7E-13, 1E-12)*	2E-12 *(1E-12, 6E-12)*	1E-11 *(5E-12, 2E-11)*	3E-11 *(2E-11, 5E-11)*	9E-11 *(6E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	4E-10 *(3E-10, 5E-10)*	
1,2,3,4,7,8-HxCDF	1E-12 *(1E-12, 1E-12)*	2E-12 *(1E-12, 2E-12)*	2E-12 *(2E-12, 3E-12)*	3E-12 *(3E-12, 6E-12)*	1E-11 *(7E-12, 3E-11)*	6E-11 *(4E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	3E-10 *(2E-10, 3E-10)*	7E-10 *(6E-10, 8E-10)*	
1,2,3,7,8,9-HxCDF	9E-14 *(9E-14, 1E-13)*	1E-13 *(1E-13, 1E-12)*	2E-13 *(1E-13, 2E-12)*	2E-12 *(1E-12, 2E-12)*	4E-12 *(2E-12, 5E-12)*	9E-12 *(6E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 3E-11)*	8E-11 *(7E-11, 8E-11)*	
1,2,3,4,6,7,8-HpCDF	* *	1E-13 *	2E-13 *(1E-13, 8E-13)*	9E-13 *(6E-13, 1E-12)*	2E-12 *(2E-12, 4E-12)*	6E-12 *(4E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 4E-11)*	7E-11 *(6E-11, 1E-10)*	
1,2,3,4,7,8,9-HpCDF	5E-14 *(5E-14, 5E-14)*	5E-14 *(5E-14, 3E-13)*	1E-13 *(6E-14, 5E-13)*	5E-13 *(3E-13, 8E-13)*	1E-12 *(8E-13, 2E-12)*	3E-12 *(2E-12, 4E-12)*	7E-12 *(5E-12, 9E-12)*	1E-11 *(8E-12, 1E-11)*	3E-11 *(2E-11, 4E-11)*	
1,2,3,4,6,7,8,9-OCDF	* *	6E-14 *	1E-13 *(6E-14, 6E-13)*	8E-13 *(5E-13, 1E-12)*	2E-12 *(1E-12, 2E-12)*	5E-12 *(3E-12, 9E-12)*	2E-11 *(1E-11, 3E-11)*	5E-11 *(2E-11, 1E-10)*	2E-10 *(9E-11, 3E-10)*	
2,3,7,8-TCDD-TEQ	1E-11 *(8E-12, 2E-11)*	2E-11 *(2E-11, 2E-11)*	2E-11 *(2E-11, 2E-11)*	3E-11 *(2E-11, 4E-11)*	7E-11 *(5E-11, 1E-10)*	3E-10 *(2E-10, 5E-10)*	8E-10 *(6E-10, 1E-09)*	1E-09 *(9E-10, 1E-09)*	3E-09 *(2E-09, 4E-09)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C2. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors: Lightweight Aggregate Kilns[a]

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*								
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	*	2E-12	3E-12	3E-12	5E-12	7E-12	1E-11	3E-11	5E-11
1,2,3,7,8-PeCDD	*	9E-12	2E-11	2E-11	3E-11	4E-11	8E-11	2E-10	3E-10
1,2,3,7,8,9-HxCDD	*	5E-12	6E-12	8E-12	1E-11	2E-11	4E-11	6E-11	2E-10
1,2,3,4,7,8-HxCDD	*	4E-12	5E-12	7E-12	9E-12	2E-11	3E-11	6E-11	2E-10
1,2,3,6,7,8-HxCDD	*	6E-12	7E-12	1E-11	1E-11	2E-11	5E-11	9E-11	2E-10
1,2,3,6,7,8,9-HpCDD	*	*	4E-12	6E-12	7E-12	2E-11	2E-11	5E-11	2E-10
1,2,3,4,5,7,8,9-OCDD	*	*	4E-12	7E-12	1E-11	3E-11	5E-11	1E-10	3E-10
2,3,7,8-TCDF	*	8E-11	2E-10	3E-10	4E-10	6E-10	1E-09	2E-09	4E-09
1,2,3,7,8-PeCDF	*	3E-11	7E-11	8E-11	1E-10	2E-10	3E-10	7E-10	1E-09
2,3,4,7,8-PeCDF	*	2E-10	5E-10	5E-10	8E-10	1E-09	2E-09	4E-09	8E-09
1,2,3,6,7,8-HxCDF	1E-11	1E-11	3E-11	4E-11	6E-11	8E-11	2E-10	4E-10	1E-09
2,3,4,6,7,8-HxCDF	5E-12	8E-12	2E-11	2E-11	3E-11	5E-11	1E-10	2E-10	6E-10
1,2,3,4,7,8-HxCDF	2E-11	3E-11	7E-11	9E-11	1E-10	2E-10	5E-10	8E-10	2E-09
1,2,3,7,8,9-HxCDF	*	*	8E-13	1E-12	1E-12	4E-12	5E-12	1E-11	3E-11
1,2,3,4,6,7,8-HpCDF	*	3E-12	4E-12	5E-12	7E-12	1E-11	2E-11	5E-11	1E-10
1,2,3,4,7,8,9-HpCDF	*	*	5E-13	8E-13	9E-13	2E-12	3E-12	7E-12	2E-11
1,2,3,4,6,7,8,9-OCDF	*	1E-12	1E-12	2E-12	2E-12	4E-12	8E-12	2E-11	6E-11
2,3,7,8-TCDD-TEQ	7E-11	1E-10	3E-10	3E-10	5E-10	7E-10	1E-09	3E-09	5E-09

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

[a] Confidence intervals are not applicable since all the lightweight aggregate kilns in the population were sampled with certainty.

All concentration values <10 have been rounded to one significant digit

Table H-C3. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	3E-15	*(3E-15, 2E-14)*	9E-15	*(6E-15, 8E-14)*	7E-14	*(1E-14, 9E-14)*	1E-13	*(8E-14, 3E-13)*	4E-13	*(2E-13, 6E-13)*	1E-12	*(4E-13, 3E-12)*	5E-12	*(2E-12, 8E-12)*	9E-12	*(4E-12, 1E-11)*	2E-11	*
1,2,3,7,8-PeCDD	8E-15	*(8E-15, 5E-14)*	3E-14	*(2E-14, 5E-13)*	3E-13	*(3E-14, 5E-13)*	5E-13	*(5E-13, 1E-12)*	2E-12	*(9E-13, 4E-12)*	6E-12	*(3E-12, 1E-11)*	2E-11	*(9E-12, 3E-11)*	3E-11	*(2E-11, 5E-11)*	1E-10	*(7E-11, 2E-10)*
1,2,3,7,8,9-HxCDD	6E-15	*(5E-15, 2E-14)*	2E-14	*(1E-14, 2E-13)*	1E-13	*(2E-14, 2E-13)*	2E-13	*(2E-13, 8E-13)*	8E-13	*(2E-13, 2E-12)*	3E-12	*(1E-12, 5E-12)*	8E-12	*(4E-12, 1E-11)*	2E-11	*(7E-12, 4E-11)*	7E-11	*(5E-11, 1E-10)*
1,2,3,4,7,8-HxCDD	*	*	7E-15	*	3E-14	*(7E-15, 3E-13)*	3E-13	*(3E-13, 5E-13)*	1E-12	*(5E-13, 2E-12)*	3E-12	*(2E-12, 5E-12)*	7E-12	*(4E-12, 1E-11)*	2E-11	*(8E-12, 3E-11)*	6E-11	*(4E-11, 1E-10)*
1,2,3,6,7,8-HxCDD	*	*	4E-15	*	2E-14	*(4E-15, 2E-13)*	3E-13	*(2E-13, 4E-13)*	9E-13	*(3E-13, 1E-12)*	2E-12	*(1E-12, 4E-12)*	7E-12	*(4E-12, 1E-11)*	2E-11	*(7E-12, 3E-11)*	8E-11	*(5E-11, 1E-10)*
1,2,3,6,7,8,9-HpCDD	7E-16	*(6E-16, 7E-15)*	2E-15	*(1E-15, 4E-14)*	4E-14	*(2E-15, 4E-14)*	6E-14	*(4E-14, 7E-13)*	7E-13	*(7E-14, 2E-12)*	3E-12	*(8E-13, 7E-12)*	1E-11	*(4E-12, 2E-11)*	3E-11	*(1E-11, 5E-11)*	1E-10	*(8E-11, 2E-10)*
1,2,3,4,5,7,8,9-OCDD	3E-15	*(3E-15, 2E-14)*	1E-14	*(6E-15, 1E-13)*	1E-13	*(1E-14, 2E-13)*	2E-13	*(1E-13, 2E-12)*	2E-12	*(2E-13, 7E-12)*	9E-12	*(3E-12, 2E-11)*	3E-11	*(1E-11, 6E-11)*	8E-11	*(3E-11, 1E-10)*	3E-10	*(2E-10, 4E-10)*
2,3,7,8-TCDF	8E-15	*(8E-15, 2E-14)*	2E-14	*(1E-14, 4E-14)*	4E-14	*(2E-14, 6E-14)*	6E-14	*(4E-14, 1E-13)*	2E-13	*(8E-14, 7E-13)*	2E-12	*(2E-13, 3E-11)*	4E-11	*(2E-12, 6E-11)*	7E-11	*(3E-11, 9E-11)*	2E-10	*(8E-11, 3E-10)*
1,2,3,7,8-PeCDF	8E-15	*	2E-14	*(1E-14, 3E-13)*	3E-13	*(3E-14, 3E-13)*	5E-13	*(3E-13, 2E-12)*	2E-12	*(6E-13, 3E-12)*	8E-12	*(2E-12, 5E-11)*	8E-11	*(1E-11, 1E-10)*	1E-10	*(5E-11, 2E-10)*	5E-10	*
2,3,4,7,8-PeCDF	2E-14	*	5E-14	*(3E-14, 1E-12)*	1E-12	*(7E-14, 1E-12)*	2E-12	*(1E-12, 8E-12)*	9E-12	*(3E-12, 2E-11)*	4E-11	*(1E-11, 5E-10)*	7E-10	*(6E-11, 1E-09)*	1E-09	*(5E-10, 2E-09)*	3E-09	*(2E-09, 5E-09)*
1,2,3,6,7,8-HxCDF	*	*	3E-15	*	2E-14	*(3E-15, 2E-13)*	3E-13	*(2E-13, 1E-12)*	1E-12	*(3E-13, 3E-12)*	6E-12	*(1E-12, 3E-11)*	6E-11	*(1E-11, 9E-11)*	1E-10	*(5E-11, 2E-10)*	5E-10	*(3E-10, 8E-10)*
2,3,4,6,7,8-HxCDF	2E-15	*(1E-15, 3E-14)*	6E-15	*(3E-15, 2E-13)*	2E-13	*(6E-15, 2E-13)*	3E-13	*(2E-13, 1E-12)*	1E-12	*(3E-13, 3E-12)*	7E-12	*(2E-12, 2E-11)*	5E-11	*(1E-11, 7E-11)*	1E-10	*(3E-11, 2E-10)*	4E-10	*(3E-10, 6E-10)*
1,2,3,4,7,8-HxCDF	*	*	2E-15	*	2E-14	*(3E-15, 2E-13)*	3E-13	*(2E-13, 1E-12)*	2E-12	*(3E-13, 6E-12)*	1E-11	*(2E-12, 7E-11)*	2E-10	*(2E-11, 3E-10)*	3E-10	*(1E-10, 7E-10)*	2E-09	*(8E-10, 3E-09)*
1,2,3,7,8,9-HxCDF	2E-15	*(2E-15, 9E-15)*	7E-15	*(4E-15, 2E-13)*	6E-14	*(8E-15, 2E-13)*	2E-13	*(2E-13, 3E-13)*	3E-13	*(3E-13, 1E-12)*	3E-12	*(1E-12, 8E-12)*	2E-11	*(4E-12, 4E-11)*	4E-11	*(1E-11, 8E-11)*	1E-10	*(7E-11, 2E-10)*
1,2,3,4,6,7,8-HpCDF	4E-16	*	2E-15	*(8E-16, 8E-14)*	8E-14	*(2E-15, 8E-14)*	1E-13	*(8E-14, 3E-13)*	4E-13	*(1E-13, 2E-12)*	5E-12	*(5E-13, 2E-11)*	3E-11	*(7E-12, 5E-11)*	6E-11	*(2E-11, 1E-10)*	5E-10	*
1,2,3,4,7,8,9-HpCDF	5E-16	*(4E-16, 6E-15)*	2E-15	*(8E-16, 1E-13)*	4E-14	*(2E-15, 1E-13)*	1E-13	*(1E-13, 2E-13)*	2E-13	*(2E-13, 9E-13)*	2E-12	*(6E-13, 6E-12)*	9E-12	*(3E-12, 2E-11)*	2E-11	*(7E-12, 4E-11)*	1E-10	*(5E-11, 1E-10)*
1,2,3,4,6,7,8,9-OCDF	8E-16	*(7E-16, 2E-14)*	3E-15	*(1E-15, 2E-13)*	2E-13	*(3E-15, 2E-13)*	3E-13	*(2E-13, 5E-13)*	7E-13	*(3E-13, 1E-12)*	4E-12	*(1E-12, 1E-11)*	1E-11	*(6E-12, 3E-11)*	4E-11	*(1E-11, 1E-10)*	5E-10	*(2E-10, 6E-10)*
2,3,7,8-TCDD-TEQ	2E-14	*(2E-14, 3E-13)*	7E-14	*(4E-14, 1E-12)*	1E-12	*(1E-13, 1E-12)*	2E-12	*(1E-12, 8E-12)*	8E-12	*(3E-12, 2E-11)*	3E-11	*(1E-11, 3E-10)*	4E-10	*(5E-11, 6E-10)*	7E-10	*(3E-10, 1E-09)*	2E-09	*(1E-09, 3E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C4. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	2E-13	*(4E-14, 2E-12)*	3E-13	*(2E-13, 3E-12)*	3E-12	*(4E-13, 4E-12)*	4E-12	*(3E-12, 5E-12)*	6E-12	*(5E-12, 8E-12)*	1E-11	*(1E-11, 2E-11)*	2E-11	*(2E-11, 2E-11)*	5E-11	*(3E-11, 7E-11)*
1,2,3,7,8-PeCDD	*	*	4E-13	*(4E-14, 7E-12)*	5E-13	*(3E-13, 9E-12)*	9E-12	*(6E-13, 2E-11)*	2E-11	*(1E-11, 2E-11)*	3E-11	*(2E-11, 4E-11)*	6E-11	*(5E-11, 8E-11)*	1E-10	*(8E-11, 2E-10)*	3E-10	*(3E-10, 3E-10)*
1,2,3,7,8,9-HxCDD	*	*	3E-13	*(2E-14, 2E-12)*	4E-13	*(3E-13, 3E-12)*	3E-12	*(5E-13, 4E-12)*	4E-12	*(3E-12, 4E-12)*	9E-12	*(5E-12, 1E-11)*	4E-11	*(1E-11, 6E-11)*	6E-11	*(3E-11, 9E-11)*	2E-10	*(6E-11, 2E-10)*
1,2,3,4,7,8-HxCDD	*	*	6E-13	*(8E-14, 3E-12)*	1E-12	*(6E-13, 4E-12)*	4E-12	*(1E-12, 4E-12)*	5E-12	*(4E-12, 5E-12)*	1E-11	*(7E-12, 1E-11)*	4E-11	*(1E-11, 5E-11)*	6E-11	*(4E-11, 8E-11)*	1E-10	*(9E-11, 2E-10)*
1,2,3,6,7,8-HxCDD	*	*	4E-13	*(3E-14, 2E-12)*	6E-13	*(4E-13, 2E-12)*	2E-12	*(7E-13, 6E-12)*	6E-12	*(2E-12, 7E-12)*	1E-11	*(5E-12, 2E-11)*	5E-11	*(2E-11, 7E-11)*	7E-11	*(3E-11, 1E-10)*	2E-10	*(9E-11, 3E-10)*
1,2,3,6,7,8,9-HpCDD	*	*	6E-13	*(5E-14, 3E-12)*	9E-13	*(6E-13, 3E-12)*	3E-12	*(1E-12, 7E-12)*	7E-12	*(3E-12, 8E-12)*	1E-11	*(9E-12, 2E-11)*	5E-11	*(2E-11, 9E-11)*	9E-11	*(4E-11, 1E-10)*	3E-10	*(1E-10, 4E-10)*
1,2,3,4,5,7,8,9-OCDD	*	*	4E-12	*(2E-13, 7E-12)*	6E-12	*(4E-12, 7E-12)*	7E-12	*(7E-12, 2E-11)*	2E-11	*(8E-12, 2E-11)*	3E-11	*(2E-11, 6E-11)*	8E-11	*(6E-11, 1E-10)*	2E-10	*(8E-11, 2E-10)*	5E-10	*(3E-10, 5E-10)*
2,3,7,8-TCDF	*	*	9E-13	*(2E-13, 1E-11)*	2E-12	*(9E-13, 3E-11)*	2E-11	*(2E-12, 3E-11)*	4E-11	*(3E-11, 5E-11)*	7E-11	*(5E-11, 7E-11)*	1E-10	*(8E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	5E-10	*(3E-10, 5E-10)*
1,2,3,7,8-PeCDF	*	*	2E-12	*(3E-13, 4E-11)*	3E-12	*(2E-12, 6E-11)*	5E-11	*(3E-12, 7E-11)*	8E-11	*(7E-11, 1E-10)*	1E-10	*(9E-11, 2E-10)*	2E-10	*(2E-10, 3E-10)*	4E-10	*(3E-10, 5E-10)*	9E-10	*(7E-10, 1E-09)*
2,3,4,7,8-PeCDF	1E-12	*(1E-12, 2E-11)*	2E-11	*(3E-12, 4E-10)*	3E-11	*(2E-11, 5E-10)*	5E-10	*(3E-11, 6E-10)*	7E-10	*(6E-10, 8E-10)*	1E-09	*(1E-09, 1E-09)*	2E-09	*(2E-09, 2E-09)*	3E-09	*(3E-09, 4E-09)*	9E-09	*(6E-09, 9E-09)*
1,2,3,6,7,8-HxCDF	*	*	7E-13	*(5E-14, 3E-11)*	1E-12	*(7E-13, 3E-11)*	3E-11	*(1E-12, 5E-11)*	6E-11	*(3E-11, 6E-11)*	7E-11	*(6E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	4E-10	*(3E-10, 5E-10)*	9E-10	*(7E-10, 2E-09)*
2,3,4,6,7,8-HxCDF	*	*	7E-13	*(7E-14, 1E-11)*	1E-12	*(4E-13, 1E-11)*	1E-11	*(1E-12, 3E-11)*	4E-11	*(1E-11, 5E-11)*	6E-11	*(5E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	3E-10	*(2E-10, 5E-10)*	8E-10	*(6E-10, 1E-09)*
1,2,3,4,7,8-HxCDF	*	*	2E-12	*(2E-13, 7E-11)*	3E-12	*(1E-12, 7E-11)*	7E-11	*(4E-12, 1E-10)*	1E-10	*(7E-11, 2E-10)*	2E-10	*(2E-10, 3E-10)*	7E-10	*(3E-10, 9E-10)*	1E-09	*(8E-10, 2E-09)*	4E-09	*(3E-09, 4E-09)*
1,2,3,7,8,9-HxCDF	*	*	9E-14	*(7E-15, 3E-12)*	1E-13	*(9E-14, 5E-12)*	5E-12	*(3E-13, 6E-12)*	1E-11	*(5E-12, 4E-11)*	4E-11	*(1E-11, 6E-11)*	7E-11	*(4E-11, 1E-10)*	1E-10	*(6E-11, 2E-10)*	5E-10	*(2E-10, 8E-10)*
1,2,3,4,6,7,8-HpCDF	*	*	2E-13	*(2E-14, 1E-11)*	3E-13	*(2E-13, 2E-11)*	2E-11	*(4E-13, 2E-11)*	2E-11	*(2E-11, 2E-11)*	4E-11	*(2E-11, 5E-11)*	7E-11	*(5E-11, 9E-11)*	2E-10	*(1E-10, 2E-10)*	4E-10	*(3E-10, 7E-10)*
1,2,3,4,7,8,9-HpCDF	*	*	6E-14	*(4E-15, 4E-12)*	9E-14	*(5E-14, 6E-12)*	6E-12	*(2E-13, 6E-12)*	7E-12	*(6E-12, 7E-12)*	9E-12	*(9E-12, 1E-11)*	2E-11	*(2E-11, 3E-11)*	5E-11	*(3E-11, 6E-11)*	1E-10	*(1E-10, 2E-10)*
1,2,3,4,6,7,8,9-OCDF	*	*	1E-12	*(9E-14, 8E-12)*	2E-12	*(4E-13, 8E-12)*	8E-12	*(2E-12, 1E-11)*	1E-11	*(9E-12, 1E-11)*	2E-11	*(1E-11, 3E-11)*	5E-11	*(3E-11, 5E-11)*	1E-10	*(7E-11, 1E-10)*	3E-10	*(2E-10, 4E-10)*
2,3,7,8-TCDD-TEQ	*	*	9E-12	*(2E-12, 2E-10)*	1E-11	*(9E-12, 3E-10)*	3E-10	*(2E-11, 4E-10)*	4E-10	*(4E-10, 5E-10)*	6E-10	*(6E-10, 7E-10)*	1E-09	*(1E-09, 1E-09)*	2E-09	*(2E-09, 3E-09)*	5E-09	*(4E-09, 6E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C5. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	9E-14 *	2E-13 *(2E-13, 4E-13)*	3E-13 *(3E-13, 4E-13)*	4E-13 *(4E-13, 5E-13)*	8E-13 *(5E-13, 1E-12)*	2E-12 *(8E-13, 8E-12)*	8E-12 *(1E-12, 1E-11)*	1E-11 *(3E-12, 2E-11)*	2E-11 *(5E-12, 5E-11)*	
1,2,3,7,8-PeCDD	2E-13 *	3E-13 *(2E-13, 3E-12)*	5E-13 *(2E-13, 3E-12)*	3E-12 *(5E-13, 3E-12)*	4E-12 *(3E-12, 6E-12)*	7E-12 *(6E-12, 1E-11)*	2E-11 *(7E-12, 3E-11)*	3E-11 *(1E-11, 3E-11)*	9E-11 *(3E-11, 9E-11)*	
1,2,3,7,8,9-HxCDD	2E-14 *(2E-14, 2E-13)*	1E-13 *(3E-14, 1E-12)*	2E-13 *(8E-14, 1E-12)*	1E-12 *(2E-13, 1E-12)*	1E-12 *(1E-12, 2E-12)*	3E-12 *(2E-12, 4E-12)*	1E-11 *(3E-12, 2E-11)*	2E-11 *(6E-12, 4E-11)*	1E-10 *(4E-11, 1E-10)*	
1,2,3,4,7,8-HxCDD	* *	* *	* *	4E-13 *	2E-12 *(4E-13, 2E-12)*	3E-12 *(2E-12, 4E-12)*	1E-11 *(4E-12, 2E-11)*	2E-11 *(5E-12, 4E-11)*	8E-11 *(4E-11, 1E-10)*	
1,2,3,6,7,8-HxCDD	* *	* *	* *	3E-13 *	1E-12 *(3E-13, 1E-12)*	2E-12 *(2E-12, 3E-12)*	8E-12 *(3E-12, 2E-11)*	2E-11 *(3E-12, 4E-11)*	7E-11 *(4E-11, 1E-10)*	
1,2,3,6,7,8,9-HpCDD	8E-14 *	2E-13 *(2E-13, 6E-13)*	5E-13 *(2E-13, 6E-13)*	7E-13 *(5E-13, 7E-13)*	1E-12 *(8E-13, 2E-12)*	3E-12 *(1E-12, 6E-12)*	1E-11 *(2E-12, 4E-11)*	4E-11 *(6E-12, 8E-11)*	2E-10 *(8E-11, 3E-10)*	
1,2,3,4,5,7,8,9-OCDD	5E-13 *	1E-12 *(9E-13, 2E-12)*	2E-12 *(1E-12, 2E-12)*	2E-12 *(2E-12, 2E-12)*	4E-12 *(3E-12, 7E-12)*	1E-11 *(4E-12, 3E-11)*	6E-11 *(7E-12, 1E-10)*	1E-10 *(2E-11, 3E-10)*	6E-10 *(3E-10, 1E-09)*	
2,3,7,8-TCDF	4E-14 *	7E-14 *(5E-14, 9E-14)*	9E-14 *(7E-14, 1E-13)*	1E-13 *(1E-13, 1E-13)*	2E-13 *(1E-13, 4E-13)*	9E-13 *(2E-13, 2E-12)*	3E-12 *(3E-13, 2E-11)*	3E-11 *(1E-12, 5E-11)*	1E-10 *(5E-11, 1E-10)*	
1,2,3,7,8-PeCDF	2E-13 *	3E-13 *(2E-13, 2E-12)*	6E-13 *(3E-13, 2E-12)*	2E-12 *(6E-13, 2E-12)*	2E-12 *(2E-12, 3E-12)*	6E-12 *(3E-12, 1E-11)*	3E-11 *(4E-12, 5E-11)*	5E-11 *(7E-12, 1E-10)*	2E-10 *(1E-10, 2E-10)*	
2,3,4,7,8-PeCDF	5E-13 *(5E-13, 8E-12)*	2E-12 *(7E-13, 8E-12)*	3E-12 *(2E-12, 8E-12)*	8E-12 *(4E-12, 9E-12)*	1E-11 *(9E-12, 2E-11)*	3E-11 *(2E-11, 6E-11)*	9E-11 *(2E-11, 4E-10)*	4E-10 *(3E-11, 9E-10)*	2E-09 *(9E-10, 2E-09)*	
1,2,3,6,7,8-HxCDF	* *	* *	* *	1E-12 *	1E-12 *(1E-12, 1E-12)*	3E-12 *(2E-12, 5E-12)*	1E-11 *(3E-12, 2E-10)*	2E-10 *(6E-12, 3E-10)*	7E-10 *(3E-10, 1E-09)*	
2,3,4,6,7,8-HxCDF	5E-14 *(4E-14, 1E-12)*	6E-13 *(6E-14, 1E-12)*	1E-12 *(5E-13, 1E-12)*	1E-12 *(1E-12, 2E-12)*	3E-12 *(2E-12, 3E-12)*	5E-12 *(3E-12, 1E-11)*	2E-11 *(5E-12, 1E-10)*	1E-10 *(1E-11, 3E-10)*	5E-10 *(3E-10, 9E-10)*	
1,2,3,4,7,8-HxCDF	* *	* *	* *	1E-12 *	2E-12 *(1E-12, 2E-12)*	3E-12 *(3E-12, 6E-12)*	2E-11 *(4E-12, 4E-10)*	4E-10 *(8E-12, 8E-10)*	2E-09 *(8E-10, 2E-09)*	
1,2,3,7,8,9-HxCDF	4E-14 *(4E-14, 3E-13)*	1E-13 *(5E-14, 1E-12)*	3E-13 *(8E-14, 1E-12)*	1E-12 *(3E-13, 1E-12)*	1E-12 *(1E-12, 2E-12)*	3E-12 *(2E-12, 6E-12)*	1E-11 *(3E-12, 4E-11)*	4E-11 *(6E-12, 8E-11)*	1E-10 *(8E-11, 3E-10)*	
1,2,3,4,6,7,8-HpCDF	8E-14 *	1E-13 *	2E-13 *(1E-13, 2E-13)*	2E-13 *(2E-13, 4E-13)*	5E-13 *(3E-13, 2E-12)*	4E-12 *(5E-13, 8E-12)*	2E-11 *(1E-12, 2E-10)*	2E-10 *(5E-12, 4E-10)*	9E-10 *(4E-10, 1E-09)*	
1,2,3,4,7,8,9-HpCDF	2E-14 *(1E-14, 2E-13)*	5E-14 *(2E-14, 7E-13)*	2E-13 *(3E-14, 8E-13)*	7E-13 *(2E-13, 9E-13)*	1E-12 *(8E-13, 2E-12)*	2E-12 *(2E-12, 3E-12)*	8E-12 *(2E-12, 5E-11)*	5E-11 *(4E-12, 1E-10)*	2E-10 *(1E-10, 3E-10)*	
1,2,3,4,6,7,8,9-OCDF	7E-14 *	2E-13 *(9E-14, 4E-13)*	4E-13 *(1E-13, 4E-13)*	5E-13 *(4E-13, 5E-13)*	8E-13 *(5E-13, 2E-12)*	3E-12 *(8E-13, 1E-11)*	1E-11 *(2E-12, 2E-10)*	2E-10 *(7E-12, 6E-10)*	1E-09 *(6E-10, 2E-09)*	
2,3,7,8-TCDD-TEQ	6E-13 *	2E-12 *(7E-13, 8E-12)*	3E-12 *(2E-12, 8E-12)*	8E-12 *(3E-12, 9E-12)*	1E-11 *(9E-12, 2E-11)*	3E-11 *(2E-11, 6E-11)*	9E-11 *(2E-11, 3E-10)*	3E-10 *(4E-11, 6E-10)*	1E-09 *(6E-10, 2E-09)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C6. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	3E-15 *(3E-15, 8E-14)*	7E-15 *(4E-15, 8E-14)*	2E-14 *(6E-15, 8E-14)*	8E-14 *(5E-14, 1E-13)*	2E-13 *(1E-13, 2E-13)*	4E-13 *(2E-13, 6E-13)*	9E-13 *(5E-13, 2E-12)*	2E-12 *(9E-13, 3E-12)*	6E-12 *(1E-12, 7E-12)*	
1,2,3,7,8-PeCDD	8E-15 *(7E-15, 5E-13)*	2E-14 *(1E-14, 5E-13)*	4E-14 *(2E-14, 5E-13)*	5E-13 *(2E-13, 8E-13)*	9E-13 *(8E-13, 2E-12)*	2E-12 *(1E-12, 4E-12)*	6E-12 *(3E-12, 1E-11)*	1E-11 *(6E-12, 2E-11)*	4E-11 *(1E-11, 5E-11)*	
1,2,3,7,8,9-HxCDD	5E-15 *	1E-14 *	2E-14 *	2E-13 *(9E-14, 2E-13)*	2E-13 *(2E-13, 2E-12)*	2E-12 *(2E-13, 3E-12)*	5E-12 *(8E-13, 8E-12)*	8E-12 *(1E-12, 2E-11)*	3E-11 *	
1,2,3,4,7,8-HxCDD	4E-15 *(3E-15, 3E-13)*	9E-15 *(6E-15, 3E-13)*	2E-14 *(8E-15, 3E-13)*	3E-13 *(1E-13, 5E-13)*	5E-13 *(5E-13, 1E-12)*	1E-12 *(6E-13, 2E-12)*	4E-12 *(2E-12, 5E-12)*	6E-12 *(4E-12, 1E-11)*	2E-11 *(7E-12, 3E-11)*	
1,2,3,6,7,8-HxCDD	2E-15 *	5E-15 *	1E-14 *	2E-13 *(7E-14, 3E-13)*	3E-13 *(3E-13, 1E-12)*	1E-12 *(3E-13, 2E-12)*	4E-12 *(1E-12, 5E-12)*	5E-12 *(1E-12, 1E-11)*	2E-11 *(5E-12, 3E-11)*	
1,2,3,6,7,8,9-HpCDD	5E-16 *	1E-15 *	3E-15 *	4E-14 *(2E-14, 6E-14)*	7E-14 *(6E-14, 1E-12)*	1E-12 *(7E-14, 5E-12)*	6E-12 *(4E-13, 9E-12)*	9E-12 *(8E-13, 2E-11)*	3E-11 *	
1,2,3,4,5,7,8,9-OCDD	2E-15 *	6E-15 *	1E-14 *	1E-13 *(6E-14, 2E-13)*	2E-13 *(2E-13, 4E-12)*	4E-12 *(2E-13, 1E-11)*	2E-11 *(9E-13, 2E-11)*	2E-11 *(2E-12, 6E-11)*	1E-10 *	
2,3,7,8-TCDF	8E-15 *	1E-14 *	3E-14 *	4E-14 *(4E-14, 6E-14)*	8E-14 *(6E-14, 5E-13)*	5E-13 *(8E-14, 1E-12)*	2E-12 *(2E-13, 2E-11)*	2E-11 *(4E-13, 5E-11)*	9E-11 *	
1,2,3,7,8-PeCDF	* *	2E-14 *	4E-14 *	3E-13 *(1E-13, 5E-13)*	6E-13 *(5E-13, 2E-12)*	3E-12 *(6E-13, 5E-12)*	8E-12 *(2E-12, 3E-11)*	3E-11 *(3E-12, 6E-11)*	1E-10 *(1E-11, 5E-09)*	
2,3,4,7,8-PeCDF	* *	4E-14 *	9E-14 *	1E-12 *(6E-13, 2E-12)*	2E-12 *(2E-12, 1E-11)*	1E-11 *(2E-12, 4E-11)*	5E-11 *(6E-12, 2E-10)*	2E-10 *(1E-11, 7E-10)*	1E-09 *(7E-11, 9E-09)*	
1,2,3,6,7,8-HxCDF	* *	4E-15 *	1E-14 *	2E-13 *(6E-14, 3E-13)*	3E-13 *(3E-13, 3E-12)*	3E-12 *(3E-13, 6E-12)*	1E-11 *(1E-12, 3E-11)*	3E-11 *(2E-12, 5E-11)*	1E-10 *(2E-11, 6E-09)*	
2,3,4,6,7,8-HxCDF	1E-15 *(1E-15, 2E-13)*	3E-15 *(2E-15, 2E-13)*	8E-15 *(3E-15, 2E-13)*	2E-13 *(7E-14, 3E-13)*	3E-13 *(3E-13, 3E-12)*	3E-12 *(3E-13, 7E-12)*	1E-11 *(9E-13, 3E-11)*	3E-11 *(2E-12, 4E-11)*	1E-10 *	
1,2,3,4,7,8-HxCDF	* *	3E-15 *	8E-15 *	2E-13 *(8E-14, 3E-13)*	3E-13 *(3E-13, 6E-12)*	5E-12 *(3E-13, 2E-11)*	2E-11 *(1E-12, 7E-11)*	7E-11 *(3E-12, 1E-10)*	3E-10 *(4E-12, 1E-08)*	
1,2,3,7,8,9-HxCDF	2E-15 *(1E-15, 1E-13)*	4E-15 *(3E-15, 2E-13)*	1E-14 *(4E-15, 2E-13)*	2E-13 *(5E-14, 2E-13)*	3E-13 *(2E-13, 3E-13)*	5E-13 *(3E-13, 1E-12)*	3E-12 *(1E-12, 1E-11)*	1E-11 *(2E-12, 3E-11)*	4E-11 *(5E-12, 2E-10)*	
1,2,3,4,6,7,8-HpCDF	* *	8E-16 *	2E-15 *	8E-14 *(3E-14, 1E-13)*	1E-13 *(1E-13, 2E-12)*	2E-12 *(1E-13, 4E-12)*	6E-12 *(4E-13, 4E-11)*	3E-11 *(8E-13, 7E-11)*	1E-10 *(2E-12, 5E-09)*	
1,2,3,4,7,8,9-HpCDF	4E-16 *(4E-16, 8E-14)*	9E-16 *(7E-16, 1E-13)*	2E-15 *(8E-16, 1E-13)*	1E-13 *(3E-14, 1E-13)*	2E-13 *(1E-13, 2E-13)*	4E-13 *(2E-13, 6E-13)*	2E-12 *(6E-13, 1E-11)*	8E-12 *(2E-12, 1E-11)*	4E-11 *(3E-12, 2E-10)*	
1,2,3,4,6,7,8,9-OCDF	6E-16 *(5E-16, 2E-13)*	2E-15 *(1E-15, 2E-13)*	4E-15 *(1E-15, 2E-13)*	2E-13 *(5E-14, 3E-13)*	3E-13 *(3E-13, 7E-13)*	9E-13 *(4E-13, 2E-12)*	4E-12 *(1E-12, 3E-11)*	2E-11 *(4E-12, 4E-11)*	1E-10 *	
2,3,7,8-TCDD-TEQ	2E-14 *	5E-14 *	1E-13 *	1E-12 *(6E-13, 2E-12)*	3E-12 *(2E-12, 1E-11)*	1E-11 *(3E-12, 2E-11)*	4E-11 *(7E-12, 1E-10)*	1E-10 *(1E-11, 4E-10)*	8E-10 *	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C7. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: Waste Heat Boilers

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	3E-13 *(2E-13, 7E-13)*	6E-13 *(4E-13, 2E-12)*	7E-13 *(6E-13, 2E-12)*	2E-12 *(9E-13, 3E-12)*	3E-12 *(2E-12, 3E-12)*	4E-12 *(3E-12, 4E-12)*	7E-12 *(6E-12, 7E-12)*	1E-11 *(8E-12, 1E-11)*	3E-11 *(2E-11, 3E-11)*
1,2,3,7,8-PeCDD	8E-13 *(7E-13, 4E-12)*	3E-12 *(1E-12, 8E-12)*	5E-12 *(3E-12, 2E-11)*	1E-11 *(6E-12, 2E-11)*	2E-11 *(2E-11, 2E-11)*	3E-11 *(3E-11, 3E-11)*	5E-11 *(4E-11, 5E-11)*	8E-11 *(6E-11, 9E-11)*	3E-10 *(2E-10, 3E-10)*
1,2,3,7,8,9-HxCDD	3E-13 *(3E-13, 2E-12)*	7E-13 *(4E-13, 3E-12)*	2E-12 *(7E-13, 4E-12)*	4E-12 *(2E-12, 4E-12)*	4E-12 *(4E-12, 6E-12)*	1E-11 *(6E-12, 2E-11)*	4E-11 *(2E-11, 4E-11)*	5E-11 *(4E-11, 6E-11)*	1E-10 *(1E-10, 1E-10)*
1,2,3,4,7,8-HxCDD	4E-13 *(4E-13, 3E-12)*	1E-12 *(6E-13, 4E-12)*	3E-12 *(1E-12, 4E-12)*	4E-12 *(4E-12, 5E-12)*	5E-12 *(5E-12, 7E-12)*	1E-11 *(7E-12, 2E-11)*	4E-11 *(2E-11, 4E-11)*	5E-11 *(4E-11, 5E-11)*	1E-10 *(1E-10, 1E-10)*
1,2,3,6,7,8-HxCDD	3E-13 *(3E-13, 3E-12)*	1E-12 *(5E-13, 4E-12)*	4E-12 *(1E-12, 5E-12)*	5E-12 *(4E-12, 7E-12)*	7E-12 *(6E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	4E-11 *(2E-11, 4E-11)*	6E-11 *(4E-11, 8E-11)*	1E-10 *(1E-10, 1E-10)*
1,2,3,6,7,8,9-HpCDD	1E-12 *(1E-12, 3E-12)*	1E-12 *(1E-12, 5E-12)*	3E-12 *(1E-12, 6E-12)*	6E-12 *(5E-12, 7E-12)*	8E-12 *(7E-12, 1E-11)*	2E-11 *(1E-11, 3E-11)*	8E-11 *(4E-11, 8E-11)*	9E-11 *(9E-11, 1E-10)*	3E-10 *(3E-10, 3E-10)*
1,2,3,4,5,7,8,9-OCDD	1E-12 *(1E-12, 8E-12)*	4E-12 *(2E-12, 1E-11)*	8E-12 *(5E-12, 2E-11)*	2E-11 *(1E-11, 2E-11)*	2E-11 *(2E-11, 3E-11)*	6E-11 *(3E-11, 1E-10)*	3E-10 *(1E-10, 3E-10)*	3E-10 *(3E-10, 4E-10)*	1E-09 *(1E-09, 1E-09)*
2,3,7,8-TCDF	1E-12 *(9E-13, 1E-11)*	3E-12 *(2E-12, 2E-11)*	1E-11 *(3E-12, 3E-11)*	3E-11 *(1E-11, 5E-11)*	5E-11 *(3E-11, 5E-11)*	7E-11 *(5E-11, 7E-11)*	1E-10 *(1E-10, 1E-10)*	2E-10 *(1E-10, 2E-10)*	5E-10 *(3E-10, 5E-10)*
1,2,3,7,8-PeCDF	4E-12 *(4E-12, 2E-11)*	2E-11 *(8E-12, 4E-11)*	2E-11 *(2E-11, 5E-11)*	5E-11 *(3E-11, 6E-11)*	7E-11 *(5E-11, 7E-11)*	1E-10 *(9E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*	4E-10 *(2E-10, 8E-10)*	1E-09 *(4E-10, 2E-09)*
2,3,4,7,8-PeCDF	2E-11 *(1E-11, 2E-10)*	9E-11 *(3E-11, 4E-10)*	2E-10 *(6E-11, 5E-10)*	4E-10 *(2E-10, 7E-10)*	8E-10 *(5E-10, 8E-10)*	1E-09 *(9E-10, 1E-09)*	2E-09 *(2E-09, 2E-09)*	3E-09 *(2E-09, 3E-09)*	9E-09 *(6E-09, 9E-09)*
1,2,3,6,7,8-HxCDF	2E-12 *(2E-12, 2E-11)*	9E-12 *(3E-12, 3E-11)*	2E-11 *(7E-12, 3E-11)*	3E-11 *(2E-11, 3E-11)*	4E-11 *(3E-11, 5E-11)*	1E-10 *(7E-11, 2E-10)*	4E-10 *(2E-10, 4E-10)*	5E-10 *(4E-10, 7E-10)*	2E-09 *(1E-09, 2E-09)*
2,3,4,6,7,8-HxCDF	2E-12 *(1E-12, 8E-12)*	7E-12 *(3E-12, 1E-11)*	1E-11 *(6E-12, 1E-11)*	1E-11 *(1E-11, 1E-11)*	2E-11 *(2E-11, 3E-11)*	5E-11 *(4E-11, 1E-10)*	3E-10 *(1E-10, 3E-10)*	3E-10 *(3E-10, 4E-10)*	1E-09 *(9E-10, 1E-09)*
1,2,3,4,7,8-HxCDF	2E-12 *(2E-12, 4E-11)*	9E-12 *(3E-12, 7E-11)*	4E-11 *(7E-12, 7E-11)*	7E-11 *(5E-11, 7E-11)*	8E-11 *(7E-11, 1E-10)*	2E-10 *(1E-10, 4E-10)*	8E-10 *(4E-10, 1E-09)*	1E-09 *(8E-10, 2E-09)*	3E-09 *(3E-09, 4E-09)*
1,2,3,7,8,9-HxCDF	7E-13 *(6E-13, 9E-12)*	3E-12 *(1E-12, 2E-11)*	9E-12 *(3E-12, 3E-11)*	2E-11 *(9E-12, 4E-11)*	4E-11 *(3E-11, 4E-11)*	7E-11 *(5E-11, 8E-11)*	1E-10 *(1E-10, 1E-10)*	2E-10 *(1E-10, 3E-10)*	8E-10 *(5E-10, 8E-10)*
1,2,3,4,6,7,8-HpCDF	7E-13 *(6E-13, 9E-12)*	3E-12 *(1E-12, 2E-11)*	1E-11 *(2E-12, 2E-11)*	2E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 5E-11)*	7E-11 *(5E-11, 2E-10)*	4E-10 *(2E-10, 5E-10)*	6E-10 *(4E-10, 7E-10)*	1E-09 *(1E-09, 2E-09)*
1,2,3,4,7,8,9-HpCDF	2E-13 *	1E-12 *(3E-13, 5E-12)*	3E-12 *(8E-13, 6E-12)*	6E-12 *(4E-12, 6E-12)*	9E-12 *(6E-12, 1E-11)*	2E-11 *(2E-11, 5E-11)*	1E-10 *(5E-11, 1E-10)*	1E-10 *(1E-10, 1E-10)*	3E-10 *(3E-10, 4E-10)*
1,2,3,4,6,7,8,9-OCDF	3E-13 *(3E-13, 3E-12)*	1E-12 *(5E-13, 8E-12)*	4E-12 *(1E-12, 8E-12)*	8E-12 *(5E-12, 9E-12)*	1E-11 *(9E-12, 3E-11)*	5E-11 *(2E-11, 2E-10)*	3E-10 *(2E-10, 6E-10)*	6E-10 *(4E-10, 7E-10)*	2E-09 *(2E-09, 2E-09)*
2,3,7,8-TCDD-TEQ	1E-11 *(1E-11, 1E-10)*	6E-11 *(2E-11, 3E-10)*	1E-10 *(4E-11, 3E-10)*	3E-10 *(1E-10, 4E-10)*	5E-10 *(3E-10, 5E-10)*	6E-10 *(6E-10, 7E-10)*	1E-09 *(1E-09, 1E-09)*	2E-09 *(2E-09, 2E-09)*	5E-09 *(3E-09, 5E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C8. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	3E-15	*(3E-15, 2E-14)*	7E-15	*(5E-15, 8E-14)*	7E-14	*(7E-15, 8E-14)*	1E-13	*(8E-14, 2E-13)*	3E-13	*(2E-13, 5E-13)*	7E-13	*(4E-13, 2E-12)*	5E-12	*(9E-13, 8E-12)*	9E-12	*(2E-12, 1E-11)*	2E-11	*
1,2,3,7,8-PeCDD	8E-15	*(8E-15, 7E-14)*	2E-14	*(1E-14, 5E-13)*	2E-13	*(3E-14, 5E-13)*	5E-13	*(5E-13, 9E-13)*	1E-12	*(9E-13, 3E-12)*	4E-12	*(2E-12, 6E-12)*	1E-11	*(6E-12, 1E-11)*	2E-11	*(9E-12, 4E-11)*	9E-11	*(5E-11, 1E-10)*
1,2,3,7,8,9-HxCDD	5E-15	*(5E-15, 2E-14)*	1E-14	*(9E-15, 2E-13)*	4E-14	*(2E-14, 2E-13)*	2E-13	*(2E-13, 5E-13)*	7E-13	*(2E-13, 2E-12)*	2E-12	*(8E-13, 3E-12)*	5E-12	*(3E-12, 9E-12)*	1E-11	*(4E-12, 3E-11)*	6E-11	*(3E-11, 9E-11)*
1,2,3,4,7,8-HxCDD	*	*	5E-15	*	2E-14	*(7E-15, 3E-13)*	3E-13	*(2E-13, 5E-13)*	5E-13	*(5E-13, 2E-12)*	2E-12	*(1E-12, 4E-12)*	5E-12	*(3E-12, 8E-12)*	1E-11	*(5E-12, 2E-11)*	6E-11	*(3E-11, 8E-11)*
1,2,3,6,7,8-HxCDD	*	*	3E-15	*	1E-14	*(4E-15, 2E-13)*	2E-13	*(2E-13, 3E-13)*	4E-13	*(3E-13, 1E-12)*	2E-12	*(9E-13, 2E-12)*	4E-12	*(2E-12, 5E-12)*	7E-12	*(4E-12, 1E-11)*	7E-11	*(2E-11, 1E-10)*
1,2,3,6,7,8,9-HpCDD	7E-16	*(5E-16, 1E-14)*	2E-15	*(9E-16, 4E-14)*	4E-14	*(2E-15, 4E-14)*	6E-14	*(4E-14, 6E-13)*	6E-13	*(7E-14, 1E-12)*	2E-12	*(5E-13, 4E-12)*	6E-12	*(1E-12, 1E-11)*	1E-11	*(3E-12, 3E-11)*	9E-11	*
1,2,3,4,5,7,8,9-OCDD	3E-15	*(3E-15, 2E-14)*	9E-15	*(5E-15, 1E-13)*	1E-13	*(9E-15, 1E-13)*	2E-13	*(1E-13, 2E-12)*	2E-12	*(2E-13, 6E-12)*	7E-12	*(2E-12, 1E-11)*	2E-11	*(6E-12, 3E-11)*	4E-11	*(1E-11, 8E-11)*	2E-10	*(9E-11, 3E-10)*
2,3,7,8-TCDF	8E-15	*(7E-15, 2E-14)*	2E-14	*(1E-14, 4E-14)*	4E-14	*(2E-14, 4E-14)*	6E-14	*(4E-14, 1E-13)*	1E-13	*(7E-14, 4E-13)*	7E-13	*(2E-13, 2E-12)*	3E-12	*(6E-13, 3E-11)*	3E-11	*(2E-12, 5E-11)*	8E-11	*(6E-12, 2E-10)*
1,2,3,7,8-PeCDF	8E-15	*	2E-14	*(1E-14, 3E-13)*	3E-13	*(2E-14, 3E-13)*	5E-13	*(3E-13, 9E-13)*	1E-12	*(6E-13, 3E-12)*	3E-12	*(2E-12, 8E-12)*	2E-11	*(4E-12, 1E-10)*	1E-10	*(8E-12, 1E-10)*	3E-10	*
2,3,4,7,8-PeCDF	2E-14	*	4E-14	*(3E-14, 1E-12)*	1E-12	*(4E-14, 2E-12)*	2E-12	*(1E-12, 5E-12)*	6E-12	*(2E-12, 2E-11)*	2E-11	*(6E-12, 4E-11)*	9E-11	*(2E-11, 6E-10)*	6E-10	*(4E-11, 1E-09)*	2E-09	*
1,2,3,6,7,8-HxCDF	*	*	2E-15	*	8E-15	*(3E-15, 2E-13)*	2E-13	*(2E-13, 1E-12)*	1E-12	*(3E-13, 2E-12)*	3E-12	*(1E-12, 7E-12)*	2E-11	*(3E-12, 6E-11)*	6E-11	*(6E-12, 1E-10)*	2E-10	*(4E-11, 1E-09)*
2,3,4,6,7,8-HxCDF	2E-15	*(1E-15, 3E-14)*	4E-15	*(3E-15, 2E-13)*	7E-14	*(4E-15, 2E-13)*	3E-13	*(2E-13, 9E-13)*	9E-13	*(3E-13, 3E-12)*	3E-12	*(9E-13, 9E-12)*	2E-11	*(3E-12, 5E-11)*	5E-11	*(8E-12, 1E-10)*	2E-10	*(4E-11, 9E-10)*
1,2,3,4,7,8-HxCDF	*	*	2E-15	*	7E-15	*(2E-15, 2E-13)*	2E-13	*(2E-13, 1E-12)*	1E-12	*(3E-13, 3E-12)*	4E-12	*(1E-12, 1E-11)*	3E-11	*(4E-12, 2E-10)*	2E-10	*(8E-12, 4E-10)*	9E-10	*(9E-11, 4E-09)*
1,2,3,7,8,9-HxCDF	2E-15	*(2E-15, 2E-14)*	4E-15	*(3E-15, 2E-13)*	5E-14	*(6E-15, 2E-13)*	2E-13	*(8E-14, 2E-13)*	3E-13	*(3E-13, 1E-12)*	1E-12	*(6E-13, 3E-12)*	5E-12	*(2E-12, 6E-12)*	7E-12	*(4E-12, 1E-11)*	3E-11	*(1E-11, 5E-11)*
1,2,3,4,6,7,8-HpCDF	4E-16	*	1E-15	*(7E-16, 8E-14)*	8E-14	*(1E-15, 8E-14)*	1E-13	*(8E-14, 2E-13)*	3E-13	*(1E-13, 7E-13)*	2E-12	*(4E-13, 5E-12)*	1E-11	*(1E-12, 2E-11)*	2E-11	*(5E-12, 5E-11)*	9E-11	*(3E-11, 3E-10)*
1,2,3,4,7,8,9-HpCDF	4E-16	*(4E-16, 1E-14)*	1E-15	*(8E-16, 1E-13)*	2E-14	*(1E-15, 1E-13)*	1E-13	*(6E-14, 2E-13)*	2E-13	*(2E-13, 7E-13)*	9E-13	*(4E-13, 2E-12)*	4E-12	*(2E-12, 7E-12)*	7E-12	*(2E-12, 1E-11)*	3E-11	*
1,2,3,4,6,7,8,9-OCDF	8E-16	*(7E-16, 3E-14)*	2E-15	*(1E-15, 2E-13)*	1E-13	*(3E-15, 2E-13)*	2E-13	*(2E-13, 4E-13)*	5E-13	*(3E-13, 8E-13)*	1E-12	*(9E-13, 5E-12)*	1E-11	*(2E-12, 1E-11)*	1E-11	*(6E-12, 3E-11)*	7E-11	*(3E-11, 1E-10)*
2,3,7,8-TCDD-TEQ	2E-14	*(2E-14, 4E-13)*	6E-14	*(4E-14, 1E-12)*	1E-12	*(6E-14, 2E-12)*	2E-12	*(2E-12, 4E-12)*	6E-12	*(3E-12, 1E-11)*	2E-11	*(7E-12, 3E-11)*	9E-11	*(2E-11, 4E-10)*	4E-10	*(4E-11, 7E-10)*	1E-09	*(2E-10, 4E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C9. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	* *	4E-14 *(2E-14, 3E-12)*	3E-13 *(4E-14, 4E-12)*	1E-12 *(3E-13, 4E-12)*	5E-12 *(2E-12, 5E-12)*	8E-12 *(5E-12, 1E-11)*	1E-11 *(1E-11, 2E-11)*	2E-11 *(2E-11, 3E-11)*	5E-11 *(4E-11, 8E-11)*
1,2,3,7,8-PeCDD	* *	4E-14 *(3E-14, 7E-12)*	5E-13 *(4E-14, 9E-12)*	2E-12 *(5E-13, 1E-11)*	1E-11 *(4E-12, 1E-11)*	3E-11 *(1E-11, 4E-11)*	7E-11 *(3E-11, 9E-11)*	1E-10 *(5E-11, 1E-10)*	3E-10 *(1E-10, 3E-10)*
1,2,3,7,8,9-HxCDD	* *	2E-14 *(1E-14, 2E-12)*	4E-13 *(2E-14, 2E-12)*	1E-12 *(4E-13, 3E-12)*	3E-12 *(2E-12, 3E-12)*	9E-12 *(4E-12, 3E-11)*	4E-11 *(1E-11, 6E-11)*	7E-11 *(3E-11, 1E-10)*	2E-10 *(5E-11, 2E-10)*
1,2,3,4,7,8-HxCDD	* *	8E-14 *(4E-14, 3E-12)*	1E-12 *(8E-14, 4E-12)*	3E-12 *(1E-12, 4E-12)*	4E-12 *(3E-12, 4E-12)*	1E-11 *(5E-12, 3E-11)*	4E-11 *(2E-11, 6E-11)*	6E-11 *(4E-11, 1E-10)*	1E-10 *(6E-11, 2E-10)*
1,2,3,6,7,8-HxCDD	* *	4E-14 *(2E-14, 1E-12)*	5E-13 *(4E-14, 2E-12)*	2E-12 *(6E-13, 2E-12)*	2E-12 *(2E-12, 2E-12)*	5E-12 *(2E-12, 3E-11)*	5E-11 *(7E-12, 7E-11)*	7E-11 *(2E-11, 1E-10)*	2E-10 *(5E-11, 3E-10)*
1,2,3,6,7,8,9-HpCDD	* *	5E-14 *(3E-14, 1E-12)*	9E-13 *(5E-14, 3E-12)*	2E-12 *(9E-13, 3E-12)*	3E-12 *(3E-12, 4E-12)*	9E-12 *(4E-12, 4E-11)*	6E-11 *(1E-11, 9E-11)*	1E-10 *(3E-11, 1E-10)*	3E-10 *(6E-11, 4E-10)*
1,2,3,4,5,7,8,9-OCDD	* *	3E-13 *(2E-13, 6E-12)*	5E-12 *(3E-13, 7E-12)*	7E-12 *(6E-12, 7E-12)*	8E-12 *(7E-12, 9E-12)*	2E-11 *(2E-11, 7E-11)*	9E-11 *(3E-11, 1E-10)*	2E-10 *(8E-11, 3E-10)*	3E-10 *(1E-10, 5E-10)*
2,3,7,8-TCDF	* *	3E-13 *(2E-13, 6E-12)*	1E-12 *(2E-13, 2E-11)*	5E-12 *(2E-12, 3E-11)*	3E-11 *(6E-12, 3E-11)*	4E-11 *(3E-11, 5E-11)*	8E-11 *(5E-11, 9E-11)*	1E-10 *(8E-11, 2E-10)*	3E-10 *(2E-10, 4E-10)*
1,2,3,7,8-PeCDF	* *	4E-13 *(2E-13, 2E-11)*	2E-12 *(4E-13, 6E-11)*	7E-12 *(3E-12, 8E-11)*	8E-11 *(9E-12, 1E-10)*	1E-10 *(1E-10, 2E-10)*	2E-10 *(2E-10, 3E-10)*	4E-10 *(3E-10, 6E-10)*	9E-10 *(7E-10, 1E-09)*
2,3,4,7,8-PeCDF	1E-12 *(1E-12, 2E-11)*	3E-12 *(1E-12, 3E-10)*	2E-11 *(3E-12, 4E-10)*	7E-11 *(2E-11, 5E-10)*	6E-10 *(9E-11, 6E-10)*	7E-10 *(6E-10, 1E-09)*	2E-09 *(1E-09, 2E-09)*	3E-09 *(2E-09, 4E-09)*	6E-09 *(5E-09, 9E-09)*
1,2,3,6,7,8-HxCDF	* *	7E-14 *(4E-14, 4E-11)*	1E-12 *(6E-14, 5E-11)*	5E-12 *(1E-12, 6E-11)*	6E-11 *(8E-12, 6E-11)*	1E-10 *(6E-11, 1E-10)*	2E-10 *(2E-10, 2E-10)*	5E-10 *(2E-10, 6E-10)*	9E-10 *(9E-10, 2E-09)*
2,3,4,6,7,8-HxCDF	* *	7E-14 *(4E-14, 3E-11)*	8E-13 *(7E-14, 5E-11)*	4E-12 *(9E-13, 5E-11)*	5E-11 *(8E-12, 5E-11)*	1E-10 *(5E-11, 2E-10)*	2E-10 *(2E-10, 3E-10)*	5E-10 *(3E-10, 5E-10)*	8E-10 *(7E-10, 2E-09)*
1,2,3,4,7,8-HxCDF	* *	2E-13 *(1E-13, 8E-11)*	3E-12 *(2E-13, 1E-10)*	1E-11 *(3E-12, 2E-10)*	2E-10 *(2E-11, 2E-10)*	3E-10 *(2E-10, 5E-10)*	7E-10 *(5E-10, 9E-10)*	2E-09 *(9E-10, 2E-09)*	4E-09 *(3E-09, 7E-09)*
1,2,3,7,8,9-HxCDF	* *	8E-15 *(5E-15, 2E-12)*	1E-13 *(8E-15, 4E-12)*	5E-13 *(1E-13, 5E-12)*	5E-12 *(1E-12, 5E-12)*	7E-12 *(5E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 5E-11)*	7E-11 *(7E-11, 1E-10)*
1,2,3,4,6,7,8-HpCDF	* *	2E-14 *(1E-14, 1E-11)*	3E-13 *(2E-14, 1E-11)*	1E-12 *(3E-13, 2E-11)*	2E-11 *(3E-12, 2E-11)*	4E-11 *(2E-11, 5E-11)*	7E-11 *(5E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	4E-10 *(3E-10, 5E-10)*
1,2,3,4,7,8,9-HpCDF	* *	5E-15 *(3E-15, 4E-12)*	9E-14 *(5E-15, 6E-12)*	3E-13 *(9E-14, 6E-12)*	6E-12 *(1E-12, 7E-12)*	1E-11 *(7E-12, 2E-11)*	2E-11 *(2E-11, 3E-11)*	4E-11 *(3E-11, 7E-11)*	1E-10 *(1E-10, 2E-10)*
1,2,3,4,6,7,8,9-OCDF	* *	9E-14 *(4E-14, 6E-12)*	1E-12 *(9E-14, 1E-11)*	6E-12 *(2E-12, 1E-11)*	1E-11 *(8E-12, 1E-11)*	2E-11 *(1E-11, 3E-11)*	5E-11 *(4E-11, 8E-11)*	1E-10 *(8E-11, 1E-10)*	3E-10 *(2E-10, 4E-10)*
2,3,7,8-TCDD-TEQ	* *	2E-12 *(1E-12, 2E-10)*	1E-11 *(2E-12, 2E-10)*	4E-11 *(1E-11, 3E-10)*	3E-10 *(8E-11, 4E-10)*	5E-10 *(3E-10, 8E-10)*	1E-09 *(8E-10, 1E-09)*	2E-09 *(1E-09, 2E-09)*	4E-09 *(3E-09, 7E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C10. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	9E-14	*	2E-13	*(2E-13, 4E-13)*	3E-13	*(2E-13, 4E-13)*	4E-13	*(4E-13, 5E-13)*	5E-13	*(5E-13, 8E-13)*	1E-12	*(8E-13, 8E-12)*	8E-12	*(9E-13, 1E-11)*	1E-11	*(1E-12, 2E-11)*	2E-11	*(3E-12, 5E-11)*
1,2,3,7,8-PeCDD	2E-13	*	2E-13	*(2E-13, 3E-12)*	5E-13	*(2E-13, 3E-12)*	2E-12	*(5E-13, 3E-12)*	4E-12	*(3E-12, 5E-12)*	6E-12	*(5E-12, 7E-12)*	1E-11	*(6E-12, 2E-11)*	2E-11	*(8E-12, 3E-11)*	4E-11	*(1E-11, 5E-11)*
1,2,3,7,8,9-HxCDD	2E-14	*(2E-14, 1E-12)*	9E-14	*(3E-14, 1E-12)*	2E-13	*(3E-14, 1E-12)*	1E-12	*(2E-13, 1E-12)*	1E-12	*(1E-12, 2E-12)*	2E-12	*(2E-12, 3E-12)*	4E-12	*(3E-12, 6E-12)*	7E-12	*(3E-12, 1E-11)*	2E-11	*(6E-12, 2E-11)*
1,2,3,4,7,8-HxCDD	*	*	*	*	*	*	4E-13	*	2E-12	*(4E-13, 2E-12)*	3E-12	*(2E-12, 3E-12)*	4E-12	*(3E-12, 9E-12)*	9E-12	*(4E-12, 2E-11)*	2E-11	*(5E-12, 3E-11)*
1,2,3,6,7,8-HxCDD	*	*	*	*	*	*	2E-13	*	1E-12	*(3E-13, 1E-12)*	2E-12	*(1E-12, 2E-12)*	3E-12	*(2E-12, 6E-12)*	6E-12	*(3E-12, 1E-11)*	1E-11	*(3E-12, 2E-11)*
1,2,3,6,7,8,9-HpCDD	8E-14	*	2E-13	*(2E-13, 6E-13)*	5E-13	*(2E-13, 6E-13)*	6E-13	*(5E-13, 7E-13)*	8E-13	*(7E-13, 1E-12)*	2E-12	*(1E-12, 5E-12)*	5E-12	*(2E-12, 1E-11)*	1E-11	*(2E-12, 1E-11)*	2E-11	*(6E-12, 3E-11)*
1,2,3,4,5,7,8,9-OCDD	5E-13	*	1E-12	*(9E-13, 2E-12)*	2E-12	*(1E-12, 2E-12)*	2E-12	*(2E-12, 2E-12)*	3E-12	*(2E-12, 4E-12)*	7E-12	*(4E-12, 3E-11)*	3E-11	*(7E-12, 4E-11)*	3E-11	*(7E-12, 6E-11)*	1E-10	*(2E-11, 2E-10)*
2,3,7,8-TCDF	4E-14	*	7E-14	*	9E-14	*	1E-13	*(1E-13, 1E-13)*	1E-13	*(1E-13, 2E-13)*	3E-13	*(2E-13, 1E-12)*	1E-12	*(2E-13, 2E-12)*	2E-12	*(4E-13, 3E-12)*	3E-12	*(9E-13, 5E-12)*
1,2,3,7,8-PeCDF	2E-13	*	3E-13	*(2E-13, 2E-12)*	6E-13	*(3E-13, 2E-12)*	2E-12	*(6E-13, 2E-12)*	2E-12	*(2E-12, 3E-12)*	3E-12	*(3E-12, 1E-11)*	1E-11	*(3E-12, 2E-11)*	2E-11	*(4E-12, 3E-11)*	3E-11	*(7E-12, 6E-11)*
2,3,4,7,8-PeCDF	5E-13	*(5E-13, 8E-12)*	2E-12	*(6E-13, 8E-12)*	3E-12	*(8E-13, 8E-12)*	8E-12	*(4E-12, 9E-12)*	1E-11	*(9E-12, 2E-11)*	2E-11	*(2E-11, 3E-11)*	3E-11	*(2E-11, 7E-11)*	7E-11	*(2E-11, 2E-10)*	2E-10	*(3E-11, 2E-10)*
1,2,3,6,7,8-HxCDF	*	*	*	*	*	*	1E-12	*	1E-12	*(1E-12, 1E-12)*	2E-12	*(2E-12, 3E-12)*	4E-12	*(3E-12, 1E-11)*	1E-11	*(4E-12, 2E-11)*	2E-11	*(7E-12, 2E-11)*
2,3,4,6,7,8-HxCDF	5E-14	*(4E-14, 1E-12)*	6E-13	*(6E-14, 1E-12)*	1E-12	*(8E-14, 1E-12)*	1E-12	*(1E-12, 2E-12)*	2E-12	*(2E-12, 3E-12)*	4E-12	*(3E-12, 6E-12)*	9E-12	*(4E-12, 1E-11)*	1E-11	*(5E-12, 2E-11)*	3E-11	*(1E-11, 5E-11)*
1,2,3,4,7,8-HxCDF	*	*	*	*	*	*	9E-13	*	2E-12	*(1E-12, 2E-12)*	3E-12	*(3E-12, 3E-12)*	5E-12	*(4E-12, 1E-11)*	1E-11	*(4E-12, 2E-11)*	2E-11	*(9E-12, 3E-11)*
1,2,3,7,8,9-HxCDF	4E-14	*(4E-14, 1E-12)*	8E-14	*(5E-14, 1E-12)*	3E-13	*(5E-14, 1E-12)*	1E-12	*(3E-13, 1E-12)*	1E-12	*(1E-12, 2E-12)*	2E-12	*(2E-12, 4E-12)*	5E-12	*(3E-12, 8E-12)*	8E-12	*(3E-12, 1E-11)*	2E-11	*(6E-12, 3E-11)*
1,2,3,4,6,7,8-HpCDF	8E-14	*	1E-13	*	2E-13	*(1E-13, 2E-13)*	2E-13	*(2E-13, 4E-13)*	4E-13	*(3E-13, 8E-13)*	2E-12	*(4E-13, 7E-12)*	8E-12	*(6E-13, 1E-11)*	9E-12	*(1E-12, 2E-11)*	3E-11	*(4E-12, 5E-11)*
1,2,3,4,7,8,9-HpCDF	2E-14	*(1E-14, 7E-13)*	3E-14	*(2E-14, 7E-13)*	2E-13	*(2E-14, 8E-13)*	7E-13	*(2E-13, 9E-13)*	1E-12	*(8E-13, 1E-12)*	2E-12	*(2E-12, 2E-12)*	3E-12	*(2E-12, 5E-12)*	5E-12	*(2E-12, 9E-12)*	1E-11	*(4E-12, 1E-11)*
1,2,3,4,6,7,8,9-OCDF	7E-14	*	1E-13	*(9E-14, 4E-13)*	4E-13	*(1E-13, 4E-13)*	4E-13	*(4E-13, 5E-13)*	7E-13	*(5E-13, 1E-12)*	2E-12	*(8E-13, 7E-12)*	8E-12	*(1E-12, 1E-11)*	1E-11	*(2E-12, 2E-11)*	3E-11	*(5E-12, 5E-11)*
2,3,7,8-TCDD-TEQ	6E-13	*	2E-12	*	3E-12	*	8E-12	*(3E-12, 9E-12)*	1E-11	*(8E-12, 2E-11)*	2E-11	*(2E-11, 4E-11)*	4E-11	*(2E-11, 7E-11)*	7E-11	*(2E-11, 1E-10)*	2E-10	*(4E-11, 2E-10)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-C11. Cumulative Frequency Distribution of Dioxins/Furans in Pork Products for Sectors with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Pork Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	3E-15	*(3E-15, 8E-14)*	6E-15	*(3E-15, 8E-14)*	1E-14	*(5E-15, 8E-14)*	8E-14	*(2E-14, 1E-13)*	1E-13	*(1E-13, 2E-13)*	3E-13	*(2E-13, 4E-13)*	5E-13	*(4E-13, 7E-13)*	1E-12	*(4E-13, 1E-12)*	3E-12	*(1E-12, 4E-12)*
1,2,3,7,8-PeCDD	8E-15	*(7E-15, 5E-13)*	1E-14	*(9E-15, 5E-13)*	4E-14	*(1E-14, 5E-13)*	5E-13	*(9E-14, 7E-13)*	8E-13	*(6E-13, 1E-12)*	2E-12	*(9E-13, 3E-12)*	3E-12	*(3E-12, 5E-12)*	8E-12	*(3E-12, 9E-12)*	2E-11	*(9E-12, 3E-11)*
1,2,3,7,8,9-HxCDD	5E-15	*	9E-15	*	2E-14	*	2E-13	*(3E-14, 2E-13)*	2E-13	*(2E-13, 8E-13)*	9E-13	*(2E-13, 3E-12)*	3E-12	*(8E-13, 8E-12)*	8E-12	*(8E-13, 1E-11)*	3E-11	*(9E-13, 5E-11)*
1,2,3,4,7,8-HxCDD	4E-15	*	7E-15	*	2E-14	*	3E-13	*(4E-14, 4E-13)*	5E-13	*(4E-13, 9E-13)*	1E-12	*(5E-13, 1E-12)*	2E-12	*(1E-12, 3E-12)*	5E-12	*(2E-12, 6E-12)*	1E-11	*(6E-12, 2E-11)*
1,2,3,6,7,8-HxCDD	2E-15	*	4E-15	*	1E-14	*	2E-13	*(3E-14, 3E-13)*	3E-13	*(3E-13, 9E-13)*	1E-12	*(3E-13, 2E-12)*	2E-12	*(9E-13, 4E-12)*	4E-12	*(9E-13, 6E-12)*	2E-11	*(1E-12, 2E-11)*
1,2,3,6,7,8,9-HpCDD	4E-16	*	9E-16	*	2E-15	*	4E-14	*(6E-15, 6E-14)*	7E-14	*(6E-14, 8E-13)*	8E-13	*(7E-14, 3E-12)*	3E-12	*(2E-13, 8E-12)*	8E-12	*(2E-13, 1E-11)*	3E-11	*(7E-13, 4E-11)*
1,2,3,4,5,7,8,9-OCDD	2E-15	*	5E-15	*	1E-14	*	1E-13	*(2E-14, 2E-13)*	2E-13	*(2E-13, 2E-12)*	2E-12	*(2E-13, 8E-12)*	9E-12	*(7E-13, 2E-11)*	2E-11	*(8E-13, 4E-11)*	9E-11	*(2E-12, 1E-10)*
2,3,7,8-TCDF	8E-15	*	1E-14	*	2E-14	*	4E-14	*(4E-14, 6E-14)*	7E-14	*(6E-14, 2E-13)*	3E-13	*(8E-14, 7E-13)*	7E-13	*(2E-13, 1E-12)*	1E-12	*(2E-13, 3E-12)*	4E-12	*(3E-13, 8E-12)*
1,2,3,7,8-PeCDF	*	*	2E-14	*	4E-14	*	3E-13	*(8E-14, 5E-13)*	6E-13	*(5E-13, 2E-12)*	2E-12	*(6E-13, 3E-12)*	4E-12	*(1E-12, 6E-12)*	6E-12	*(2E-12, 1E-11)*	2E-11	*(2E-12, 4E-11)*
2,3,4,7,8-PeCDF	*	*	4E-14	*	8E-14	*	1E-12	*(2E-13, 2E-12)*	2E-12	*(2E-12, 6E-12)*	7E-12	*(2E-12, 2E-11)*	2E-11	*(6E-12, 4E-11)*	4E-11	*(6E-12, 7E-11)*	1E-10	*(7E-12, 2E-10)*
1,2,3,6,7,8-HxCDF	*	*	3E-15	*	8E-15	*	2E-13	*(2E-14, 3E-13)*	3E-13	*(3E-13, 1E-12)*	1E-12	*(3E-13, 4E-12)*	4E-12	*(9E-13, 1E-11)*	1E-11	*(1E-12, 2E-11)*	4E-11	*(1E-12, 7E-11)*
2,3,4,6,7,8-HxCDF	1E-15	*	2E-15	*	7E-15	*	2E-13	*(2E-14, 3E-13)*	3E-13	*(3E-13, 9E-13)*	1E-12	*(3E-13, 4E-12)*	4E-12	*(9E-13, 9E-12)*	9E-12	*(9E-13, 1E-11)*	4E-11	*(1E-12, 6E-11)*
1,2,3,4,7,8-HxCDF	*	*	3E-15	*	7E-15	*	2E-13	*(2E-14, 3E-13)*	3E-13	*(3E-13, 2E-12)*	2E-12	*(3E-13, 8E-12)*	8E-12	*(1E-12, 2E-11)*	2E-11	*(1E-12, 4E-11)*	8E-11	*(2E-12, 1E-10)*
1,2,3,7,8,9-HxCDF	2E-15	*(1E-15, 2E-13)*	3E-15	*(2E-15, 2E-13)*	8E-15	*(3E-15, 2E-13)*	2E-13	*(3E-14, 2E-13)*	3E-13	*(2E-13, 3E-13)*	3E-13	*(3E-13, 3E-13)*	1E-12	*(8E-13, 1E-12)*	2E-12	*(1E-12, 3E-12)*	4E-12	*(4E-12, 7E-12)*
1,2,3,4,6,7,8-HpCDF	*	*	7E-16	*	2E-15	*	8E-14	*(1E-14, 1E-13)*	1E-13	*(1E-13, 5E-13)*	5E-13	*(1E-13, 2E-12)*	2E-12	*(4E-13, 5E-12)*	5E-12	*(4E-13, 8E-12)*	2E-11	*(5E-13, 3E-11)*
1,2,3,4,7,8,9-HpCDF	4E-16	*(4E-16, 1E-13)*	8E-16	*(5E-16, 1E-13)*	2E-15	*(8E-16, 1E-13)*	1E-13	*(1E-14, 1E-13)*	2E-13	*(1E-13, 2E-13)*	2E-13	*(2E-13, 2E-13)*	6E-13	*(5E-13, 6E-13)*	1E-12	*(7E-13, 2E-12)*	3E-12	*(3E-12, 4E-12)*
1,2,3,4,6,7,8,9-OCDF	6E-16	*(5E-16, 2E-13)*	1E-15	*(9E-16, 2E-13)*	3E-15	*(1E-15, 2E-13)*	2E-13	*(2E-14, 3E-13)*	3E-13	*(2E-13, 6E-13)*	8E-13	*(3E-13, 1E-12)*	1E-12	*(1E-12, 2E-12)*	4E-12	*(1E-12, 5E-12)*	1E-11	*(5E-12, 2E-11)*
2,3,7,8-TCDD-TEQ	2E-14	*	5E-14	*	1E-13	*	1E-12	*(3E-13, 2E-12)*	2E-12	*(2E-12, 6E-12)*	7E-12	*(3E-12, 1E-11)*	2E-11	*(6E-12, 3E-11)*	3E-11	*(7E-12, 6E-11)*	1E-10	*(7E-12, 2E-10)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D1. Cumulative Frequency Distribution of Dioxin TEQ and Mercury (Methyl) in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: Cement Kilns

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
TCDD-TEQ																		
beef	*	*	6E-11	*	9E-11	*(7E-11, 2E-10)*	4E-10	*(3E-10, 6E-10)*	1E-09	*(8E-10, 3E-09)*	5E-09	*(3E-09, 6E-09)*	8E-09	*(7E-09, 1E-08)*	1E-08	*(1E-08, 1E-08)*	2E-08	*(2E-08, 2E-08)*
milk	*	*	1E-11	*	2E-11	*(2E-11, 5E-11)*	1E-10	*(6E-11, 1E-10)*	4E-10	*(2E-10, 7E-10)*	1E-09	*(8E-10, 2E-09)*	2E-09	*(2E-09, 3E-09)*	3E-09	*(3E-09, 3E-09)*	5E-09	*(4E-09, 5E-09)*
pork	*	*	8E-12	*	1E-11	*(8E-12, 2E-11)*	4E-11	*(3E-11, 6E-11)*	2E-10	*(9E-11, 3E-10)*	5E-10	*(3E-10, 7E-10)*	1E-09	*(7E-10, 1E-09)*	1E-09	*(1E-09, 2E-09)*	3E-09	*(2E-09, 3E-09)*
chicken thigh meat	*	*	2E-11	*	4E-11	*	1E-10	*(7E-11, 2E-10)*	5E-10	*(3E-10, 8E-10)*	1E-09	*(1E-09, 2E-09)*	3E-09	*(3E-09, 4E-09)*	6E-09	*(4E-09, 6E-09)*	1E-08	*(1E-08, 2E-08)*
chicken egg	*	*	4E-11	*	6E-11	*	2E-10	*(1E-10, 3E-10)*	9E-10	*(5E-10, 1E-09)*	2E-09	*(2E-09, 4E-09)*	6E-09	*(5E-09, 7E-09)*	1E-08	*(6E-09, 1E-08)*	2E-08	*(2E-08, 3E-08)*
aboveground fruit	*	*	2E-12	*	2E-12	*	9E-12	*(6E-12, 1E-11)*	5E-11	*(3E-11, 7E-11)*	1E-10	*(8E-11, 2E-10)*	2E-10	*(2E-10, 3E-10)*	3E-10	*(3E-10, 4E-10)*	6E-10	*(5E-10, 6E-10)*
aboveground vegetable	*	*	1E-12	*	2E-12	*	8E-12	*(6E-12, 1E-11)*	4E-11	*(2E-11, 6E-11)*	1E-10	*(8E-11, 2E-10)*	2E-10	*(2E-10, 2E-10)*	3E-10	*(2E-10, 3E-10)*	5E-10	*(4E-10, 6E-10)*
belowground vegetable	*	*	6E-14	*	1E-13	*	3E-13	*(2E-13, 5E-13)*	1E-12	*(1E-12, 2E-12)*	4E-12	*(3E-12, 7E-12)*	9E-12	*(8E-12, 1E-11)*	2E-11	*(1E-11, 2E-11)*	4E-11	*(3E-11, 5E-11)*
Mercury (Methyl)																		
fish (farm pond)	*	*	4E-11	*	6E-11	*	1E-10	*(8E-11, 1E-10)*	3E-10	*(2E-10, 6E-10)*	1E-09	*(9E-10, 2E-09)*	4E-09	*(2E-09, 5E-09)*	7E-09	*(4E-09, 7E-09)*	1E-08	*(1E-08, 2E-08)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D2. Cumulative Frequency Distribution of Dioxin TEQ and Mercury (Methyl) in Subsistence Food Commodities Produced in Sectors: Lightweight Aggregate Kilns[a]

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*								
	1%	5%	10%	25%	50%	75%	90%	95%	99%
TCDD-TEQ									
beef	*	7E-10	9E-10	3E-09	5E-09	8E-09	2E-08	3E-08	6E-08
milk	*	2E-10	2E-10	1E-09	2E-09	2E-09	4E-09	8E-09	2E-08
pork	*	7E-11	8E-11	3E-10	5E-10	8E-10	1E-09	2E-09	6E-09
chicken thigh meat	*	1E-10	2E-10	6E-10	8E-10	1E-09	3E-09	6E-09	2E-08
chicken egg	*	3E-10	4E-10	9E-10	2E-09	2E-09	6E-09	1E-08	3E-08
aboveground fruit	*	2E-11	2E-11	1E-10	2E-10	3E-10	5E-10	8E-10	2E-09
aboveground vegetable	*	2E-11	2E-11	1E-10	2E-10	2E-10	5E-10	8E-10	2E-09
belowground vegetable	*	3E-13	5E-13	2E-12	3E-12	5E-12	1E-11	2E-11	6E-11
Mercury (Methyl)									
fish (farm pond)	*	4E-11	5E-11	7E-11	1E-10	2E-10	4E-10	1E-09	4E-09

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

[a] Confidence intervals are not applicable since all the lightweight aggregate kilns in the population were sampled with certainty.

All concentration values <10 have been rounded to one significant digit

Table H-D3. Cumulative Frequency Distribution of Dioxin TEQ and Mercury (Methyl) in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: All Incinerators

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
TCDD-TEQ																		
beef	3E-13	*(2E-13, 5E-13)*	5E-13	*(4E-13, 2E-12)*	1E-12	*(6E-13, 5E-12)*	1E-11	*(5E-12, 2E-11)*	6E-11	*(3E-11, 1E-10)*	6E-10	*(3E-10, 1E-09)*	6E-09	*(3E-09, 9E-09)*	1E-08	*(7E-09, 1E-08)*	3E-08	*(2E-08, 4E-08)*
milk	7E-14	*(6E-14, 1E-13)*	1E-13	*(1E-13, 5E-13)*	3E-13	*(1E-13, 1E-12)*	3E-12	*(1E-12, 5E-12)*	2E-11	*(9E-12, 4E-11)*	2E-10	*(7E-11, 3E-10)*	2E-09	*(8E-10, 3E-09)*	3E-09	*(2E-09, 4E-09)*	8E-09	*(6E-09, 1E-08)*
pork	2E-14	*(2E-14, 5E-14)*	5E-14	*(4E-14, 2E-13)*	1E-13	*(5E-14, 4E-13)*	8E-13	*(4E-13, 2E-12)*	5E-12	*(3E-12, 1E-11)*	6E-11	*(2E-11, 1E-10)*	5E-10	*(3E-10, 8E-10)*	1E-09	*(6E-10, 1E-09)*	2E-09	*(2E-09, 4E-09)*
chicken thigh meat	3E-14	*(2E-14, 7E-14)*	8E-14	*(6E-14, 3E-13)*	2E-13	*(1E-13, 6E-13)*	1E-12	*(6E-13, 3E-12)*	1E-11	*(5E-12, 2E-11)*	9E-11	*(4E-11, 2E-10)*	7E-10	*(5E-10, 1E-09)*	2E-09	*(1E-09, 2E-09)*	5E-09	*(4E-09, 7E-09)*
chicken egg	6E-14	*(5E-14, 1E-13)*	1E-13	*(9E-14, 4E-13)*	3E-13	*(1E-13, 1E-12)*	2E-12	*(1E-12, 5E-12)*	2E-11	*(9E-12, 4E-11)*	2E-10	*(7E-11, 3E-10)*	1E-09	*(9E-10, 2E-09)*	3E-09	*(2E-09, 4E-09)*	9E-09	*(8E-09, 1E-08)*
aboveground fruit	6E-15	*(6E-15, 1E-14)*	1E-14	*(1E-14, 5E-14)*	3E-14	*(1E-14, 1E-13)*	2E-13	*(1E-13, 5E-13)*	1E-12	*(8E-13, 3E-12)*	1E-11	*(6E-12, 3E-11)*	1E-10	*(8E-11, 2E-10)*	3E-10	*(2E-10, 3E-10)*	7E-10	*(6E-10, 1E-09)*
aboveground vegetable	6E-15	*(6E-15, 1E-14)*	1E-14	*(1E-14, 5E-14)*	3E-14	*(1E-14, 1E-13)*	2E-13	*(1E-13, 5E-13)*	1E-12	*(8E-13, 3E-12)*	1E-11	*(6E-12, 3E-11)*	1E-10	*(7E-11, 2E-10)*	3E-10	*(2E-10, 3E-10)*	7E-10	*(5E-10, 1E-09)*
belowground vegetable	1E-16	*(7E-17, 3E-16)*	3E-16	*(2E-16, 8E-16)*	7E-16	*(3E-16, 2E-15)*	4E-15	*(2E-15, 8E-15)*	3E-14	*(1E-14, 6E-14)*	3E-13	*(1E-13, 6E-13)*	2E-12	*	4E-12	*	1E-11	*
Mercury (Methyl)																		
fish (farm pond)	*	*	5E-16	*	6E-14	*	5E-13	*(2E-13, 9E-13)*	3E-12	*(2E-12, 6E-12)*	2E-11	*(1E-11, 4E-11)*	1E-10	*(6E-11, 2E-10)*	4E-10	*(2E-10, 7E-10)*	2E-09	*(8E-10, 2E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D4. Cumulative Frequency Distribution of Dioxin TEQ and Mercury (Methyl) in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: Commercial Incinerators

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
TCDD-TEQ										
beef	* *	2E-11 *(1E-11, 3E-11)*	2E-11 *(2E-11, 6E-11)*	1E-10 *(4E-11, 5E-10)*	3E-09 *(5E-10, 5E-09)*	8E-09 *(5E-09, 1E-08)*	1E-08 *(1E-08, 2E-08)*	2E-08 *(2E-08, 3E-08)*	6E-08 *(4E-08, 7E-08)*	
milk	* *	4E-12 *(3E-12, 8E-12)*	6E-12 *(5E-12, 1E-11)*	3E-11 *(1E-11, 1E-10)*	9E-10 *(1E-10, 1E-09)*	2E-09 *(1E-09, 3E-09)*	4E-09 *(3E-09, 7E-09)*	7E-09 *(5E-09, 7E-09)*	2E-08 *(1E-08, 2E-08)*	
pork	* *	1E-12 *(9E-13, 3E-12)*	2E-12 *(1E-12, 5E-12)*	1E-11 *(3E-12, 4E-11)*	3E-10 *(4E-11, 4E-10)*	6E-10 *(4E-10, 8E-10)*	1E-09 *(9E-10, 2E-09)*	2E-09 *(2E-09, 2E-09)*	5E-09 *(4E-09, 6E-09)*	
chicken thigh meat	* *	1E-12 *(8E-13, 5E-12)*	4E-12 *(1E-12, 1E-11)*	2E-11 *(5E-12, 9E-11)*	4E-10 *(7E-11, 6E-10)*	9E-10 *(6E-10, 1E-09)*	2E-09 *(2E-09, 2E-09)*	4E-09 *(2E-09, 5E-09)*	1E-08 *(8E-09, 1E-08)*	
chicken egg	* *	2E-12 *(2E-12, 7E-12)*	6E-12 *(2E-12, 2E-11)*	4E-11 *(9E-12, 2E-10)*	8E-10 *(1E-10, 1E-09)*	2E-09 *(1E-09, 3E-09)*	4E-09 *(3E-09, 4E-09)*	7E-09 *(5E-09, 9E-09)*	2E-08 *(2E-08, 2E-08)*	
aboveground fruit	* *	4E-13 *(3E-13, 8E-13)*	5E-13 *(4E-13, 1E-12)*	3E-12 *(1E-12, 1E-11)*	8E-11 *(1E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	3E-10 *(2E-10, 5E-10)*	5E-10 *(4E-10, 6E-10)*	1E-09 *(1E-09, 2E-09)*	
aboveground vegetable	* *	4E-13 *(3E-13, 7E-13)*	5E-13 *(4E-13, 1E-12)*	3E-12 *(1E-12, 1E-11)*	7E-11 *(1E-11, 1E-10)*	2E-10 *(1E-10, 2E-10)*	3E-10 *(2E-10, 5E-10)*	5E-10 *(4E-10, 6E-10)*	1E-09 *(9E-10, 1E-09)*	
belowground vegetable	* *	4E-15 *(3E-15, 2E-14)*	1E-14 *(4E-15, 3E-14)*	7E-14 *(2E-14, 3E-13)*	1E-12 *(2E-13, 2E-12)*	2E-12 *(2E-12, 4E-12)*	5E-12 *(4E-12, 5E-12)*	1E-11 *(7E-12, 1E-11)*	3E-11 *(3E-11, 3E-11)*	
Mercury (Methyl)										
fish (farm pond)	3E-13 *	5E-13 *(4E-13, 9E-13)*	7E-13 *(6E-13, 7E-12)*	1E-11 *(2E-12, 2E-11)*	4E-11 *(2E-11, 5E-11)*	2E-10 *(7E-11, 4E-10)*	5E-10 *(3E-10, 7E-10)*	9E-10 *(6E-10, 1E-09)*	3E-09 *(2E-09, 4E-09)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D5. Cumulative Frequency Distribution of Dioxin TEQ and Mercury (Methyl) in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: Large Onsite Incinerators

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
TCDD-TEQ										
beef	* *	7E-12 *	1E-11 *(8E-12, 3E-11)*	4E-11 *(2E-11, 1E-10)*	2E-10 *(1E-10, 3E-10)*	7E-10 *(4E-10, 2E-09)*	5E-09 *(1E-09, 1E-08)*	1E-08 *(2E-09, 1E-08)*	3E-08 *(5E-09, 5E-08)*	
milk	* *	2E-12 *	3E-12 *	1E-11 *(4E-12, 3E-11)*	5E-11 *(3E-11, 8E-11)*	2E-10 *(9E-11, 5E-10)*	1E-09 *(2E-10, 3E-09)*	3E-09 *(5E-10, 4E-09)*	7E-09 *(1E-09, 1E-08)*	
pork	* *	6E-13 *	1E-12 *	3E-12 *(1E-12, 1E-11)*	2E-11 *(1E-11, 3E-11)*	7E-11 *(3E-11, 2E-10)*	6E-10 *(9E-11, 1E-09)*	1E-09 *(2E-10, 1E-09)*	2E-09 *(6E-10, 5E-09)*	
chicken thigh meat	* *	9E-13 *	1E-12 *	6E-12 *(2E-12, 2E-11)*	3E-11 *(2E-11, 5E-11)*	1E-10 *(5E-11, 3E-10)*	1E-09 *(2E-10, 1E-09)*	2E-09 *(5E-10, 3E-09)*	5E-09 *(2E-09, 1E-08)*	
chicken egg	* *	2E-12 *	2E-12 *	1E-11 *(3E-12, 3E-11)*	5E-11 *(3E-11, 9E-11)*	2E-10 *(9E-11, 6E-10)*	2E-09 *(3E-10, 3E-09)*	3E-09 *(9E-10, 6E-09)*	9E-09 *(3E-09, 3E-08)*	
aboveground fruit	* *	2E-13 *	3E-13 *	8E-13 *(4E-13, 3E-12)*	5E-12 *(2E-12, 8E-12)*	2E-11 *(8E-12, 4E-11)*	1E-10 *(2E-11, 3E-10)*	3E-10 *(5E-11, 4E-10)*	6E-10 *(1E-10, 1E-09)*	
aboveground vegetable	* *	1E-13 *	3E-13 *	8E-13 *(3E-13, 3E-12)*	4E-12 *(2E-12, 7E-12)*	2E-11 *(7E-12, 4E-11)*	1E-10 *(2E-11, 3E-10)*	3E-10 *(5E-11, 3E-10)*	6E-10 *(1E-10, 1E-09)*	
belowground vegetable	* *	3E-15 *	4E-15 *	2E-14 *(6E-15, 5E-14)*	9E-14 *(5E-14, 2E-13)*	4E-13 *(2E-13, 1E-12)*	3E-12 *	4E-12 *	1E-11 *	
Mercury (Methyl)										
fish (farm pond)	* *	* *	* *	3E-13 *	4E-12 *	4E-11 *(1E-11, 9E-11)*	3E-10 *(6E-11, 7E-10)*	7E-10 *(2E-10, 2E-09)*	3E-09 *(6E-10, 8E-09)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D6. Cumulative Frequency Distribution of Dioxin TEQ and Mercury (Methyl) in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: Small Onsite Incinerators

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
TCDD-TEQ										
beef	2E-13 *	4E-13 *(3E-13, 7E-13)*	6E-13 *(4E-13, 3E-12)*	3E-12 *(1E-12, 7E-12)*	2E-11 *(8E-12, 5E-11)*	1E-10 *(5E-11, 3E-10)*	1E-09 *(2E-10, 5E-09)*	6E-09 *(9E-10, 1E-08)*	2E-08 *(6E-09, 5E-08)*	
milk	6E-14 *	1E-13 *(7E-14, 2E-13)*	1E-13 *(1E-13, 7E-13)*	8E-13 *(3E-13, 2E-12)*	6E-12 *(2E-12, 1E-11)*	3E-11 *(1E-11, 7E-11)*	4E-10 *(6E-11, 1E-09)*	1E-09 *(2E-10, 3E-09)*	7E-09 *(2E-09, 1E-08)*	
pork	2E-14 *	3E-14 *(2E-14, 6E-14)*	5E-14 *(4E-14, 2E-13)*	3E-13 *(9E-14, 6E-13)*	2E-12 *(7E-13, 4E-12)*	1E-11 *(4E-12, 2E-11)*	1E-10 *(2E-11, 4E-10)*	4E-10 *(9E-11, 8E-10)*	2E-09 *	
chicken thigh meat	3E-14 *	5E-14 *(4E-14, 1E-13)*	8E-14 *(6E-14, 3E-13)*	5E-13 *(2E-13, 1E-12)*	3E-12 *(1E-12, 6E-12)*	2E-11 *(7E-12, 4E-11)*	2E-10 *(4E-11, 4E-10)*	5E-10 *(1E-10, 1E-09)*	3E-09 *(7E-10, 9E-09)*	
chicken egg	5E-14 *	9E-14 *(7E-14, 2E-13)*	1E-13 *(1E-13, 5E-13)*	9E-13 *(3E-13, 2E-12)*	5E-12 *(2E-12, 1E-11)*	3E-11 *(1E-11, 8E-11)*	3E-10 *(6E-11, 9E-10)*	1E-09 *(3E-10, 3E-09)*	5E-09 *(1E-09, 2E-08)*	
aboveground fruit	6E-15 *	1E-14 *(7E-15, 2E-14)*	1E-14 *(1E-14, 6E-14)*	8E-14 *(3E-14, 2E-13)*	5E-13 *(2E-13, 1E-12)*	3E-12 *(1E-12, 6E-12)*	3E-11 *(5E-12, 1E-10)*	1E-10 *(2E-11, 3E-10)*	6E-10 *(1E-10, 1E-09)*	
aboveground vegetable	6E-15 *	9E-15 *(6E-15, 2E-14)*	1E-14 *(1E-14, 6E-14)*	7E-14 *(3E-14, 2E-13)*	5E-13 *(2E-13, 1E-12)*	3E-12 *(1E-12, 6E-12)*	3E-11 *(5E-12, 1E-10)*	1E-10 *(2E-11, 3E-10)*	6E-10 *(1E-10, 1E-09)*	
belowground vegetable	7E-17 *	2E-16 *(1E-16, 4E-16)*	3E-16 *(2E-16, 9E-16)*	1E-15 *(6E-16, 3E-15)*	1E-14 *(4E-15, 2E-14)*	5E-14 *(2E-14, 1E-13)*	5E-13 *(1E-13, 1E-12)*	1E-12 *(4E-13, 3E-12)*	7E-12 *(2E-12, 2E-11)*	
Mercury (Methyl)										
fish (farm pond)	2E-15 *	3E-14 *(4E-15, 9E-14)*	6E-14 *(3E-14, 2E-13)*	3E-13 *(1E-13, 7E-13)*	2E-12 *(8E-13, 3E-12)*	1E-11 *(3E-12, 1E-11)*	3E-11 *(1E-11, 5E-11)*	5E-11 *(3E-11, 8E-11)*	2E-10 *(1E-10, 3E-10)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D7. Cumulative Frequency Distribution of Dioxin TEQ in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: Waste Heat Boilers

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
TCDD-TEQ										
beef	8E-11 *	2E-10 *(1E-10, 3E-10)*	2E-10 *(2E-10, 7E-10)*	1E-09 *(4E-10, 3E-09)*	5E-09 *(2E-09, 8E-09)*	1E-08 *(7E-09, 1E-08)*	2E-08 *(1E-08, 2E-08)*	3E-08 *(2E-08, 4E-08)*	7E-08 *(6E-08, 9E-08)*	
milk	2E-11 *	4E-11 *(3E-11, 7E-11)*	5E-11 *(4E-11, 2E-10)*	3E-10 *(1E-10, 8E-10)*	1E-09 *(7E-10, 2E-09)*	3E-09 *(2E-09, 4E-09)*	6E-09 *(4E-09, 7E-09)*	8E-09 *(7E-09, 1E-08)*	2E-08 *(2E-08, 3E-08)*	
pork	6E-12 *	1E-11 *(1E-11, 2E-11)*	2E-11 *(1E-11, 6E-11)*	8E-11 *(4E-11, 2E-10)*	4E-10 *(2E-10, 6E-10)*	8E-10 *(6E-10, 1E-09)*	2E-09 *(1E-09, 2E-09)*	2E-09 *(2E-09, 3E-09)*	6E-09 *(5E-09, 8E-09)*	
chicken thigh meat	5E-12 *	1E-11 *(1E-11, 3E-11)*	3E-11 *(1E-11, 1E-10)*	1E-10 *(5E-11, 3E-10)*	6E-10 *(3E-10, 9E-10)*	1E-09 *(9E-10, 2E-09)*	2E-09 *(2E-09, 3E-09)*	4E-09 *(3E-09, 5E-09)*	1E-08 *(1E-08, 2E-08)*	
chicken egg	1E-11 *	3E-11 *(2E-11, 6E-11)*	5E-11 *(3E-11, 2E-10)*	2E-10 *(9E-11, 6E-10)*	1E-09 *(6E-10, 2E-09)*	3E-09 *(2E-09, 3E-09)*	5E-09 *(4E-09, 6E-09)*	9E-09 *(7E-09, 1E-08)*	3E-08 *(2E-08, 4E-08)*	
aboveground fruit	2E-12 *	4E-12 *(3E-12, 7E-12)*	5E-12 *(4E-12, 2E-11)*	2E-11 *(1E-11, 6E-11)*	1E-10 *(5E-11, 2E-10)*	2E-10 *(2E-10, 3E-10)*	5E-10 *(3E-10, 6E-10)*	7E-10 *(5E-10, 9E-10)*	2E-09 *(1E-09, 2E-09)*	
aboveground vegetable	2E-12 *	3E-12 *(3E-12, 6E-12)*	5E-12 *(4E-12, 2E-11)*	2E-11 *(1E-11, 6E-11)*	1E-10 *(5E-11, 2E-10)*	2E-10 *(2E-10, 3E-10)*	5E-10 *(3E-10, 6E-10)*	7E-10 *(5E-10, 8E-10)*	2E-09 *(1E-09, 2E-09)*	
belowground vegetable	2E-14 *	4E-14 *(3E-14, 9E-14)*	9E-14 *(4E-14, 3E-13)*	3E-13 *(1E-13, 8E-13)*	1E-12 *(8E-13, 2E-12)*	4E-12 *(2E-12, 4E-12)*	7E-12 *(5E-12, 8E-12)*	1E-11 *(9E-12, 1E-11)*	3E-11 *(3E-11, 5E-11)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D8. Cumulative Frequency Distribution of Dioxin TEQ in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: All Incinerators

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
TCDD-TEQ										
beef	2E-13 *	5E-13 *(3E-13, 1E-12)*	8E-13 *(5E-13, 4E-12)*	6E-12 *(3E-12, 1E-11)*	3E-11 *(2E-11, 5E-11)*	2E-10 *(8E-11, 3E-10)*	7E-10 *(4E-10, 9E-10)*	2E-09 *(8E-10, 3E-09)*	9E-09 *(5E-09, 1E-08)*	
milk	6E-14 *	1E-13 *(8E-14, 3E-13)*	2E-13 *(1E-13, 9E-13)*	2E-12 *(8E-13, 4E-12)*	8E-12 *(4E-12, 1E-11)*	4E-11 *(2E-11, 7E-11)*	2E-10 *(9E-11, 2E-10)*	5E-10 *(2E-10, 9E-10)*	2E-09 *(1E-09, 3E-09)*	
pork	2E-14 *	4E-14 *(3E-14, 1E-13)*	7E-14 *(5E-14, 3E-13)*	5E-13 *(3E-13, 1E-12)*	3E-12 *(2E-12, 5E-12)*	1E-11 *(7E-12, 2E-11)*	6E-11 *(3E-11, 1E-10)*	2E-10 *(7E-11, 3E-10)*	9E-10 *(5E-10, 1E-09)*	
chicken thigh meat	3E-14 *	7E-14 *(5E-14, 2E-13)*	2E-13 *(7E-14, 5E-13)*	7E-13 *(5E-13, 1E-12)*	4E-12 *(2E-12, 8E-12)*	2E-11 *(1E-11, 4E-11)*	1E-10 *(6E-11, 2E-10)*	4E-10 *(2E-10, 6E-10)*	2E-09 *(9E-10, 2E-09)*	
chicken egg	6E-14 *	1E-13 *(9E-14, 3E-13)*	2E-13 *(1E-13, 9E-13)*	1E-12 *(8E-13, 3E-12)*	8E-12 *(4E-12, 1E-11)*	4E-11 *(3E-11, 6E-11)*	2E-10 *(1E-10, 4E-10)*	7E-10 *(3E-10, 1E-09)*	3E-09 *(2E-09, 4E-09)*	
aboveground fruit	6E-15 *	1E-14 *(8E-15, 3E-14)*	2E-14 *(1E-14, 9E-14)*	1E-13 *(8E-14, 3E-13)*	7E-13 *(4E-13, 1E-12)*	4E-12 *(2E-12, 6E-12)*	1E-11 *(8E-12, 2E-11)*	4E-11 *(2E-11, 8E-11)*	2E-10 *(1E-10, 3E-10)*	
aboveground vegetable	6E-15 *	1E-14 *(7E-15, 3E-14)*	2E-14 *(1E-14, 8E-14)*	1E-13 *(7E-14, 3E-13)*	7E-13 *(4E-13, 1E-12)*	4E-12 *(2E-12, 6E-12)*	1E-11 *(8E-12, 2E-11)*	4E-11 *(2E-11, 8E-11)*	2E-10 *(1E-10, 2E-10)*	
belowground vegetable	8E-17 *	2E-16 *(1E-16, 6E-16)*	5E-16 *(3E-16, 2E-15)*	2E-15 *(1E-15, 5E-15)*	1E-14 *(7E-15, 2E-14)*	7E-14 *(4E-14, 1E-13)*	3E-13 *	1E-12 *	5E-12 *	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D9. Cumulative Frequency Distribution of Dioxin TEQ in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: Commercial Incinerators

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
TCDD-TEQ										
beef	* *	1E-11 *	2E-11 *(1E-11, 3E-11)*	4E-11 *(2E-11, 1E-10)*	2E-10 *(6E-11, 7E-10)*	4E-09 *(4E-10, 5E-09)*	8E-09 *(4E-09, 1E-08)*	1E-08 *(5E-09, 1E-08)*	3E-08 *(2E-08, 4E-08)*	
milk	* *	3E-12 *	5E-12 *(3E-12, 8E-12)*	1E-11 *(6E-12, 3E-11)*	5E-11 *(2E-11, 2E-10)*	9E-10 *(1E-10, 1E-09)*	2E-09 *(1E-09, 3E-09)*	3E-09 *(1E-09, 4E-09)*	8E-09 *(5E-09, 1E-08)*	
pork	* *	9E-13 *	2E-12 *(9E-13, 3E-12)*	3E-12 *(2E-12, 1E-11)*	2E-11 *(5E-12, 7E-11)*	3E-10 *(4E-11, 4E-10)*	7E-10 *(3E-10, 9E-10)*	1E-09 *(5E-10, 1E-09)*	3E-09 *(2E-09, 4E-09)*	
chicken thigh meat	* *	9E-13 *	1E-12 *(9E-13, 5E-12)*	5E-12 *(2E-12, 2E-11)*	3E-11 *(1E-11, 2E-10)*	6E-10 *(6E-11, 7E-10)*	1E-09 *(6E-10, 2E-09)*	2E-09 *(1E-09, 3E-09)*	6E-09 *(4E-09, 9E-09)*	
chicken egg	* *	2E-12 *	2E-12 *(2E-12, 7E-12)*	8E-12 *(4E-12, 4E-11)*	6E-11 *(2E-11, 3E-10)*	1E-09 *(1E-10, 1E-09)*	2E-09 *(1E-09, 3E-09)*	4E-09 *(2E-09, 6E-09)*	1E-08 *(8E-09, 2E-08)*	
aboveground fruit	* *	3E-13 *	4E-13 *(3E-13, 8E-13)*	8E-13 *(5E-13, 3E-12)*	5E-12 *(1E-12, 2E-11)*	8E-11 *(1E-11, 1E-10)*	2E-10 *(9E-11, 3E-10)*	3E-10 *(1E-10, 4E-10)*	7E-10 *(5E-10, 1E-09)*	
aboveground vegetable	* *	3E-13 *	4E-13 *(3E-13, 7E-13)*	8E-13 *(5E-13, 3E-12)*	5E-12 *(1E-12, 2E-11)*	8E-11 *(1E-11, 1E-10)*	2E-10 *(8E-11, 2E-10)*	2E-10 *(1E-10, 3E-10)*	7E-10 *(5E-10, 9E-10)*	
belowground vegetable	* *	3E-15 *	4E-15 *(3E-15, 2E-14)*	2E-14 *(7E-15, 6E-14)*	9E-14 *(3E-14, 4E-13)*	2E-12 *(2E-13, 2E-12)*	4E-12 *(2E-12, 5E-12)*	5E-12 *(3E-12, 9E-12)*	2E-11 *(1E-11, 3E-11)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D10. Cumulative Frequency Distribution of Dioxin TEQ in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: Large Onsite Incinerators

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
TCDD-TEQ																		
beef	*	*	7E-12	*	1E-11	*	3E-11	*(1E-11, 1E-10)*	1E-10	*(5E-11, 3E-10)*	4E-10	*(3E-10, 7E-10)*	9E-10	*(5E-10, 2E-09)*	2E-09	*(8E-10, 3E-09)*	5E-09	*(2E-09, 6E-09)*
milk	*	*	2E-12	*	3E-12	*	7E-12	*(4E-12, 2E-11)*	4E-11	*(1E-11, 7E-11)*	1E-10	*(7E-11, 2E-10)*	2E-10	*(1E-10, 5E-10)*	5E-10	*(2E-10, 6E-10)*	1E-09	*(5E-10, 2E-09)*
pork	*	*	6E-13	*	9E-13	*	2E-12	*(1E-12, 8E-12)*	1E-11	*(4E-12, 2E-11)*	4E-11	*(2E-11, 7E-11)*	1E-10	*(5E-11, 1E-10)*	2E-10	*(7E-11, 2E-10)*	5E-10	*(2E-10, 1E-09)*
chicken thigh meat	*	*	8E-13	*	1E-12	*	4E-12	*(1E-12, 1E-11)*	2E-11	*(8E-12, 3E-11)*	6E-11	*(3E-11, 1E-10)*	2E-10	*(9E-11, 3E-10)*	4E-10	*(2E-10, 6E-10)*	2E-09	*(5E-10, 2E-09)*
chicken egg	*	*	2E-12	*	2E-12	*	7E-12	*(2E-12, 3E-11)*	4E-11	*(2E-11, 6E-11)*	1E-10	*(6E-11, 2E-10)*	3E-10	*(2E-10, 5E-10)*	7E-10	*(3E-10, 1E-09)*	3E-09	*(9E-10, 3E-09)*
aboveground fruit	*	*	1E-13	*	2E-13	*	6E-13	*(3E-13, 2E-12)*	3E-12	*(1E-12, 6E-12)*	9E-12	*(6E-12, 2E-11)*	2E-11	*(1E-11, 4E-11)*	4E-11	*(2E-11, 6E-11)*	1E-10	*(5E-11, 2E-10)*
aboveground vegetable	*	*	1E-13	*	2E-13	*	6E-13	*(3E-13, 2E-12)*	3E-12	*(1E-12, 6E-12)*	8E-12	*(6E-12, 1E-11)*	2E-11	*(1E-11, 4E-11)*	4E-11	*(2E-11, 6E-11)*	1E-10	*(5E-11, 2E-10)*
belowground vegetable	*	*	3E-15	*	4E-15	*	1E-14	*(5E-15, 4E-14)*	7E-14	*(2E-14, 1E-13)*	2E-13	*(1E-13, 4E-13)*	7E-13	*(3E-13, 1E-12)*	1E-12	*(5E-13, 2E-12)*	5E-12	*(2E-12, 6E-12)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-D11. Cumulative Frequency Distribution of Dioxin TEQ in Subsistence Food Commodities Produced in Sectors with 90 Percent Confidence Intervals: Small Onsite Incinerators

Commodities	*Percentile of Food Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
TCDD-TEQ										
beef	2E-13 *	3E-13 *(3E-13, 6E-13)*	5E-13 *(3E-13, 1E-12)*	2E-12 *(7E-13, 5E-12)*	1E-11 *(5E-12, 2E-11)*	5E-11 *(2E-11, 7E-11)*	1E-10 *(5E-11, 2E-10)*	2E-10 *(7E-11, 3E-10)*	6E-10 *(2E-10, 1E-09)*	
milk	6E-14 *	8E-14 *(7E-14, 1E-13)*	1E-13 *(9E-14, 3E-13)*	6E-13 *(2E-13, 1E-12)*	3E-12 *(1E-12, 6E-12)*	1E-11 *(6E-12, 2E-11)*	3E-11 *(1E-11, 5E-11)*	5E-11 *(2E-11, 8E-11)*	2E-10 *(4E-11, 3E-10)*	
pork	2E-14 *	3E-14 *(2E-14, 5E-14)*	4E-14 *(3E-14, 1E-13)*	2E-13 *(6E-14, 5E-13)*	1E-12 *(4E-13, 2E-12)*	4E-12 *(2E-12, 6E-12)*	1E-11 *(5E-12, 2E-11)*	2E-11 *(7E-12, 3E-11)*	6E-11 *	
chicken thigh meat	3E-14 *	5E-14 *(4E-14, 1E-13)*	7E-14 *(5E-14, 2E-13)*	3E-13 *(1E-13, 6E-13)*	2E-12 *(6E-13, 4E-12)*	6E-12 *(3E-12, 1E-11)*	2E-11 *(8E-12, 3E-11)*	4E-11 *(1E-11, 6E-11)*	1E-10 *(5E-11, 2E-10)*	
chicken egg	5E-14 *	9E-14 *(6E-14, 2E-13)*	1E-13 *(9E-14, 3E-13)*	4E-13 *(2E-13, 1E-12)*	3E-12 *(1E-12, 6E-12)*	1E-11 *(5E-12, 2E-11)*	4E-11 *(1E-11, 6E-11)*	6E-11 *(2E-11, 1E-10)*	2E-10 *(5E-11, 7E-10)*	
aboveground fruit	6E-15 *	7E-15 *(6E-15, 1E-14)*	1E-14 *(9E-15, 3E-14)*	5E-14 *(2E-14, 1E-13)*	3E-13 *(1E-13, 6E-13)*	1E-12 *(5E-13, 2E-12)*	3E-12 *(1E-12, 4E-12)*	4E-12 *(2E-12, 7E-12)*	1E-11 *(5E-12, 3E-11)*	
aboveground vegetable	6E-15 *	7E-15 *(6E-15, 1E-14)*	1E-14 *(9E-15, 3E-14)*	4E-14 *(2E-14, 1E-13)*	3E-13 *(1E-13, 5E-13)*	1E-12 *(5E-13, 2E-12)*	3E-12 *(1E-12, 4E-12)*	4E-12 *(2E-12, 6E-12)*	1E-11 *(4E-12, 2E-11)*	
belowground vegetable	7E-17 *	2E-16 *(9E-17, 4E-16)*	3E-16 *(2E-16, 7E-16)*	9E-16 *(4E-16, 2E-15)*	5E-15 *(2E-15, 1E-14)*	2E-14 *(9E-15, 3E-14)*	6E-14 *(2E-14, 9E-14)*	1E-13 *(4E-14, 2E-13)*	3E-13 *(1E-13, 7E-13)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E1. Cumulative Frequency Distribution of Dioxins/Furans and Mercury (Methyl) in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: Cement Kilns

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	8E-12	*(4E-12, 3E-11)*	3E-11	*(2E-11, 3E-11)*	8E-11	*(6E-11, 2E-10)*	9E-10	*(5E-10, 1E-09)*	4E-09	*(3E-09, 6E-09)*	7E-09	*(6E-09, 8E-09)*	9E-09	*(8E-09, 1E-08)*	*	*
1,2,3,7,8-PeCDD	*	*	2E-11	*(6E-12, 8E-11)*	9E-11	*(5E-11, 2E-10)*	4E-10	*(3E-10, 7E-10)*	6E-09	*(3E-09, 1E-08)*	2E-08	*(2E-08, 3E-08)*	5E-08	*(3E-08, 6E-08)*	6E-08	*(6E-08, 9E-08)*	*	*
1,2,3,7,8,9-HxCDD	*	*	2E-12	*(7E-13, 9E-12)*	1E-11	*(4E-12, 2E-11)*	5E-11	*(3E-11, 9E-11)*	8E-10	*(3E-10, 1E-09)*	3E-09	*(2E-09, 5E-09)*	8E-09	*(5E-09, 1E-08)*	1E-08	*(9E-09, 2E-08)*	*	*
1,2,3,4,7,8-HxCDD	*	*	8E-12	*(3E-12, 3E-11)*	5E-11	*(2E-11, 8E-11)*	2E-10	*(1E-10, 3E-10)*	3E-09	*(2E-09, 4E-09)*	1E-08	*(6E-09, 1E-08)*	2E-08	*(2E-08, 4E-08)*	5E-08	*(3E-08, 7E-08)*	*	*
1,2,3,6,7,8-HxCDD	*	*	8E-12	*(4E-12, 3E-11)*	4E-11	*(2E-11, 9E-11)*	2E-10	*(1E-10, 6E-10)*	4E-09	*(1E-09, 6E-09)*	1E-08	*(1E-08, 2E-08)*	3E-08	*(2E-08, 4E-08)*	4E-08	*(3E-08, 5E-08)*	*	*
1,2,3,6,7,8,9-HpCDD	*	*	7E-12	*(5E-12, 3E-11)*	4E-11	*(8E-12, 9E-11)*	3E-10	*(1E-10, 8E-10)*	6E-09	*(2E-09, 8E-09)*	2E-08	*(2E-08, 2E-08)*	4E-08	*(3E-08, 5E-08)*	9E-08	*(5E-08, 1E-07)*	*	*
1,2,3,4,5,7,8,9-OCDD	*	*	5E-12	*(2E-12, 4E-11)*	4E-11	*(1E-11, 9E-11)*	3E-10	*(2E-10, 7E-10)*	2E-09	*(1E-09, 4E-09)*	9E-09	*(7E-09, 1E-08)*	2E-08	*(1E-08, 4E-08)*	5E-08	*(3E-08, 7E-08)*	*	*
2,3,7,8-TCDF	*	*	6E-12	*(3E-12, 3E-11)*	3E-11	*(1E-11, 5E-11)*	1E-10	*(5E-11, 3E-10)*	3E-09	*(7E-10, 5E-09)*	1E-08	*(8E-09, 2E-08)*	7E-08	*(2E-08, 9E-08)*	1E-07	*(7E-08, 1E-07)*	*	*
1,2,3,7,8-PeCDF	*	*	4E-12	*(9E-13, 4E-11)*	3E-11	*(1E-11, 8E-11)*	1E-10	*(9E-11, 4E-10)*	5E-09	*(8E-10, 9E-09)*	2E-08	*(1E-08, 3E-08)*	4E-08	*(3E-08, 7E-08)*	8E-08	*(4E-08, 1E-07)*	*	*
2,3,4,7,8-PeCDF	*	*	1E-11	*(6E-12, 1E-10)*	1E-10	*(2E-11, 2E-10)*	5E-10	*(3E-10, 1E-09)*	1E-08	*(3E-09, 2E-08)*	4E-08	*(4E-08, 5E-08)*	1E-07	*(7E-08, 1E-07)*	2E-07	*(1E-07, 2E-07)*	*	*
1,2,3,6,7,8-HxCDF	*	*	2E-12	*(5E-13, 2E-11)*	1E-11	*(5E-12, 3E-11)*	8E-11	*(4E-11, 1E-10)*	1E-09	*(4E-10, 3E-09)*	4E-09	*(4E-09, 5E-09)*	1E-08	*(8E-09, 1E-08)*	2E-08	*(1E-08, 2E-08)*	*	*
2,3,4,6,7,8-HxCDF	*	*	3E-12	*(6E-13, 2E-11)*	2E-11	*(5E-12, 5E-11)*	1E-10	*(9E-11, 3E-10)*	2E-09	*(7E-10, 5E-09)*	9E-09	*(6E-09, 1E-08)*	2E-08	*(2E-08, 2E-08)*	3E-08	*(2E-08, 3E-08)*	*	*
1,2,3,4,7,8-HxCDF	*	*	1E-12	*(4E-13, 8E-12)*	8E-12	*(3E-12, 2E-11)*	4E-11	*(3E-11, 9E-11)*	1E-09	*(2E-10, 2E-09)*	4E-09	*(3E-09, 5E-09)*	9E-09	*(6E-09, 1E-08)*	1E-08	*(1E-08, 1E-08)*	*	*
1,2,3,7,8,9-HxCDF	*	*	4E-13	*(8E-14, 8E-12)*	6E-12	*(7E-13, 1E-11)*	6E-11	*(2E-11, 8E-11)*	6E-10	*(3E-10, 7E-10)*	1E-09	*(1E-09, 1E-09)*	3E-09	*(2E-09, 3E-09)*	4E-09	*(3E-09, 4E-09)*	*	*
1,2,3,4,6,7,8-HpCDF	*	*	1E-13	*(3E-14, 2E-12)*	2E-12	*(3E-13, 4E-12)*	1E-11	*(8E-12, 3E-11)*	2E-10	*(1E-10, 3E-10)*	6E-10	*(4E-10, 7E-10)*	1E-09	*(1E-09, 1E-09)*	2E-09	*(1E-09, 2E-09)*	*	*
1,2,3,4,7,8,9-HpCDF	*	*	1E-13	*(2E-14, 1E-12)*	1E-12	*(2E-13, 3E-12)*	9E-12	*(4E-12, 2E-11)*	1E-10	*(8E-11, 2E-10)*	3E-10	*(3E-10, 4E-10)*	7E-10	*(5E-10, 8E-10)*	1E-09	*(7E-10, 1E-09)*	*	*
1,2,3,4,6,7,8,9-OCDF	*	*	2E-14	*(5E-15, 5E-13)*	4E-13	*(5E-14, 1E-12)*	4E-12	*(2E-12, 8E-12)*	5E-11	*(1E-11, 6E-11)*	3E-10	*(2E-10, 4E-10)*	7E-10	*(4E-10, 9E-10)*	1E-09	*(7E-10, 2E-09)*	*	*
TCDD-TEQ	*	*	4E-11	*(1E-11, 2E-10)*	2E-10	*(8E-11, 5E-10)*	1E-09	*(6E-10, 2E-09)*	1E-08	*(5E-09, 3E-08)*	6E-08	*(5E-08, 7E-08)*	1E-07	*(9E-08, 1E-07)*	2E-07	*(1E-07, 2E-07)*	*	*
Mercury (Methyl)	*	*	1E-05	*(1E-05, 2E-05)*	2E-05	*(1E-05, 1E-04)*	5E-04	*(2E-04, 1E-03)*	4E-03	*(1E-03, 1E-02)*	3E-02	*(2E-02, 3E-02)*	4E-02	*(3E-02, 7E-02)*	7E-02	*(4E-02, 7E-02)*	*	*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E2. Cumulative Frequency Distribution of Dioxins/Furans and Mercury (Methyl) in Recreational Fish in Waterbodies: Lightweight Aggregate Kilns[a]

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*								
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	*	*	1E-10	2E-10	4E-10	1E-09	2E-09	*	*
1,2,3,7,8-PeCDD	*	*	6E-10	1E-09	2E-09	8E-09	1E-08	*	*
1,2,3,7,8,9-HxCDD	*	*	1E-10	1E-10	3E-10	7E-10	2E-09	*	*
1,2,3,4,7,8-HxCDD	*	*	2E-10	3E-10	5E-10	2E-09	4E-09	*	*
1,2,3,6,7,8-HxCDD	*	*	5E-10	7E-10	1E-09	3E-09	1E-08	*	*
1,2,3,6,7,8,9-HpCDD	*	*	2E-10	6E-10	1E-09	2E-09	7E-09	*	*
1,2,3,4,5,7,8,9-OCDD	*	*	2E-10	9E-10	1E-09	4E-09	1E-08	*	*
2,3,7,8-TCDF	*	*	9E-10	5E-09	4E-08	1E-07	2E-07	*	*
1,2,3,7,8-PeCDF	*	*	1E-09	4E-09	7E-09	2E-08	4E-08	*	*
2,3,4,7,8-PeCDF	*	*	3E-09	9E-09	2E-08	7E-08	1E-07	*	*
1,2,3,6,7,8-HxCDF	*	*	4E-10	1E-09	2E-09	8E-09	1E-08	*	*
2,3,4,6,7,8-HxCDF	*	*	4E-10	1E-09	2E-09	8E-09	1E-08	*	*
1,2,3,4,7,8-HxCDF	*	*	4E-10	1E-09	3E-09	9E-09	1E-08	*	*
1,2,3,7,8,9-HxCDF	*	*	4E-11	1E-10	2E-10	4E-10	1E-09	*	*
1,2,3,4,6,7,8-HpCDF	*	*	6E-11	1E-10	2E-10	6E-10	1E-09	*	*
1,2,3,4,7,8,9-HpCDF	*	*	2E-11	4E-11	6E-11	1E-10	4E-10	*	*
1,2,3,4,6,7,8,9-OCDF	*	*	1E-11	1E-11	2E-11	9E-11	3E-10	*	*
TCDD-TEQ	*	*	2E-09	8E-09	2E-08	6E-08	1E-07	*	*
Mercury (Methyl)	*	*	6E-05	2E-04	6E-04	4E-03	1E-02	*	*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

[a] Confidence intervals are not applicable since all the lightweight aggregate kilns in the population were sampled with certainty.

All concentration values <10 have been rounded to one significant digit

Table H-E3. Cumulative Frequency Distribution of Dioxins/Furans and Mercury (Methyl) in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	4E-16 *	6E-14 *(4E-14, 3E-13)*	5E-13 *(9E-14, 9E-13)*	3E-12 *(2E-12, 5E-12)*	2E-11 *(1E-11, 4E-11)*	2E-10 *(1E-10, 5E-10)*	2E-09 *(7E-10, 2E-09)*	4E-09 *(2E-09, 6E-09)*	2E-08 *	
1,2,3,7,8-PeCDD	1E-15 *	2E-13 *(1E-13, 1E-12)*	1E-12 *(3E-13, 3E-12)*	1E-11 *(5E-12, 2E-11)*	7E-11 *(4E-11, 1E-10)*	8E-10 *(3E-10, 2E-09)*	7E-09 *(3E-09, 7E-09)*	1E-08 *(7E-09, 1E-08)*	2E-08 *	
1,2,3,7,8,9-HxCDD	5E-17 *	2E-14 *(1E-14, 9E-14)*	1E-13 *(2E-14, 4E-13)*	1E-12 *(6E-13, 2E-12)*	8E-12 *(5E-12, 2E-11)*	7E-11 *(4E-11, 2E-10)*	6E-10 *(3E-10, 9E-10)*	1E-09 *(8E-10, 2E-09)*	4E-09 *	
1,2,3,4,7,8-HxCDD	* *	* *	5E-14 *(4E-17, 2E-13)*	1E-12 *(5E-13, 4E-12)*	1E-11 *(8E-12, 2E-11)*	2E-10 *(7E-11, 4E-10)*	1E-09 *(6E-10, 2E-09)*	3E-09 *(2E-09, 4E-09)*	1E-08 *	
1,2,3,6,7,8-HxCDD	* *	* *	5E-14 *(3E-17, 3E-13)*	1E-12 *(7E-13, 4E-12)*	2E-11 *(1E-11, 3E-11)*	2E-10 *(7E-11, 4E-10)*	2E-09 *(8E-10, 3E-09)*	3E-09 *(2E-09, 5E-09)*	1E-08 *	
1,2,3,6,7,8,9-HpCDD	2E-17 *	2E-14 *(7E-15, 1E-13)*	1E-13 *(4E-14, 4E-13)*	1E-12 *(6E-13, 3E-12)*	3E-11 *(1E-11, 6E-11)*	4E-10 *(2E-10, 9E-10)*	3E-09 *(1E-09, 3E-09)*	6E-09 *(3E-09, 8E-09)*	2E-08 *(2E-08, 3E-08)*	
1,2,3,4,5,7,8,9-OCDD	6E-17 *	4E-14 *(2E-14, 4E-13)*	6E-13 *(1E-13, 1E-12)*	4E-12 *(2E-12, 1E-11)*	9E-11 *(5E-11, 2E-10)*	1E-09 *(7E-10, 3E-09)*	7E-09 *(4E-09, 1E-08)*	2E-08 *(1E-08, 3E-08)*	8E-08 *(5E-08, 9E-08)*	
2,3,7,8-TCDF	2E-15 *	1E-13 *(3E-14, 5E-13)*	6E-13 *(2E-13, 2E-12)*	6E-12 *(4E-12, 1E-11)*	5E-11 *(2E-11, 8E-11)*	5E-10 *(2E-10, 1E-09)*	4E-09 *(2E-09, 6E-09)*	1E-08 *(5E-09, 2E-08)*	4E-08 *(2E-08, 4E-08)*	
1,2,3,7,8-PeCDF	3E-15 *	1E-13 *(8E-14, 1E-12)*	1E-12 *(6E-13, 3E-12)*	1E-11 *(4E-12, 2E-11)*	9E-11 *(6E-11, 2E-10)*	1E-09 *(4E-10, 3E-09)*	1E-08 *(5E-09, 1E-08)*	3E-08 *(1E-08, 3E-08)*	6E-08 *(4E-08, 8E-08)*	
2,3,4,7,8-PeCDF	4E-15 *	2E-13 *(1E-13, 1E-12)*	2E-12 *(6E-13, 4E-12)*	1E-11 *(7E-12, 3E-11)*	1E-10 *(9E-11, 3E-10)*	3E-09 *(1E-09, 7E-09)*	3E-08 *(2E-08, 4E-08)*	5E-08 *(4E-08, 7E-08)*	2E-07 *(1E-07, 2E-07)*	
1,2,3,6,7,8-HxCDF	* *	* *	4E-14 *(2E-16, 2E-13)*	1E-12 *(5E-13, 4E-12)*	4E-11 *(1E-11, 6E-11)*	4E-10 *(1E-10, 1E-09)*	4E-09 *(2E-09, 7E-09)*	2E-08 *(5E-09, 2E-08)*	5E-08 *(3E-08, 7E-08)*	
2,3,4,6,7,8-HxCDF	2E-16 *	8E-14 *(6E-14, 3E-13)*	4E-13 *(1E-13, 1E-12)*	4E-12 *(2E-12, 9E-12)*	6E-11 *(3E-11, 9E-11)*	1E-09 *(3E-10, 3E-09)*	9E-09 *(5E-09, 1E-08)*	2E-08 *(1E-08, 3E-08)*	6E-08 *(5E-08, 8E-08)*	
1,2,3,4,7,8-HxCDF	* *	* *	2E-14 *(5E-16, 1E-13)*	8E-13 *(3E-13, 2E-12)*	2E-11 *(1E-11, 5E-11)*	3E-10 *(1E-10, 1E-09)*	4E-09 *(2E-09, 7E-09)*	1E-08 *(7E-09, 2E-08)*	7E-08 *(3E-08, 7E-08)*	
1,2,3,7,8,9-HxCDF	1E-16 *	6E-14 *(3E-14, 1E-13)*	2E-13 *(7E-14, 9E-13)*	2E-12 *(1E-12, 4E-12)*	2E-11 *(1E-11, 2E-11)*	4E-10 *(9E-11, 7E-10)*	3E-09 *(2E-09, 4E-09)*	7E-09 *(5E-09, 9E-09)*	3E-08 *(1E-08, 3E-08)*	
1,2,3,4,6,7,8-HpCDF	3E-16 *	1E-14 *(8E-15, 4E-14)*	6E-14 *(2E-14, 2E-13)*	7E-13 *(2E-13, 2E-12)*	1E-11 *(7E-12, 3E-11)*	2E-10 *(7E-11, 6E-10)*	2E-09 *(9E-10, 4E-09)*	7E-09 *(4E-09, 1E-08)*	3E-08 *(2E-08, 4E-08)*	
1,2,3,4,7,8,9-HpCDF	2E-17 *	2E-14 *(6E-15, 4E-14)*	4E-14 *(2E-14, 1E-13)*	7E-13 *(4E-13, 1E-12)*	5E-12 *(3E-12, 1E-11)*	2E-10 *(4E-11, 3E-10)*	1E-09 *(7E-10, 2E-09)*	3E-09 *(2E-09, 4E-09)*	1E-08 *(4E-09, 2E-08)*	
1,2,3,4,6,7,8,9-OCDF	9E-18 *	8E-15 *(2E-15, 2E-14)*	2E-14 *(1E-14, 8E-14)*	3E-13 *(1E-13, 1E-12)*	4E-12 *(2E-12, 1E-11)*	1E-10 *(4E-11, 2E-10)*	8E-10 *(4E-10, 1E-09)*	2E-09 *(1E-09, 3E-09)*	1E-08 *(4E-09, 2E-08)*	
TCDD-TEQ	4E-15 *	4E-13 *(3E-13, 3E-12)*	3E-12 *(9E-13, 9E-12)*	2E-11 *(1E-11, 6E-11)*	2E-10 *(1E-10, 4E-10)*	4E-09 *(1E-09, 8E-09)*	3E-08 *(2E-08, 4E-08)*	6E-08 *(4E-08, 8E-08)*	1E-07 *(1E-07, 1E-07)*	
Mercury (Methyl)	* *	* *	* *	2E-09 *	2E-06 *(6E-07, 6E-06)*	5E-05 *(1E-05, 1E-04)*	6E-04 *(2E-04, 1E-03)*	3E-03 *(6E-04, 6E-03)*	3E-02 *(6E-03, 4E-02)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E4. Cumulative Frequency Distribution of Dioxins/Furans and Mercury (Methyl) in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	5E-12	*(4E-12, 7E-12)*	8E-12	*(5E-12, 2E-11)*	3E-11	*(2E-11, 7E-11)*	2E-10	*(9E-11, 3E-10)*	5E-10	*(4E-10, 6E-10)*	2E-09	*(6E-10, 2E-09)*	2E-09	*	*	*
1,2,3,7,8-PeCDD	*	*	9E-12	*(6E-12, 4E-11)*	1E-11	*(1E-11, 4E-11)*	7E-11	*(4E-11, 2E-10)*	5E-10	*(2E-10, 1E-09)*	2E-09	*(1E-09, 4E-09)*	9E-09	*(4E-09, 1E-08)*	1E-08	*(8E-09, 1E-08)*	*	*
1,2,3,7,8,9-HxCDD	*	*	2E-12	*(1E-12, 2E-12)*	2E-12	*(2E-12, 4E-12)*	5E-12	*(3E-12, 3E-11)*	4E-11	*(3E-11, 9E-11)*	1E-10	*(1E-10, 2E-10)*	8E-10	*(2E-10, 1E-09)*	1E-09	*(8E-10, 1E-09)*	*	*
1,2,3,4,7,8-HxCDD	*	*	6E-12	*(4E-12, 8E-12)*	8E-12	*(6E-12, 1E-11)*	2E-11	*(1E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*	5E-10	*(4E-10, 1E-09)*	2E-09	*(1E-09, 3E-09)*	3E-09	*(2E-09, 4E-09)*	*	*
1,2,3,6,7,8-HxCDD	*	*	8E-12	*(6E-12, 1E-11)*	1E-11	*(9E-12, 1E-11)*	3E-11	*(1E-11, 1E-10)*	2E-10	*(2E-10, 2E-10)*	8E-10	*(4E-10, 1E-09)*	3E-09	*(1E-09, 5E-09)*	5E-09	*(2E-09, 6E-09)*	*	*
1,2,3,6,7,8,9-HpCDD	*	*	7E-12	*(5E-12, 1E-11)*	1E-11	*(1E-11, 1E-11)*	3E-11	*(2E-11, 2E-10)*	3E-10	*(2E-10, 6E-10)*	9E-10	*(7E-10, 1E-09)*	3E-09	*(1E-09, 5E-09)*	6E-09	*(3E-09, 1E-08)*	*	*
1,2,3,4,5,7,8,9-OCDD	*	*	2E-11	*(1E-11, 4E-11)*	4E-11	*(3E-11, 9E-11)*	2E-10	*(9E-11, 5E-10)*	9E-10	*(6E-10, 1E-09)*	4E-09	*(2E-09, 5E-09)*	1E-08	*(5E-09, 1E-08)*	1E-08	*(9E-09, 3E-08)*	*	*
2,3,7,8-TCDF	*	*	2E-11	*(7E-12, 4E-11)*	7E-11	*(3E-11, 1E-10)*	1E-10	*(1E-10, 3E-10)*	8E-10	*(5E-10, 2E-09)*	4E-09	*(2E-09, 6E-09)*	1E-08	*(5E-09, 3E-08)*	3E-08	*(1E-08, 4E-08)*	*	*
1,2,3,7,8-PeCDF	*	*	3E-11	*(2E-12, 3E-11)*	3E-11	*(3E-11, 6E-11)*	9E-11	*(8E-11, 4E-10)*	8E-10	*(4E-10, 2E-09)*	9E-09	*(3E-09, 1E-08)*	3E-08	*(1E-08, 4E-08)*	4E-08	*	*	*
2,3,4,7,8-PeCDF	*	*	3E-11	*(4E-12, 9E-11)*	1E-10	*(9E-11, 2E-10)*	4E-10	*(3E-10, 1E-09)*	4E-09	*(1E-09, 1E-08)*	3E-08	*(1E-08, 3E-08)*	6E-08	*(4E-08, 2E-07)*	2E-07	*	*	*
1,2,3,6,7,8-HxCDF	*	*	7E-12	*(5E-12, 2E-11)*	1E-11	*(1E-11, 4E-11)*	4E-11	*(1E-11, 1E-10)*	5E-10	*(2E-10, 1E-09)*	4E-09	*(1E-09, 1E-08)*	2E-08	*(4E-09, 3E-08)*	3E-08	*(2E-08, 3E-08)*	*	*
2,3,4,6,7,8-HxCDF	*	*	5E-12	*(4E-12, 2E-11)*	2E-11	*(9E-12, 3E-11)*	7E-11	*(3E-11, 2E-10)*	6E-10	*(3E-10, 1E-09)*	6E-09	*(1E-09, 1E-08)*	1E-08	*(8E-09, 3E-08)*	3E-08	*(1E-08, 5E-08)*	*	*
1,2,3,4,7,8-HxCDF	*	*	5E-12	*(1E-12, 2E-11)*	1E-11	*(8E-12, 3E-11)*	3E-11	*(2E-11, 2E-10)*	3E-10	*(2E-10, 1E-09)*	6E-09	*(1E-09, 9E-09)*	2E-08	*(8E-09, 2E-08)*	2E-08	*	*	*
1,2,3,7,8,9-HxCDF	*	*	2E-12	*(1E-12, 6E-12)*	3E-12	*(2E-12, 2E-11)*	2E-11	*(5E-12, 5E-11)*	1E-10	*(4E-11, 5E-10)*	2E-09	*(5E-10, 3E-09)*	5E-09	*(3E-09, 6E-09)*	6E-09	*(4E-09, 3E-08)*	*	*
1,2,3,4,6,7,8-HpCDF	*	*	1E-12	*(8E-13, 4E-12)*	2E-12	*(2E-12, 1E-11)*	2E-11	*(3E-12, 3E-11)*	1E-10	*(3E-11, 4E-10)*	7E-10	*(4E-10, 4E-09)*	5E-09	*(9E-10, 7E-09)*	7E-09	*(4E-09, 1E-08)*	*	*
1,2,3,4,7,8,9-HpCDF	*	*	1E-12	*(9E-13, 2E-12)*	1E-12	*(1E-12, 6E-12)*	9E-12	*(2E-12, 2E-11)*	6E-11	*(2E-11, 2E-10)*	4E-10	*(2E-10, 7E-10)*	2E-09	*(5E-10, 2E-09)*	3E-09	*	*	*
1,2,3,4,6,7,8,9-OCDF	*	*	9E-13	*(3E-13, 2E-12)*	2E-12	*(2E-12, 4E-12)*	5E-12	*(4E-12, 3E-11)*	9E-11	*(4E-11, 1E-10)*	2E-10	*(2E-10, 4E-10)*	8E-10	*(4E-10, 1E-09)*	1E-09	*(8E-10, 1E-09)*	*	*
TCDD-TEQ	*	*	1E-10	*(2E-11, 2E-10)*	2E-10	*(1E-10, 3E-10)*	4E-10	*(2E-10, 1E-09)*	3E-09	*(1E-09, 7E-09)*	2E-08	*(8E-09, 2E-08)*	5E-08	*(3E-08, 1E-07)*	1E-07	*	*	*
Mercury (Methyl)	*	*	*	*	*	*	3E-07	*	8E-05	*(6E-06, 2E-04)*	3E-04	*(1E-04, 6E-04)*	2E-03	*(4E-04, 6E-03)*	6E-03	*	*	*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E5. Cumulative Frequency Distribution of Dioxins/Furans and Mercury (Methyl) in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	2E-13	*(6E-14, 5E-12)*	1E-12	*(2E-13, 1E-11)*	2E-11	*(3E-12, 7E-11)*	2E-10	*(6E-11, 7E-10)*	2E-09	*(5E-10, 3E-09)*	7E-09	*(3E-09, 2E-08)*	2E-08	*(6E-09, 3E-08)*	*	*
1,2,3,7,8-PeCDD	*	*	2E-13	*(6E-14, 9E-12)*	2E-12	*(2E-13, 2E-11)*	2E-11	*(6E-12, 9E-11)*	2E-10	*(9E-11, 2E-09)*	4E-09	*(2E-09, 7E-09)*	1E-08	*(7E-09, 2E-08)*	2E-08	*(1E-08, 2E-08)*	*	*
1,2,3,7,8,9-HxCDD	*	*	2E-14	*(6E-15, 5E-13)*	1E-13	*(2E-14, 1E-12)*	2E-12	*(3E-13, 8E-12)*	2E-11	*(6E-12, 2E-10)*	3E-10	*(1E-10, 9E-10)*	2E-09	*(9E-10, 2E-09)*	2E-09	*(2E-09, 3E-09)*	*	*
1,2,3,4,7,8-HxCDD	*	*	*	*	*	*	5E-14	*	2E-11	*(3E-12, 7E-11)*	7E-10	*(4E-11, 2E-09)*	3E-09	*(1E-09, 5E-09)*	6E-09	*(3E-09, 9E-09)*	*	*
1,2,3,6,7,8-HxCDD	*	*	*	*	*	*	5E-14	*	2E-11	*(1E-12, 6E-11)*	7E-10	*(5E-11, 2E-09)*	3E-09	*(1E-09, 5E-09)*	6E-09	*(3E-09, 9E-09)*	*	*
1,2,3,6,7,8,9-HpCDD	*	*	1E-13	*(4E-14, 3E-12)*	7E-13	*(1E-13, 9E-12)*	1E-11	*(6E-12, 6E-11)*	2E-10	*(6E-11, 9E-10)*	2E-09	*(9E-10, 3E-09)*	7E-09	*(6E-09, 9E-09)*	1E-08	*(8E-09, 2E-08)*	2E-08	*(2E-08, 2E-08)*
1,2,3,4,5,7,8,9-OCDD	*	*	3E-13	*(1E-13, 7E-12)*	2E-12	*(3E-13, 4E-11)*	5E-11	*(2E-11, 2E-10)*	6E-10	*(2E-10, 4E-09)*	7E-09	*(3E-09, 1E-08)*	2E-08	*(1E-08, 4E-08)*	5E-08	*(3E-08, 7E-08)*	1E-07	*(7E-08, 1E-07)*
2,3,7,8-TCDF	*	*	1E-13	*(3E-14, 6E-12)*	1E-12	*(1E-13, 2E-11)*	2E-11	*(4E-12, 5E-11)*	1E-10	*(5E-11, 4E-10)*	1E-09	*(3E-10, 2E-09)*	4E-09	*(2E-09, 6E-09)*	6E-09	*(5E-09, 2E-08)*	2E-08	*(1E-08, 2E-08)*
1,2,3,7,8-PeCDF	*	*	2E-13	*(8E-14, 1E-11)*	3E-12	*(2E-13, 4E-11)*	5E-11	*(9E-12, 1E-10)*	4E-10	*(1E-10, 1E-09)*	3E-09	*(1E-09, 5E-09)*	1E-08	*(7E-09, 2E-08)*	3E-08	*(2E-08, 3E-08)*	*	*
2,3,4,7,8-PeCDF	*	*	5E-13	*(2E-13, 4E-11)*	6E-12	*(5E-13, 5E-11)*	7E-11	*(2E-11, 3E-10)*	7E-10	*(2E-10, 3E-09)*	7E-09	*(3E-09, 1E-08)*	4E-08	*(2E-08, 5E-08)*	6E-08	*(4E-08, 7E-08)*	1E-07	*(7E-08, 1E-07)*
1,2,3,6,7,8-HxCDF	*	*	*	*	*	*	5E-14	*	4E-11	*(4E-12, 1E-10)*	1E-09	*(8E-11, 2E-09)*	4E-09	*(1E-09, 8E-09)*	1E-08	*(5E-09, 2E-08)*	3E-08	*(3E-08, 3E-08)*
2,3,4,6,7,8-HxCDF	*	*	3E-13	*(1E-13, 3E-12)*	2E-12	*(3E-13, 2E-11)*	3E-11	*(7E-12, 1E-10)*	4E-10	*(1E-10, 1E-09)*	5E-09	*(1E-09, 6E-09)*	2E-08	*(6E-09, 2E-08)*	3E-08	*(2E-08, 4E-08)*	5E-08	*(4E-08, 5E-08)*
1,2,3,4,7,8-HxCDF	*	*	*	*	*	*	5E-14	*	3E-11	*(2E-12, 1E-10)*	1E-09	*(7E-11, 2E-09)*	3E-09	*(1E-09, 6E-09)*	8E-09	*(4E-09, 1E-08)*	3E-08	*(3E-08, 3E-08)*
1,2,3,7,8,9-HxCDF	*	*	8E-14	*(3E-14, 3E-12)*	1E-12	*(9E-14, 5E-12)*	8E-12	*(3E-12, 2E-11)*	1E-10	*(2E-11, 4E-10)*	1E-09	*(5E-10, 3E-09)*	8E-09	*(3E-09, 1E-08)*	1E-08	*(9E-09, 1E-08)*	*	*
1,2,3,4,6,7,8-HpCDF	*	*	5E-14	*(2E-14, 1E-12)*	6E-13	*(5E-14, 2E-12)*	4E-12	*(2E-12, 2E-11)*	6E-11	*(2E-11, 3E-10)*	8E-10	*(2E-10, 1E-09)*	3E-09	*(2E-09, 6E-09)*	8E-09	*(4E-09, 1E-08)*	3E-08	*(2E-08, 3E-08)*
1,2,3,4,7,8,9-HpCDF	*	*	4E-14	*(1E-14, 6E-13)*	3E-13	*(4E-14, 1E-12)*	3E-12	*(1E-12, 2E-11)*	7E-11	*(8E-12, 3E-10)*	7E-10	*(3E-10, 1E-09)*	3E-09	*(2E-09, 4E-09)*	4E-09	*(3E-09, 8E-09)*	2E-08	*(7E-09, 2E-08)*
1,2,3,4,6,7,8,9-OCDF	*	*	2E-14	*(6E-15, 3E-13)*	1E-13	*(2E-14, 2E-12)*	2E-12	*(7E-13, 8E-12)*	3E-11	*(7E-12, 1E-10)*	5E-10	*(1E-10, 8E-10)*	1E-09	*(1E-09, 2E-09)*	3E-09	*(2E-09, 4E-09)*	2E-08	*(1E-08, 2E-08)*
TCDD-TEQ	*	*	7E-13	*(3E-13, 4E-11)*	1E-11	*(7E-13, 8E-11)*	1E-10	*(3E-11, 4E-10)*	9E-10	*(4E-10, 6E-09)*	1E-08	*(4E-09, 2E-08)*	5E-08	*(3E-08, 7E-08)*	7E-08	*(6E-08, 1E-07)*	*	*
Mercury (Methyl)	*	*	*	*	*	*	*	*	4E-07	*	3E-05	*(6E-06, 8E-05)*	2E-04	*(6E-05, 4E-03)*	4E-03	*(2E-04, 2E-02)*	*	*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E6. Cumulative Frequency Distribution of Dioxins/Furans and Mercury (Methyl) in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*																					
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	4E-14	*(9E-16, 1E-13)*	9E-14	*(5E-14, 7E-13)*	1E-12	*(7E-13, 3E-12)*	6E-12	*(3E-12, 1E-11)*	3E-11	*(2E-11, 5E-11)*	1E-10	*(8E-11, 4E-10)*	6E-10	*(1E-10, 9E-10)*	2E-09	*(8E-10, 2E-09)*
1,2,3,7,8-PeCDD	*	*	1E-13	*(3E-15, 1E-12)*	3E-13	*(2E-13, 3E-12)*	5E-12	*(2E-12, 1E-11)*	3E-11	*(1E-11, 5E-11)*	1E-10	*(7E-11, 2E-10)*	9E-10	*(3E-10, 2E-09)*	4E-09	*(9E-10, 7E-09)*	1E-08	*(4E-09, 1E-08)*
1,2,3,7,8,9-HxCDD	*	*	2E-14	*(2E-16, 7E-14)*	2E-14	*(2E-14, 3E-13)*	5E-13	*(3E-13, 1E-12)*	4E-12	*(2E-12, 8E-12)*	2E-11	*(1E-11, 4E-11)*	1E-10	*(5E-11, 2E-10)*	4E-10	*(1E-10, 6E-10)*	1E-09	*(4E-10, 3E-09)*
1,2,3,4,7,8-HxCDD	*	*	5E-14	*(5E-16, 2E-13)*	8E-14	*(5E-14, 6E-13)*	1E-12	*(6E-13, 4E-12)*	8E-12	*(4E-12, 1E-11)*	5E-11	*(2E-11, 8E-11)*	4E-10	*(1E-10, 7E-10)*	8E-10	*(4E-10, 3E-09)*	4E-09	*(1E-09, 6E-09)*
1,2,3,6,7,8-HxCDD	*	*	5E-14	*(5E-16, 2E-13)*	8E-14	*(5E-14, 7E-13)*	1E-12	*(7E-13, 3E-12)*	1E-11	*(5E-12, 2E-11)*	6E-11	*(3E-11, 1E-10)*	3E-10	*(1E-10, 1E-09)*	1E-09	*(3E-10, 3E-09)*	5E-09	*(2E-09, 1E-08)*
1,2,3,6,7,8,9-HpCDD	*	*	8E-15	*(7E-17, 6E-14)*	3E-14	*(8E-15, 2E-13)*	6E-13	*(2E-13, 1E-12)*	3E-12	*(1E-12, 2E-11)*	7E-11	*(2E-11, 2E-10)*	6E-10	*(2E-10, 2E-09)*	2E-09	*(5E-10, 3E-09)*	5E-09	*(2E-09, 1E-08)*
1,2,3,4,5,7,8,9-OCDD	*	*	3E-14	*(2E-16, 2E-13)*	1E-13	*(3E-14, 6E-13)*	2E-12	*(6E-13, 3E-12)*	1E-11	*(5E-12, 5E-11)*	2E-10	*(6E-11, 7E-10)*	2E-09	*(8E-10, 3E-09)*	4E-09	*(2E-09, 1E-08)*	3E-08	*(5E-09, 4E-08)*
2,3,7,8-TCDF	*	*	3E-14	*(3E-15, 4E-13)*	4E-13	*(3E-14, 1E-12)*	3E-12	*(1E-12, 6E-12)*	2E-11	*(8E-12, 2E-11)*	8E-11	*(5E-11, 1E-10)*	8E-10	*(1E-10, 4E-09)*	5E-09	*(6E-10, 2E-08)*	4E-08	*
1,2,3,7,8-PeCDF	*	*	9E-14	*(5E-15, 1E-12)*	8E-13	*(9E-14, 2E-12)*	3E-12	*(2E-12, 1E-11)*	3E-11	*(1E-11, 6E-11)*	3E-10	*(9E-11, 4E-10)*	3E-09	*(4E-10, 5E-09)*	7E-09	*(2E-09, 3E-08)*	6E-08	*
2,3,4,7,8-PeCDF	*	*	1E-13	*(6E-15, 8E-13)*	8E-13	*(2E-13, 3E-12)*	4E-12	*(2E-12, 1E-11)*	5E-11	*(1E-11, 9E-11)*	3E-10	*(1E-10, 8E-10)*	5E-09	*(8E-10, 2E-08)*	4E-08	*(4E-09, 6E-08)*	1E-07	*(5E-08, 2E-07)*
1,2,3,6,7,8-HxCDF	*	*	3E-14	*(2E-15, 9E-14)*	9E-14	*(4E-14, 5E-13)*	8E-13	*(4E-13, 2E-12)*	2E-11	*(3E-12, 4E-11)*	1E-10	*(6E-11, 2E-10)*	2E-09	*(3E-10, 4E-09)*	5E-09	*(1E-09, 3E-08)*	6E-08	*
2,3,4,6,7,8-HxCDF	*	*	7E-14	*(5E-16, 2E-13)*	1E-13	*(7E-14, 8E-13)*	2E-12	*(7E-13, 4E-12)*	1E-11	*(5E-12, 4E-11)*	8E-11	*(6E-11, 2E-10)*	2E-09	*(3E-10, 5E-09)*	9E-09	*(2E-09, 3E-08)*	6E-08	*(1E-08, 9E-08)*
1,2,3,4,7,8-HxCDF	*	*	2E-14	*(3E-15, 4E-14)*	5E-14	*(2E-14, 3E-13)*	6E-13	*(3E-13, 1E-12)*	1E-11	*(1E-12, 3E-11)*	8E-11	*(5E-11, 2E-10)*	1E-09	*(2E-10, 5E-09)*	7E-09	*(8E-10, 3E-08)*	6E-08	*
1,2,3,7,8,9-HxCDF	*	*	4E-14	*(4E-16, 9E-14)*	7E-14	*(4E-14, 5E-13)*	1E-12	*(5E-13, 2E-12)*	4E-12	*(3E-12, 1E-11)*	3E-11	*(2E-11, 8E-11)*	8E-10	*(5E-11, 2E-09)*	3E-09	*(4E-10, 6E-09)*	1E-08	*(5E-09, 2E-08)*
1,2,3,4,6,7,8-HpCDF	*	*	9E-15	*(5E-16, 2E-14)*	2E-14	*(9E-15, 8E-14)*	2E-13	*(8E-14, 6E-13)*	5E-12	*(7E-13, 1E-11)*	4E-11	*(2E-11, 7E-11)*	4E-10	*(7E-11, 2E-09)*	4E-09	*(3E-10, 2E-08)*	3E-08	*(4E-09, 5E-08)*
1,2,3,4,7,8,9-HpCDF	*	*	8E-15	*(6E-17, 3E-14)*	2E-14	*(8E-15, 7E-14)*	3E-13	*(7E-14, 6E-13)*	2E-12	*(7E-13, 3E-12)*	1E-11	*(4E-12, 3E-11)*	2E-10	*(3E-11, 1E-09)*	1E-09	*(2E-10, 3E-09)*	7E-09	*(2E-09, 2E-08)*
1,2,3,4,6,7,8,9-OCDF	*	*	3E-15	*(2E-17, 1E-14)*	1E-14	*(3E-15, 4E-14)*	1E-13	*(4E-14, 3E-13)*	1E-12	*(4E-13, 2E-12)*	1E-11	*(3E-12, 4E-11)*	3E-10	*(5E-11, 5E-10)*	8E-10	*(2E-10, 3E-09)*	9E-09	*(8E-10, 2E-08)*
TCDD-TEQ	*	*	3E-13	*(8E-15, 2E-12)*	1E-12	*(4E-13, 6E-12)*	1E-11	*(6E-12, 2E-11)*	7E-11	*(4E-11, 1E-10)*	4E-10	*(2E-10, 1E-09)*	5E-09	*(1E-09, 1E-08)*	2E-08	*(4E-09, 4E-08)*	1E-07	*(4E-08, 1E-07)*
Mercury (Methyl)	*	*	*	*	4E-11	*	4E-08	*(3E-09, 3E-07)*	2E-06	*(4E-07, 5E-06)*	2E-05	*(4E-06, 1E-04)*	5E-04	*(4E-05, 1E-03)*	1E-03	*(2E-04, 4E-03)*	*	*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E7. Cumulative Frequency Distribution of Dioxins/Furans in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: Waste Heat Boilers

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	6E-13	*	3E-12	*(7E-13, 1E-11)*	2E-11	*(1E-11, 4E-11)*	2E-10	*(7E-11, 3E-10)*	6E-10	*(5E-10, 8E-10)*	1E-09	*(7E-10, 2E-09)*	2E-09	*(1E-09, 2E-09)*	*	*
1,2,3,7,8-PeCDD	*	*	2E-12	*(1E-12, 9E-12)*	7E-12	*(2E-12, 3E-11)*	1E-10	*(4E-11, 2E-10)*	1E-09	*(6E-10, 2E-09)*	4E-09	*(3E-09, 7E-09)*	9E-09	*(8E-09, 1E-08)*	1E-08	*(9E-09, 1E-08)*	*	*
1,2,3,7,8,9-HxCDD	*	*	1E-13	*	8E-13	*(1E-13, 2E-12)*	7E-12	*(3E-12, 4E-11)*	7E-11	*(4E-11, 1E-10)*	3E-10	*(2E-10, 5E-10)*	9E-10	*(4E-10, 1E-09)*	1E-09	*(8E-10, 3E-09)*	*	*
1,2,3,4,7,8-HxCDD	*	*	3E-13	*	2E-12	*(3E-13, 6E-12)*	2E-11	*(9E-12, 1E-10)*	3E-10	*(1E-10, 5E-10)*	1E-09	*(5E-10, 2E-09)*	3E-09	*(2E-09, 4E-09)*	5E-09	*(3E-09, 6E-09)*	*	*
1,2,3,6,7,8-HxCDD	*	*	6E-13	*	2E-12	*(6E-13, 1E-11)*	3E-11	*(2E-11, 2E-10)*	4E-10	*(2E-10, 8E-10)*	1E-09	*(1E-09, 3E-09)*	4E-09	*(2E-09, 5E-09)*	5E-09	*(4E-09, 9E-09)*	*	*
1,2,3,6,7,8,9-HpCDD	*	*	8E-13	*	3E-12	*(8E-13, 1E-11)*	4E-11	*(2E-11, 2E-10)*	6E-10	*(3E-10, 9E-10)*	2E-09	*(1E-09, 3E-09)*	6E-09	*(3E-09, 7E-09)*	9E-09	*(6E-09, 2E-08)*	*	*
1,2,3,4,5,7,8,9-OCDD	*	*	1E-12	*	6E-12	*(1E-12, 3E-11)*	8E-11	*(4E-11, 4E-10)*	1E-09	*(8E-10, 1E-09)*	3E-09	*(2E-09, 8E-09)*	2E-08	*(5E-09, 2E-08)*	3E-08	*(1E-08, 6E-08)*	*	*
2,3,7,8-TCDF	*	*	1E-11	*(3E-12, 2E-11)*	2E-11	*(1E-11, 6E-11)*	2E-10	*(4E-11, 8E-10)*	2E-09	*(2E-09, 4E-09)*	1E-08	*(5E-09, 2E-08)*	3E-08	*(2E-08, 4E-08)*	4E-08	*(2E-08, 4E-08)*	*	*
1,2,3,7,8-PeCDF	*	*	5E-12	*(2E-12, 3E-11)*	3E-11	*(6E-12, 9E-11)*	4E-10	*(1E-10, 1E-09)*	5E-09	*(3E-09, 6E-09)*	2E-08	*(8E-09, 3E-08)*	4E-08	*(2E-08, 5E-08)*	5E-08	*(3E-08, 7E-08)*	*	*
2,3,4,7,8-PeCDF	*	*	2E-11	*(7E-12, 6E-11)*	6E-11	*(2E-11, 3E-10)*	8E-10	*(2E-10, 4E-09)*	1E-08	*(6E-09, 2E-08)*	5E-08	*(4E-08, 7E-08)*	1E-07	*(7E-08, 1E-07)*	2E-07	*(9E-08, 2E-07)*	*	*
1,2,3,6,7,8-HxCDF	*	*	1E-12	*(6E-13, 8E-12)*	6E-12	*(2E-12, 4E-11)*	8E-11	*(3E-11, 8E-10)*	2E-09	*(9E-10, 4E-09)*	1E-08	*(4E-09, 2E-08)*	4E-08	*(2E-08, 5E-08)*	6E-08	*(4E-08, 8E-08)*	*	*
2,3,4,6,7,8-HxCDF	*	*	1E-12	*	1E-11	*(2E-12, 4E-11)*	1E-10	*(5E-11, 9E-10)*	2E-09	*(1E-09, 4E-09)*	1E-08	*(4E-09, 3E-08)*	3E-08	*(1E-08, 5E-08)*	6E-08	*(3E-08, 8E-08)*	*	*
1,2,3,4,7,8-HxCDF	*	*	9E-13	*(7E-13, 5E-12)*	5E-12	*(1E-12, 2E-11)*	6E-11	*(2E-11, 8E-10)*	2E-09	*(9E-10, 5E-09)*	1E-08	*(5E-09, 2E-08)*	3E-08	*(2E-08, 5E-08)*	6E-08	*(3E-08, 8E-08)*	*	*
1,2,3,7,8,9-HxCDF	*	*	2E-12	*(8E-13, 6E-12)*	6E-12	*(2E-12, 2E-11)*	9E-11	*(2E-11, 4E-10)*	1E-09	*(5E-10, 2E-09)*	5E-09	*(3E-09, 7E-09)*	1E-08	*(7E-09, 2E-08)*	2E-08	*(1E-08, 3E-08)*	*	*
1,2,3,4,6,7,8-HpCDF	*	*	3E-13	*(1E-13, 2E-12)*	1E-12	*(4E-13, 6E-12)*	2E-11	*(6E-12, 2E-10)*	8E-10	*(3E-10, 2E-09)*	4E-09	*(2E-09, 1E-08)*	2E-08	*(8E-09, 3E-08)*	4E-08	*(2E-08, 5E-08)*	*	*
1,2,3,4,7,8,9-HpCDF	*	*	1E-13	*(8E-14, 1E-12)*	7E-13	*(2E-13, 3E-12)*	1E-11	*(3E-12, 1E-10)*	3E-10	*(1E-10, 6E-10)*	2E-09	*(7E-10, 2E-09)*	3E-09	*(2E-09, 7E-09)*	9E-09	*(3E-09, 2E-08)*	*	*
1,2,3,4,6,7,8,9-OCDF	*	*	4E-14	*(3E-14, 3E-13)*	2E-13	*(6E-14, 1E-12)*	5E-12	*(1E-12, 4E-11)*	2E-10	*(6E-11, 3E-10)*	8E-10	*(4E-10, 1E-09)*	4E-09	*(1E-09, 8E-09)*	1E-08	*(1E-09, 2E-08)*	*	*
TCDD-TEQ	*	*	2E-11	*(6E-12, 6E-11)*	5E-11	*(2E-11, 2E-10)*	7E-10	*(2E-10, 3E-09)*	1E-08	*(6E-09, 2E-08)*	4E-08	*(2E-08, 6E-08)*	7E-08	*(6E-08, 1E-07)*	1E-07	*(7E-08, 1E-07)*	*	*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E8. Cumulative Frequency Distribution of Dioxins/Furans in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	2E-16 *	5E-14 *(4E-14, 2E-13)*	2E-13 *(6E-14, 8E-13)*	2E-12 *(1E-12, 4E-12)*	2E-11 *(8E-12, 3E-11)*	1E-10 *(6E-11, 4E-10)*	2E-09 *(4E-10, 3E-09)*	4E-09 *(2E-09, 1E-08)*	3E-08 *	
1,2,3,7,8-PeCDD	6E-16 *	2E-13 *(7E-14, 6E-13)*	7E-13 *(2E-13, 3E-12)*	7E-12 *(4E-12, 1E-11)*	5E-11 *(2E-11, 7E-11)*	3E-10 *(1E-10, 9E-10)*	2E-09 *(1E-09, 7E-09)*	8E-09 *(7E-09, 1E-08)*	2E-08 *	
1,2,3,7,8,9-HxCDD	3E-17 *	2E-14 *(7E-15, 8E-14)*	8E-14 *(2E-14, 3E-13)*	8E-13 *(4E-13, 2E-12)*	6E-12 *(3E-12, 1E-11)*	4E-11 *(2E-11, 1E-10)*	3E-10 *(1E-10, 8E-10)*	1E-09 *(6E-10, 2E-09)*	3E-09 *	
1,2,3,4,7,8-HxCDD	* *	* *	2E-14 *	1E-12 *(3E-13, 4E-12)*	1E-11 *(6E-12, 2E-11)*	7E-11 *(3E-11, 2E-10)*	6E-10 *(3E-10, 2E-09)*	3E-09 *(6E-10, 4E-09)*	8E-09 *	
1,2,3,6,7,8-HxCDD	* *	* *	2E-14 *	1E-12 *(3E-13, 2E-12)*	1E-11 *(6E-12, 2E-11)*	6E-11 *(3E-11, 2E-10)*	6E-10 *(2E-10, 2E-09)*	3E-09 *(5E-10, 3E-09)*	9E-09 *	
1,2,3,6,7,8,9-HpCDD	1E-17 *	2E-14 *(5E-15, 7E-14)*	6E-14 *(2E-14, 2E-13)*	8E-13 *(6E-13, 2E-12)*	2E-11 *(5E-12, 3E-11)*	2E-10 *(9E-11, 4E-10)*	1E-09 *(7E-10, 3E-09)*	4E-09 *(3E-09, 6E-09)*	2E-08 *(9E-09, 2E-08)*	
1,2,3,4,5,7,8,9-OCDD	4E-17 *	4E-14 *(2E-14, 2E-13)*	2E-13 *(4E-14, 1E-12)*	3E-12 *(2E-12, 7E-12)*	5E-11 *(3E-11, 1E-10)*	8E-10 *(3E-10, 2E-09)*	7E-09 *(3E-09, 1E-08)*	2E-08 *(9E-09, 3E-08)*	6E-08 *	
2,3,7,8-TCDF	1E-15 *	4E-14 *(2E-14, 4E-13)*	4E-13 *(1E-13, 1E-12)*	5E-12 *(2E-12, 8E-12)*	2E-11 *(2E-11, 5E-11)*	1E-10 *(8E-11, 3E-10)*	1E-09 *(5E-10, 2E-09)*	2E-09 *(1E-09, 4E-09)*	6E-09 *(5E-09, 2E-08)*	
1,2,3,7,8-PeCDF	2E-15 *	9E-14 *(7E-14, 7E-13)*	8E-13 *(1E-13, 2E-12)*	5E-12 *(3E-12, 1E-11)*	6E-11 *(3E-11, 8E-11)*	4E-10 *(2E-10, 8E-10)*	3E-09 *(1E-09, 4E-09)*	9E-09 *(3E-09, 1E-08)*	4E-08 *(3E-08, 4E-08)*	
2,3,4,7,8-PeCDF	2E-15 *	2E-13 *(1E-13, 7E-13)*	9E-13 *(2E-13, 3E-12)*	8E-12 *(4E-12, 2E-11)*	9E-11 *(5E-11, 1E-10)*	9E-10 *(3E-10, 2E-09)*	7E-09 *(3E-09, 1E-08)*	2E-08 *(8E-09, 3E-08)*	6E-08 *(4E-08, 1E-07)*	
1,2,3,6,7,8-HxCDF	* *	* *	2E-14 *	6E-13 *(3E-13, 2E-12)*	2E-11 *(5E-12, 4E-11)*	1E-10 *(7E-11, 2E-10)*	1E-09 *(3E-10, 2E-09)*	2E-09 *(1E-09, 4E-09)*	1E-08 *(6E-09, 2E-08)*	
2,3,4,6,7,8-HxCDF	1E-16 *	7E-14 *(3E-14, 2E-13)*	2E-13 *(8E-14, 1E-12)*	3E-12 *(1E-12, 7E-12)*	3E-11 *(1E-11, 6E-11)*	3E-10 *(1E-10, 7E-10)*	4E-09 *(1E-09, 6E-09)*	1E-08 *(5E-09, 2E-08)*	4E-08 *(2E-08, 5E-08)*	
1,2,3,4,7,8-HxCDF	* *	* *	1E-14 *	4E-13 *(1E-13, 1E-12)*	2E-11 *(3E-12, 3E-11)*	9E-11 *(5E-11, 2E-10)*	9E-10 *(3E-10, 2E-09)*	2E-09 *(9E-10, 7E-09)*	1E-08 *(6E-09, 3E-08)*	
1,2,3,7,8,9-HxCDF	8E-17 *	5E-14 *(2E-14, 1E-13)*	1E-13 *(6E-14, 6E-13)*	2E-12 *(1E-12, 3E-12)*	1E-11 *(4E-12, 2E-11)*	5E-11 *(3E-11, 3E-10)*	7E-10 *(4E-10, 2E-09)*	3E-09 *(2E-09, 3E-09)*	1E-08 *	
1,2,3,4,6,7,8-HpCDF	2E-16 *	1E-14 *(3E-15, 3E-14)*	4E-14 *(2E-14, 1E-13)*	4E-13 *(2E-13, 2E-12)*	1E-11 *(4E-12, 2E-11)*	6E-11 *(4E-11, 2E-10)*	7E-10 *(2E-10, 1E-09)*	2E-09 *(7E-10, 3E-09)*	8E-09 *	
1,2,3,4,7,8,9-HpCDF	1E-17 *	1E-14 *(4E-15, 3E-14)*	3E-14 *(1E-14, 1E-13)*	4E-13 *(3E-13, 8E-13)*	3E-12 *(2E-12, 6E-12)*	3E-11 *(1E-11, 2E-10)*	6E-10 *(2E-10, 1E-09)*	2E-09 *(8E-10, 3E-09)*	4E-09 *	
1,2,3,4,6,7,8,9-OCDF	5E-18 *	6E-15 *(1E-15, 1E-14)*	1E-14 *(7E-15, 5E-14)*	2E-13 *(1E-13, 7E-13)*	3E-12 *(2E-12, 5E-12)*	4E-11 *(1E-11, 1E-10)*	5E-10 *(2E-10, 7E-10)*	1E-09 *(5E-10, 1E-09)*	3E-09 *	
TCDD-TEQ	2E-15 *	4E-13 *(2E-13, 2E-12)*	2E-12 *(4E-13, 6E-12)*	2E-11 *(1E-11, 4E-11)*	1E-10 *(9E-11, 2E-10)*	1E-09 *(4E-10, 3E-09)*	1E-08 *(3E-09, 2E-08)*	3E-08 *(1E-08, 5E-08)*	1E-07 *(7E-08, 1E-07)*	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E9. Cumulative Frequency Distribution of Dioxins/Furans in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%	
2,3,7,8-TCDD	* *	4E-12 *(4E-12, 9E-12)*	9E-12 *(5E-12, 2E-11)*	2E-11 *(1E-11, 5E-11)*	9E-11 *(5E-11, 2E-10)*	4E-10 *(3E-10, 5E-10)*	7E-10 *(4E-10, 2E-09)*	2E-09 *	* *	
1,2,3,7,8-PeCDD	* *	6E-12 *(3E-12, 2E-11)*	1E-11 *(7E-12, 4E-11)*	4E-11 *(1E-11, 1E-10)*	2E-10 *(9E-11, 2E-10)*	6E-10 *(3E-10, 2E-09)*	3E-09 *(8E-10, 8E-09)*	9E-09 *(2E-09, 1E-08)*	* *	
1,2,3,7,8,9-HxCDD	* *	1E-12 *(4E-13, 3E-12)*	2E-12 *(2E-12, 4E-12)*	4E-12 *(3E-12, 2E-11)*	3E-11 *(1E-11, 4E-11)*	1E-10 *(4E-11, 1E-10)*	6E-10 *(1E-10, 1E-09)*	1E-09 *(5E-10, 1E-09)*	* *	
1,2,3,4,7,8-HxCDD	* *	5E-12 *(1E-12, 1E-11)*	9E-12 *(5E-12, 1E-11)*	1E-11 *(1E-11, 8E-11)*	1E-10 *(2E-11, 2E-10)*	4E-10 *(3E-10, 4E-10)*	1E-09 *(5E-10, 3E-09)*	3E-09 *(1E-09, 6E-09)*	* *	
1,2,3,6,7,8-HxCDD	* *	6E-12 *(2E-12, 9E-12)*	9E-12 *(7E-12, 1E-11)*	1E-11 *(1E-11, 1E-10)*	1E-10 *(5E-11, 2E-10)*	2E-10 *(2E-10, 4E-10)*	1E-09 *(5E-10, 3E-09)*	4E-09 *(9E-10, 5E-09)*	* *	
1,2,3,6,7,8,9-HpCDD	* *	6E-12 *(2E-12, 1E-11)*	1E-11 *(6E-12, 1E-11)*	2E-11 *(1E-11, 1E-10)*	2E-10 *(4E-11, 3E-10)*	7E-10 *(4E-10, 8E-10)*	3E-09 *(9E-10, 5E-09)*	7E-09 *(2E-09, 2E-08)*	* *	
1,2,3,4,5,7,8,9-OCDD	* *	2E-11 *(8E-12, 5E-11)*	5E-11 *(2E-11, 9E-11)*	1E-10 *(8E-11, 4E-10)*	9E-10 *(3E-10, 1E-09)*	4E-09 *(3E-09, 5E-09)*	9E-09 *(5E-09, 1E-08)*	2E-08 *(8E-09, 3E-08)*	* *	
2,3,7,8-TCDF	* *	7E-12 *(5E-12, 2E-11)*	2E-11 *(1E-11, 7E-11)*	1E-10 *(9E-11, 2E-10)*	4E-10 *(1E-10, 8E-10)*	1E-09 *(7E-10, 4E-09)*	4E-09 *(2E-09, 1E-08)*	1E-08 *	* *	
1,2,3,7,8-PeCDF	* *	2E-12 *(2E-12, 3E-11)*	3E-11 *(2E-11, 3E-11)*	7E-11 *(6E-11, 2E-10)*	4E-10 *(1E-10, 6E-10)*	1E-09 *(6E-10, 9E-09)*	9E-09 *(2E-09, 3E-08)*	3E-08 *	* *	
2,3,4,7,8-PeCDF	* *	4E-12 *(4E-12, 4E-11)*	8E-11 *(3E-11, 1E-10)*	2E-10 *(1E-10, 9E-10)*	1E-09 *(3E-10, 2E-09)*	6E-09 *(2E-09, 2E-08)*	3E-08 *(9E-09, 9E-08)*	1E-07 *	* *	
1,2,3,6,7,8-HxCDF	* *	5E-12 *(1E-12, 1E-11)*	1E-11 *(5E-12, 2E-11)*	2E-11 *(1E-11, 1E-10)*	1E-10 *(7E-11, 2E-10)*	6E-10 *(2E-10, 4E-09)*	4E-09 *(8E-10, 1E-08)*	2E-08 *	* *	
2,3,4,6,7,8-HxCDF	* *	4E-12 *(1E-12, 2E-11)*	1E-11 *(4E-12, 3E-11)*	3E-11 *(2E-11, 1E-10)*	3E-10 *(7E-11, 5E-10)*	1E-09 *(5E-10, 6E-09)*	9E-09 *(2E-09, 2E-08)*	3E-08 *(7E-09, 5E-08)*	* *	
1,2,3,4,7,8-HxCDF	* *	1E-12 *(4E-13, 9E-12)*	9E-12 *(3E-12, 2E-11)*	2E-11 *(2E-11, 9E-11)*	2E-10 *(3E-11, 3E-10)*	9E-10 *(3E-10, 7E-09)*	8E-09 *(9E-10, 2E-08)*	2E-08 *	* *	
1,2,3,7,8,9-HxCDF	* *	1E-12 *(5E-13, 3E-12)*	2E-12 *(2E-12, 8E-12)*	9E-12 *(2E-12, 2E-11)*	4E-11 *(2E-11, 9E-11)*	1E-10 *(9E-11, 5E-10)*	5E-10 *(1E-10, 1E-09)*	2E-09 *	* *	
1,2,3,4,6,7,8-HpCDF	* *	7E-13 *(2E-13, 2E-12)*	2E-12 *(1E-12, 7E-12)*	6E-12 *(2E-12, 2E-11)*	3E-11 *(2E-11, 6E-11)*	4E-10 *(6E-11, 7E-10)*	1E-09 *(5E-10, 3E-09)*	4E-09 *(7E-10, 6E-09)*	* *	
1,2,3,4,7,8,9-HpCDF	* *	9E-13 *(3E-13, 1E-12)*	1E-12 *(1E-12, 3E-12)*	3E-12 *(1E-12, 1E-11)*	2E-11 *(9E-12, 3E-11)*	2E-10 *(4E-11, 4E-10)*	5E-10 *(2E-10, 2E-09)*	2E-09 *	* *	
1,2,3,4,6,7,8,9-OCDF	* *	3E-13 *(1E-13, 2E-12)*	2E-12 *(6E-13, 4E-12)*	4E-12 *(3E-12, 1E-11)*	3E-11 *(1E-11, 1E-10)*	2E-10 *(2E-10, 2E-10)*	8E-10 *(3E-10, 1E-09)*	1E-09 *(8E-10, 2E-09)*	* *	
TCDD-TEQ	* *	2E-11 *(1E-11, 1E-10)*	1E-10 *(1E-10, 2E-10)*	2E-10 *(2E-10, 8E-10)*	1E-09 *(4E-10, 2E-09)*	5E-09 *(2E-09, 2E-08)*	2E-08 *(7E-09, 8E-08)*	1E-07 *	* *	

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E10. Cumulative Frequency Distribution of Dioxins/Furans in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	2E-13	*	2E-12	*(2E-13, 2E-11)*	3E-11	*(3E-12, 1E-10)*	2E-10	*(6E-11, 2E-09)*	2E-09	*(5E-10, 4E-09)*	1E-08	*(4E-09, 2E-08)*	2E-08	*(8E-09, 3E-08)*	*	*
1,2,3,7,8-PeCDD	*	*	1E-13	*(6E-14, 1E-11)*	2E-12	*(1E-13, 2E-11)*	2E-11	*(5E-12, 1E-10)*	2E-10	*(8E-11, 2E-09)*	2E-09	*(1E-09, 7E-09)*	1E-08	*(7E-09, 2E-08)*	2E-08	*(1E-08, 2E-08)*	*	*
1,2,3,7,8,9-HxCDD	*	*	1E-14	*(6E-15, 7E-13)*	1E-13	*(1E-14, 2E-12)*	2E-12	*(3E-13, 8E-12)*	2E-11	*(5E-12, 2E-10)*	3E-10	*(1E-10, 9E-10)*	1E-09	*(8E-10, 2E-09)*	2E-09	*(2E-09, 3E-09)*	*	*
1,2,3,4,7,8-HxCDD	*	*	*	*	*	*	2E-14	*	1E-11	*(9E-13, 6E-11)*	5E-10	*(3E-11, 1E-09)*	3E-09	*(6E-10, 4E-09)*	5E-09	*(2E-09, 8E-09)*	*	*
1,2,3,6,7,8-HxCDD	*	*	*	*	*	*	2E-14	*	1E-11	*(8E-13, 6E-11)*	5E-10	*(4E-11, 1E-09)*	3E-09	*(5E-10, 4E-09)*	5E-09	*(2E-09, 9E-09)*	*	*
1,2,3,6,7,8,9-HpCDD	*	*	8E-14	*(4E-14, 5E-12)*	6E-13	*(9E-14, 1E-11)*	1E-11	*(5E-12, 6E-11)*	1E-10	*(5E-11, 1E-09)*	1E-09	*(6E-10, 3E-09)*	6E-09	*(3E-09, 9E-09)*	1E-08	*(6E-09, 2E-08)*	*	*
1,2,3,4,5,7,8,9-OCDD	*	*	3E-13	*	3E-12	*(3E-13, 5E-11)*	6E-11	*(2E-11, 2E-10)*	5E-10	*(2E-10, 4E-09)*	5E-09	*(2E-09, 1E-08)*	2E-08	*(1E-08, 4E-08)*	4E-08	*(2E-08, 6E-08)*	*	*
2,3,7,8-TCDF	*	*	1E-13	*	8E-13	*(9E-14, 1E-11)*	2E-11	*(2E-12, 6E-11)*	9E-11	*(5E-11, 3E-10)*	8E-10	*(3E-10, 2E-09)*	2E-09	*(2E-09, 4E-09)*	5E-09	*	*	*
1,2,3,7,8-PeCDF	*	*	2E-13	*	2E-12	*(2E-13, 4E-11)*	5E-11	*(6E-12, 1E-10)*	3E-10	*(1E-10, 1E-09)*	3E-09	*(1E-09, 4E-09)*	1E-08	*(4E-09, 2E-08)*	3E-08	*(9E-09, 3E-08)*	*	*
2,3,4,7,8-PeCDF	*	*	4E-13	*	4E-12	*(4E-13, 6E-11)*	8E-11	*(2E-11, 3E-10)*	6E-10	*(2E-10, 3E-09)*	7E-09	*(2E-09, 1E-08)*	2E-08	*(1E-08, 4E-08)*	4E-08	*(3E-08, 5E-08)*	*	*
1,2,3,6,7,8-HxCDF	*	*	*	*	*	*	3E-14	*	3E-11	*(2E-12, 1E-10)*	9E-10	*(7E-11, 2E-09)*	2E-09	*(8E-10, 4E-09)*	5E-09	*(1E-09, 1E-08)*	*	*
2,3,4,6,7,8-HxCDF	*	*	2E-13	*(1E-13, 5E-12)*	1E-12	*(2E-13, 3E-11)*	3E-11	*(6E-12, 2E-10)*	3E-10	*(9E-11, 2E-09)*	4E-09	*(9E-10, 6E-09)*	1E-08	*(5E-09, 2E-08)*	2E-08	*(2E-08, 3E-08)*	*	*
1,2,3,4,7,8-HxCDF	*	*	*	*	*	*	3E-14	*	3E-11	*(1E-12, 8E-11)*	5E-10	*(5E-11, 1E-09)*	2E-09	*(4E-10, 3E-09)*	4E-09	*(1E-09, 8E-09)*	*	*
1,2,3,7,8,9-HxCDF	*	*	6E-14	*(2E-14, 3E-12)*	6E-13	*(7E-14, 6E-12)*	8E-12	*(3E-12, 3E-11)*	8E-11	*(2E-11, 5E-10)*	9E-10	*(4E-10, 3E-09)*	3E-09	*(3E-09, 9E-09)*	9E-09	*(3E-09, 1E-08)*	*	*
1,2,3,4,6,7,8-HpCDF	*	*	4E-14	*	5E-13	*(4E-14, 4E-12)*	5E-12	*(2E-12, 3E-11)*	5E-11	*(1E-11, 3E-10)*	8E-10	*(2E-10, 1E-09)*	2E-09	*(1E-09, 5E-09)*	6E-09	*(2E-09, 9E-09)*	*	*
1,2,3,4,7,8,9-HpCDF	*	*	4E-14	*	2E-13	*(3E-14, 2E-12)*	3E-12	*(1E-12, 2E-11)*	6E-11	*(7E-12, 3E-10)*	6E-10	*(2E-10, 1E-09)*	3E-09	*(1E-09, 3E-09)*	4E-09	*(3E-09, 4E-09)*	*	*
1,2,3,4,6,7,8,9-OCDF	*	*	2E-14	*	1E-13	*(1E-14, 2E-12)*	2E-12	*(9E-13, 1E-11)*	3E-11	*(7E-12, 1E-10)*	5E-10	*(7E-11, 8E-10)*	1E-09	*(6E-10, 2E-09)*	2E-09	*	*	*
TCDD-TEQ	*	*	6E-13	*	8E-12	*(6E-13, 1E-10)*	1E-10	*(2E-11, 4E-10)*	7E-10	*(3E-10, 6E-09)*	1E-08	*(3E-09, 2E-08)*	4E-08	*(2E-08, 6E-08)*	7E-08	*(5E-08, 1E-07)*	*	*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-E11. Cumulative Frequency Distribution of Dioxins/Furans in Recreational Fish in Waterbodies with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Fish Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	4E-14	*(4E-16, 1E-13)*	5E-14	*(4E-14, 6E-13)*	9E-13	*(6E-13, 2E-12)*	4E-12	*(2E-12, 7E-12)*	2E-11	*(8E-12, 3E-11)*	6E-11	*(3E-11, 1E-10)*	1E-10	*(6E-11, 1E-10)*	*	*
1,2,3,7,8-PeCDD	*	*	1E-13	*(1E-15, 5E-13)*	3E-13	*(1E-13, 2E-12)*	4E-12	*(1E-12, 8E-12)*	2E-11	*(1E-11, 3E-11)*	7E-11	*(5E-11, 1E-10)*	3E-10	*(1E-10, 4E-10)*	4E-10	*(2E-10, 8E-10)*	*	*
1,2,3,7,8,9-HxCDD	*	*	1E-14	*(5E-17, 5E-14)*	2E-14	*(1E-14, 3E-13)*	4E-13	*(2E-13, 1E-12)*	3E-12	*(1E-12, 8E-12)*	2E-11	*(8E-12, 2E-11)*	4E-11	*(2E-11, 7E-11)*	7E-11	*(4E-11, 1E-10)*	*	*
1,2,3,4,7,8-HxCDD	*	*	3E-14	*(2E-16, 1E-13)*	7E-14	*(4E-14, 5E-13)*	1E-12	*(3E-13, 4E-12)*	7E-12	*(3E-12, 1E-11)*	3E-11	*(2E-11, 5E-11)*	7E-11	*(5E-11, 2E-10)*	3E-10	*(7E-11, 5E-10)*	*	*
1,2,3,6,7,8-HxCDD	*	*	4E-14	*(2E-16, 1E-13)*	7E-14	*(4E-14, 7E-13)*	1E-12	*(3E-13, 3E-12)*	8E-12	*(3E-12, 1E-11)*	3E-11	*(2E-11, 6E-11)*	1E-10	*(6E-11, 2E-10)*	2E-10	*(8E-11, 3E-10)*	*	*
1,2,3,6,7,8,9-HpCDD	*	*	7E-15	*(2E-17, 5E-14)*	2E-14	*(7E-15, 1E-13)*	3E-13	*(7E-14, 8E-13)*	2E-12	*(8E-13, 5E-12)*	3E-11	*(5E-12, 6E-11)*	2E-10	*(5E-11, 2E-10)*	3E-10	*(1E-10, 5E-10)*	*	*
1,2,3,4,5,7,8,9-OCDD	*	*	3E-14	*(7E-17, 2E-13)*	4E-14	*(2E-14, 6E-13)*	1E-12	*(3E-13, 3E-12)*	7E-12	*(3E-12, 3E-11)*	9E-11	*(3E-11, 2E-10)*	7E-10	*(2E-10, 1E-09)*	1E-09	*(7E-10, 2E-09)*	*	*
2,3,7,8-TCDF	*	*	3E-14	*(2E-15, 4E-13)*	2E-13	*(3E-14, 1E-12)*	2E-12	*(7E-13, 5E-12)*	1E-11	*(5E-12, 2E-11)*	4E-11	*(2E-11, 8E-11)*	1E-10	*(7E-11, 1E-10)*	1E-10	*	*	*
1,2,3,7,8-PeCDF	*	*	8E-14	*(3E-15, 3E-13)*	1E-13	*(9E-14, 1E-12)*	3E-12	*(1E-12, 7E-12)*	2E-11	*(6E-12, 4E-11)*	8E-11	*(5E-11, 2E-10)*	4E-10	*(2E-10, 4E-10)*	4E-10	*(4E-10, 7E-10)*	*	*
2,3,4,7,8-PeCDF	*	*	1E-13	*(4E-15, 3E-13)*	2E-13	*(1E-13, 2E-12)*	3E-12	*(1E-12, 9E-12)*	2E-11	*(9E-12, 6E-11)*	1E-10	*(6E-11, 2E-10)*	6E-10	*(2E-10, 9E-10)*	9E-10	*(6E-10, 1E-09)*	*	*
1,2,3,6,7,8-HxCDF	*	*	2E-14	*(1E-15, 5E-14)*	4E-14	*(3E-14, 3E-13)*	7E-13	*(3E-13, 2E-12)*	7E-12	*(2E-12, 2E-11)*	6E-11	*(2E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*	3E-10	*(2E-10, 5E-10)*	*	*
2,3,4,6,7,8-HxCDF	*	*	5E-14	*(2E-16, 1E-13)*	8E-14	*(5E-14, 5E-13)*	1E-12	*(2E-13, 3E-12)*	8E-12	*(3E-12, 2E-11)*	6E-11	*(2E-11, 8E-11)*	1E-10	*(8E-11, 3E-10)*	3E-10	*(1E-10, 6E-10)*	*	*
1,2,3,4,7,8-HxCDF	*	*	1E-14	*(2E-15, 3E-14)*	3E-14	*(2E-14, 2E-13)*	4E-13	*(2E-13, 1E-12)*	4E-12	*(1E-12, 2E-11)*	5E-11	*(2E-11, 6E-11)*	2E-10	*(7E-11, 3E-10)*	4E-10	*(1E-10, 6E-10)*	*	*
1,2,3,7,8,9-HxCDF	*	*	3E-14	*(1E-16, 7E-14)*	7E-14	*(3E-14, 3E-13)*	9E-13	*(2E-13, 2E-12)*	4E-12	*(2E-12, 5E-12)*	2E-11	*(7E-12, 2E-11)*	4E-11	*(2E-11, 1E-10)*	1E-10	*(3E-11, 3E-10)*	*	*
1,2,3,4,6,7,8-HpCDF	*	*	5E-15	*(3E-16, 1E-14)*	1E-14	*(8E-15, 6E-14)*	1E-13	*(5E-14, 5E-13)*	2E-12	*(3E-13, 7E-12)*	2E-11	*(1E-11, 3E-11)*	6E-11	*(5E-11, 8E-11)*	9E-11	*(6E-11, 2E-10)*	*	*
1,2,3,4,7,8,9-HpCDF	*	*	6E-15	*(2E-17, 2E-14)*	2E-14	*(6E-15, 5E-14)*	2E-13	*(3E-14, 4E-13)*	8E-13	*(5E-13, 2E-12)*	4E-12	*(3E-12, 9E-12)*	2E-11	*(8E-12, 5E-11)*	5E-11	*(1E-11, 1E-10)*	*	*
1,2,3,4,6,7,8,9-OCDF	*	*	2E-15	*(9E-18, 1E-14)*	9E-15	*(2E-15, 2E-14)*	7E-14	*(1E-14, 3E-13)*	8E-13	*(2E-13, 2E-12)*	3E-12	*(2E-12, 1E-11)*	2E-11	*(9E-12, 6E-11)*	9E-11	*(2E-11, 3E-10)*	*	*
TCDD-TEQ	*	*	3E-13	*(4E-15, 1E-12)*	5E-13	*(3E-13, 5E-12)*	8E-12	*(3E-12, 2E-11)*	5E-11	*(2E-11, 9E-11)*	2E-10	*(1E-10, 3E-10)*	8E-10	*(3E-10, 1E-09)*	1E-09	*(8E-10, 1E-09)*	*	*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F1. Cumulative Frequency Distribution of Dioxins/Furans and Mercury Species in Sector Soil with 90 Percent Confidence Intervals: Cement Kilns

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	8E-12	*(8E-12, 8E-12)*	1E-11	*(1E-11, 2E-11)*	3E-11	*(2E-11, 5E-11)*	8E-11	*(7E-11, 1E-10)*	2E-10	*(2E-10, 3E-10)*	5E-10	*(4E-10, 5E-10)*	7E-10	*(6E-10, 9E-10)*	2E-09	*(2E-09, 3E-09)*
1,2,3,7,8-PeCDD	*	*	1E-10	*(1E-10, 1E-10)*	1E-10	*(1E-10, 2E-10)*	4E-10	*(2E-10, 5E-10)*	1E-09	*(9E-10, 2E-09)*	4E-09	*(3E-09, 7E-09)*	1E-08	*(7E-09, 1E-08)*	2E-08	*(1E-08, 2E-08)*	4E-08	*(3E-08, 5E-08)*
1,2,3,7,8,9-HxCDD	*	*	1E-10	*(1E-10, 2E-10)*	2E-10	*(1E-10, 2E-10)*	4E-10	*(3E-10, 6E-10)*	2E-09	*(1E-09, 3E-09)*	9E-09	*(5E-09, 2E-08)*	2E-08	*(2E-08, 3E-08)*	3E-08	*(2E-08, 4E-08)*	9E-08	*(7E-08, 1E-07)*
1,2,3,4,7,8-HxCDD	*	*	2E-10	*(2E-10, 4E-10)*	4E-10	*(2E-10, 4E-10)*	6E-10	*(5E-10, 7E-10)*	3E-09	*(1E-09, 3E-09)*	1E-08	*(6E-09, 2E-08)*	3E-08	*(2E-08, 4E-08)*	4E-08	*(3E-08, 5E-08)*	9E-08	*(8E-08, 1E-07)*
1,2,3,6,7,8-HxCDD	*	*	1E-10	*(1E-10, 3E-10)*	2E-10	*(1E-10, 4E-10)*	5E-10	*(4E-10, 9E-10)*	3E-09	*(2E-09, 4E-09)*	9E-09	*(6E-09, 1E-08)*	2E-08	*(1E-08, 2E-08)*	3E-08	*(2E-08, 4E-08)*	7E-08	*(6E-08, 8E-08)*
1,2,3,6,7,8,9-HpCDD	*	*	9E-10	*(4E-10, 2E-09)*	2E-09	*(1E-09, 4E-09)*	5E-09	*(4E-09, 1E-08)*	2E-08	*(2E-08, 4E-08)*	9E-08	*(6E-08, 2E-07)*	2E-07	*(2E-07, 2E-07)*	3E-07	*(2E-07, 4E-07)*	8E-07	*(6E-07, 1E-06)*
1,2,3,4,5,7,8,9-OCDD	*	*	1E-09	*(1E-09, 2E-09)*	2E-09	*(1E-09, 3E-09)*	4E-09	*(3E-09, 5E-09)*	1E-08	*(8E-09, 2E-08)*	4E-08	*(3E-08, 8E-08)*	1E-07	*(9E-08, 2E-07)*	2E-07	*(1E-07, 2E-07)*	5E-07	*(4E-07, 7E-07)*
2,3,7,8-TCDF	*	*	4E-11	*(4E-11, 4E-11)*	4E-11	*(4E-11, 7E-11)*	1E-10	*(1E-10, 2E-10)*	1E-09	*(8E-10, 2E-09)*	4E-09	*(2E-09, 1E-08)*	1E-08	*(9E-09, 2E-08)*	2E-08	*(1E-08, 3E-08)*	6E-08	*(5E-08, 9E-08)*
1,2,3,7,8-PeCDF	*	*	5E-11	*(5E-11, 5E-11)*	6E-11	*(5E-11, 1E-10)*	2E-10	*(1E-10, 3E-10)*	2E-09	*(1E-09, 3E-09)*	6E-09	*(5E-09, 8E-09)*	2E-08	*(1E-08, 2E-08)*	2E-08	*(2E-08, 3E-08)*	7E-08	*(5E-08, 9E-08)*
2,3,4,7,8-PeCDF	*	*	8E-11	*(6E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	6E-10	*(4E-10, 1E-09)*	3E-09	*(2E-09, 6E-09)*	1E-08	*(9E-09, 2E-08)*	3E-08	*(2E-08, 3E-08)*	4E-08	*(3E-08, 5E-08)*	1E-07	*(7E-08, 1E-07)*
1,2,3,6,7,8-HxCDF	*	*	9E-11	*(8E-11, 1E-10)*	1E-10	*(9E-11, 2E-10)*	4E-10	*(3E-10, 8E-10)*	2E-09	*(1E-09, 3E-09)*	7E-09	*(4E-09, 9E-09)*	1E-08	*(1E-08, 2E-08)*	2E-08	*(2E-08, 3E-08)*	5E-08	*(4E-08, 6E-08)*
2,3,4,6,7,8-HxCDF	*	*	6E-11	*(5E-11, 7E-11)*	9E-11	*(7E-11, 1E-10)*	3E-10	*(1E-10, 9E-10)*	2E-09	*(1E-09, 2E-09)*	6E-09	*(3E-09, 7E-09)*	1E-08	*(8E-09, 1E-08)*	2E-08	*(1E-08, 2E-08)*	5E-08	*(4E-08, 5E-08)*
1,2,3,4,7,8-HxCDF	*	*	8E-11	*(7E-11, 1E-10)*	1E-10	*(8E-11, 2E-10)*	3E-10	*(2E-10, 8E-10)*	2E-09	*(1E-09, 4E-09)*	6E-09	*(5E-09, 9E-09)*	2E-08	*(1E-08, 2E-08)*	2E-08	*(2E-08, 3E-08)*	5E-08	*(4E-08, 6E-08)*
1,2,3,7,8,9-HxCDF	*	*	9E-12	*(8E-12, 1E-11)*	2E-11	*(1E-11, 8E-11)*	1E-10	*(9E-11, 2E-10)*	4E-10	*(3E-10, 4E-10)*	1E-09	*(7E-10, 1E-09)*	2E-09	*(1E-09, 2E-09)*	3E-09	*(2E-09, 3E-09)*	7E-09	*(6E-09, 9E-09)*
1,2,3,4,6,7,8-HpCDF	*	*	6E-11	*(4E-11, 2E-10)*	1E-10	*(8E-11, 3E-10)*	4E-10	*(3E-10, 8E-10)*	2E-09	*(1E-09, 2E-09)*	4E-09	*(3E-09, 6E-09)*	1E-08	*(6E-09, 1E-08)*	2E-08	*(1E-08, 2E-08)*	4E-08	*(3E-08, 4E-08)*
1,2,3,4,7,8,9-HpCDF	*	*	1E-11	*(1E-11, 2E-11)*	2E-11	*(1E-11, 1E-10)*	1E-10	*(1E-10, 2E-10)*	4E-10	*(3E-10, 5E-10)*	1E-09	*(7E-10, 2E-09)*	2E-09	*(2E-09, 3E-09)*	3E-09	*(2E-09, 5E-09)*	8E-09	*(7E-09, 1E-08)*
1,2,3,4,6,7,8,9-OCDF	*	*	7E-11	*(4E-11, 3E-10)*	2E-10	*(8E-11, 4E-10)*	5E-10	*(4E-10, 7E-10)*	2E-09	*(1E-09, 4E-09)*	8E-09	*(6E-09, 1E-08)*	3E-08	*(1E-08, 7E-08)*	8E-08	*(3E-08, 1E-07)*	2E-07	*(9E-08, 4E-07)*
TCDD-TEQ	*	*	3E-10	*(3E-10, 4E-10)*	4E-10	*(3E-10, 6E-10)*	1E-09	*(7E-10, 2E-09)*	6E-09	*(3E-09, 9E-09)*	2E-08	*(1E-08, 3E-08)*	4E-08	*(3E-08, 4E-08)*	6E-08	*(4E-08, 7E-08)*	2E-07	*(1E-07, 2E-07)*
Mercury (Elemental)	*	*	2E-10	*(2E-10, 9E-10)*	9E-10	*(3E-10, 1E-09)*	2E-09	*(1E-09, 4E-09)*	2E-08	*(9E-09, 3E-08)*	4E-08	*(3E-08, 6E-08)*	1E-07	*(6E-08, 1E-07)*	1E-07	*(1E-07, 2E-07)*	3E-07	*(2E-07, 4E-07)*
Mercury (Divalent)	*	*	5E-05	*(5E-05, 2E-04)*	2E-04	*(6E-05, 2E-04)*	4E-04	*(3E-04, 8E-04)*	4E-03	*(2E-03, 5E-03)*	8E-03	*(6E-03, 9E-03)*	2E-02	*(1E-02, 2E-02)*	2E-02	*(2E-02, 3E-02)*	5E-02	*(3E-02, 1E-01)*
Mercury (Methyl)	*	*	1E-06	*(9E-07, 4E-06)*	4E-06	*(1E-06, 5E-06)*	8E-06	*(5E-06, 2E-05)*	8E-05	*(3E-05, 1E-04)*	2E-04	*(1E-04, 2E-04)*	4E-04	*(2E-04, 5E-04)*	5E-04	*(4E-04, 7E-04)*	1E-03	*(7E-04, 2E-03)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F2. Cumulative Frequency Distribution of Dioxins/Furans and Mercury Species in Sector Soil: Lightweight Aggregate Kilns[a]

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*								
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	*	2E-11	2E-11	3E-11	4E-11	8E-11	1E-10	3E-10	1E-09
1,2,3,7,8-PeCDD	*	2E-10	3E-10	5E-10	7E-10	1E-09	3E-09	5E-09	2E-08
1,2,3,7,8,9-HxCDD	*	3E-10	4E-10	6E-10	8E-10	2E-09	3E-09	6E-09	2E-08
1,2,3,4,7,8-HxCDD	*	2E-10	3E-10	5E-10	7E-10	1E-09	2E-09	5E-09	2E-08
1,2,3,6,7,8-HxCDD	*	4E-10	6E-10	8E-10	1E-09	2E-09	4E-09	7E-09	3E-08
1,2,3,6,7,8,9-HpCDD	*	2E-09	2E-09	4E-09	7E-09	1E-08	3E-08	4E-08	2E-07
1,2,3,4,5,7,8,9-OCDD	*	2E-09	3E-09	5E-09	1E-08	2E-08	5E-08	7E-08	3E-07
2,3,7,8-TCDF	*	4E-10	5E-10	8E-09	2E-08	3E-08	7E-08	1E-07	4E-07
1,2,3,7,8-PeCDF	*	1E-09	1E-09	3E-09	5E-09	8E-09	2E-08	3E-08	1E-07
2,3,4,7,8-PeCDF	*	1E-09	2E-09	5E-09	8E-09	1E-08	3E-08	6E-08	2E-07
1,2,3,6,7,8-HxCDF	*	9E-10	1E-09	3E-09	4E-09	7E-09	2E-08	3E-08	1E-07
2,3,4,6,7,8-HxCDF	*	4E-10	6E-10	1E-09	2E-09	4E-09	9E-09	2E-08	6E-08
1,2,3,4,7,8-HxCDF	*	1E-09	2E-09	4E-09	6E-09	1E-08	3E-08	5E-08	2E-07
1,2,3,7,8,9-HxCDF	*	5E-11	7E-11	1E-10	2E-10	4E-10	8E-10	1E-09	6E-09
1,2,3,4,6,7,8-HpCDF	*	8E-10	1E-09	2E-09	2E-09	5E-09	9E-09	2E-08	7E-08
1,2,3,4,7,8,9-HpCDF	*	1E-10	1E-10	2E-10	3E-10	5E-10	1E-09	2E-09	8E-09
1,2,3,4,6,7,8,9-OCDF	*	8E-10	8E-10	1E-09	2E-09	3E-09	8E-09	2E-08	5E-08
TCDD-TEQ	*	2E-09	2E-09	6E-09	9E-09	2E-08	4E-08	6E-08	2E-07
Mercury (Elemental)	*	3E-10	4E-10	6E-10	3E-09	2E-08	7E-08	8E-08	3E-07
Mercury (Divalent)	*	5E-05	5E-05	9E-05	6E-04	4E-03	1E-02	1E-02	4E-02
Mercury (Methyl)	*	9E-07	1E-06	2E-06	1E-05	8E-05	2E-04	3E-04	8E-04

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

[a] Confidence intervals are not applicable since all the lightweight aggregate kilns in the population were sampled with certainty.

All concentration values <10 have been rounded to one significant digit

Table H-F3. Cumulative Frequency Distribution of Dioxins/Furans and Mercury Species in Sector Soil with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	6E-15	*(4E-15, 4E-14)*	4E-14	*(2E-14, 8E-14)*	8E-14	*(5E-14, 1E-13)*	3E-13	*(2E-13, 6E-13)*	3E-12	*(1E-12, 4E-12)*	2E-11	*(1E-11, 3E-11)*	5E-11	*(4E-11, 7E-11)*	9E-11	*(7E-11, 1E-10)*	3E-10	*(2E-10, 4E-10)*
1,2,3,7,8-PeCDD	6E-14	*(4E-14, 3E-13)*	3E-13	*(2E-13, 8E-13)*	8E-13	*(4E-13, 2E-12)*	3E-12	*(2E-12, 7E-12)*	2E-11	*(1E-11, 4E-11)*	2E-10	*(9E-11, 3E-10)*	8E-10	*(4E-10, 1E-09)*	1E-09	*(1E-09, 2E-09)*	5E-09	*(4E-09, 6E-09)*
1,2,3,7,8,9-HxCDD	3E-14	*(2E-14, 5E-13)*	6E-13	*(3E-13, 9E-13)*	9E-13	*(6E-13, 2E-12)*	2E-12	*(2E-12, 7E-12)*	4E-11	*(2E-11, 5E-11)*	2E-10	*(1E-10, 2E-10)*	6E-10	*(4E-10, 8E-10)*	2E-09	*(9E-10, 2E-09)*	7E-09	*(4E-09, 9E-09)*
1,2,3,4,7,8-HxCDD	*	*	7E-15	*	4E-13	*(9E-14, 1E-12)*	3E-12	*(1E-12, 5E-12)*	2E-11	*(1E-11, 5E-11)*	2E-10	*(9E-11, 2E-10)*	7E-10	*(4E-10, 1E-09)*	2E-09	*(1E-09, 2E-09)*	7E-09	*(5E-09, 1E-08)*
1,2,3,6,7,8-HxCDD	*	*	4E-15	*	2E-13	*(5E-14, 6E-13)*	2E-12	*(7E-13, 4E-12)*	2E-11	*(9E-12, 3E-11)*	1E-10	*(7E-11, 2E-10)*	7E-10	*(4E-10, 1E-09)*	2E-09	*(1E-09, 2E-09)*	7E-09	*(5E-09, 8E-09)*
1,2,3,6,7,8,9-HpCDD	3E-14	*(2E-14, 4E-13)*	4E-13	*(2E-13, 8E-13)*	8E-13	*(4E-13, 4E-12)*	1E-11	*(3E-12, 5E-11)*	3E-10	*(8E-11, 5E-10)*	2E-09	*(1E-09, 3E-09)*	6E-09	*(4E-09, 8E-09)*	1E-08	*(1E-08, 2E-08)*	6E-08	*(5E-08, 9E-08)*
1,2,3,4,5,7,8,9-OCDD	8E-14	*(6E-14, 2E-12)*	2E-12	*(9E-13, 3E-12)*	3E-12	*(2E-12, 1E-11)*	5E-11	*(9E-12, 1E-10)*	7E-10	*(3E-10, 1E-09)*	5E-09	*(3E-09, 8E-09)*	2E-08	*(1E-08, 2E-08)*	4E-08	*(2E-08, 4E-08)*	1E-07	*(1E-07, 2E-07)*
2,3,7,8-TCDF	1E-13	*(8E-14, 4E-13)*	4E-13	*(3E-13, 7E-13)*	6E-13	*(5E-13, 1E-12)*	3E-12	*(1E-12, 6E-12)*	2E-11	*(9E-12, 3E-11)*	1E-10	*(6E-11, 2E-10)*	2E-09	*(9E-10, 4E-09)*	5E-09	*(3E-09, 7E-09)*	2E-08	*(9E-09, 2E-08)*
1,2,3,7,8-PeCDF	3E-13	*(2E-13, 5E-13)*	5E-13	*(4E-13, 1E-12)*	1E-12	*(6E-13, 3E-12)*	6E-12	*(3E-12, 1E-11)*	5E-11	*(2E-11, 1E-10)*	5E-10	*(3E-10, 8E-10)*	3E-09	*(2E-09, 4E-09)*	6E-09	*(4E-09, 9E-09)*	3E-08	*(1E-08, 4E-08)*
2,3,4,7,8-PeCDF	2E-13	*	3E-13	*(3E-13, 1E-12)*	8E-13	*(4E-13, 3E-12)*	8E-12	*(4E-12, 2E-11)*	6E-11	*(3E-11, 1E-10)*	7E-10	*(3E-10, 1E-09)*	8E-09	*(4E-09, 1E-08)*	2E-08	*(1E-08, 2E-08)*	6E-08	*(4E-08, 8E-08)*
1,2,3,6,7,8-HxCDF	*	*	2E-14	*	3E-13	*(2E-13, 1E-12)*	4E-12	*(1E-12, 1E-11)*	6E-11	*(3E-11, 1E-10)*	7E-10	*(3E-10, 2E-09)*	5E-09	*(3E-09, 7E-09)*	1E-08	*(7E-09, 2E-08)*	5E-08	*(3E-08, 8E-08)*
2,3,4,6,7,8-HxCDF	4E-14	*(3E-14, 2E-13)*	2E-13	*(1E-13, 6E-13)*	5E-13	*(2E-13, 2E-12)*	5E-12	*(2E-12, 1E-11)*	6E-11	*(3E-11, 1E-10)*	7E-10	*(3E-10, 1E-09)*	3E-09	*(2E-09, 4E-09)*	8E-09	*(5E-09, 1E-08)*	3E-08	*(2E-08, 4E-08)*
1,2,3,4,7,8-HxCDF	*	*	1E-14	*	2E-13	*(1E-13, 1E-12)*	4E-12	*(1E-12, 1E-11)*	6E-11	*(3E-11, 1E-10)*	6E-10	*(2E-10, 2E-09)*	7E-09	*(4E-09, 1E-08)*	2E-08	*(1E-08, 3E-08)*	9E-08	*(4E-08, 1E-07)*
1,2,3,7,8,9-HxCDF	3E-14	*(2E-14, 2E-13)*	2E-13	*(1E-13, 4E-13)*	4E-13	*(2E-13, 2E-12)*	3E-12	*(2E-12, 5E-12)*	2E-11	*(9E-12, 4E-11)*	2E-10	*(1E-10, 5E-10)*	3E-09	*(1E-09, 4E-09)*	5E-09	*(3E-09, 7E-09)*	2E-08	*(1E-08, 2E-08)*
1,2,3,4,6,7,8-HpCDF	1E-13	*	3E-13	*(2E-13, 2E-12)*	9E-13	*(4E-13, 5E-12)*	2E-11	*(5E-12, 3E-11)*	1E-10	*(7E-11, 3E-10)*	2E-09	*(9E-10, 4E-09)*	1E-08	*(7E-09, 2E-08)*	3E-08	*(2E-08, 5E-08)*	2E-07	*(1E-07, 2E-07)*
1,2,3,4,7,8,9-HpCDF	2E-14	*(2E-14, 1E-13)*	1E-13	*(8E-14, 4E-13)*	4E-13	*(1E-13, 2E-12)*	4E-12	*(1E-12, 7E-12)*	3E-11	*(2E-11, 7E-11)*	4E-10	*(2E-10, 9E-10)*	2E-09	*(1E-09, 3E-09)*	6E-09	*(3E-09, 7E-09)*	2E-08	*(2E-08, 3E-08)*
1,2,3,4,6,7,8,9-OCDF	1E-13	*(8E-14, 6E-13)*	7E-13	*(4E-13, 2E-12)*	2E-12	*(8E-13, 2E-11)*	4E-11	*(1E-11, 8E-11)*	3E-10	*(1E-10, 5E-10)*	4E-09	*(2E-09, 5E-09)*	1E-08	*(9E-09, 2E-08)*	3E-08	*(2E-08, 6E-08)*	3E-07	*(1E-07, 4E-07)*
TCDD-TEQ	4E-13	*(3E-13, 8E-13)*	8E-13	*(6E-13, 3E-12)*	2E-12	*(1E-12, 7E-12)*	1E-11	*(7E-12, 3E-11)*	1E-10	*(6E-11, 2E-10)*	1E-09	*(5E-10, 2E-09)*	8E-09	*(6E-09, 1E-08)*	2E-08	*(1E-08, 2E-08)*	6E-08	*(4E-08, 8E-08)*
Mercury (Elemental)	2E-13	*	5E-13	*(3E-13, 9E-13)*	7E-13	*(6E-13, 2E-12)*	7E-12	*(2E-12, 3E-11)*	9E-11	*(4E-11, 2E-10)*	7E-10	*(3E-10, 1E-09)*	4E-09	*(2E-09, 6E-09)*	8E-09	*(4E-09, 1E-08)*	1E-07	*(1E-08, 4E-07)*
Mercury (Divalent)	6E-08	*	1E-07	*(7E-08, 2E-07)*	1E-07	*(1E-07, 4E-07)*	1E-06	*(4E-07, 5E-06)*	2E-05	*(8E-06, 4E-05)*	1E-04	*(6E-05, 2E-04)*	6E-04	*(3E-04, 1E-03)*	2E-03	*(8E-04, 3E-03)*	2E-02	*(3E-03, 6E-02)*
Mercury (Methyl)	1E-09	*	2E-09	*(1E-09, 3E-09)*	3E-09	*(2E-09, 7E-09)*	2E-08	*(7E-09, 1E-07)*	3E-07	*(2E-07, 7E-07)*	2E-06	*(1E-06, 4E-06)*	1E-05	*(5E-06, 2E-05)*	3E-05	*(2E-05, 6E-05)*	4E-04	*(6E-05, 1E-03)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F4. Cumulative Frequency Distribution of Dioxins/Furans and Mercury Species in Sector Soil with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*																			
	1%		5%		10%		25%		50%		75%		90%		95%		99%			
2,3,7,8-TCDD	*	*	2E-13	*(1E-13, 3E-12)*	2E-12	*(1E-13, 5E-12)*	7E-12	*(3E-12, 2E-11)*	2E-11	*(2E-11, 3E-11)*	5E-11	*(3E-11, 6E-11)*	9E-11	*(7E-11, 1E-10)*	2E-10	*(1E-10, 2E-10)*	4E-10	*(3E-10, 6E-10)*		
1,2,3,7,8-PeCDD	*	*	6E-13	*(4E-13, 1E-11)*	6E-12	*(6E-13, 1E-11)*	2E-11	*(1E-11, 1E-10)*	3E-10	*(1E-10, 4E-10)*	9E-10	*(4E-10, 1E-09)*	2E-09	*(1E-09, 3E-09)*	3E-09	*(3E-09, 4E-09)*	9E-09	*(8E-09, 1E-08)*		
1,2,3,7,8,9-HxCDD	*	*	8E-13	*(7E-13, 6E-12)*	3E-12	*(8E-13, 3E-11)*	4E-11	*(6E-12, 1E-10)*	2E-10	*(1E-10, 2E-10)*	6E-10	*(3E-10, 8E-10)*	3E-09	*(9E-10, 4E-09)*	4E-09	*(2E-09, 7E-09)*	2E-08	*(7E-09, 2E-08)*		
1,2,3,4,7,8-HxCDD	*	*	2E-12	*(2E-12, 8E-12)*	6E-12	*(2E-12, 6E-11)*	8E-11	*(1E-11, 2E-10)*	3E-10	*(2E-10, 3E-10)*	7E-10	*(4E-10, 1E-09)*	2E-09	*(1E-09, 4E-09)*	5E-09	*(2E-09, 6E-09)*	2E-08	*(8E-09, 2E-08)*		
1,2,3,6,7,8-HxCDD	*	*	1E-12	*(9E-13, 2E-11)*	8E-12	*(1E-12, 4E-11)*	5E-11	*(2E-11, 1E-10)*	3E-10	*(1E-10, 4E-10)*	9E-10	*(4E-10, 1E-09)*	3E-09	*(1E-09, 4E-09)*	6E-09	*(3E-09, 7E-09)*	2E-08	*(9E-09, 3E-08)*		
1,2,3,6,7,8,9-HpCDD	*	*	1E-11	*(1E-11, 5E-11)*	3E-11	*(1E-11, 3E-10)*	5E-10	*(6E-11, 1E-09)*	2E-09	*(1E-09, 3E-09)*	7E-09	*(4E-09, 1E-08)*	3E-08	*(1E-08, 4E-08)*	6E-08	*(2E-08, 7E-08)*	2E-07	*(8E-08, 3E-07)*		
1,2,3,4,5,7,8,9-OCDD	*	*	7E-11	*(6E-11, 1E-09)*	6E-10	*(7E-11, 2E-09)*	3E-09	*(1E-09, 4E-09)*	7E-09	*(4E-09, 8E-09)*	2E-08	*(9E-09, 2E-08)*	4E-08	*(2E-08, 6E-08)*	7E-08	*(5E-08, 9E-08)*	2E-07	*(1E-07, 4E-07)*		
2,3,7,8-TCDF	*	*	7E-12	*(5E-12, 4E-11)*	2E-11	*(7E-12, 5E-11)*	8E-11	*(4E-11, 3E-10)*	9E-10	*(3E-10, 2E-09)*	3E-09	*(1E-09, 4E-09)*	7E-09	*(4E-09, 8E-09)*	9E-09	*(7E-09, 2E-08)*	2E-08	*(2E-08, 4E-08)*		
1,2,3,7,8-PeCDF	*	*	6E-12	*(5E-12, 1E-11)*	1E-11	*(6E-12, 3E-11)*	8E-11	*(2E-11, 3E-10)*	2E-09	*(3E-10, 2E-09)*	4E-09	*(3E-09, 5E-09)*	8E-09	*(6E-09, 1E-08)*	1E-08	*(1E-08, 2E-08)*	4E-08	*(3E-08, 5E-08)*		
2,3,4,7,8-PeCDF	*	*	1E-11	*(1E-11, 2E-11)*	2E-11	*(1E-11, 4E-11)*	2E-10	*(4E-11, 9E-10)*	4E-09	*(9E-10, 8E-09)*	1E-08	*(8E-09, 1E-08)*	2E-08	*(2E-08, 3E-08)*	4E-08	*(3E-08, 5E-08)*	1E-07	*(9E-08, 1E-07)*		
1,2,3,6,7,8-HxCDF	*	*	3E-12	*(2E-12, 2E-11)*	9E-12	*(3E-12, 8E-11)*	1E-10	*(2E-11, 7E-10)*	3E-09	*(6E-10, 3E-09)*	6E-09	*(4E-09, 9E-09)*	2E-08	*(1E-08, 2E-08)*	4E-08	*(2E-08, 4E-08)*	1E-07	*(6E-08, 1E-07)*		
2,3,4,6,7,8-HxCDF	*	*	2E-12	*(2E-12, 7E-12)*	4E-12	*(2E-12, 4E-11)*	7E-11	*(7E-12, 6E-10)*	1E-09	*(6E-10, 2E-09)*	4E-09	*(2E-09, 6E-09)*	1E-08	*(7E-09, 2E-08)*	2E-08	*(1E-08, 2E-08)*	7E-08	*(4E-08, 9E-08)*		
1,2,3,4,7,8-HxCDF	*	*	5E-12	*(4E-12, 2E-11)*	1E-11	*(5E-12, 4E-11)*	1E-10	*(2E-11, 7E-10)*	4E-09	*(6E-10, 6E-09)*	1E-08	*(7E-09, 1E-08)*	2E-08	*(2E-08, 3E-08)*	4E-08	*(3E-08, 5E-08)*	1E-07	*(9E-08, 2E-07)*		
1,2,3,7,8,9-HxCDF	*	*	3E-13	*(2E-13, 8E-12)*	3E-12	*(3E-13, 1E-11)*	2E-11	*(8E-12, 1E-10)*	4E-10	*(9E-11, 2E-09)*	3E-09	*(1E-09, 3E-09)*	7E-09	*(3E-09, 9E-09)*	9E-09	*(7E-09, 2E-08)*	4E-08	*(3E-08, 5E-08)*		
1,2,3,4,6,7,8-HpCDF	*	*	3E-12	*(2E-12, 3E-11)*	1E-11	*(3E-12, 8E-11)*	1E-10	*(3E-11, 2E-09)*	4E-09	*(2E-09, 5E-09)*	1E-08	*(7E-09, 2E-08)*	3E-08	*(2E-08, 5E-08)*	7E-08	*(3E-08, 1E-07)*	3E-07	*(1E-07, 3E-07)*		
1,2,3,4,7,8,9-HpCDF	*	*	5E-13	*(4E-13, 1E-11)*	4E-12	*(5E-13, 2E-11)*	4E-11	*(9E-12, 4E-10)*	1E-09	*(3E-10, 1E-09)*	2E-09	*(1E-09, 3E-09)*	4E-09	*(3E-09, 6E-09)*	7E-09	*(6E-09, 1E-08)*	2E-08	*(2E-08, 3E-08)*		
1,2,3,4,6,7,8,9-OCDF	*	*	3E-11	*(3E-11, 9E-11)*	6E-11	*(3E-11, 3E-10)*	8E-10	*(9E-11, 4E-09)*	5E-09	*(3E-09, 6E-09)*	1E-08	*(9E-09, 2E-08)*	3E-08	*(2E-08, 3E-08)*	5E-08	*(3E-08, 6E-08)*	1E-07	*(1E-07, 2E-07)*		
TCDD-TEQ	*	*	1E-11	*(8E-12, 6E-11)*	4E-11	*(1E-11, 1E-10)*	2E-10	*(6E-11, 1E-09)*	5E-09	*(7E-10, 6E-09)*	1E-08	*(6E-09, 1E-08)*	2E-08	*(2E-08, 2E-08)*	4E-08	*(2E-08, 5E-08)*	1E-07	*(9E-08, 1E-07)*		
Mercury (Elemental)	*	*	1E-11	*(5E-12, 2E-10)*	1E-10	*(1E-11, 2E-10)*	2E-10	*(2E-10, 3E-10)*	5E-10	*(3E-10, 1E-09)*	2E-09	*(8E-10, 7E-09)*	9E-09	*(3E-09, 1E-08)*	1E-08	*(8E-09, 2E-08)*	4E-08	*(2E-08, 5E-08)*		
Mercury (Divalent)	*	*	2E-06	*(8E-07, 3E-05)*	3E-05	*(2E-06, 3E-05)*	4E-05	*(3E-05, 6E-05)*	9E-05	*(6E-05, 2E-04)*	3E-04	*(2E-04, 1E-03)*	2E-03	*(6E-04, 3E-03)*	3E-03	*(1E-03, 4E-03)*	6E-03	*(3E-03, 1E-02)*		
Mercury (Methyl)	*	*	5E-08	*(2E-08, 6E-07)*	5E-07	*(5E-08, 7E-07)*	8E-07	*(7E-07, 1E-06)*	2E-06	*(1E-06, 4E-06)*	7E-06	*(3E-06, 3E-05)*	4E-05	*(1E-05, 5E-05)*	5E-05	*(3E-05, 7E-05)*	1E-04	*(7E-05, 2E-04)*		

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F5. Cumulative Frequency Distribution of Dioxins/Furans and Mercury Species in Sector Soil with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*																					
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	*	*	5E-13	*(3E-13, 1E-12)*	7E-13	*(5E-13, 2E-12)*	3E-12	*(1E-12, 7E-12)*	1E-11	*(6E-12, 3E-11)*	5E-11	*(3E-11, 7E-11)*	1E-10	*(7E-11, 2E-10)*	2E-10	*(1E-10, 2E-10)*	6E-10	*(4E-10, 7E-10)*
1,2,3,7,8-PeCDD	*	*	2E-12	*(1E-12, 5E-12)*	3E-12	*(2E-12, 9E-12)*	1E-11	*(5E-12, 4E-11)*	8E-11	*(3E-11, 1E-10)*	4E-10	*(1E-10, 8E-10)*	1E-09	*(6E-10, 2E-09)*	2E-09	*(1E-09, 3E-09)*	7E-09	*(3E-09, 1E-08)*
1,2,3,7,8,9-HxCDD	*	*	2E-12	*(1E-12, 3E-12)*	2E-12	*(2E-12, 8E-12)*	1E-11	*(4E-12, 4E-11)*	7E-11	*(3E-11, 1E-10)*	4E-10	*(1E-10, 6E-10)*	1E-09	*(6E-10, 2E-09)*	3E-09	*(1E-09, 3E-09)*	1E-08	*(5E-09, 1E-08)*
1,2,3,4,7,8-HxCDD	*	*	*	*	*	*	3E-12	*	3E-11	*(1E-11, 7E-11)*	3E-10	*(7E-11, 7E-10)*	2E-09	*(5E-10, 2E-09)*	3E-09	*(1E-09, 5E-09)*	1E-08	*(4E-09, 2E-08)*
1,2,3,6,7,8-HxCDD	*	*	*	*	*	*	2E-12	*	2E-11	*(7E-12, 6E-11)*	2E-10	*(6E-11, 7E-10)*	1E-09	*(4E-10, 2E-09)*	2E-09	*(1E-09, 3E-09)*	8E-09	*(4E-09, 1E-08)*
1,2,3,6,7,8,9-HpCDD	*	*	3E-11	*(3E-11, 5E-11)*	5E-11	*(3E-11, 9E-11)*	2E-10	*(7E-11, 4E-10)*	7E-10	*(3E-10, 2E-09)*	3E-09	*(2E-09, 6E-09)*	9E-09	*(5E-09, 2E-08)*	2E-08	*(1E-08, 3E-08)*	8E-08	*(6E-08, 1E-07)*
1,2,3,4,5,7,8,9-OCDD	*	*	1E-10	*(7E-11, 2E-10)*	1E-10	*(1E-10, 4E-10)*	5E-10	*(2E-10, 1E-09)*	3E-09	*(1E-09, 5E-09)*	1E-08	*(5E-09, 2E-08)*	3E-08	*(2E-08, 4E-08)*	6E-08	*(5E-08, 1E-07)*	3E-07	*(2E-07, 3E-07)*
2,3,7,8-TCDF	*	*	1E-12	*(9E-13, 3E-12)*	2E-12	*(1E-12, 6E-12)*	6E-12	*(3E-12, 3E-11)*	4E-11	*(2E-11, 6E-11)*	1E-10	*(6E-11, 2E-10)*	2E-09	*(2E-10, 6E-09)*	6E-09	*(3E-10, 8E-09)*	2E-08	*(2E-09, 4E-08)*
1,2,3,7,8-PeCDF	*	*	5E-12	*(3E-12, 9E-12)*	6E-12	*(4E-12, 2E-11)*	3E-11	*(9E-12, 6E-11)*	1E-10	*(6E-11, 3E-10)*	6E-10	*(3E-10, 2E-09)*	4E-09	*(1E-09, 5E-09)*	5E-09	*(2E-09, 1E-08)*	2E-08	*(5E-09, 5E-08)*
2,3,4,7,8-PeCDF	*	*	6E-12	*(5E-12, 1E-11)*	9E-12	*(6E-12, 4E-11)*	5E-11	*(1E-11, 1E-10)*	2E-10	*(1E-10, 4E-10)*	1E-09	*(4E-10, 3E-09)*	1E-08	*(1E-09, 2E-08)*	2E-08	*(3E-09, 3E-08)*	6E-08	*(1E-08, 2E-07)*
1,2,3,6,7,8-HxCDF	*	*	*	*	*	*	1E-11	*	1E-10	*(4E-11, 2E-10)*	7E-10	*(2E-10, 2E-09)*	5E-09	*(1E-09, 9E-09)*	1E-08	*(3E-09, 2E-08)*	4E-08	*(3E-08, 6E-08)*
2,3,4,6,7,8-HxCDF	*	*	6E-12	*(4E-12, 2E-11)*	1E-11	*(6E-12, 5E-11)*	5E-11	*(2E-11, 1E-10)*	2E-10	*(1E-10, 4E-10)*	9E-10	*(4E-10, 2E-09)*	3E-09	*(2E-09, 5E-09)*	7E-09	*(4E-09, 1E-08)*	2E-08	*(2E-08, 4E-08)*
1,2,3,4,7,8-HxCDF	*	*	*	*	*	*	7E-12	*	1E-10	*(3E-11, 2E-10)*	6E-10	*(2E-10, 2E-09)*	6E-09	*(1E-09, 1E-08)*	1E-08	*(3E-09, 3E-08)*	6E-08	*(5E-08, 9E-08)*
1,2,3,7,8,9-HxCDF	*	*	3E-12	*(2E-12, 5E-12)*	3E-12	*(3E-12, 9E-12)*	1E-11	*(6E-12, 3E-11)*	8E-11	*(3E-11, 2E-10)*	4E-10	*(2E-10, 1E-09)*	5E-09	*(6E-10, 7E-09)*	7E-09	*(2E-09, 1E-08)*	2E-08	*(6E-09, 7E-08)*
1,2,3,4,6,7,8-HpCDF	*	*	2E-11	*(2E-11, 3E-11)*	2E-11	*(2E-11, 5E-11)*	7E-11	*(3E-11, 3E-10)*	7E-10	*(2E-10, 1E-09)*	2E-09	*(1E-09, 6E-09)*	1E-08	*(3E-09, 1E-08)*	2E-08	*(8E-09, 4E-08)*	1E-07	*(1E-07, 2E-07)*
1,2,3,4,7,8,9-HpCDF	*	*	4E-12	*(3E-12, 7E-12)*	7E-12	*(4E-12, 1E-11)*	3E-11	*(9E-12, 1E-10)*	2E-10	*(1E-10, 3E-10)*	8E-10	*(3E-10, 2E-09)*	3E-09	*(1E-09, 6E-09)*	8E-09	*(4E-09, 1E-08)*	3E-08	*(2E-08, 4E-08)*
1,2,3,4,6,7,8,9-OCDF	*	*	4E-11	*(3E-11, 7E-11)*	6E-11	*(4E-11, 1E-10)*	2E-10	*(7E-11, 7E-10)*	2E-09	*(5E-10, 3E-09)*	8E-09	*(3E-09, 9E-09)*	1E-08	*(1E-08, 3E-08)*	4E-08	*(3E-08, 8E-08)*	4E-07	*(4E-07, 4E-07)*
TCDD-TEQ	*	*	1E-11	*(9E-12, 2E-11)*	1E-11	*(1E-11, 5E-11)*	7E-11	*(2E-11, 2E-10)*	3E-10	*(2E-10, 6E-10)*	1E-09	*(6E-10, 4E-09)*	1E-08	*(2E-09, 2E-08)*	2E-08	*(6E-09, 3E-08)*	6E-08	*(2E-08, 1E-07)*
Mercury (Elemental)	*	*	6E-12	*(5E-12, 3E-11)*	8E-12	*(6E-12, 3E-11)*	4E-11	*(3E-11, 1E-10)*	2E-10	*(1E-10, 4E-10)*	9E-10	*(3E-10, 2E-09)*	4E-09	*(1E-09, 9E-08)*	3E-08	*(2E-09, 2E-07)*	2E-07	*(8E-09, 5E-07)*
Mercury (Divalent)	*	*	1E-06	*(9E-07, 6E-06)*	2E-06	*(1E-06, 6E-06)*	8E-06	*(5E-06, 2E-05)*	4E-05	*(2E-05, 8E-05)*	1E-04	*(7E-05, 3E-04)*	8E-04	*(2E-04, 1E-02)*	7E-03	*(4E-04, 3E-02)*	3E-02	*(2E-03, 9E-02)*
Mercury (Methyl)	*	*	2E-08	*(2E-08, 1E-07)*	3E-08	*(2E-08, 1E-07)*	2E-07	*(1E-07, 5E-07)*	8E-07	*(4E-07, 2E-06)*	3E-06	*(1E-06, 6E-06)*	2E-05	*(4E-06, 3E-04)*	1E-04	*(8E-06, 5E-04)*	6E-04	*(4E-05, 2E-03)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F6. Cumulative Frequency Distribution of Dioxins/Furans and Mercury Species in Sector Soil with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*																	
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
2,3,7,8-TCDD	4E-15	*	2E-14	*(6E-15, 7E-14)*	4E-14	*(2E-14, 8E-14)*	1E-13	*(8E-14, 2E-13)*	4E-13	*(3E-13, 1E-12)*	4E-12	*(1E-12, 5E-12)*	9E-12	*(5E-12, 2E-11)*	2E-11	*(1E-11, 3E-11)*	7E-11	*(3E-11, 9E-11)*
1,2,3,7,8-PeCDD	4E-14	*	2E-13	*(7E-14, 6E-13)*	3E-13	*(2E-13, 9E-13)*	1E-12	*(8E-13, 3E-12)*	8E-12	*(3E-12, 2E-11)*	5E-11	*(2E-11, 8E-11)*	2E-10	*(7E-11, 3E-10)*	3E-10	*(2E-10, 6E-10)*	1E-09	*(5E-10, 2E-09)*
1,2,3,7,8,9-HxCDD	2E-14	*	3E-13	*(4E-14, 7E-13)*	6E-13	*(3E-13, 1E-12)*	2E-12	*(9E-13, 3E-12)*	1E-11	*(3E-12, 3E-11)*	5E-11	*(3E-11, 2E-10)*	2E-10	*(1E-10, 3E-10)*	4E-10	*(2E-10, 6E-10)*	2E-09	*(8E-10, 3E-09)*
1,2,3,4,7,8-HxCDD	4E-14	*	2E-13	*(6E-14, 7E-13)*	4E-13	*(2E-13, 1E-12)*	2E-12	*(9E-13, 4E-12)*	1E-11	*(4E-12, 2E-11)*	6E-11	*(2E-11, 9E-11)*	2E-10	*(9E-11, 3E-10)*	3E-10	*(2E-10, 5E-10)*	1E-09	*(8E-10, 2E-09)*
1,2,3,6,7,8-HxCDD	2E-14	*	1E-13	*(3E-14, 4E-13)*	2E-13	*(1E-13, 6E-13)*	1E-12	*(5E-13, 2E-12)*	9E-12	*(2E-12, 2E-11)*	5E-11	*(2E-11, 9E-11)*	2E-10	*(9E-11, 3E-10)*	4E-10	*(2E-10, 5E-10)*	1E-09	*(8E-10, 2E-09)*
1,2,3,6,7,8,9-HpCDD	2E-14	*	2E-13	*(3E-14, 6E-13)*	4E-13	*(2E-13, 9E-13)*	2E-12	*(7E-13, 5E-12)*	3E-11	*(5E-12, 1E-10)*	4E-10	*(1E-10, 1E-09)*	2E-09	*(8E-10, 4E-09)*	4E-09	*(2E-09, 6E-09)*	1E-08	*(8E-09, 2E-08)*
1,2,3,4,5,7,8,9-OCDD	6E-14	*	1E-12	*(1E-13, 2E-12)*	2E-12	*(9E-13, 4E-12)*	6E-12	*(3E-12, 2E-11)*	8E-11	*(1E-11, 4E-10)*	9E-10	*(4E-10, 3E-09)*	5E-09	*(2E-09, 8E-09)*	1E-08	*(5E-09, 2E-08)*	4E-08	*(2E-08, 6E-08)*
2,3,7,8-TCDF	9E-14	*	3E-13	*(1E-13, 5E-13)*	4E-13	*(3E-13, 8E-13)*	1E-12	*(6E-13, 3E-12)*	6E-12	*(3E-12, 1E-11)*	3E-11	*(1E-11, 7E-11)*	5E-10	*(6E-11, 2E-09)*	2E-09	*(2E-10, 6E-09)*	1E-08	*(2E-09, 4E-08)*
1,2,3,7,8-PeCDF	2E-13	*	4E-13	*(3E-13, 9E-13)*	5E-13	*(4E-13, 1E-12)*	2E-12	*(1E-12, 6E-12)*	1E-11	*(5E-12, 4E-11)*	1E-10	*(4E-11, 2E-10)*	8E-10	*(2E-10, 2E-09)*	2E-09	*(7E-10, 6E-09)*	3E-08	*(3E-09, 4E-07)*
2,3,4,7,8-PeCDF	2E-13	*	3E-13	*(2E-13, 6E-13)*	4E-13	*(3E-13, 1E-12)*	3E-12	*(8E-13, 5E-12)*	2E-11	*(6E-12, 4E-11)*	1E-10	*(4E-11, 3E-10)*	1E-09	*(2E-10, 6E-09)*	7E-09	*(1E-09, 1E-08)*	2E-08	*(7E-09, 4E-08)*
1,2,3,6,7,8-HxCDF	1E-13	*	2E-13	*(2E-13, 5E-13)*	3E-13	*(2E-13, 2E-12)*	2E-12	*(6E-13, 8E-12)*	2E-11	*(7E-12, 6E-11)*	2E-10	*(7E-11, 4E-10)*	2E-09	*(4E-10, 4E-09)*	5E-09	*(2E-09, 2E-08)*	4E-08	*(7E-09, 3E-07)*
2,3,4,6,7,8-HxCDF	3E-14	*	1E-13	*(5E-14, 3E-13)*	2E-13	*(1E-13, 6E-13)*	1E-12	*(4E-13, 3E-12)*	1E-11	*(3E-12, 4E-11)*	1E-10	*(4E-11, 3E-10)*	1E-09	*(3E-10, 2E-09)*	3E-09	*(1E-09, 8E-09)*	2E-08	*
1,2,3,4,7,8-HxCDF	6E-14	*	1E-13	*(1E-13, 3E-13)*	2E-13	*(1E-13, 1E-12)*	2E-12	*(4E-13, 1E-11)*	3E-11	*(6E-12, 6E-11)*	2E-10	*(7E-11, 5E-10)*	3E-09	*(4E-10, 5E-09)*	5E-09	*(2E-09, 2E-08)*	6E-08	*(9E-09, 4E-07)*
1,2,3,7,8,9-HxCDF	2E-14	*	1E-13	*(3E-14, 3E-13)*	2E-13	*(1E-13, 6E-13)*	1E-12	*(4E-13, 3E-12)*	5E-12	*(2E-12, 1E-11)*	4E-11	*(1E-11, 7E-11)*	5E-10	*(7E-11, 1E-09)*	2E-09	*(3E-10, 3E-09)*	6E-09	*
1,2,3,4,6,7,8-HpCDF	1E-13	*	2E-13	*(1E-13, 5E-13)*	3E-13	*(2E-13, 2E-12)*	3E-12	*(6E-13, 2E-11)*	4E-11	*(1E-11, 1E-10)*	3E-10	*(1E-10, 7E-10)*	5E-09	*(6E-10, 1E-08)*	1E-08	*(3E-09, 5E-08)*	1E-07	*(2E-08, 7E-07)*
1,2,3,4,7,8,9-HpCDF	2E-14	*	8E-14	*(3E-14, 2E-13)*	1E-13	*(9E-14, 4E-13)*	1E-12	*(3E-13, 4E-12)*	7E-12	*(3E-12, 2E-11)*	5E-11	*(2E-11, 1E-10)*	6E-10	*(1E-10, 2E-09)*	2E-09	*(5E-10, 6E-09)*	1E-08	*(3E-09, 5E-08)*
1,2,3,4,6,7,8,9-OCDF	8E-14	*	4E-13	*(1E-13, 1E-12)*	7E-13	*(4E-13, 2E-12)*	6E-12	*(2E-12, 3E-11)*	1E-10	*(3E-11, 2E-10)*	4E-10	*(2E-10, 8E-10)*	3E-09	*(8E-10, 2E-08)*	2E-08	*(3E-09, 8E-08)*	2E-07	*(2E-08, 1E-06)*
TCDD-TEQ	3E-13	*	6E-13	*(5E-13, 1E-12)*	9E-13	*(6E-13, 3E-12)*	5E-12	*(2E-12, 1E-11)*	4E-11	*(1E-11, 8E-11)*	2E-10	*(8E-11, 5E-10)*	2E-09	*(4E-10, 5E-09)*	6E-09	*(2E-09, 2E-08)*	3E-08	*(8E-09, 7E-08)*
Mercury (Elemental)	2E-13	*	3E-13	*(3E-13, 6E-13)*	6E-13	*(3E-13, 1E-12)*	1E-12	*(7E-13, 5E-12)*	2E-11	*(3E-12, 6E-11)*	2E-10	*(6E-11, 9E-10)*	2E-09	*(5E-10, 4E-09)*	5E-09	*(1E-09, 7E-09)*	1E-08	*(3E-09, 3E-08)*
Mercury (Divalent)	4E-08	*	7E-08	*(6E-08, 1E-07)*	1E-07	*(7E-08, 2E-07)*	3E-07	*(1E-07, 1E-06)*	4E-06	*(6E-07, 1E-05)*	4E-05	*(9E-06, 2E-04)*	3E-04	*(9E-05, 7E-04)*	8E-04	*(2E-04, 1E-03)*	2E-03	*(5E-04, 6E-03)*
Mercury (Methyl)	9E-10	*	1E-09	*(1E-09, 3E-09)*	2E-09	*(1E-09, 3E-09)*	5E-09	*(3E-09, 2E-08)*	8E-08	*(1E-08, 2E-07)*	8E-07	*(2E-07, 4E-06)*	6E-06	*(2E-06, 1E-05)*	2E-05	*(4E-06, 2E-05)*	4E-05	*(1E-05, 1E-04)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F7. Cumulative Frequency Distribution of Dioxins/Furans in Sector Soil with 90 Percent Confidence Intervals: Waste Heat Boilers

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	1E-12 *	3E-12 *(2E-12, 4E-12)*	4E-12 *(3E-12, 5E-12)*	6E-12 *(5E-12, 1E-11)*	2E-11 *(1E-11, 2E-11)*	4E-11 *(2E-11, 5E-11)*	7E-11 *(6E-11, 1E-10)*	1E-10 *(9E-11, 2E-10)*	4E-10 *(3E-10, 6E-10)*
1,2,3,7,8-PeCDD	1E-11 *	2E-11 *(2E-11, 6E-11)*	4E-11 *(3E-11, 9E-11)*	1E-10 *(7E-11, 2E-10)*	4E-10 *(2E-10, 5E-10)*	9E-10 *(5E-10, 1E-09)*	2E-09 *(1E-09, 2E-09)*	3E-09 *(2E-09, 4E-09)*	9E-09 *(8E-09, 1E-08)*
1,2,3,7,8,9-HxCDD	5E-12 *	2E-11 *(9E-12, 4E-11)*	3E-11 *(2E-11, 5E-11)*	8E-11 *(5E-11, 2E-10)*	2E-10 *(2E-10, 4E-10)*	6E-10 *(4E-10, 6E-10)*	1E-09 *(1E-09, 2E-09)*	3E-09 *(2E-09, 3E-09)*	1E-08 *(9E-09, 1E-08)*
1,2,3,4,7,8-HxCDD	7E-12 *	2E-11 *(1E-11, 5E-11)*	3E-11 *(2E-11, 1E-10)*	1E-10 *(7E-11, 2E-10)*	3E-10 *(2E-10, 4E-10)*	7E-10 *(5E-10, 7E-10)*	2E-09 *(1E-09, 2E-09)*	3E-09 *(3E-09, 3E-09)*	1E-08 *(9E-09, 1E-08)*
1,2,3,6,7,8-HxCDD	7E-12 *	2E-11 *(1E-11, 5E-11)*	3E-11 *(2E-11, 8E-11)*	1E-10 *(7E-11, 2E-10)*	4E-10 *(2E-10, 4E-10)*	9E-10 *(5E-10, 1E-09)*	2E-09 *(1E-09, 2E-09)*	3E-09 *(3E-09, 4E-09)*	1E-08 *(9E-09, 1E-08)*
1,2,3,6,7,8,9-HpCDD	6E-11 *	2E-10 *(1E-10, 5E-10)*	4E-10 *(3E-10, 6E-10)*	1E-09 *(6E-10, 2E-09)*	3E-09 *(2E-09, 4E-09)*	8E-09 *(5E-09, 9E-09)*	2E-08 *(1E-08, 2E-08)*	4E-08 *(3E-08, 4E-08)*	1E-07 *(1E-07, 2E-07)*
1,2,3,4,5,7,8,9-OCDD	9E-11 *	4E-10 *(2E-10, 8E-10)*	5E-10 *(4E-10, 1E-09)*	2E-09 *(9E-10, 4E-09)*	7E-09 *(4E-09, 8E-09)*	2E-08 *(1E-08, 2E-08)*	5E-08 *(3E-08, 6E-08)*	9E-08 *(8E-08, 1E-07)*	4E-07 *(3E-07, 4E-07)*
2,3,7,8-TCDF	2E-11 *	4E-11 *(4E-11, 7E-11)*	6E-11 *(5E-11, 1E-10)*	2E-10 *(8E-11, 9E-10)*	2E-09 *(6E-10, 3E-09)*	4E-09 *(3E-09, 6E-09)*	9E-09 *(6E-09, 1E-08)*	2E-08 *(1E-08, 2E-08)*	5E-08 *(3E-08, 5E-08)*
1,2,3,7,8-PeCDF	5E-11 *	1E-10 *(1E-10, 2E-10)*	2E-10 *(1E-10, 6E-10)*	6E-10 *(4E-10, 1E-09)*	2E-09 *(1E-09, 3E-09)*	5E-09 *(3E-09, 7E-09)*	1E-08 *(7E-09, 2E-08)*	3E-08 *(1E-08, 4E-08)*	9E-08 *(3E-08, 1E-07)*
2,3,4,7,8-PeCDF	5E-11 *	1E-10 *(1E-10, 3E-10)*	2E-10 *(1E-10, 8E-10)*	9E-10 *(5E-10, 4E-09)*	7E-09 *(3E-09, 1E-08)*	1E-08 *(9E-09, 2E-08)*	3E-08 *(2E-08, 4E-08)*	5E-08 *(3E-08, 6E-08)*	2E-07 *(1E-07, 2E-07)*
1,2,3,6,7,8-HxCDF	3E-11 *	1E-10 *(5E-11, 3E-10)*	2E-10 *(1E-10, 1E-09)*	1E-09 *(4E-10, 2E-09)*	3E-09 *(2E-09, 5E-09)*	9E-09 *(6E-09, 1E-08)*	3E-08 *(2E-08, 4E-08)*	5E-08 *(3E-08, 7E-08)*	2E-07 *(1E-07, 3E-07)*
2,3,4,6,7,8-HxCDF	2E-11 *	8E-11 *(4E-11, 2E-10)*	2E-10 *(8E-11, 5E-10)*	6E-10 *(3E-10, 1E-09)*	2E-09 *(1E-09, 2E-09)*	4E-09 *(3E-09, 7E-09)*	1E-08 *(8E-09, 2E-08)*	2E-08 *(2E-08, 3E-08)*	8E-08 *(7E-08, 1E-07)*
1,2,3,4,7,8-HxCDF	2E-11 *	6E-11 *(4E-11, 2E-10)*	1E-10 *(7E-11, 2E-09)*	2E-09 *(2E-10, 3E-09)*	4E-09 *(3E-09, 6E-09)*	1E-08 *(8E-09, 2E-08)*	4E-08 *(2E-08, 6E-08)*	6E-08 *(4E-08, 9E-08)*	3E-07 *(1E-07, 4E-07)*
1,2,3,7,8,9-HxCDF	9E-12 *	3E-11 *(2E-11, 7E-11)*	6E-11 *(3E-11, 2E-10)*	2E-10 *(1E-10, 1E-09)*	2E-09 *(8E-10, 3E-09)*	5E-09 *(3E-09, 7E-09)*	9E-09 *(7E-09, 1E-08)*	2E-08 *(1E-08, 2E-08)*	6E-08 *(5E-08, 7E-08)*
1,2,3,4,6,7,8-HpCDF	3E-11 *	1E-10 *(6E-11, 3E-10)*	2E-10 *(1E-10, 2E-09)*	3E-09 *(5E-10, 5E-09)*	8E-09 *(5E-09, 1E-08)*	2E-08 *(1E-08, 3E-08)*	9E-08 *(4E-08, 1E-07)*	2E-07 *(1E-07, 2E-07)*	5E-07 *(4E-07, 8E-07)*
1,2,3,4,7,8,9-HpCDF	7E-12 *	2E-11 *(1E-11, 7E-11)*	5E-11 *(3E-11, 4E-10)*	4E-10 *(1E-10, 1E-09)*	1E-09 *(9E-10, 2E-09)*	3E-09 *(2E-09, 5E-09)*	1E-08 *(7E-09, 1E-08)*	2E-08 *(2E-08, 2E-08)*	7E-08 *(6E-08, 8E-08)*
1,2,3,4,6,7,8,9-OCDF	3E-11 *	1E-10 *(5E-11, 3E-10)*	3E-10 *(1E-10, 1E-09)*	2E-09 *(5E-10, 5E-09)*	6E-09 *(4E-09, 1E-08)*	2E-08 *(1E-08, 3E-08)*	1E-07 *(4E-08, 2E-07)*	3E-07 *(1E-07, 4E-07)*	1E-06 *(5E-07, 1E-06)*
TCDD-TEQ	6E-11 *	2E-10 *(1E-10, 3E-10)*	3E-10 *(2E-10, 1E-09)*	1E-09 *(5E-10, 4E-09)*	6E-09 *(3E-09, 9E-09)*	1E-08 *(9E-09, 2E-08)*	3E-08 *(2E-08, 4E-08)*	5E-08 *(4E-08, 6E-08)*	2E-07 *(1E-07, 2E-07)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F8. Cumulative Frequency Distribution of Dioxins/Furans in Sector Soil with 90 Percent Confidence Intervals: All Incinerators

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	4E-15 *	3E-14 *(2E-14, 7E-14)*	7E-14 *(4E-14, 1E-13)*	2E-13 *(1E-13, 3E-13)*	1E-12 *(5E-13, 2E-12)*	8E-12 *(4E-12, 2E-11)*	5E-11 *(3E-11, 7E-11)*	8E-11 *(6E-11, 1E-10)*	3E-10 *(2E-10, 4E-10)*
1,2,3,7,8-PeCDD	4E-14 *	3E-13 *(1E-13, 7E-13)*	6E-13 *(3E-13, 1E-12)*	3E-12 *(1E-12, 4E-12)*	1E-11 *(6E-12, 2E-11)*	6E-11 *(3E-11, 9E-11)*	3E-10 *(1E-10, 5E-10)*	8E-10 *(3E-10, 1E-09)*	3E-09 *(2E-09, 5E-09)*
1,2,3,7,8,9-HxCDD	2E-14 *	5E-13 *(9E-14, 8E-13)*	8E-13 *(5E-13, 1E-12)*	2E-12 *(2E-12, 3E-12)*	2E-11 *(6E-12, 4E-11)*	8E-11 *(5E-11, 2E-10)*	3E-10 *(2E-10, 7E-10)*	1E-09 *(5E-10, 2E-09)*	6E-09 *(3E-09, 9E-09)*
1,2,3,4,7,8-HxCDD	* *	* *	2E-13 *	2E-12 *(8E-13, 3E-12)*	1E-11 *(4E-12, 2E-11)*	6E-11 *(3E-11, 9E-11)*	3E-10 *(1E-10, 6E-10)*	9E-10 *(3E-10, 2E-09)*	5E-09 *(3E-09, 9E-09)*
1,2,3,6,7,8-HxCDD	* *	* *	1E-13 *	9E-13 *(5E-13, 2E-12)*	8E-12 *(3E-12, 2E-11)*	5E-11 *(2E-11, 7E-11)*	2E-10 *(1E-10, 4E-10)*	6E-10 *(2E-10, 2E-09)*	6E-09 *(2E-09, 8E-09)*
1,2,3,6,7,8,9-HpCDD	2E-14 *	3E-13 *(9E-14, 7E-13)*	6E-13 *(4E-13, 2E-12)*	5E-12 *(2E-12, 3E-11)*	7E-11 *(3E-11, 2E-10)*	7E-10 *(3E-10, 1E-09)*	3E-09 *(2E-09, 5E-09)*	7E-09 *(4E-09, 1E-08)*	4E-08 *(2E-08, 7E-08)*
1,2,3,4,5,7,8,9-OCDD	6E-14 *	1E-12 *(2E-13, 3E-12)*	2E-12 *(1E-12, 6E-12)*	1E-11 *(6E-12, 8E-11)*	3E-10 *(1E-10, 7E-10)*	3E-09 *(1E-09, 4E-09)*	1E-08 *(7E-09, 1E-08)*	2E-08 *(1E-08, 4E-08)*	1E-07 *(6E-08, 1E-07)*
2,3,7,8-TCDF	1E-13 *	4E-13 *(2E-13, 6E-13)*	5E-13 *(4E-13, 1E-12)*	2E-12 *(1E-12, 3E-12)*	8E-12 *(5E-12, 1E-11)*	4E-11 *(3E-11, 5E-11)*	1E-10 *(8E-11, 2E-10)*	3E-10 *(2E-10, 8E-10)*	2E-09 *(1E-09, 4E-09)*
1,2,3,7,8-PeCDF	2E-13 *	4E-13 *(4E-13, 1E-12)*	1E-12 *(5E-13, 2E-12)*	4E-12 *(2E-12, 8E-12)*	2E-11 *(1E-11, 4E-11)*	1E-10 *(7E-11, 2E-10)*	6E-10 *(3E-10, 8E-10)*	2E-09 *(8E-10, 3E-09)*	6E-09 *(4E-09, 1E-08)*
2,3,4,7,8-PeCDF	2E-13 *	3E-13 *(3E-13, 8E-13)*	7E-13 *(3E-13, 3E-12)*	4E-12 *(2E-12, 1E-11)*	3E-11 *(1E-11, 5E-11)*	2E-10 *(8E-11, 3E-10)*	9E-10 *(5E-10, 1E-09)*	3E-09 *(1E-09, 5E-09)*	2E-08 *(9E-09, 2E-08)*
1,2,3,6,7,8-HxCDF	* *	* *	2E-13 *	2E-12 *(6E-13, 7E-12)*	2E-11 *(1E-11, 5E-11)*	1E-10 *(8E-11, 2E-10)*	7E-10 *(3E-10, 1E-09)*	3E-09 *(1E-09, 5E-09)*	1E-08 *(7E-09, 2E-08)*
2,3,4,6,7,8-HxCDF	3E-14 *	1E-13 *(9E-14, 5E-13)*	3E-13 *(2E-13, 1E-12)*	3E-12 *(1E-12, 8E-12)*	3E-11 *(1E-11, 5E-11)*	2E-10 *(9E-11, 3E-10)*	9E-10 *(5E-10, 2E-09)*	3E-09 *(1E-09, 5E-09)*	1E-08 *(9E-09, 2E-08)*
1,2,3,4,7,8-HxCDF	* *	* *	1E-13 *	2E-12 *(4E-13, 6E-12)*	3E-11 *(9E-12, 6E-11)*	2E-10 *(8E-11, 3E-10)*	7E-10 *(4E-10, 1E-09)*	3E-09 *(1E-09, 8E-09)*	2E-08 *(1E-08, 4E-08)*
1,2,3,7,8,9-HxCDF	2E-14 *	2E-13 *(8E-14, 4E-13)*	3E-13 *(2E-13, 9E-13)*	2E-12 *(6E-13, 3E-12)*	8E-12 *(4E-12, 1E-11)*	4E-11 *(2E-11, 8E-11)*	3E-10 *(1E-10, 5E-10)*	6E-10 *(3E-10, 1E-09)*	3E-09 *(1E-09, 5E-09)*
1,2,3,4,6,7,8-HpCDF	1E-13 *	2E-13 *(2E-13, 7E-13)*	5E-13 *(3E-13, 4E-12)*	1E-11 *(2E-12, 2E-11)*	7E-11 *(3E-11, 1E-10)*	6E-10 *(2E-10, 9E-10)*	2E-09 *(1E-09, 3E-09)*	6E-09 *(3E-09, 8E-09)*	3E-08 *(2E-08, 3E-08)*
1,2,3,4,7,8,9-HpCDF	2E-14 *	1E-13 *(6E-14, 3E-13)*	3E-13 *(1E-13, 9E-13)*	3E-12 *(6E-13, 5E-12)*	1E-11 *(7E-12, 3E-11)*	1E-10 *(5E-11, 2E-10)*	7E-10 *(3E-10, 1E-09)*	2E-09 *(9E-10, 3E-09)*	7E-09 *(4E-09, 1E-08)*
1,2,3,4,6,7,8,9-OCDF	9E-14 *	6E-13 *(3E-13, 2E-12)*	1E-12 *(7E-13, 7E-12)*	3E-11 *(4E-12, 5E-11)*	1E-10 *(6E-11, 3E-10)*	1E-09 *(5E-10, 3E-09)*	7E-09 *(4E-09, 9E-09)*	1E-08 *(9E-09, 2E-08)*	4E-08 *(4E-08, 7E-08)*
TCDD-TEQ	3E-13 *	8E-13 *(5E-13, 2E-12)*	2E-12 *(8E-13, 6E-12)*	8E-12 *(6E-12, 2E-11)*	5E-11 *(3E-11, 9E-11)*	3E-10 *(2E-10, 4E-10)*	1E-09 *(7E-10, 3E-09)*	4E-09 *(2E-09, 7E-09)*	2E-08 *(1E-08, 2E-08)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F9. Cumulative Frequency Distribution of Dioxins/Furans in Sector Soil with 90 Percent Confidence Intervals: Commercial Incinerators

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	* *	1E-13 *	2E-13 *(1E-13, 3E-12)*	3E-12 *(3E-13, 6E-12)*	1E-11 *(5E-12, 2E-11)*	3E-11 *(2E-11, 5E-11)*	9E-11 *(4E-11, 1E-10)*	1E-10 *(9E-11, 2E-10)*	3E-10 *(3E-10, 6E-10)*
1,2,3,7,8-PeCDD	* *	5E-13 *	7E-13 *(5E-13, 1E-11)*	1E-11 *(1E-12, 2E-11)*	4E-11 *(2E-11, 2E-10)*	3E-10 *(1E-10, 8E-10)*	1E-09 *(3E-10, 2E-09)*	3E-09 *(1E-09, 4E-09)*	8E-09 *(4E-09, 1E-08)*
1,2,3,7,8,9-HxCDD	* *	7E-13 *	1E-12 *(7E-13, 6E-12)*	6E-12 *(2E-12, 4E-11)*	8E-11 *(3E-11, 1E-10)*	3E-10 *(1E-10, 2E-09)*	3E-09 *(5E-10, 6E-09)*	7E-09 *(2E-09, 1E-08)*	2E-08 *(8E-09, 4E-08)*
1,2,3,4,7,8-HxCDD	* *	2E-12 *	3E-12 *(2E-12, 8E-12)*	9E-12 *(4E-12, 7E-11)*	1E-10 *(6E-11, 2E-10)*	3E-10 *(2E-10, 1E-09)*	3E-09 *(6E-10, 5E-09)*	5E-09 *(2E-09, 8E-09)*	2E-08 *(7E-09, 3E-08)*
1,2,3,6,7,8-HxCDD	* *	9E-13 *	1E-12 *(9E-13, 2E-11)*	2E-11 *(2E-12, 4E-11)*	8E-11 *(4E-11, 1E-10)*	2E-10 *(1E-10, 2E-09)*	3E-09 *(4E-10, 6E-09)*	6E-09 *(2E-09, 9E-09)*	2E-08 *(7E-09, 4E-08)*
1,2,3,6,7,8,9-HpCDD	* *	1E-11 *	2E-11 *(1E-11, 5E-11)*	6E-11 *(2E-11, 5E-10)*	9E-10 *(3E-10, 1E-09)*	2E-09 *(1E-09, 2E-08)*	3E-08 *(5E-09, 6E-08)*	6E-08 *(2E-08, 1E-07)*	2E-07 *(7E-08, 4E-07)*
1,2,3,4,5,7,8,9-OCDD	* *	6E-11 *	9E-11 *(6E-11, 1E-09)*	1E-09 *(2E-10, 3E-09)*	3E-09 *(3E-09, 6E-09)*	1E-08 *(7E-09, 3E-08)*	4E-08 *(2E-08, 6E-08)*	7E-08 *(3E-08, 1E-07)*	3E-07 *(1E-07, 4E-07)*
2,3,7,8-TCDF	* *	6E-12 *	8E-12 *(6E-12, 4E-11)*	4E-11 *(1E-11, 8E-11)*	1E-10 *(6E-11, 4E-10)*	8E-10 *(2E-10, 1E-09)*	2E-09 *(9E-10, 2E-09)*	4E-09 *(1E-09, 4E-09)*	1E-08 *(4E-09, 1E-08)*
1,2,3,7,8-PeCDF	* *	5E-12 *	7E-12 *(5E-12, 2E-11)*	2E-11 *(9E-12, 8E-11)*	1E-10 *(3E-11, 4E-10)*	2E-09 *(3E-10, 3E-09)*	5E-09 *(2E-09, 6E-09)*	9E-09 *(4E-09, 1E-08)*	3E-08 *(1E-08, 4E-08)*
2,3,4,7,8-PeCDF	* *	1E-11 *(1E-11, 1E-11)*	1E-11 *(1E-11, 2E-11)*	3E-11 *(2E-11, 2E-10)*	4E-10 *(6E-11, 1E-09)*	5E-09 *(8E-10, 7E-09)*	1E-08 *(5E-09, 2E-08)*	2E-08 *(1E-08, 3E-08)*	7E-08 *(4E-08, 9E-08)*
1,2,3,6,7,8-HxCDF	* *	3E-12 *	4E-12 *(3E-12, 2E-11)*	2E-11 *(6E-12, 1E-10)*	3E-10 *(8E-11, 2E-09)*	4E-09 *(5E-10, 6E-09)*	1E-08 *(5E-09, 2E-08)*	2E-08 *(9E-09, 2E-08)*	6E-08 *(4E-08, 8E-08)*
2,3,4,6,7,8-HxCDF	* *	2E-12 *	2E-12 *(2E-12, 6E-12)*	7E-12 *(4E-12, 6E-11)*	2E-10 *(4E-11, 1E-09)*	4E-09 *(5E-10, 7E-09)*	1E-08 *(4E-09, 2E-08)*	2E-08 *(9E-09, 3E-08)*	6E-08 *(4E-08, 1E-07)*
1,2,3,4,7,8-HxCDF	* *	4E-12 *	6E-12 *(4E-12, 1E-11)*	2E-11 *(9E-12, 1E-10)*	2E-10 *(4E-11, 2E-09)*	8E-09 *(6E-10, 1E-08)*	2E-08 *(8E-09, 3E-08)*	4E-08 *(2E-08, 5E-08)*	1E-07 *(7E-08, 2E-07)*
1,2,3,7,8,9-HxCDF	* *	2E-13 *	3E-13 *(2E-13, 7E-12)*	8E-12 *(6E-13, 2E-11)*	4E-11 *(1E-11, 2E-10)*	3E-10 *(8E-11, 4E-10)*	7E-10 *(3E-10, 8E-10)*	1E-09 *(7E-10, 1E-09)*	4E-09 *(2E-09, 5E-09)*
1,2,3,4,6,7,8-HpCDF	* *	2E-12 *	3E-12 *(2E-12, 3E-11)*	3E-11 *(6E-12, 1E-10)*	3E-10 *(8E-11, 3E-09)*	5E-09 *(1E-09, 9E-09)*	2E-08 *(7E-09, 3E-08)*	3E-08 *(2E-08, 5E-08)*	1E-07 *(6E-08, 1E-07)*
1,2,3,4,7,8,9-HpCDF	* *	4E-13 *	6E-13 *(4E-13, 9E-12)*	9E-12 *(1E-12, 3E-11)*	7E-11 *(2E-11, 7E-10)*	1E-09 *(2E-10, 2E-09)*	3E-09 *(1E-09, 4E-09)*	4E-09 *(3E-09, 7E-09)*	2E-08 *(1E-08, 2E-08)*
1,2,3,4,6,7,8,9-OCDF	* *	3E-11 *	3E-11 *(3E-11, 9E-11)*	9E-11 *(6E-11, 7E-10)*	2E-09 *(3E-10, 6E-09)*	9E-09 *(5E-09, 1E-08)*	3E-08 *(1E-08, 3E-08)*	4E-08 *(3E-08, 6E-08)*	1E-07 *(9E-08, 2E-07)*
TCDD-TEQ	* *	9E-12 *	1E-11 *(9E-12, 6E-11)*	6E-11 *(2E-11, 2E-10)*	4E-10 *(1E-10, 2E-09)*	6E-09 *(7E-10, 7E-09)*	1E-08 *(6E-09, 2E-08)*	2E-08 *(1E-08, 4E-08)*	7E-08 *(5E-08, 1E-07)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F10. Cumulative Frequency Distribution of Dioxins/Furans in Sector Soil with 90 Percent Confidence Intervals: Large Onsite Incinerators

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	* *	5E-13 *(3E-13, 9E-13)*	6E-13 *(4E-13, 2E-12)*	2E-12 *(9E-13, 6E-12)*	1E-11 *(3E-12, 3E-11)*	5E-11 *(2E-11, 7E-11)*	9E-11 *(6E-11, 2E-10)*	2E-10 *(1E-10, 2E-10)*	6E-10 *(3E-10, 7E-10)*
1,2,3,7,8-PeCDD	* *	2E-12 *(1E-12, 4E-12)*	3E-12 *(2E-12, 7E-12)*	8E-12 *(4E-12, 2E-11)*	4E-11 *(2E-11, 9E-11)*	2E-10 *(9E-11, 4E-10)*	7E-10 *(3E-10, 1E-09)*	1E-09 *(5E-10, 3E-09)*	6E-09 *(2E-09, 1E-08)*
1,2,3,7,8,9-HxCDD	* *	2E-12 *(1E-12, 2E-12)*	2E-12 *(2E-12, 5E-12)*	7E-12 *(3E-12, 2E-11)*	5E-11 *(2E-11, 9E-11)*	2E-10 *(9E-11, 5E-10)*	7E-10 *(3E-10, 2E-09)*	2E-09 *(6E-10, 3E-09)*	7E-09 *(2E-09, 2E-08)*
1,2,3,4,7,8-HxCDD	* *	* *	* *	1E-12 *	2E-11 *(4E-12, 5E-11)*	1E-10 *(3E-11, 4E-10)*	8E-10 *(1E-10, 2E-09)*	2E-09 *(3E-10, 4E-09)*	8E-09 *(8E-10, 1E-08)*
1,2,3,6,7,8-HxCDD	* *	* *	* *	9E-13 *	1E-11 *(3E-12, 5E-11)*	6E-11 *(2E-11, 3E-10)*	6E-10 *(1E-10, 1E-09)*	1E-09 *(2E-10, 3E-09)*	6E-09 *(6E-10, 8E-09)*
1,2,3,6,7,8,9-HpCDD	* *	3E-11 *(2E-11, 5E-11)*	4E-11 *(3E-11, 7E-11)*	9E-11 *(5E-11, 3E-10)*	6E-10 *(2E-10, 8E-10)*	2E-09 *(8E-10, 4E-09)*	5E-09 *(3E-09, 9E-09)*	1E-08 *(5E-09, 2E-08)*	4E-08 *(2E-08, 6E-08)*
1,2,3,4,5,7,8,9-OCDD	* *	1E-10 *(7E-11, 2E-10)*	1E-10 *(1E-10, 3E-10)*	4E-10 *(2E-10, 1E-09)*	3E-09 *(9E-10, 4E-09)*	8E-09 *(3E-09, 1E-08)*	2E-08 *(1E-08, 3E-08)*	4E-08 *(2E-08, 5E-08)*	1E-07 *(9E-08, 2E-07)*
2,3,7,8-TCDF	* *	1E-12 *(8E-13, 3E-12)*	2E-12 *(1E-12, 5E-12)*	6E-12 *(3E-12, 2E-11)*	3E-11 *(1E-11, 5E-11)*	6E-11 *(5E-11, 8E-11)*	1E-10 *(1E-10, 2E-10)*	2E-10 *(2E-10, 3E-10)*	6E-10 *(4E-10, 1E-09)*
1,2,3,7,8-PeCDF	* *	4E-12 *(3E-12, 8E-12)*	6E-12 *(4E-12, 2E-11)*	2E-11 *(8E-12, 5E-11)*	7E-11 *(4E-11, 3E-10)*	3E-10 *(1E-10, 6E-10)*	1E-09 *(5E-10, 2E-09)*	2E-09 *(1E-09, 2E-09)*	5E-09 *(3E-09, 6E-09)*
2,3,4,7,8-PeCDF	* *	6E-12 *(5E-12, 1E-11)*	8E-12 *(6E-12, 3E-11)*	3E-11 *(1E-11, 1E-10)*	2E-10 *(8E-11, 3E-10)*	5E-10 *(2E-10, 1E-09)*	1E-09 *(7E-10, 2E-09)*	3E-09 *(1E-09, 3E-09)*	9E-09 *(4E-09, 1E-08)*
1,2,3,6,7,8-HxCDF	* *	* *	* *	3E-12 *	5E-11 *(1E-11, 1E-10)*	2E-10 *(1E-10, 7E-10)*	1E-09 *(3E-10, 2E-09)*	2E-09 *(7E-10, 4E-09)*	1E-08 *(2E-09, 1E-08)*
2,3,4,6,7,8-HxCDF	* *	4E-12 *(4E-12, 2E-11)*	1E-11 *(4E-12, 3E-11)*	5E-11 *(1E-11, 1E-10)*	2E-10 *(9E-11, 3E-10)*	6E-10 *(3E-10, 1E-09)*	2E-09 *(8E-10, 2E-09)*	4E-09 *(1E-09, 4E-09)*	1E-08 *(4E-09, 1E-08)*
1,2,3,4,7,8-HxCDF	* *	* *	* *	3E-12 *	7E-11 *(1E-11, 2E-10)*	2E-10 *(1E-10, 6E-10)*	1E-09 *(3E-10, 2E-09)*	2E-09 *(6E-10, 3E-09)*	9E-09 *(2E-09, 1E-08)*
1,2,3,7,8,9-HxCDF	* *	3E-12 *(2E-12, 4E-12)*	3E-12 *(3E-12, 7E-12)*	9E-12 *(4E-12, 2E-11)*	4E-11 *(2E-11, 1E-10)*	3E-10 *(9E-11, 5E-10)*	1E-09 *(3E-10, 2E-09)*	2E-09 *(6E-10, 3E-09)*	7E-09 *(2E-09, 9E-09)*
1,2,3,4,6,7,8-HpCDF	* *	2E-11 *(2E-11, 3E-11)*	2E-11 *(2E-11, 4E-11)*	5E-11 *(3E-11, 2E-10)*	6E-10 *(1E-10, 9E-10)*	2E-09 *(9E-10, 2E-09)*	3E-09 *(2E-09, 6E-09)*	7E-09 *(4E-09, 9E-09)*	2E-08 *(2E-08, 3E-08)*
1,2,3,4,7,8,9-HpCDF	* *	4E-12 *(3E-12, 7E-12)*	6E-12 *(4E-12, 1E-11)*	1E-11 *(8E-12, 1E-10)*	1E-10 *(5E-11, 2E-10)*	4E-10 *(2E-10, 1E-09)*	2E-09 *(6E-10, 3E-09)*	4E-09 *(1E-09, 7E-09)*	2E-08 *(4E-09, 3E-08)*
1,2,3,4,6,7,8,9-OCDF	* *	4E-11 *(3E-11, 6E-11)*	5E-11 *(4E-11, 9E-11)*	1E-10 *(6E-11, 5E-10)*	1E-09 *(3E-10, 3E-09)*	4E-09 *(3E-09, 8E-09)*	1E-08 *(7E-09, 1E-08)*	2E-08 *(1E-08, 3E-08)*	7E-08 *(4E-08, 1E-07)*
TCDD-TEQ	* *	1E-11 *(8E-12, 2E-11)*	1E-11 *(1E-11, 4E-11)*	5E-11 *(2E-11, 2E-10)*	2E-10 *(9E-11, 4E-10)*	7E-10 *(4E-10, 1E-09)*	2E-09 *(1E-09, 4E-09)*	5E-09 *(2E-09, 7E-09)*	2E-08 *(6E-09, 2E-08)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-F11. Cumulative Frequency Distribution of Dioxins/Furans in Sector Soil with 90 Percent Confidence Intervals: Small Onsite Incinerators

Constituents	*Percentile of Soil Concentration Distribution (mg/kg)*									
	1%	5%	10%	25%	50%	75%	90%	95%	99%
2,3,7,8-TCDD	4E-15 *	2E-14 *(5E-15, 6E-14)*	4E-14 *(2E-14, 8E-14)*	9E-14 *(7E-14, 1E-13)*	3E-13 *(1E-13, 5E-13)*	1E-12 *(4E-13, 2E-12)*	4E-12 *(2E-12, 5E-12)*	6E-12 *(4E-12, 1E-11)*	2E-11 *(1E-11, 3E-11)*
1,2,3,7,8-PeCDD	4E-14 *	2E-13 *(5E-14, 5E-13)*	3E-13 *(2E-13, 8E-13)*	9E-13 *(5E-13, 3E-12)*	4E-12 *(3E-12, 1E-11)*	2E-11 *(8E-12, 4E-11)*	5E-11 *(2E-11, 8E-11)*	8E-11 *(4E-11, 2E-10)*	3E-10 *(2E-10, 6E-10)*
1,2,3,7,8,9-HxCDD	2E-14 *	3E-13 *(3E-14, 6E-13)*	5E-13 *(1E-13, 9E-13)*	1E-12 *(7E-13, 2E-12)*	4E-12 *(2E-12, 2E-11)*	4E-11 *(1E-11, 6E-11)*	1E-10 *(5E-11, 2E-10)*	2E-10 *(6E-11, 5E-10)*	8E-10 *
1,2,3,4,7,8-HxCDD	4E-14 *	2E-13 *(5E-14, 6E-13)*	4E-13 *(2E-13, 9E-13)*	1E-12 *(6E-13, 3E-12)*	4E-12 *(3E-12, 1E-11)*	2E-11 *(1E-11, 5E-11)*	7E-11 *(3E-11, 1E-10)*	1E-10 *(6E-11, 2E-10)*	5E-10 *
1,2,3,6,7,8-HxCDD	2E-14 *	1E-13 *(3E-14, 4E-13)*	2E-13 *(1E-13, 5E-13)*	6E-13 *(4E-13, 2E-12)*	4E-12 *(2E-12, 1E-11)*	2E-11 *(8E-12, 3E-11)*	7E-11 *(2E-11, 1E-10)*	1E-10 *(5E-11, 2E-10)*	5E-10 *(2E-10, 9E-10)*
1,2,3,6,7,8,9-HpCDD	2E-14 *	2E-13 *(3E-14, 5E-13)*	4E-13 *(1E-13, 7E-13)*	1E-12 *(5E-13, 4E-12)*	9E-12 *(2E-12, 5E-11)*	1E-10 *(3E-11, 3E-10)*	6E-10 *(2E-10, 1E-09)*	1E-09 *(3E-10, 2E-09)*	5E-09 *(8E-10, 1E-08)*
1,2,3,4,5,7,8,9-OCDD	6E-14 *	9E-13 *(8E-14, 2E-12)*	2E-12 *(3E-13, 3E-12)*	5E-12 *(2E-12, 1E-11)*	3E-11 *(7E-12, 2E-10)*	4E-10 *(8E-11, 8E-10)*	2E-09 *(6E-10, 3E-09)*	3E-09 *(9E-10, 6E-09)*	1E-08 *
2,3,7,8-TCDF	9E-14 *	2E-13 *(1E-13, 5E-13)*	4E-13 *(2E-13, 6E-13)*	8E-13 *(5E-13, 2E-12)*	3E-12 *(1E-12, 7E-12)*	1E-11 *(7E-12, 2E-11)*	3E-11 *(1E-11, 4E-11)*	5E-11 *(2E-11, 8E-11)*	2E-10 *(7E-11, 3E-10)*
1,2,3,7,8-PeCDF	2E-13 *	4E-13 *(3E-13, 7E-13)*	5E-13 *(4E-13, 1E-12)*	1E-12 *(8E-13, 4E-12)*	7E-12 *(3E-12, 2E-11)*	4E-11 *(2E-11, 7E-11)*	1E-10 *(5E-11, 2E-10)*	2E-10 *(1E-10, 3E-10)*	7E-10 *(3E-10, 1E-09)*
2,3,4,7,8-PeCDF	* *	2E-13 *(2E-13, 5E-13)*	3E-13 *(3E-13, 1E-12)*	1E-12 *(6E-13, 4E-12)*	7E-12 *(3E-12, 2E-11)*	3E-11 *(2E-11, 5E-11)*	1E-10 *(4E-11, 2E-10)*	2E-10 *(6E-11, 4E-10)*	8E-10 *(2E-10, 2E-09)*
1,2,3,6,7,8-HxCDF	* *	2E-13 *(1E-13, 4E-13)*	3E-13 *(2E-13, 8E-13)*	1E-12 *(5E-13, 5E-12)*	1E-11 *(3E-12, 4E-11)*	7E-11 *(2E-11, 1E-10)*	2E-10 *(8E-11, 3E-10)*	4E-10 *(1E-10, 8E-10)*	1E-09 *(3E-10, 4E-09)*
2,3,4,6,7,8-HxCDF	3E-14 *	9E-14 *(4E-14, 2E-13)*	2E-13 *(9E-14, 5E-13)*	6E-13 *(3E-13, 2E-12)*	6E-12 *(2E-12, 2E-11)*	4E-11 *(1E-11, 6E-11)*	2E-10 *(4E-11, 3E-10)*	3E-10 *(7E-11, 5E-10)*	1E-09 *(2E-10, 3E-09)*
1,2,3,4,7,8-HxCDF	* *	1E-13 *(9E-14, 3E-13)*	2E-13 *(1E-13, 8E-13)*	1E-12 *(3E-13, 4E-12)*	1E-11 *(2E-12, 4E-11)*	7E-11 *(3E-11, 1E-10)*	3E-10 *(9E-11, 4E-10)*	4E-10 *(1E-10, 9E-10)*	2E-09 *(3E-10, 5E-09)*
1,2,3,7,8,9-HxCDF	2E-14 *	1E-13 *(3E-14, 3E-13)*	2E-13 *(1E-13, 4E-13)*	6E-13 *(3E-13, 2E-12)*	3E-12 *(2E-12, 6E-12)*	1E-11 *(5E-12, 2E-11)*	4E-11 *(1E-11, 5E-11)*	6E-11 *(2E-11, 8E-11)*	2E-10 *
1,2,3,4,6,7,8-HpCDF	* *	2E-13 *(1E-13, 4E-13)*	3E-13 *(2E-13, 1E-12)*	2E-12 *(4E-13, 1E-11)*	2E-11 *(5E-12, 6E-11)*	1E-10 *(4E-11, 2E-10)*	4E-10 *(1E-10, 7E-10)*	7E-10 *(3E-10, 1E-09)*	3E-09 *(5E-10, 9E-09)*
1,2,3,4,7,8,9-HpCDF	2E-14 *	7E-14 *(2E-14, 2E-13)*	1E-13 *(7E-14, 4E-13)*	4E-13 *(2E-13, 3E-12)*	5E-12 *(1E-12, 9E-12)*	2E-11 *(8E-12, 3E-11)*	6E-11 *(3E-11, 1E-10)*	1E-10 *(4E-11, 2E-10)*	4E-10 *(2E-10, 1E-09)*
1,2,3,4,6,7,8,9-OCDF	8E-14 *	4E-13 *(1E-13, 1E-12)*	6E-13 *(3E-13, 2E-12)*	2E-12 *(1E-12, 2E-11)*	3E-11 *(8E-12, 1E-10)*	2E-10 *(1E-10, 4E-10)*	6E-10 *(3E-10, 8E-10)*	1E-09 *(5E-10, 2E-09)*	4E-09 *(2E-09, 7E-09)*
TCDD-TEQ	3E-13 *	5E-13 *(4E-13, 1E-12)*	8E-13 *(5E-13, 2E-12)*	3E-12 *(1E-12, 7E-12)*	2E-11 *(7E-12, 4E-11)*	8E-11 *(4E-11, 1E-10)*	3E-10 *(9E-11, 4E-10)*	4E-10 *(2E-10, 7E-10)*	2E-09 *(3E-10, 5E-09)*

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

All concentration values <10 have been rounded to one significant digit

Table H-G1. Cumulative Frequency Distribution of Particulate Matter in Atmosphere with 90 Percent Confidence Intervals

	Percentile of PM Concentration Distribution (mg/m^3)																					
	1%		5%		10%		25%		50%		75%		90%		95%		99%	
Cement Kilns																						
PM 2.5	*	*	*	*	*	*	*	*	1E-05	*	6E-03	*(6E-03, 6E-03)*	2E-02	*(2E-02, 2E-02)*	3E-02	*(3E-02, 3E-02)*	7E-02	*				
PM 10	*	*	*	*	*	*	*	*	2E-05	*	1E-02	*(1E-02, 1E-02)*	3E-02	*(3E-02, 3E-02)*	5E-02	*(5E-02, 5E-02)*	1E-01	*				
Area Source Cement Kilns[a]																						
PM 2.5	*	*	*	*	*	*	*	*	*	*	3E-03	*(3E-03, 4E-03)*	1E-02	*(1E-02, 2E-02)*	2E-02	*(2E-02, 3E-02)*	5E-02	*(4E-02, 6E-02)*				
PM 10	*	*	*	*	*	*	*	*	*	*	6E-03	*(5E-03, 7E-03)*	2E-02	*(2E-02, 3E-02)*	4E-02	*(3E-02, 5E-02)*	9E-02	*(7E-02, 1E-01)*				
Lightweight Aggregate Kilns[b]																						
PM 2.5	*		*		*		*		6E-06		3E-03		1E-02		2E-02		6E-02					
PM 10	*		*		*		*		1E-05		5E-03		2E-02		3E-02		1E-01					
All Incinerators																						
PM 2.5	*	*	*	*	*	*	*	*	*	*	5E-04	*(3E-04, 1E-03)*	4E-03	*(1E-03, 9E-03)*	1E-02	*(5E-03, 3E-02)*	1E-01	*(3E-02, 2E-01)*				
PM 10	*	*	*	*	*	*	*	*	*	*	5E-04	*(3E-04, 1E-03)*	5E-03	*(2E-03, 1E-02)*	2E-02	*(5E-03, 3E-02)*	1E-01	*(4E-02, 2E-01)*				
Area Source Incinerators																						
PM 2.5	*	*	*	*	*	*	*	*	*	*	5E-04	*(2E-04, 1E-03)*	6E-03	*(4E-03, 9E-03)*	2E-02	*(1E-02, 2E-02)*	7E-02	*(5E-02, 8E-02)*				
PM 10	*	*	*	*	*	*	*	*	*	*	6E-04	*(2E-04, 2E-03)*	8E-03	*(5E-03, 1E-02)*	2E-02	*(1E-02, 3E-02)*	9E-02	*(7E-02, 1E-01)*				
Commercial Incinerators																						
PM 2.5	*	*	*	*	*	*	*	*	*	*	5E-04	*(3E-04, 8E-04)*	4E-03	*(3E-03, 6E-03)*	1E-02	*(9E-03, 2E-02)*	6E-02	*(5E-02, 7E-02)*				
PM 10	*	*	*	*	*	*	*	*	*	*	6E-04	*(4E-04, 1E-03)*	6E-03	*(4E-03, 8E-03)*	2E-02	*(1E-02, 2E-02)*	8E-02	*(6E-02, 1E-01)*				
Large Onsite Incinerators																						
PM 2.5	*	*	*	*	*	*	*	*	*	*	4E-03	*(3E-03, 8E-03)*	3E-02	*(1E-02, 6E-02)*	8E-02	*(3E-02, 1E-01)*	3E-01	*(1E-01, 4E-01)*				
PM 10	*	*	*	*	*	*	*	*	*	*	5E-03	*(3E-03, 1E-02)*	4E-02	*(2E-02, 7E-02)*	1E-01	*(4E-02, 2E-01)*	4E-01	*(2E-01, 5E-01)*				
Small Onsite Incinerators																						
PM 2.5	*	*	*	*	*	*	*	*	1E-07	*	3E-04	*(2E-04, 5E-04)*	2E-03	*(8E-04, 3E-03)*	4E-03	*(1E-03, 7E-03)*	2E-02	*(5E-03, 2E-02)*				
PM 10	*	*	*	*	*	*	*	*	1E-07	*	3E-04	*(2E-04, 5E-04)*	2E-03	*(8E-04, 4E-03)*	4E-03	*(1E-03, 8E-03)*	2E-02	*(6E-03, 3E-02)*				

* Percentile and/or confidence level could not be estimated due to small sample size or an insufficient spread of modeled risk values.

[a] There are only two area source cement kilns in the facility population and both happened to be sampled. The confidence intervals reflect the variability that a different sample may have provided different results. However, an argument exists that the sampling variance can be ignored since the entire population domain is in the sample.

[b] Confidence intervals are not applicable since all the lightweight aggregate kilns in the population were sampled with certainty.

All concentration values <10 have been rounded to one significant digit

Appendix I

Exposure Parameter Variability Analysis

***DRAFT* MEMORANDUM**

DATE: June 26, 1999

TO: David Layland EPA/OSW/EMRAD

FROM: Douglas Crawford-Brown

THROUGH: Zachary Pekar and Tony Marimpietri

SUBJECT: Exposure Factor Variability Analysis (Options 1 and 2)

I. Introduction

This memorandum describes the methodology used in the Hazardous Waste Combustor (HWC) risk analysis to evaluate the impact of exposure parameter variability on risk estimates for three key receptor population/constituent combinations, including the recreational fisher for mercury and the beef farmer and dairy farmer for dioxin. It also describes the methodology used to evaluate uncertainty introduced into the variability analysis (i.e. uncertainty in identifying the risk associated with specific percentiles of the inter-subject variability distribution describing the variation of risk in the exposed population) through the selection of a subset of facilities and through the finite number of individuals sampled in the vicinity of each facility during Monte Carlo analysis. The problem may be stated as follows: ***Considering variability of exposure factors across individuals in the exposed population, what is the risk (probability of cancer or hazard quotient) associated with an individual at the Xth percentile (e.g. 95th percentile) of the cumulative frequency distribution in the exposed population, and what is the confidence interval surrounding this estimate?***

The HWC methodology utilizes a post-processing approach wherein exposure parameter variability is incorporated into the cumulative distribution of risk in the exposed population after that distribution has been generated using only central tendency values for exposure factors. As a baseline, calculations of risk were performed using only mean values for all exposure factors. This distribution of risk in the exposed population represents the best estimate of risks to individuals when only variability of exposure conditions (and not exposure factors) is considered. In effect, it represents the distribution of risk in the population if all individuals in a geographic sector have the mean exposure factors for individuals in that sector. After generating this baseline distribution of risks, the methodology replaced all mean values of the exposure factors by an inter-subject variability distribution. The means for these inter-subject variability distributions were selected to be the same as the mean values used in the baseline assessment. The process of generating the inter-subject variability for risk (probability of cancer or hazard quotient) then was repeated and a new variability distribution generated that reflected both variability of exposure and variability of exposure factors. As will be described below, this post-processing approach was accomplished in three steps:

The baseline variability analysis, incorporating variability of exposure but not variability of exposure factors, was produced. This distribution was stored for later comparison with the full, post-processing, variability analysis. The same analysis produced the mean estimate of risk in each geographic sector surrounding a facility. The population-weighted distribution of these means across the different sectors constitutes the probability density function produced in the baseline analysis.

- The risk (probability of cancer or hazard quotient) for each geographic sector generated by the baseline analysis was retrieved. The inter-subject variability in the risk associated with a given sector then was determined by using the same exposure conditions as in the baseline analysis for that sector, but allowing inter-subject variability of exposure factors (i.e. probability density functions for each exposure factor). The mean values of these probability density functions were equal to the point estimate value used for that exposure factor in the baseline assessment. This step produced one probability density function, reflecting inter-subject variability of risk, for each geographic sector.

- The resulting probability density functions from the previous steps (one for each geographic sector) were combined through population-weighting to obtain the new inter-subject variability distribution for risk in the entire exposed population. This new distribution reflects variability in both exposure and exposure factors.

The HWC post-processing methodology above is designed to handle receptor populations whose risk is dominated by a single exposure pathway (e.g., in the case of the beef farmer, risk for dioxin is dominated by beef ingestion). The presence of a single risk-driving pathway for the three key receptor population/constituent combinations evaluated in the HWC variability analysis simplifies the methodology needed to assess the impact of exposure parameter variability, since it is not necessary to evaluate multiple exposure pathways separately for each receptor population. If there is a single pathway, and if the same inter-subject variability distributions for exposure factors apply to all geographic sectors (as was assumed here), it is possible to apply the post-processing approach directly to the risk estimate for each geographic sector as described above. If multiple pathways contributed significantly, it would be necessary to decompose the risk in each geographic sector into the contributions from each pathway, apply the variability of exposure factors to each pathway, and then re-combine these new variability distributions within the sector. As described later, a single pathway did dominate in each sector (contributing more than 95 of the risk), and was the same in each sector (for a given constitutent), and so the post-processing approach used here is valid.

The resulting HWC methodology evaluates the aggregate impact of inter-subject variability associated with three exposure factors: (1) ingestion rate per unit body mass, (2) occupancy period, and (3) age crossing correction factor (note: the latter two factors do not apply to the recreational fisher for which noncarcinogenic hazard quotients [HQs] are generated). *This memorandum describes the rationale and data sources used in deriving the inter-subject variability distributions for these three exposure factors, as well as the uncertainty associated with specific percentiles in the overall variability distribution of risk in the exposed population as a result of sampling issues.* The HWC variability analysis methodology is consistent with guidelines for variability analysis set out in EPA's *Guiding Principles for Monte Carlo Analysis* (EPA, 1997). The uncertainty analysis also is consistent with these guidelines for the components of uncertainty considered here, although this uncertainty analysis did not examine uncertainty introduced by model errors and uncertainty in exposure factors (focusing instead on uncertainties introduced by sampling of facilities to represent source categories and by sampling of a finite number of individuals from the exposure factor inter-subject variability distributions).

In performing the variability and uncertainty analyses, two methodologies were used. The first, Monte Carlo sampling, is the most commonly employed method in risk analysis for treatment of both variability and uncertainty. So long as the underlying distributions (probability density functions) for all parameter values in a model can be specified, Monte Carlo analysis allows analysis of the propagation of variability and uncertainty through the model. The present analysis, however, had a component of uncertainty which is not handled readily by Monte Carlo analysis: some facilities included in a facility category were selected at random from a defined set, and others were selected to be representative of higher-end

exposures from a different defined set. This problem can be addressed through use of the SUDAAN software, which allows determination of uncertainty introduced by non-random sampling. The same software can be used, with modifications discussed later, to determine both the percentiles of the variability distribution for risk in the exposed population, and the confidence intervals around any specific percentile.

Since these modifications to SUDAAN had not been employed as frequently in regulatory analyses as have the Monte Carlo methods, it was decided that the SUDAAN variability results should be benchmarked against a Monte Carlo analysis for the variability results in a simulation where Monte Carlo analyses have been established as appropriate and accurate. This procedure will be described later. The result is that a Monte Carlo analysis of the variability distributions for risk (probability of cancer or HQ) was generated; the modified SUDAAN analysis for these same distributions was generated; and the SUDAAN and Monte Carlo results for identical percentiles in the variability distributions were compared. If the modified SUDAAN approach is valid, specific percentiles of the inter-subject variability distribution for risk should be approximately the same as that produced by the Monte Carlo analysis. A subsequent analysis of these results indicated that the modified SUDAAN procedure produced percentiles of the variability distributions which were essentially the same as those generated under the Monte Carlo procedure, establishing the utility of the modified SUDAAN procedure in generating both the variability distributions and the confidence intervals around the percentiles in those variability distributions.

The following discussion describes the benchmark Monte Carlo analysis of variability first. It then turns to the formulation of both variability and uncertainty within the SUDAAN analysis. It closes with a discussion of the comparison between the Monte Carlo and SUDAAN results, establishing the validity of the modified SUDAAN procedure.

II. Problem Formulation for Variability

The HWC risk assessment focuses on the risk of cancer and non-cancer endpoints resulting from exposure of the U.S. population to air emissions from a variety of facility categories. The risk metric for cancer was the lifetime excess probability of cancer, and the risk metric for non-cancer was the hazard quotient. To perform the calculations of risk imposed by a facility category, a representative sample of sites was selected for that category (uncertainty introduced by the fact that this sample was not truly random will be discussed later). For each of these sites, source terms were estimated either through emissions data from that site or by imputation based on data from similar sites. The region surrounding each site was divided into 16 geographical sectors and dispersion calculations performed to estimate the concentration of each pollutant in the environmental media of each sector. Exposures to individuals in a sector then were estimated based on rates of ingestion and inhalation per unit body mass (to obtain average daily rate of intake), as well as exposure duration and loss through food preparation. Finally, these exposures were converted to estimates of risk using measures of sensitivity (slope factors for cancer risk and RfDs/RfCs for noncancer risk). The result is an estimate of the lifetime excess probability of cancer and/or hazard quotient for each individual and each constituent.

In the baseline assessment, “central tendency” calculations of risk were performed using only the mean value for each exposure factor (i.e. the point estimate representing the mean of any inter-subject variability distribution for that exposure factor). This resulted in risk estimates that were the same for all individuals in a given receptor population for a given sector, although there was variation of the risk across sectors due to inter-sector variability of source terms and dispersion factors. From this information, distributions displaying the fraction of exposed individuals with a risk at or below any particular value were developed through population-weighting of the mean risk estimates in the various

geographic sectors. Such an assessment does not fully reflect variability of risk in the exposed population, however, since it does not incorporate inter-individual variability of risk within a sector.

One strategy for considering variability more fully in decision making is to repeat the calculations of risk using inhalation rates, ingestion rates, exposure duration, and food loss factors representative of individuals at the "upper tail" of exposure in a sector (a "maximally exposed" individual). The problem with such an approach is that the selection of multiple exposure factors, each representative of maximally exposed individuals, can lead to the creation of a composite individual with exposure characteristics at the extreme tail of the distribution of risk in a sector. This kind of analysis does not provide full information on the percentile of risk represented by that individual, so it is impossible to state the degree to which that individual is realistic and the fraction of the actual population whose risk will fall above that maximally exposed individual.

To produce a more complete characterization of variability of risk within the exposed population, this project used a formal procedure of Monte Carlo analysis to generate distributions of risk within a sector, and then to "fold together" the variability distributions from separate sectors (through population-weighting) and facilities to produce a composite variability distribution for risk in the entire population exposed to emissions from a facility category. This procedure is consistent with guidelines for variability analysis set out in EPA's *Guiding Principles for Monte Carlo Analysis* (EPA, 1997), and allows the determination of the fraction of individuals with a risk at or below any particular value of interest (the Monte Carlo analysis did not include an assessment of uncertainty, which will be discussed in the section on the SUDAAN analysis). These individual risks vary across the exposed population due to variability in several of the factors used in the calculations:

- Inter-facility variability of the source terms for facilities within a category
- Inter-facility and inter-sector variability in the dispersion factors
- Inter-subject variability in the exposure factors for a given receptor population;
- Inter-subject variability in the sensitivity to carcinogens and noncarcinogens in the different receptor populations.

The numerical values of all parameters above are variable in one or more senses; i.e., they vary between facilities, between sectors around a facility, between receptor populations, and/or between individuals in a receptor population within a sector. The study did reflect variability of the source term and dispersion factor within a sector; instead, the exposure conditions were averaged across the geographic region encompassing a sector and this mean exposure condition used for all individuals in that sector. There is, however, variability of the source term between facilities and of the dispersion factor between sectors associated with a facility. ***This variability (of source terms and dispersion factors) is incorporated into the present analysis by using site-specific source terms and spatially-varying dispersion characteristics. The exposure factors, however, are variable across an exposed population even within a single geographic sector, and were represented in the post-processing analysis by a distribution of these factors across the exposed population (with different distributions for different receptor populations in a sector). The variability of sensitivity of individuals to carcinogens and noncarcinogens cannot be characterized at present and cannot, therefore, be considered formally. Instead, it should be noted that these sensitivities were represented here by use of the cancer slope factors and RfDs/RfCs generated under conservative assumptions used commonly as default science policy assumptions. These measures of sensitivity include within them uncertainty factors, modifying***

factors, etc, that are likely to make them representative of upper bound estimates of the values for the most sensitive members of the exposed population.

For any given assessment of risk associated with a facility category, there are N facilities. Associated with each facility is a source term S_{imn}, where the subscript i indicates the facility, the subscript m indicates the environmental medium into which the constituent (compound) is released, and the subscript n indicates the constituent. There are geographic sectors surrounding each facility and the dispersion coefficient (concentration in the environmental medium per unit source term) is DC_{ijmn}, where the subscript i refers to a facility, subscript j refers to a sector associated with that facility, and m and n are as defined previously. For an individual in a sector, assigned to a receptor population, there is an exposure factor EF_{ijmn} which converts concentration in the environmental medium to the average daily rate of intake (ADRI) into the body. For this individual, there is a sensitivity factor SF_{ijmn} which converts from the average daily rate of intake to the probability of cancer or the hazard quotient. In addition, there is a population of size P_{ij} in that sector and specific to that receptor category. This results in two equations, the first for carcinogens and the second for noncarcinogens:

$$Prob_{ij} = \Sigma \Sigma S_{imn} \times DC_{ijmn} \times EF_{ijmn} \times SF_{ijmn} \quad (1)$$

$$HI_{ij} = \Sigma \Sigma S_{imn} \times DC_{ijmn} \times EF_{ijmn} \times SF_{ijmn} \quad (2)$$

where the first (external) summation is over all constituents to which an individual is exposed and the second (internal) summation is over all exposure pathways. In Equation 1, the lifetime excess probability of cancer is shown as Prob. In Equation 2, HI is the hazard index, or sum over all hazard quotients from constituents acting by a common mechanism of action. In this analysis, there was no summation over constituents (they do not act by a common mechanism of action) and so HI may be replaced by HQ for each constituent and the external summation dropped from Equation 2.

In Equations 1 and 2, there are three sources of variability as discussed previously (sensitivity not being treated as variable). The variability in S_{imn} is treated through making this numerical value site-specific for the different facilities. No further consideration of variability of the source term (e.g. temporal variability) is included in the variability analysis. The variability in DC_{ijmn} is treated through making this numerical value specific to the individual sectors associated with individual facilities. No further consideration of variability of the dispersion coefficient (e.g. temporal variability or variability within a geographic sector) is included in the variability analysis. The dispersion coefficient for the center of a sector is used for all individuals in that sector. Variability of EF_{ijmn}, however, is not accounted for by inter-facility and inter-sector differences in environmental concentrations. To fully characterize variability of the risk in the exposed population, it is necessary to consider inter-subject variability of the exposure factors. With variability of exposure factors incorporated into the assessment, the result is a probability density function describing the variability of risk for cancer, and a probability density function describing the variability of hazard quotient in the exposed U.S. population. Note that in these distributions, the term “exposed” means the population located in one of the sectors associated with facilities contained in a facility category (i.e., it does not mean the total U.S. population).

The variability of exposure factors occurs due to three sources. Individuals differ in these factors as they age; they differ in these factors depending on the kinds of activities in which they engage (e.g., fishing); and there is inter-individual variability even within an age group and activity. The inter-subject variability distributions of risk will differ for these different combinations of age and activity. The present analysis reflects this by developing separate variability distributions for different age/activity populations (referred to here as *receptor populations*). The problem of variability analysis addressed in this report is:

What is the variability of risk (i.e., distributions $Prob_{var}$ and HQ_{var}) in the exposed populations when inter-facility variability of source term, inter-sector variability of dispersion, and inter-subject variability of the exposure factors (EF) are incorporated? Specifically, what are these distributions for different receptor subpopulations defined by age and activity?

For the analysis of hazard quotients associated with recreational fishers (one of the activity categories discussed later), a modified approach to variability estimation and characterization was used. For this category of receptors, there is insufficient information on which to reliably determine the number of recreational fishers in the different age groups for the separate sectors. This precludes developing a population-weighted distribution, HQ_{var}. As an alternative to estimating variability of HQ in the entire exposed population for a facility category, therefore, the present analysis examined only a related but simpler issue for fishing exposures. The question asked was:

For which facilities may it be stated that some specified fraction of the recreational fishers exposed in one or more of the sectors surrounding that facility have a hazard quotient greater than or equal to 1.0? If there were equal numbers of recreational fishers in each sector, what would be the inter-subject variability of HQ across all sectors for the exposed population?

III. Sensitivity Analysis

For the facility categories examined here, a baseline central tendency analysis first was performed to determine the relative importance of different constituents and exposure pathways in Equations 1 and 2. Three receptor populations showed the largest risks for the facility categories examined here (i.e. were the subpopulations whose risks were maximal in the entire exposed population), and were determined to be the "driving" receptor categories for regulatory decisions:

- Beef cattle farmers
- Dairy cattle farmers
- Recreational fishers.

When the separate contributions of the pathways and constituents were examined for these receptor populations, two constituents contributed more than 95% of the total risk in all geographic sectors; these were determined to be the "driving" constituents:

- Dioxin
- Methylmercury.

To ensure consideration of all age groups, including young ages, four separate age groups were examined; these were selected on the basis of the relative uniformity of exposure factors across the ages in an age group, with distinct differences in these factors between age groups:

- 0-5 years
- 6-11 years
- 12-19 years
- 20+ years.

Finally, exposure pathways were considered for these different combinations of receptor population, constituent and age group. In all facility categories and geographic sectors considered in the baseline analysis, the following exposure pathways contributed more than 95% of the risk for all age groups:

- # Ingestion of dioxin in beef for the beef farmer
- # Ingestion of dioxin in milk for the dairy farmer
- # Ingestion of methylmercury in fish for the recreational fisher.

These three exposure scenarios, for all four age groups, therefore represent adequately the risks that will drive regulatory decisions. Inter-subject variability distributions were developed for each. ***As is shown in Section IV, inter-individual variability within a receptor population is controlled by several separate factors which appear in multiplicative fashion within the exposure factor. As a result of this multiplication, the exposure factor is equally sensitive to unit changes in each of these components, so sensitivity analysis indicates that each must be considered equally in generating variability distributions.***

IV. Selection of Parameters for Evaluation

The discussion above of the sensitivity analysis for contributions to total risk indicates that for three receptor groups there is a single constituent and exposure pathway which contributes more than 95% of the total risk to individuals in the exposed population. For these cases, the variability distributions for total risk are approximated well by the variability distributions constructed from these dominant constituents and pathways. In other words, including inter-subject variability of exposure pathways and constituents other than those mentioned above would not significantly affect the final variability distribution of risks across the exposed population.

As outlined in Section II, the baseline risk estimates already incorporate inter-sector variability in S_i and DC_{ij} as used in Equations 3 and 4. Variability of EF_{ij} for each of these three constituent/receptor population combinations must, therefore, be specified.

The exposure factor, EF, converts the concentration in an environmental medium (determined by the product of S and DC) to the average daily rate of intake. If C is the concentration in the environmental medium, the average daily rate of intake (ADRI) may be found by:

$$ADRI = C \times IR \times ED / (AT \times BW) \quad (3)$$

where IR is the intake rate of the environmental medium, ED is the exposure duration, AT is the averaging time (taken to be 70 years for carcinogens and equal to ED for non-carcinogens), and BW is the body weight or mass. For carcinogens, the lifetime risk is the product of the ADRI and the slope factor; for noncarcinogens, the value of HQ is equal to the ratio of the ADRI over the RfD or RfC. The exposure factor, EF, may be found by dividing the right-hand side of Equation 3 by C, or:

$$EF = (IR/BW) \times (ED) / (AT) \quad (4)$$

The first term in brackets on the right hand side is the intake rate per unit body mass, and the second is the length of exposure (which depends on the occupancy period). Both are components of the exposure factor considered in this analysis. The averaging time, AT, is a matter of policy. In Equations 3 and 4, ED and AT are not needed for non-cancer effects and so are not used in the calculation of the hazard quotient.

This variability analysis examines three primary components of the value of EF for which there is significant inter-subject variability:

- Variability in the ingestion rate per unit body mass for beef, milk, and fish (i.e., for both dioxin and mercury exposures). This is the ratio of IR over BW as shown in Equation 4. It is required for both cancer and non-cancer risks.

- Variability in exposure duration for the beef and milk ingestion (i.e., for dioxin where cancer risks are dominant) but not for fish ingestion (i.e., for mercury where non-cancer risks are dominant and, therefore, ED and AT are not required). This is the value of ED as shown in Equation 4.

- Variability in a correction factor for crossing age groups. This factor accounts for the fact that the baseline central tendency risk estimates assumed values of IR/BW were constant for an individual beginning exposure in a given age group, whereas the actual aging of an individual may cause movement between age groups during the exposure duration. For example, if an individual began exposure in the 0-5 year age group, and the exposure continued for 7 years, the values of IR/BW used in the baseline calculations were those of the 0-5 age group for all 7 years of exposure, despite the fact that two of those years were spent in the 6-11 year age group. This factor is relevant for the carcinogen exposures (dioxin) but not for the non-carcinogen exposures (mercury) since in the latter case cumulative exposure is not relevant.

Note that there is no variability in the averaging time, AT, in Equation 4 since this is a matter of the definition of the ADRI.

V. Establishment of Exposure Parameter Distributions

These two sources of variability in Equation 4 (IR/BW and ED) as well as the age correction factor were analyzed separately using available data sets. They then were combined for a composite variability distribution for EF. Separate discussions are provided for each of the exposure parameters described above. In each case, lognormal distributions were selected based on the fact that this distributional form often is found for environmental and biological parameters (Morgan and Henrion, 1990; Crawford-Brown, 1996), provided a good fit to the relevant data contained in the *Exposure Factors Handbook*, and compared well to other distributional forms, as discussed later. The lognormal distribution is characterized by a median (M, 50^{th} percentile value) and a geometric standard deviation (GSD). The defining probability density function is:

$$PDF(x) = \exp\{-(\ln x - \ln M)^2 / (2\ln^2 GSD)\} / \{2pi(x\ln(GSD))\} \quad (5)$$

where exp is the exponential function and pi is 3.1417.

In such a distribution, 68% of the values are contained in the interval defined by the median divided by the GSD and by the median times the GSD. The 95% confidence interval is defined at the lower end by the median divided by the square of the GSD, and at the upper end by the median times the square of the GSD. The GSD, in turn, equals the ratio of the 84^{th} percentile of the distribution divided by the 50^{th} percentile (see the discussion in Crawford-Brown, 1996), or the 50^{th} percentile divided by the 16^{th} percentile (note that the interval from the 16^{th} to 84^{th} percentiles contains 68% of the values of the distribution).

This report does not present a discussion of the particular data sets used to obtain these individual variability distributions. The justification for using these data sets as a basis for estimating exposure to the receptor populations examined here has been summarized previously in the *Exposure Factors Handbook*, and the reader is referred to that reference for a full discussion of the validity of those data

sets. What is noted here is that the data sets described below are specific to the receptor populations to which they have been applied in this analysis, with a difficulty in applying the recreational fisher data as described later.

On the issue of selection of distributional forms, a comparison was made of the best fitting curves from each of several distributions: the lognormal, the gamma, the Weibull and the generalized gamma. In fitting such distributions, several considerations must be taken into account. First, there is the need to select a distribution that succeeds in approximating the data at the upper percentiles (i.e., above the 90th percentile). Second is the need for a good statistical measure (goodness of fit) for the ability of the mathematical form of the distribution function to fit the data. Given the assumption in such goodness of fit measures of a random sample, rather than a survey sample (the latter being the kind of sample underlying the data examined here), a third consideration is that a visual inspection of the best fitting curve for a distributional form should show the fit to be reasonable. This should be backed by inspection of the table of values comparing the data and the best fitting distributional model at specific percentiles. Finally, any choice between marginally different distributions (i.e., distributions with marginally different goodness of fit measures) should reflect the sensitivity of final risk estimates to the inability to select reasonably between these distributions.

As a formal goodness of fit test, the data sets discussed below were examined under Chi Square and p-value tests using the gamma, lognormal, Weibull, and generalized gamma models. In addition, a simpler square of the residuals examination was performed for the lognormal, beta, and normal distributions. For the residuals test, the lognormal distribution provided the smallest residual for all of the parameters fit; this test, however, is the least sensitive. In considering the more rigorous p-value test (the results of which are summarized in Chapter 6 of the Background Document), the lognormal distribution provided either the best, or an approximately equivalent, p value for the majority of the data sets considered (see Table 6-18 of the Background Document). This was particularly true for the beef ingestion parameter values (3 age groups considered), the fish ingestion parameter values (all distributions produced p values below 0.1), and the ACF factor. For beef ingestion, ages 6-11, the p values for the gamma, lognormal, Weibull, and generalized gamma were 0.17, 0.53, 0.091 and 0.314, respectively. For the 12-19 age group, these were 0.57, 0.45, 0.46 and 0.42, respectively. For the adult, these were 0.001 for all models. For the ACF factor, these were 0.2, 0.26, 0.043, and 0.13, respectively.

For the milk ingestion rate and farm occupancy factors, the gamma or generalized gamma provided the better overall fit, although in the case of the occupancy factors all distributions had p values below 0.1. For milk consumption, the p values for the four distributions were 0.4, 0.1, 0.4, and 0.56, respectively, although visual fits to the data were not distinguishable. These two parameter values were determined through surveys of small populations, precisely the form of data least suited to formal p value tests.

To consider the issue of whether the marginally better fits provided by the gamma and generalized gamma distributions, relative to the lognormal distribution, indicated a need to switch to these for at least the milk ingestion rate, a sensitivity analysis was performed considering the first three distributions (the gamma, lognormal, and Weibull; the generalized gamma can be simulated in the Monte Carlo software used here but only with significant effort that was not justified by its marginal improvement over the gamma distribution). The sensitivity analysis was conducted for the product of the milk ingestion rate and farm occupancy factor, the two parameters for which there was even an issue about switching from the lognormal. The analysis simulated a four-sector geographic region. The distributions for the milk ingestion rate and occupancy period were taken from the best fits of the three distributions above to the data contained in the *Exposure Factors Handbook* (where the numerical values corresponding to specific percentiles of the data were provided). The medians for the milk ingestion rate then were adjusted for the four sectors to reflect inter-sector variability of concentrations in milk. One sector was multiplied by 0.1,

one by 0.5, one by 1.0, and one by 5.0. Equal populations were placed into each of the four sectors. A random sample of 5,000 individuals then was drawn using the Monte Carlo (CrystalBall)® methods described elsewhere in this report. The 95th, 97th and 99th percentiles of the resulting population distribution were obtained, and the procedure repeated over the three candidate distributions.

The ratio of the percentile value obtained from a given distributional form over the percentile value from the lognormal form was calculated. For example, the inter-subject variability distribution for the total milk ingestion during the exposure interval under the assumption of a lognormal distribution was generated. Thenm the 95^{th}, 97^{th} and 99^{th} percentiles of this distribution were obtained. This process was repeated for the gamma distribution, and the same percentiles determined. Then the ratio of the 95^{th} percentile for the gamma distribution over the 95^{th} percentile for the lognormal distribution was calculated (seen to be 0.85 below). The same procedure was done for other percentiles, and for the Weibull distribution. This necessarily produces a ratio of 1.0 for the lognormal distribution itself since that is the reference distribution. For the 3 percentiles and three candidate distributional forms, the following ratios were determined:

95th: 0.85 for the gamma; 1.00 for the lognormal; 1.16 for the Weibull
97th: 0.90 for the gamma; 1.00 for the lognormal; 1.22 for the Weibull
99th: 0.83 for the gamma; 1.00 for the lognormal; 1.25 for the Weibull

It may be noted from this analysis that the sensitivity of the upper percentiles in an aggregated population (aggregated across sectors) is not large when at least four sectors are present. The variations of the ratios from 1.0 will be less when there are more than 4 sectors due to convergence to the mean. There are significantly more than four sectors in the analyses developed for this study, so it is unlikely that the selection of a distribution other than the lognormal for the factors where lognormal did not provide the best p value will be significant. **When this sensitivity analysis is coupled with the good visual fit of the lognormal distribution (an equally valid method of selecting fits for data of this quality), with the fact that the lognormal provided the best, or an equally good, p value in 5 of the 7 parameters considered, and with the ability of the lognormal to retain lognormal properties when one takes the product of lognormally distributed parameters, it was determined that the lognormal distribution would be used throughout this analysis.**

On the issue of correlation, it should be noted that the three factors considered in this variability analysis are statistically independent (i.e., there is no correlation). While ingestion rate (IR) and body mass (BW) are correlated, this analysis uses a data set in which IR and BW were determined for each individual in the population, and the ratio (IR/BW) calculated based on the values specific to that individual. There was no selection of random samples of IR and of BW, so any correlation between IR and BW already is included in the data set taken from the *Exposure Factors Handbook*. The exposure duration (ED) is correlated with the ratio IR/BW, since both quantities are functions of age. Within a subpopulation of a given age, (which is the type of subpopulation used in the present analysis), however, there is no reason to suspect a correlation between ED and the ratio IR/BW, since there is no reason why exposure duration should be related to either intake rate or body mass. Still, this lack of correlation has not been examined empirically to date, so remains a source of uncertainty. The age correction factor also is assumed to be uncorrelated with IR, BW or ED, using the argument advanced above for correlation between IR/BW and ED. Again, this lack of correlation has not been tested to date.

Goodness of fit between the lognormal distributions and the data in the *Exposure Factors Handbook* also was assessed by direct comparison of predictions from the lognormal distribution against specific cumulative percentiles provided in the *Handbook*. These comparisons are provided in Tables 6-20 through 6-23 in the Background Document for this analysis. Agreement at the upper percentiles

generally was to within 20%. In addition, the mean from the lognormal fits was compared against the mean from the data by calculating the ratio of the former over the latter. These ratios varied between 0.92 and 1.17, indicating good agreement on mean values.
In the following discussion, a slight revision to the methodology in Equations 1 and 2 was used. The baseline central tendency risk estimates for each sector first were calculated based on mean values for exposure factors. The composite variability distribution for the exposure factor (IR/BW times ED times ACF for the cancer risks; IR/BW for the non-cancer risks) then was calculated from the following relationships that apply to the product of lognormal distributions:

$$\text{Median of Products} = M_1 \times M_2 \times M_3 \ldots\ldots \quad (6)$$

where M_i is the median of the ith exposure factor. In addition, the GSD for the product is:

$$GSD_{product} = \exp(\ln^2(GSD_1) + \ln^2(GSD_2) + \ldots + \ln^2(GSD_n))^{0.5} \quad (7)$$

where GSD_i is the GSD of the ith exposure factor.

The relationship between the mean and median for a lognormal distribution is

$$\text{Median} = \text{Mean} \times \exp(-\ln^2 GSD)/2) \quad (8)$$

where the GSD is for the composite exposure factor distribution as defined in Equation 7. The GSD for the composite exposure factor distribution is known and is the same for all geographic sectors (although varying between the cancer and non-cancer effects due to differences in the number of factors considered in the composite exposure factor). The risk for each sector determined from the baseline analysis (which represented then mean) then was converted to a median value using Equation 8.

Finally, the variability distributions for the exposure factors were normalized by dividing all values in the distribution by the median value. This yields the distribution of the ratios of the exposure factor over the median exposure factor. The resulting variability distribution for EF then is a ***normalized distribution*** with a median value of 1.0 and the GSD defined previously. This normalized distribution is obtained from the following equation (analogous to Equation 4 with the ACF added):

$$EF_{ratio} = (IR/BW)_{ratio} \times ED_{ratio} \times ACF_{ratio} \quad (9)$$

where ED and ACF are dropped for the case of non-cancer effects. The distribution of EF_{ratio} then is the distribution of ratios of individual-specific values of EF over the median value for that subpopulation of receptors. The variability distribution of risks in a sector then may be obtained by multiplying this normalized distribution by the median risk for that sector as obtained previously. ***This approach is mathematically identical to one in which the separate, non-normalized, distributions for IR/BW, ED and ACF are used in Equations 1 or 2, but greatly simplifies calculation efforts since the same normalized distribution may be applied to each sector for a given constituent and pathway. In other words, this approach requires that only one normalized distribution be developed for each constituent/receptor population combination.***

The approach described above has the effect of both introducing inter-subject variability and ensuring that the mean of the variability distribution for risk is estimated correctly in each sector.

To better understand the application of Equation 9 in Equations 1 and 2, consider an individual selected at random from a sector. The mean risk for that individual is available from the baseline analysis in

which a single estimate of risk is developed for all individuals in a sector; this mean then is converted to a median using Equation 7. The risk to that randomly selected individual then is

$$Risk_{individual} = Risk_{CT} \times (IR/BW)_{ratio} \times ED_{ratio} \times CF_{ratio} \quad (10)$$

for dioxin exposures and

$$HQ_{individual} = HQ_{CT} \times (IR/BW)_{ratio} \quad (11)$$

for mercury exposures where

$Risk_{individual}$ = risk to an individual selected at random from a sector

$HQ_{individual}$ = hazard quotient for an individual selected at random from a sector

$Risk_{CT}$ = median risk for individuals in that sector (from the baseline analysis)

HQ_{CT} = median hazard quotient for individuals in that sector (from the baseline analysis)

$(IR/BW)_{ratio}$ = ***ratio*** of the ingestion rate per unit body mass for the individual over the median ingestion rate per unit body mass (selected at random from the normalized distribution for this factor)

ED_{ratio} = ***ratio*** of the exposure duration for the individual over the median exposure duration (selected at random from the normalized distribution for this factor)

CF_{ratio} = ***ratio*** of the correction factor for crossing age groups for that individual over the median correction factor (selected at random from the normalized distribution for this factor).

Estimating the variability of $Risk_{individual}$ and $HQ_{individual}$ in a sector then requires development of variability distributions for $(IR/BW)_{ratio}$, ED_{ratio} and CF_{ratio}. These are described below.

For each of the parameters displaying variability, separate figures are provided here for the cumulative distribution function (Figures 1 through 5). Comparisons between the data and distributional fits are provided in Tables 1 through 5, and distributional characteristics are summarized in Table 6. For these cumulative distribution functions, the associated probability density functions have not been provided since the original data tables in the *Exposure Factors Handbook* (the source of the data used here) were already in the form of cumulative frequency results. The PDF for a distribution is not actually used in Monte Carlo sampling; instead, it must be converted to a CDF. As a result, only the CDF is relevant for the present analysis and is reported. The locations of medians and means for each distribution of ratios (discussed above) can be found in Table 6, which contains an equation for estimating the mean of any of the ratio distributions from the median ratio and the GSD reported in that table.

Ingestion Rate per Unit Body Mass

This exposure factor component applies to both dioxin and mercury exposures. Variability distributions were developed for ingestion of beef, milk, and fish, and for the age groups 0-5 years, 6-11 years, 12-19 years, and 20+ (adult) years. Since the ingestion rate per unit body mass reported in the *Exposure*

Factors Handbook uses individual-specific body masses when analyzing available data, there is no need to account further for variability in body mass. In other words, the reported variability in the ingestion rate per unit body mass already incorporates inter-individual variability in both ingestion rate and body mass.

Beef Ingestion

The variability of the ingestion rate per unit body mass for home produced beef was determined from the summary of data in Table 13-36 of the 1997 *Exposure Factors Handbook* (1997 EFH), which is entitled "Intake of Home Produced Beef (g/kg-day)." The numerical value associated with each percentile (for a given age group) was first divided by the median (50^{th} percentile) value to obtain $(IR/BW)_{ratio}$. The distribution of this ratio then was plotted on log-probit paper using the maximum likelihood estimate (see Figure 1); on such paper a lognormal distribution appears as a straight line. The geometric standard deviation was determined from the best fitting line by dividing the 84^{th} percentile by the 50^{th} percentile. This procedure was followed for the 6-11, 12-19, and 20+ age groups since data were available in the table for those groups. No such data had been reported for the 0-5 year age group. As a result, the data for the 6-11 year age group were used as surrogate data for the 0-5 year age group in estimating the GSD for the latter group (although the mean for the 0-5 year age group was taken from the data on that age group, and not from the data on the 6-11 year age group as discussed in Section 6.3.1 of the Background Document). The decision to use the 6-11 year age group as the surrogate for the 0-5 year age group in estimating the measure of variance (GSD) was based on the findings in Figure 1, which indicate that the GSD varies as a function of age. The resulting distributional characteristics for all age groups are shown in Table 1.

Milk Ingestion

The variability of the ingestion rate per unit body mass for home produced milk was determined from the summary of data in Table 13-28 of the 1997 *Exposure Factors Handbook* (1997 EFH*)*, which is entitled "Intake of Home Produced Dairy (g/kg-day)." This table summarizes data on intake of all home produced dairy products as averaged over all regions of the country. It is the most complete data set on variability for this exposure pathway, although it requires the assumption that the GSD is the same across all age groups (since only results aggregated across age groups were reported). It also requires the assumption that the variability in fluid milk consumption is the same as the variability in total dairy consumption (data in the 1997 EFH indicates that variability in the former is lower than in the latter for the youngest age group, so variability of milk consumption may have been overestimated in the present analysis for this age group).

The numerical value associated with each percentile (for the aggregate population) was first divided by the median (50^{th} percentile) value to obtain $(IR/BW)_{ratio}$. The distribution of this ratio then was plotted on log-probit paper using the maximum likelihood estimate (see Figure 2); on such paper a lognormal distribution appears as a straight line. The geometric standard deviation was determined from the best fitting line by dividing the 84^{th} percentile by the 50^{th} percentile. The same variability distribution is applied to all age groups (with the GSD values the same for all ages, but the means taken from the age-specific values). The resulting distributional characteristics for all age groups are shown in Table 2.

Fish Ingestion

The variability of the ingestion rate per unit body mass for recreational fish was determined from the summary of data in the final column of Table 12-34 of the 1996 *Exposure Factors Handbook (1996 EFH)*, which is entitled "Distribution of Usual Fish Intake Among Survey Main Respondents who Fished

and Consumed Recreationally Caught Fish." This table summarizes data on intake of fish caught through recreational activities as aggregated over all ages. It is the most complete data set on variability for this exposure pathway, although it requires the assumption that the GSD is the same across all age groups (since only results aggregated across age groups were reported).

The numerical value associated with each percentile (for the aggregate population) was first divided by the median (50^{th} percentile) value to obtain $(IR/BW)_{ratio}$. The distribution of this ratio then was plotted on log-probit paper using the maximum likelihood estimate (see Figure 3); on such paper a lognormal distribution appears as a straight line. The geometric standard deviation was determined from the best fitting line by dividing the 84^{th} percentile by the 50^{th} percentile. The same variability distribution is applied to all age groups, with the means taken from data in the EFH on the different age groups (see Section 6.3.1 of the Background Document). The resulting distributional characteristics for all age groups are shown in Table 3.

Treatment of the Loss Factors

The data described above for beef, milk, and fish reflect the amount of each food category used. They do not reflect the fact that some of the food (particularly in the case of beef) is lost during preparation for eating. The data in the 1997 *Exposure Factors Handbook* on loss during preparation was examined using Table 13-5, entitled "Percent Weight Losses from Preparation of Various Meats." The data in this table reflect variability across separate instances of food preparation and are based on a random sample from a population similar to that examined in the present analysis (so the issue of surrogate data is not significant here). An individual exposed over many years will prepare the food many times, with intra-subject variability between instances of preparation. This will tend to cause an individual's lifetime average food loss to converge onto the mean food loss for the population (the issue of convergence to the mean in sampling). As a result, inter-subject variability of the loss factor must reflect the variability of the mean loss factor for the exposed population, not the variability of individual instances of food preparation (the latter variability being much larger than the former for the reasons given above).

To determine the inter-subject variability in the mean loss factor, the distribution of loss factors from Table 13-5 was used as the basis of a Monte Carlo sampling. A sample of size 100 (a reasonable estimate of the number of food preparation events over which the loss factor might be averaged in a person's exposure duration) was selected at random from this empirical distribution (no distributional shape was assigned *a priori*) and the mean determined for this sample. A second random sample of 100 then was taken and the mean estimated. This process was repeated 2,000 times, yielding a sample of the variability of this mean. The GSD associated with this distribution was less than 1.1, indicating that the loss factor is not a significant source of inter-subject variability relative to the factors described above. It should be noted, however, that the inter-subject variability in loss factor may have been underestimated here since it was assumed that an individual had a loss factor for each instance of food preparation that was drawn randomly from the distribution of loss factors. In actuality, a given individual may consistently lie at the upper or lower ends of the distribution. ***No further consideration of the loss factor was used in the analysis due to the results of this analysis of the relative contribution of different sources of variability, which indicates that this source of variability is insignificant compared to the other sources***.

Exposure Duration

Exposure duration was taken to be equal to the occupancy period in a home. For the farming populations (for which this factor is relevant), data in Table 15-164 of the 1997 *Exposure Factors Handbook*, entitled "Total Residence Time Corresponding to Selected Values of R(t) by Housing Category," were

used to determine variability in exposure duration for this population. This table contains a statistical summary of such data for all age groups. The variability for the 0-5 year age group was taken from the data on 3-year-olds, since this is the age at the midpoint of the age interval. The variability for the 6-11-year age group was taken from the data on 9-year-olds, since this is the age at the midpoint of the age interval. The variability for the 12-19-year age group was taken from the data on 15-year-olds, since this is the age at the midpoint of the age interval. The variability for the adult age group was taken from the data on 42-year-olds, which is the median age of the adult population.

The numerical value associated with each percentile (for an age group) was first divided by the median (50^{th} percentile) value to obtain ED_{ratio}. The distribution of this ratio then was plotted on log-probit paper using the maximum likelihood estimate (see Figure 4); on such paper a lognormal distribution appears as a straight line. The geometric standard deviation was determined from the best fitting line by dividing the 84^{th} percentile by the 50^{th} percentile. The same variability distribution is applied to all age groups. The resulting distributional characteristics for all age groups are shown in Table 4.

To determine the age-specific median values of ED for the farming population, the data on the non-farming population was used. The decision to use the median values from the non-farming populations as a surrogate for the median values of the variability distribution for the farming population is based on the observation that the age-adjusted median in the farming population is approximately the same as the age-adjusted median in the non-farming population (both are approximately 10 years). The sole difference in these two distributions (farming and non-farming) lies in the variance.

The numerical value associated with each percentile (for an age group) was first divided by the median (50^{th} percentile) value to obtain ED_{ratio}. The distribution of this ratio then was plotted on log-probit paper using the maximum likelihood estimate (see Figure 4); on such paper a lognormal distribution appears as a straight line. The geometric standard deviation was determined from the best fitting line by dividing the 84^{th} percentile by the 50^{th} percentile. The same GSD is applied to all age groups, with the median value for the separate age groups taken from the distributions for the non-farming population as described above. The resulting distributional characteristics for all age groups are shown in Table 4. The procedure for generating these distributions was:

- The ratio of the median occupancy period for an age group in the non-farming population was divided by the median for the age-adjusted non-farming distribution.

- The same ratio was assumed to hold for that age group in the farming population. The median of the age-adjusted distribution for the farming population was multiplied by the ratio obtained in the first step for the same age group.

- For this same age group in the farming population, the GSD of the distribution was assumed to be the GSD of the age-adjusted distribution, based on the fact that the GSD was not a significant function of age in the non-farming population.

Correction Factors for Crossing Age Groups

The central tendency calculations employed the assumption that an individual beginning exposure at age X continued exposure under parameter values identical to those of the age group in which the age X falls. This means the ingestion rate per unit body mass was constant during the exposure interval even if, in reality, that individual would have crossed into a higher age group at some point during the exposure interval. Since the ingestion rate per unit body mass generally decreases with age, particularly in the first

several age groups, the central tendency estimates will tend to overestimate slightly the mean values of risk.

To explore the effect of this assumption used in the central tendency estimates, the calculations of lifetime risk were repeated using a life-table approach in which individuals were followed year-by-year throughout the period of exposure. (***Note: the term life-table also is used in the epidemiological literature to refer to probabilities of survival at specific ages. This is not the usage here***). During each year, age-specific intake rates per unit body mass were used, with these changing as the individual ages. A Monte Carlo procedure was developed in which:

- An age at beginning of exposure was selected at random (uniform distribution) from within an age interval (e.g., the 0-5 year age interval).

- An exposure duration was selected at random based on the distribution described previously (specific to that age interval in which exposure began).

- The life-table information was used to calculate the total ingestion per unit body mass (g/kg) over the selected exposure period assuming the ingestion rate per unit body mass changes with age.

- The total ingestion per unit body mass (g/kg) was calculated for the same exposure duration assuming the ingestion rate per unit body mass did not change (i.e., the assumption of the central tendency calculation).

- The ratio of the total ingestion per unit body mass using the life-table over the total ingestion per unit body mass calculated without the life-table was obtained.

- This process was repeated over a sample of size 1000 for the same age interval (e.g. 0-5 year age interval).

The result of this process is a sample of 1,000 calculations of the ratio of the lifetime intake per unit body mass with a life-table approach and without such an approach. This, in turn, is equivalent to a sample of 1,000 ratios of the "true" lifetime intake per unit body mass over the value obtained by the central tendency approach. The median for this population of samples is 1.0 (so the original assumption used in the central tendency estimates did not produce a biased result). The GSD was obtained by plotting this distribution on log-probit paper (see Figure 5), determining the maximum likelihood fit, and determining the ratio of the 84^{th} percentile over the 50^{th} percentile. Separate distributions were developed for each of the four age groups. Results are summarized in Table 5. This correction factor was applied only for estimation of cancer risks (i.e., TCDD calculations for beef and milk ingestion) and not for fish ingestion (i.e., methylmercury calculations), since it is irrelevant in the case of non-cancer effects.

VI. Analytic Methodology

The methodology of Monte Carlo analysis employed here to assess variability is structured to follow the guidelines set out in EPA's *Guiding Principles for Monte Carlo Analysis* (EPA, 1997). To incorporate variability of exposure into the distributions $Prob_{var}$ and HQ_{var} from Equations 1 and 2, the present assessment returns to the stage in calculations at which the sector-constituent-pathway-specific exposures are calculated; i.e., the stage at which $S_{imn} \times DC_{ijmn} \times EF_{ijmn}$ is calculated in Equations 1 and 2. This point estimate from the baseline assessment then is converted to a median value as explained in Section V. Normalized variability of EF_{ijmn} within the sector then is characterized for each constituent and exposure

pathway using the methods described previously. Monte Carlo analysis then is performed using Equations 1 or 2 (depending on the constituent), with the probability of sampling an individual from a given sector being equal to the fraction of the exposed population in that sector. Once an individual is selected from a sector, random values for EF_{ijmn} are selected by multiplying the median EF_{ijmn} by randomly selected values from the normalized distribution EF_{ratio} as described in Section V. This process is repeated over all sectors, resulting in a composite variability distribution for either $Prob_{var}$ or HQ_{var} which is specific to an age group and receptor population.

Note that for the receptor populations and constituents considered in this analysis, there is a single pathway and constituent which dominates (see the discussion in Section II). The calculation of variability distributions is simplified when there is a single constituent and a single exposure pathway in Equations 1 and 2. If this is the case, a single distribution of EF_{ij} must be generated and used in the process above, rather than one for each of several combinations of pathways and constituents contributing to the risk in individuals. There then is no summation over constituents and exposure pathways, resulting in simplified versions of Equations 1 and 2:

$$Risk_{ij} = S_i \times DC_{ij} \times EF_{ij} \times SF_{ij} \quad (12)$$

$$HQ_{ij} = S_i \times DC_{ij} \times EF_{ij} \times SF_{ij} \quad (13)$$

The present assessment of variability uses this simplified approach for a subset of receptor populations where there is a dominant compound and exposure pathway (identified in Section II). Note that HI in Equation 2 is replaced by HQ above since there is a single constituent considered.

The HWC risk analysis first generated one mean risk estimate for each:

- Facility (the number of facilities depends on the facility category)
- Sector surrounding a facility (16 per facility)
- Compound or constituent (dioxin or mercury)
- Age group (0-5, 6-11, 12-19, adult)
- Relevant receptor subpopulation (beef cattle farmer, dairy cattle farmer, or recreational fisher).

For example, if there were 10 facilities, there would be 160 sectors and for each of these 160 sectors there would be a single central tendency risk estimate for dioxin exposures to dairy cattle farmers in the 11 to 19-year-old age group. This example will be used in the following discussion; exactly the same methodology was applied to all facility category/constituent/receptor analyses.

In the present study, variability in exposure characteristics (EF in Equations 12 and 13) is incorporated into the analysis after these separate sector-specific central tendency risk estimates have been generated. As a result, the present assessment is referred to as “post-processing” since the variability is incorporated after the point, mean, estimates of risk have been generated in each sector. This post-processing approach is valid because the values S_i, DC_{ij} and S_{ij} in Equations 12 and 13 are not treated as variable within a sector, and all individuals in a sector have values of EF selected from the same variability distribution.

In the example above, there are 160 mean estimates of the risk generated in the baseline analysis (one for each sector). For each of these 160 central tendency estimates, a lognormal variability distribution for

EF_{ratio} with a median of 1.0 and an associated geometric standard deviation was assigned based on some combination of the factors mentioned in Section V (variability of ingestion rate per unit body mass, exposure duration, and correction factor for crossing age groups in the case of dioxin exposures; variability of ingestion rate per unit body mass in the case of mercury exposures). This distribution of EF_{ratio} then was multiplied by the median value in a sector (obtained by converting the mean to a median as described in Section V) to yield the distribution of risk in that sector. This resulted in 160 separate variability distributions for the example used here, each describing variability of risk within a sector.

The task is to combine these 160 separate variability distributions into a single, composite, variability distribution. This composite distribution must weight the 160 separate distributions according to their relative contribution to the total population; i.e., the contribution of a given sector's variability distribution to the composite variability distribution must equal the fraction of the total exposed population contained in that sector (where this fraction depends on the receptor subpopulation). While the separate distributions are lognormal, the weighted sum of lognormal distributions is not itself lognormal. As a result, there is no analytic solution to the statistical characteristics of this composite distribution. A Monte Carlo sampling procedure based in the software CrystalBall® was used, therefore, to construct the composite distribution (this software is one of the risk assessment profession standards for performance of variability and uncertainty analyses). The steps of sampling are as follows:

- The population size in each separate sector was determined from GIS analysis.

- The total size of the exposed population was determined by summing populations across all sectors in the assessment.

- The fraction of the total exposed population contained in each sector was calculated by dividing the population in a sector by the total exposed population.

- A random number was generated using a uniform probability density on the interval [0,1]; the algorithm for this generation was the RAND() function in EXCEL (CrystalBall® resides on top of EXCEL).

- A sector was selected at random from the total population of 160 sectors using this random number. The probability of a particular sector being selected was equal to the fraction of the total exposed population in that sector (see the discussion in Crawford-Brown, 1996).

- Once a sector was selected at random, the variability of EF_{ratio} in that sector was assigned as a lognormal probability density function with median of 1.0 and geometric standard deviation specific to that constituent, pathway and receptor population (see Table 1).

- One sample of the value of EF_{ratio} was selected from the variability distribution using Monte Carlo sampling with a seed value of 0.0. This value of EF_{ratio} was multiplied by the median value for risk in that sector to obtain the value of risk for that sampled individual; this was stored in a file (a "forecast" file within CrystalBall®).

- The process above was repeated for the number of trials necessary to meet criteria of stability for the resulting composite variability distribution (see the discussion later in this section).

- Risks associated with prescribed percentiles of the composite variability distribution (e.g. 50^{th}, 75^{th} and 97^{th} percentiles) then were determined.

Truncation of Distributions

It is common in fitting variability data to find that the distributions are partially truncated at the lower and upper ends of the distribution, with truncation usually at between 2 and 3 geometric standard deviations (Crawford-Brown, *Theoretical and Mathematical Foundations of Human Health Risk Analysis*, Kluwer Academic Publishers, 1997). This is due to physical and biological limitations on the range of values that can occur. This general result was found to hold in the present analysis, as the data from the *Exposure Factors Handbook* could be fitted appropriately by a lognormal distribution out to approximately 2 to 3 geometric standard deviations around the median. Beyond that range, the lognormal distribution is inaccurate (as are all analytic, *a priori*, distributional forms) since the probability density for the data outside this region is significantly less than that predicted by the distribution. In the present analysis, truncation for sampling was at 3 geometric standard deviations; values beyond these limits were rejected and resampled. This truncation is not shown in Figures 1 through 5. *To reflect truncation, the reader can follow the displayed curves to approximately the 1% and 99% values at the two tails, and then draw lines horizontal to the X-axis from these two points.*

Note: Truncation does not introduce inaccuracies into the composite risk or HQ variability distribution for the population. As mentioned above, truncation is a feature of the underlying data on which the parameter variability distributions are developed, and are not introduced a priori into the analysis. Failure to truncate the lognormal distributions would introduce inaccuracies by artificially increasing the likelihood of parameters being selected at values more than 3 GSDs from the median.

Sampling Criteria for the Cumulative Probability Distributions

A trade-off is necessary in selecting the sample size for a Monte Carlo analysis. A larger sample size improves the estimates of risk associated with each percentile in the variability distribution. This larger sample size, however, requires greater computation time, with the potential for computation times that are too long to provide timely answers for decisions. The number of samples employed in the Monte Carlo analysis performed here was based on criteria related to the stability of the median (50^{th} percentile) risk value and of the 97^{th} percentile, following guidelines in EPA's *Guiding Principles for Monte Carlo Analysis* (EPA, 1997). Sample size was selected initially to be 1,000 runs of the model (i.e., 1,000 randomly selected individuals from the exposed population). Sample size then was increased in increments of 500 on the same model, and estimates at the 50^{th} and 97^{th} percentiles compared (e.g., the median estimate for a sample size of 1,500 compared against that for a sample size of 1000, and the 97^{th} percentile estimate also compared at these two sample sizes). Sample size was increased until the change in the estimate (for both the 50th and 97^{th} percentiles) was not larger than 5%. ***This criterion ensures the stability of the first decimal place of the percentile estimates, which is consistent with the number of significant digits available through the underlying data sets.***

For example, if the 97^{th} percentile value of the risk were 1×10^{-6} with a sample size of 3000, this sample size was considered adequate if and only if the 97^{th} percentile value of the risk for a sample size of 2,500 was between 0.995×10^{-6} and 1.05×10^{-6}. If it were not, the sample size would be increased to 3,500 and the run performed again. This test was run on several of the facility categories with the largest number of facilities (where meeting the criterion would be most difficult). In particular, it was run for the facility categories with more than 200 facilities. From this analysis, it was determined that a sample size of 3,000 runs provided the necessary stability of the variability distribution at both of these percentiles. This sample size then was used in all analyses.

Treatment of the Recreational Fishing Scenario

As described in Section II, the question asked for recreational fishers was: ***for which facilities may it be stated that some fraction of the recreational fishers exposed in the sectors surrounding that facility have a hazard quotient (HQ) greater than or equal to 1.0, and if there are an equal number of recreational fishers in all sectors, what is the variability of HQ in the total exposed population of recreational fishers*?** To answer this first question, the variability distribution of hazard quotients from methylmercury exposures via fish consumption within each sector was generated. The 95th percentile of this variability distribution then was examined in each sector. Any sector where this 95th percentile estimate is above 1.0 was "flagged" as being of potential concern. Note that this analysis does not identify the **number** of individuals exceeding this hazard index, and does not produce a population-weighted variability distribution for a facility category.

To address the second question, the analysis of variability used for the dioxin exposures was repeated for the methylmercury exposures, with the exception that the population in each sector was equal. As a result, the probability of selecting an individual from a given sector was the same for all sectors. The result is the variability distribution of hazard quotients in a hypothetical population spread evenly across the geographic sectors.

Relationship Between Central Tendency Estimates of Risk and Median Estimates of Risk from the Variability Analysis

Two analyses were performed of the risks to individuals in the exposed populations. In the first analysis (conducted prior to the variability analysis discussed in this report), point, mean, estimates of exposure parameters were used in Equations 3 and 4, and the distribution of risk in the total exposed population generated without incorporating variability of exposure parameters.

In the second analysis, described in this report, variability distributions were developed to reflect variability of risk as introduced by variability in exposure factor parameters. Since the median value for the distribution of EF_{ratio} is identical to the adjusted median value used in the first analysis (i.e. where the mean from the first analysis is converted to a median as described in Section V), it might be assumed that the median value of the distribution showing variability of risk when parameter variability is incorporated would be the same as the adjusted median value of risk when parameter variability is not incorporated. In addition, it might be assumed that the mean in both analyses should be the same.

This is not, however, the case, as can be seen from the results of this analysis. The median of the variability distribution for risks associated with a facility category when exposure factor variability is incorporated differs from the median of the variability distribution produced without consideration of exposure factor variability. The same is true for the means. The reason for this apparent discrepancy lies in the fact that multiple facilities, and multiple geographic sectors or sub-regions surrounding a facility, are combined within the analysis of risks for a facility category. When lognormal variability distributions are constructed around point estimates in individual sectors, and these separate sector-specific distributions combined (as in the present analysis), the composite variability distribution will not be lognormal and the median of that composite variability distribution will not be the same as the median of the distribution produced when exposure factor variability is ignored. The same is true for means. This would not have been the case if the exposure factor variability distributions had been symmetrical, but they are not.

As an example of the reason for this difference, let $R_{i,j}$ be the median estimate of risk for a given age group and subpopulation (e.g., adult recreational fisher) in sector i associated with facility j (there being

N such facilities in a facility category). Consider two such sector and facility combinations (e.g., $R_{3,8}$ and $R_{7,5}$). Let the median value of $R_{3,8}$ be 1×10^{-5} and of $R_{7,5}$ be 1×10^{-4}. Let 30% of the population be found in sector 3,8 and 70% in sector 7,5. Let the geometric standard deviation for the variability distributions associated with the relationship between exposure and risk be 4.0 for both sectors (the medians of the variability distributions are the central tendency estimates).

Without exposure factor variability, the median for this situation is 1×10^{-4} (since 30% of the population is at a risk of 1×10^{-5} and the remaining 20% needed to reach a cumulative fraction of 50% is at 1×10^{-4}). Note that there are no individuals with a risk of between 1×10^{-5} and 1×10^{-4}. With exposure factor variability incorporated, the medians for the two separate populations do not shift (these are still 1×10^{-5} and 1×10^{-4} for the first and second populations, respectively). Some of the individuals from the first population, however, will have a risk above 1×10^{-5}, and some from the second population will have a risk of below 1×10^{-4}. The result is that risk values between 1×10^{-5} and 1×10^{-4} will now be present in the composite distribution of risk. In this example (simulated for the present analysis using Monte Carlo analysis), the median of the composite distribution shifts to 5.1×10^{-5}. Both the degree and the direction of shift of the median (from the value that is present without variability incorporated) are functions of the difference in central tendency values for the two distributions, the geometric standard deviations for the variability distributions, and the fraction of the total exposed population contained in each of the two distributions.

VII. Uncertainty Analysis Using SUDAAN

The structure of the analysis for risks associated with specific facility categories divided the risk assessment into several stages:

- First, the central tendency risk was calculated for the population in each separate geographic sector surrounding each facility sampled from the facility category. This produced a mean risk for individuals in each sector.

- Second, the variability of risk associated with inter-subject variability of exposure parameters was calculated for the population in each separate sector surrounding each facility sampled from the facility category. This produced a point estimate of the risk associated with each specific percentile from that sector's variability distribution.

- Third, the variability of risk in the total exposed population was determined by aggregating the variability distributions from different sectors, weighted by the population in that sector, into a composite distribution. This produced a point estimate of the risk associated with each specific percentile from that aggregate distribution describing the total exposed population.

- Finally, the uncertainty associated with specific percentiles in this aggregate distribution was determined and summarized as confidence intervals around the point estimates of the risks associated with each percentile produced in the third step.

The first through third steps of the analysis have been described in previous sections. This section focuses on the fourth step, and on the validation of this step through use of the Monte Carlo variability analysis as a benchmark. The goal of this step was to construct confidence intervals around the point estimates of specific percentiles in the variability distribution for the aggregate, exposed population. The procedure for estimating these confidence intervals was the SUDAAN software. SUDAAN allows specification of a single value of the risk associated with each geographic sector, and so is able to reflect both inter-facility and inter-sector variability of the environmental concentrations. This, in turn, allows

the calculation of variances associated with the selection of a subset of facilities from a facility category. SUDAAN does not, however, explicitly handle variability distributions within a sector such as those that arise from inter-subject variability of exposure parameters. Without this latter source of variability incorporated into the SUDAAN analysis, the estimates of variance produced by SUDAAN do not include variance introduced by sampling of individuals from the variability distribution in a sector.

It is possible, however, to reflect inter-subject variability within a sector through the use of a discrete approximation to the inter-subject variability distribution within that sector, with each interval of the discretized variability distributions treated as a subsector within the sector. This discrete approximation introduces a potential error into the calculation of both the best estimate values and confidence intervals for the risk associated with specific percentiles in the aggregate variability distribution. It is necessary, therefore, to determine whether the approach used to generate confidence intervals around point estimates of percentile values in the variability distribution accurately captures the best estimates of these percentiles. This following discussion describes both how the aggregate distribution was determined and how the accuracy of the approach based on discrete distributions and SUDAAN was assessed.

VII. Discrete Distributions and SUDAAN

As described above, SUDAAN produces an estimate of the confidence intervals around specific percentiles in the variability distribution for the total exposed population (total aggregated over all sectors). To do this, it is necessary to provide as input into SUDAAN a single value of risk for each sector around a facility. If a single value is provided for each geographic sector, the analysis of variance reflects uncertainties introduced by:

- Sampling a subset of facilities from within the set of all facilities
- Inter-facility variability in source characteristics and environmental parameters
- Inter-sector variability of environmental concentrations due to dispersion patterns around a given facility.

These three contributions to the variance in risk estimates for the exposed population, however, omit the variance introduced by inter-subject variability of risk within each sector. The result can be errors in both the point estimates of percentiles in the aggregate variability distribution and in the confidence intervals constructed around these point estimates.

To reflect the influence on the variance contributed by inter-subject variability within a sector, the SUDAAN analysis divided the inter-subject variability distribution within each geographic sector into a series of subsectors (such subsectors can be accommodated within SUDAAN), each characterized by a single value of risk for the individuals contained in that subsector. Each subsector represents a subset of the population contained within a sector, rather than representing a geographic subdivision of the sector (i.e., the individuals in different subsectors of a sector are at the same geographic location; they differ only in representing different exposure factor values). The result is a discrete approximation (histogram) of the continuous variability distribution of risk for that sector. In the analysis performed here, the variability distribution in a sector was divided into 20 subsectors, each containing 5% of the total population within that sector (SUDAAN must have the population size equal within the subsectors of a given sector).

The task then was to determine a single value of the risk to be assigned to all individuals in each subsector. This single value is the mean risk for the individuals in that subsector. The requirement that it

be the mean, rather than some other quantity such as the median, arises from the need to retain the correct mean value for the entire population in the sector containing the 20 subsectors. Determination of this mean for a given subsector within a sector requires specification of the lower and upper endpoints within the variability distribution (for the sector) associated with that subsector, conditional upon the requirement that each subsector contain 5% of the total population in a sector.

Let PDF(x) be the probability density function (lognormal) for the risk in a sector; PDF(x) reflects the inter-subject variability of risk in that sector. PDF(x) must then be divided into 20 subsectors of equal cumulative probability (i.e. 0.05). For the first subsector, the condition is that the integral of PDF(x) from 0 to UL (the upper limit of the first subsector) must equal 0.05. The lower limit (LL) of the second subsector is the the value of UL for the first subsector. This process is continued through all 20 subsectors.

Determination of the lower (LL) and upper (UL) limits of each of the 20 subsectors was accomplished through numerical integration (Newton's method) of the probability density function PDF(x), since there is no analytic solution to this integral for lognormal PDFs. Let Δx be the size of the integration interval used in the numerical integration of PDF(x). In defining LL and UL for the first subsector, the value of PDF($\Delta x/2$) was calculated (this being at the midpoint of the first integration interval). The integral of PDF(x) from 0 to Δx then equals PDF($\Delta x/2$) Δx. If this value is less than 0.05 (which it was in this analysis, since Δx must be small relative to 0.05), the integration continues and PDF($3\Delta x/2$) Δx is added to PDF($\Delta x/2$) Δx. Again, this is compared against 0.05 and, if it less than 0.05, the integration continues and PDF($5\Delta x/2$) Δx is added to PDF($\Delta x/2$) Δx plus PDF($3\Delta x/2$) Δx. This process continues until 0.05 is reached by the sum. The value of UL for the first subsector in that sector then equals Δx times the number of integration intervals necessary to reach 0.05. This also becomes LL for the second subsector, and UL for that subsector is determined as above.

Once the lower and upper limits were determined for each subsector in a sector, the mean value for the risk in each subsector was determined, again through numerical integration. Let PDF(x) be the probability density function for the risk in a sector, lognormal in shape. The mean risk in a subsector then is the integral of the product xPDF(x), with the integration performed numerically (Newton's method) from LL to UL as described previously (LL and UL are specific to that subsector, and PDF(x) is specific to the sector containing the subsector). This mean value was assigned to all individuals in that subsector, and this mean value was provided to SUDAAN for the analysis of variance (20 such mean values for each sector).

VIII. Comparison of SUDAAN to Monte Carlo

There is a potential error introduced by this approach, since all individuals in a subsector are assigned the mean for that subsector (even though in reality there is a continuous distribution within that subsector). This essentially replaces the continuous distribution by a discrete distribution. The question to be addressed is: ***Does the use of a discrete distribution, with the characteristics described above, cause significant inaccuracies in the best estimates of the percentile values in the variability distribution developed for the total exposed population (i.e., aggregated over all geographical sectors)?*** To address this question, several procedures were developed and applied to a sample of populations as described below.

In the first analysis, the best estimates of the 95th, 97th and 99th percentiles for the aggregated distribution as produced by SUDAAN were compared against the estimates from the Monte Carlo analysis described previously for a sample of the facility categories and control options. The Monte Carlo analysis employs the full distribution in each geographical sector, rather than a discrete approximation of the variability

distribution (but does not characterize uncertainty properly and so is not useful for this uncertainty analysis). The results for all facility categories, and with all control strategies (including baseline) were used for this analysis where both the Monte Carlo and the SUDAAN estimates were available. The ratio of the SUDAAN best estimate result over the Monte Carlo result (for the same percentile of the variability distribution) was obtained, and a distribution developed of these ratios. The mean and standard deviation of this distribution of ratios then was determined. The desired feature here would be a mean of 1.0, indicating that, on average, the Monte Carlo and SUDAAN estimates agreed, and a standard deviation of 0, indicating they agreed at all times.

For the beef farmer, this analysis produced a mean of 0.98 and a standard deviation of 0.15 for the 95^{th} percentile values. For the beef farmer, this analysis produced a mean of 0.91 and a standard deviation of 0.2 for the 97^{th} percentile values. For the beef farmer, this analysis produced a mean of 0.8 and a standard deviation of 0.2 for the 99^{th} percentile values. For the dairy farmer, this analysis produced a mean of 0.97 and a standard deviation of 0.17 for the 95^{th} percentile values. For the dairy farmer, this analysis produced a mean of 0.95 and a standard deviation of 0.15 for the 97^{th} percentile values. For the dairy farmer, this analysis produced a mean of 0.91 and a standard deviation of 0.15 for the 99^{th} percentile values. For the recreational fisher, this analysis produced a mean of 1.02 and a standard deviation of 0.3 for the 95^{th} percentile values. For the recreational fisher, this analysis produced a mean of 1.04 and a standard deviation of 0.3 for the 97^{th} percentile values. For the recreational fisher, this analysis produced a mean of 0.8 and a standard deviation of 0.22 for the 99^{th} percentile values. These six analyses also are summarized in Figures 6 through 13. The reason for plotting these as bar graphs is that it was possible to locate samples (e.g., recreational fishers in the LWAC category with a particular control strategy) where there were systematic differences between the SUDAAN and Monte Carlo results. This allowed a quality assurance check and identified several areas of miscalculations that were resolved before this final analysis was generated. In these figures, RF stands for recreational fisher, BF stands for beef farmer, DF stands for dairy farmer, "new" refers to the SUDAAN results and "old" refers to the Monte Carlo results.

From this analysis, it may be concluded that use of the SUDAAN procedure with the introduction of the discrete approximation for the intra-sector variability distributions (with 20 discrete slices) produces best estimates of the upper percentiles (95^{th}, 97^{th} and 99^{th}) of the aggregate distributions of risk within 25% of the values obtained using the Monte Carlo analysis as the benchmark procedure. For example, if the Monte Carlo procedure (which is the most accurate for estimating variability) indicated that the risk associated with an individual at the 95^{th} percentile of the variability distribution is 10^{-4}, the SUDAAN analysis generally produced an estimate at this same percentile that was between 0.75×10^{-4} and 1.25×10^{-4}. *It should be borne in mind that the results presented above indicate the upper limit on the degree of difference between the Monte Carlo and SUDAAN results, since rounding differences (only the first significant digit was used in the comparison) in the two procedures will produce ratios that are further from 1.0 than would be the case if more significant digits were examined. It is likely that the actual differences are smaller.*

IX. Influence of the Number of Subsectors

In a second analysis, a Monte Carlo procedure for sampling from variability distributions associated with populations (one population from each of two sectors) was developed. Two populations were assumed: one with a mean of 10 and a geometric standard deviation of 4 (lognormal PDF) and a second with a mean of 1 and a geometric standard deviation of 4 (lognormal PDF). The discrete approximation to the variability distributions should introduce the largest inaccuracies into the estimates of the 95^{th}, 97^{th} and 99^{th} percentiles of the aggregate distribution when 100% of the exposed population is in only one of the two distributions described above. As the two distributions become more equal in size, the errors in the 95^{th}, 97^{th} and 99^{th} percentiles should be reduced.

The procedure for this analysis was to first select a fraction of the aggregate population in each of the two distributions. The parameter f is taken to be the fraction in the first population (the population with mean of 10). The fraction in the second population then is 1-f. A Monte Carlo procedure then was developed to sample at random from each of the two distributions, with the probability of sampling from the first distribution being f and the probability of sampling from the second being 1-f. A total of 10,000 samples were obtained to construct the aggregate ariability distribution of risk for the population (this being the sample size necessary to ensure that the 97th percentile can be estimated to within 5%, the criterion selected for stability of that estimate). The 95th, 97th and 99th percentiles for this distribution were obtained and recorded. This process then was repeated for values of f between 0 and 1.0, in increments of 0.1.

To simulate the SUDAAN analysis, the two distributions then were developed in discrete form through the method of numerical integration described previously. The mean in each "slice" of this discrete distribution was assigned to each individual from that slice, as was done in the SUDAAN analysis. This resulted in N numerical values for each of the two distributions, where N is the number of slices in the discretized distribution. The fraction of people assigned to each slice equals the fraction of people in that population (there are two populations) divided by N (1/N being the fraction of a given population contained in a slice). Monte Carlo analysis then was used (with a sample size of 10,000) to determine the variability distribution for the aggregate population and to specify the 95th, 97th and 99th percentiles of the aggregated distribution.

The 95th percentile from the SUDAAN result minus the 95th percentile from the non-discretized (Monte Carlo) result then was calculated and divided by the 95th percentile from the non-discretized result for each value of f. The same was done for the 97th and 99th percentiles. The magnitude of this ratio (with the absolute value of the differences) indicates the fractional degree of inaccuracy introduced by the discretization of the variability distributions for the two populations. This inaccuracy will become smaller as the number of "slices" is increased (going to 0.0 as N approaches infinity, since the distribution no longer is discretized and the method approaches the Monte Carlo method). Values of N equal to 5, 10, 20, 30 and 40 were examined. The results are summarized in Table 7 (only the limiting cases of f equal to 1 and 0.5 are considered).

In summary, the use of 20 slices for each variability distribution produces estimates of risk associated with individuals at the upper percentiles (95th and 97th) of the aggregate distribution that are within 25% of the values obtained from a complete Monte Carlo analysis. Bear in mind that the actual error introduced decreases as the number of populations sampled to create the aggregated population increases, and that in the actual SUDAAN analysis developed for this project the number of sampled populations was significantly larger than 2. This analysis, therefore, supports the contention that the SUDAAN approach adequately represents the inter-subject variability distribution for risk in the total exposed population, and may be used for both the variability and uncertainty analyses.

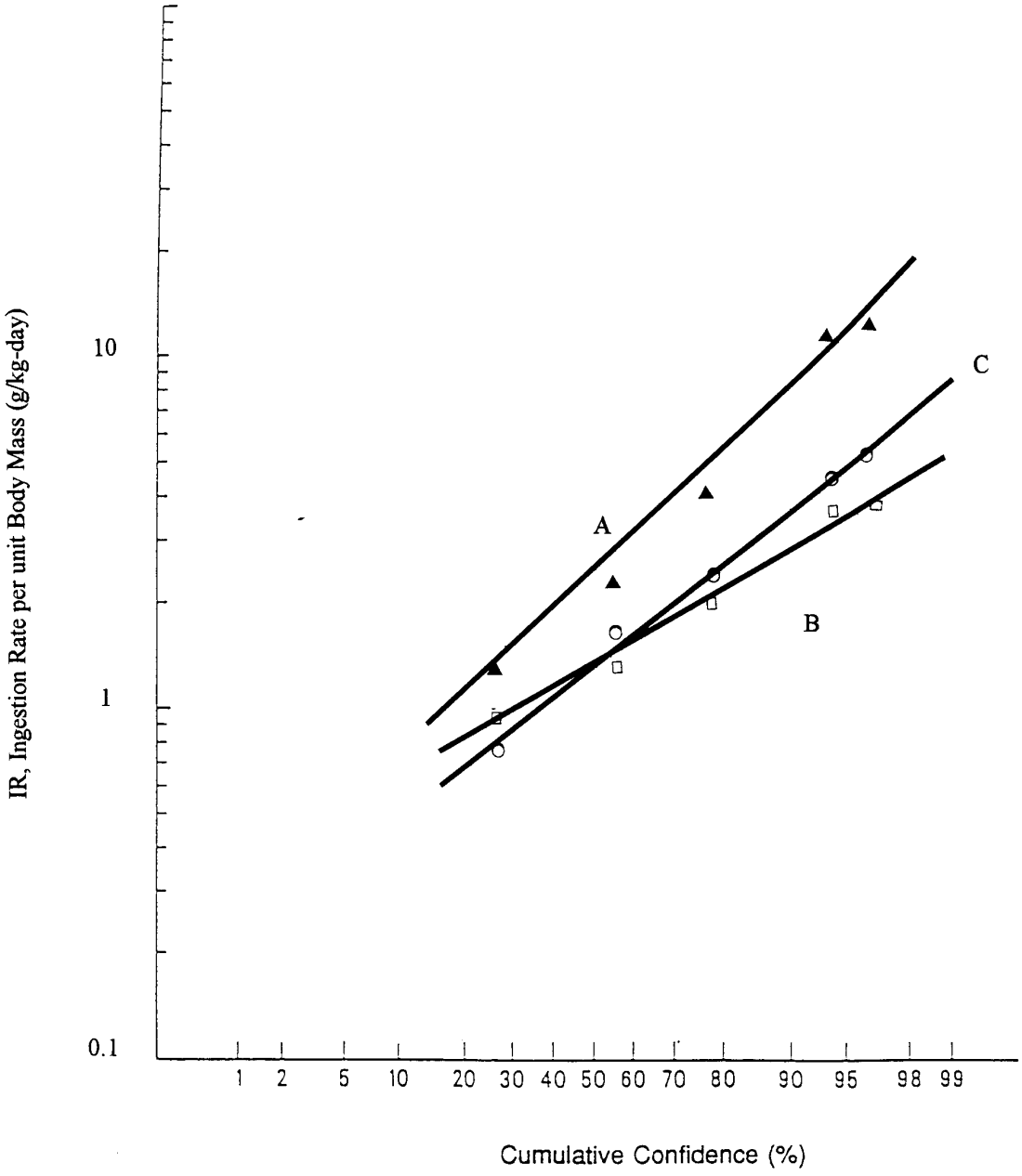

Figure 1. Variability of the ingestion rate per unit body mass for home produced beef. Curve A is for the 6-11 year age group (and the 0-5 year age group; curve B is for the 12-19 year age group. Curve C is for adults. The cumulative confidence refers to the fraction of results with a value less than or equal to that shown on the y-axis. The geometric standard deviations are the only properties of these curves relevant to the analysis in this memo; they equal the ratio of the 84th percentile over the 50th percentile.

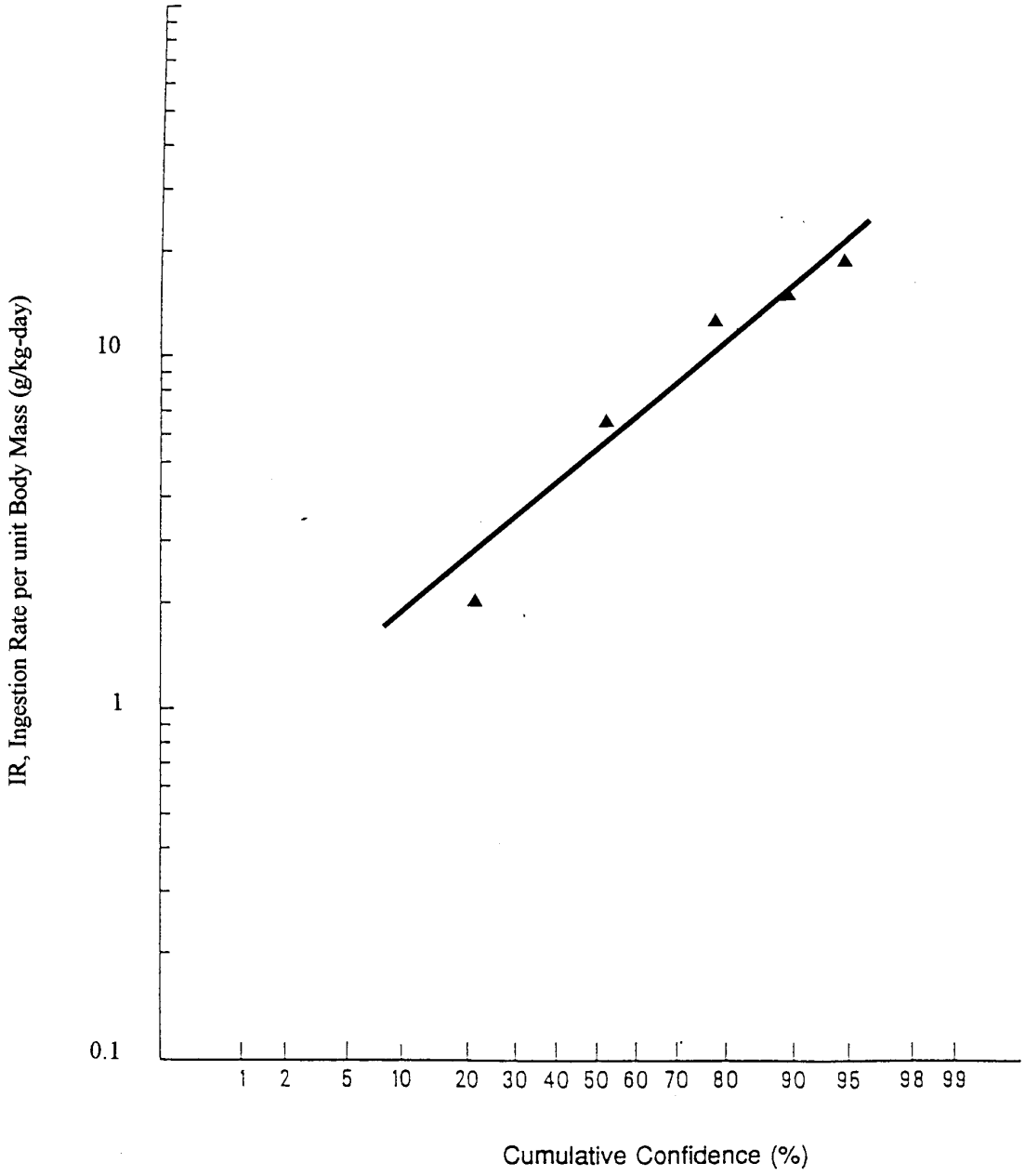

Figure 2. Variability of the ingestion rate per unit body mass for home produced milk. The curve is for all age groups. The cumulative confidence refers to the fraction of results with a value less than or equal to that shown on the y-axis. The geometric standard deviations are the only properties of these curves relevant to the analysis in this memo; they equal the ratio of the 84th percentile over the 50th percentile.

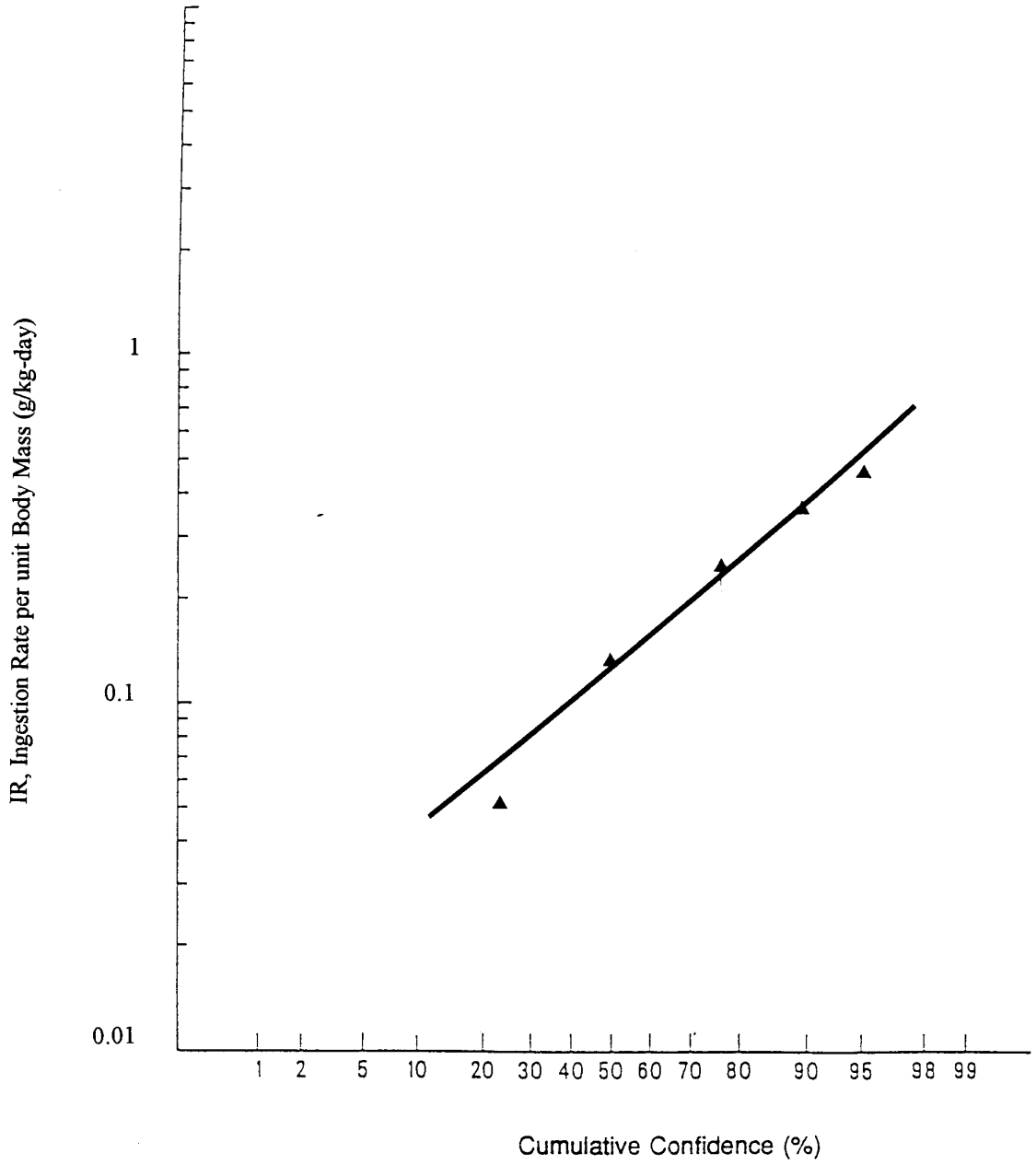

Figure 3. Variability of the ingestion rate per unit body mass for the recreational fisher. The curve is for all age groups. The cumulative confidence refers to the fraction of results with a value less than or equal to that shown on the y-axis. The geometric standard deviations are the only properties of these curves relevant to the analysis in this memo; they equal the ratio of the 84^{th} percentile over the 50^{th} percentile.

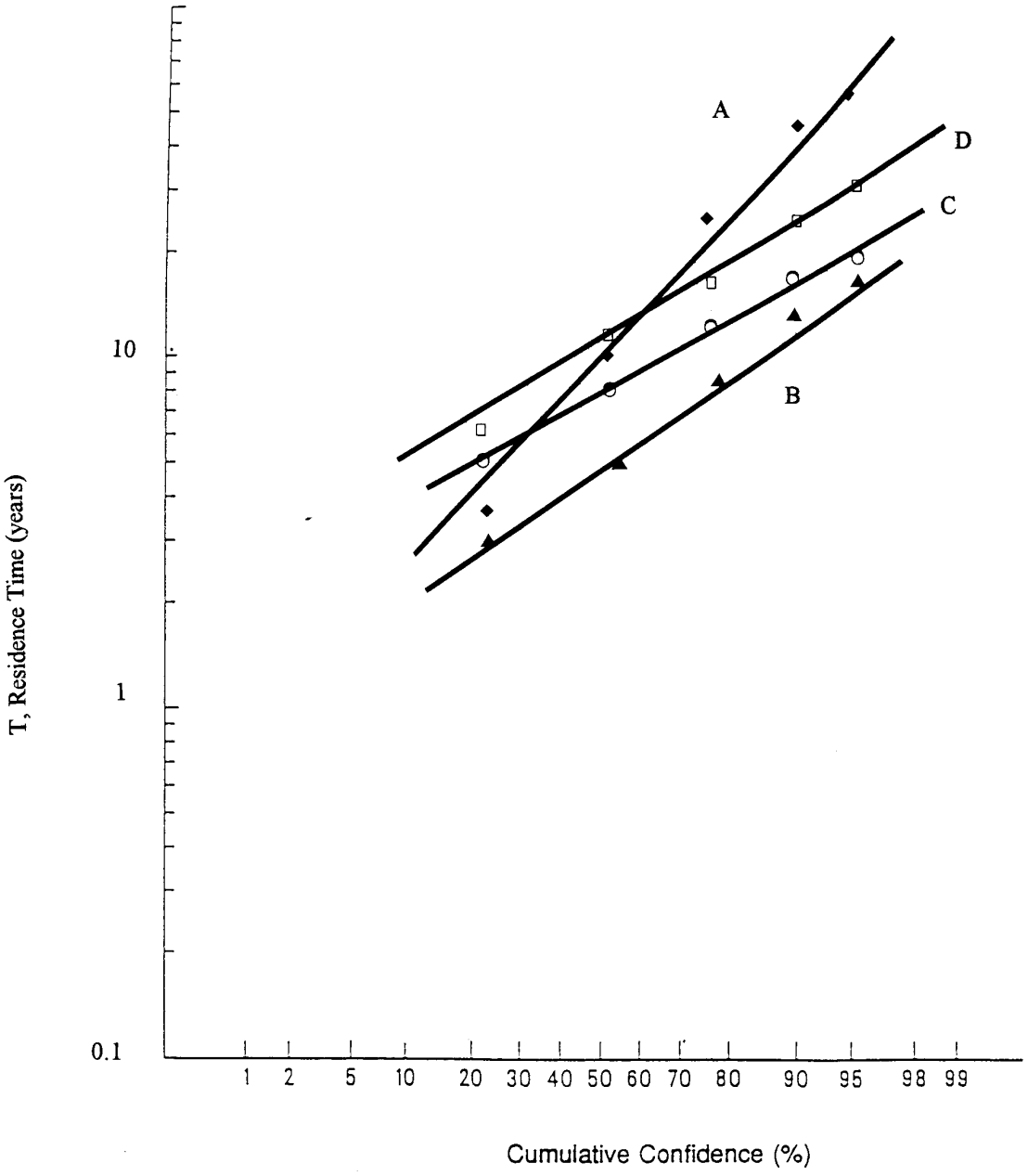

Figure 4. Variability of the residence times (occupancy periods) for the farming and non-farming populations. Curve A is for the farming population (all ages); curve B is for the non-farming population 0-5 years). Curve C is for the non-farming population (6-11 and 12-19 years). Curve D is for the non-farming population (adults). The cumulative confidence refers to the fraction of results with a value less than or equal to that shown on the y-axis. The geometric standard deviations are the only properties of these curves relevant to the analysis in this memo; they equal the ratio of the 84^{th} percentile over the 50^{th} percentile.

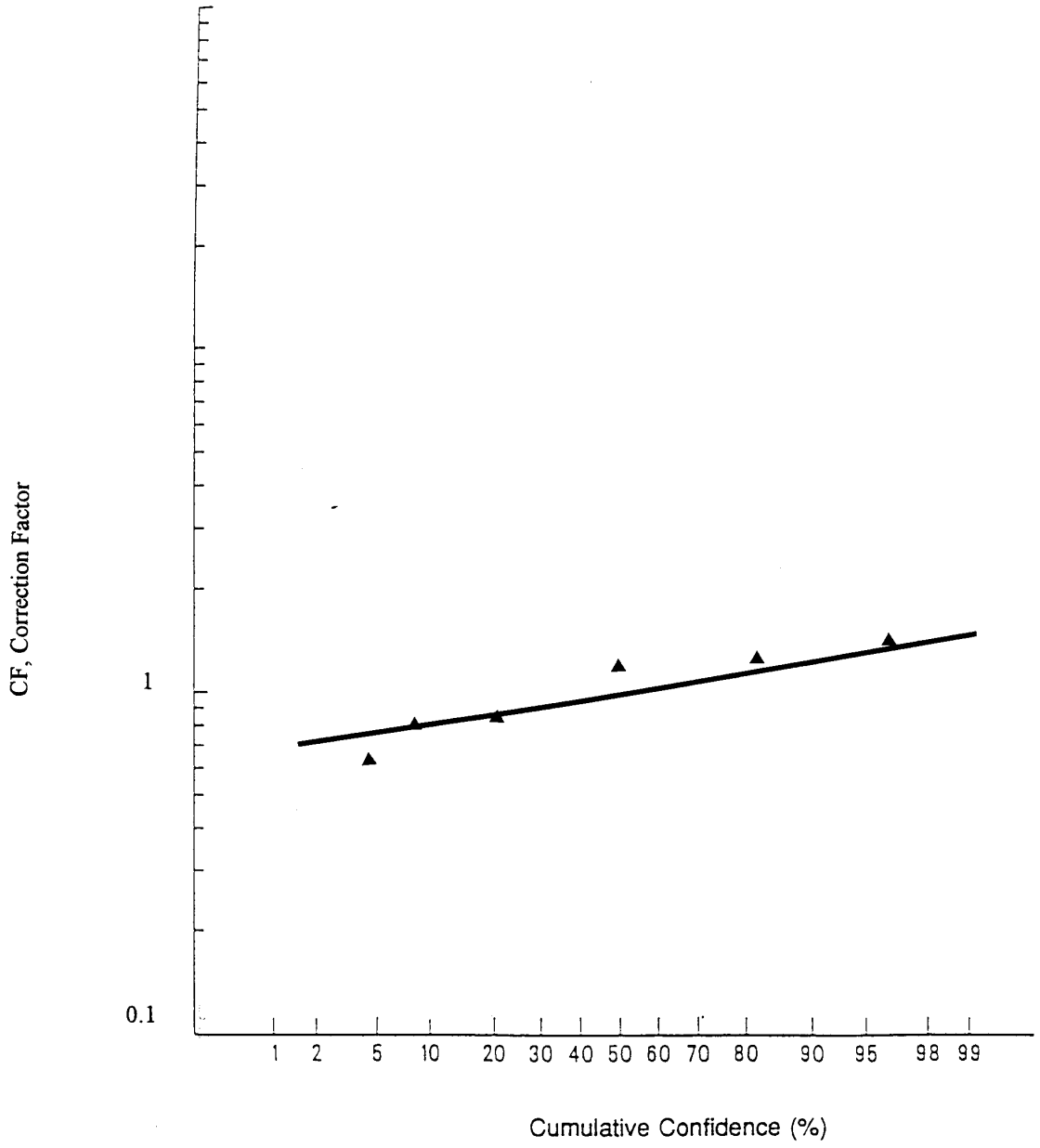

Figure 5. Variability of the correction factor for crossing age groups. There is no significant difference for the 3 exposure pathways, so the same distribution is used. The curve applies to the 0-5, 6-11 and 12-19 year age groups only. The cumulative confidence refers to the fraction of results with a value less than or equal to that shown on the y-axis.

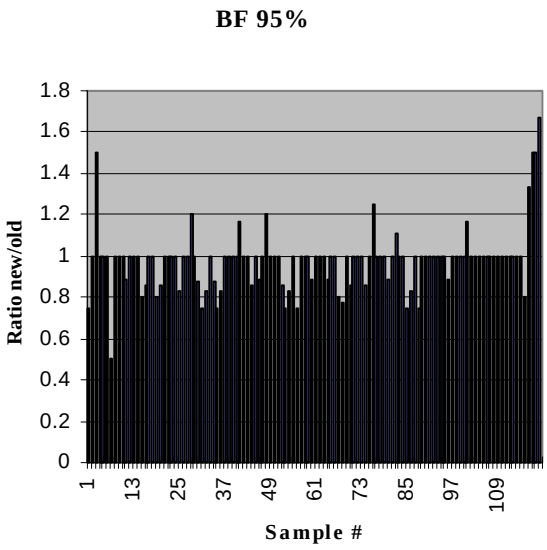

Figure 6.

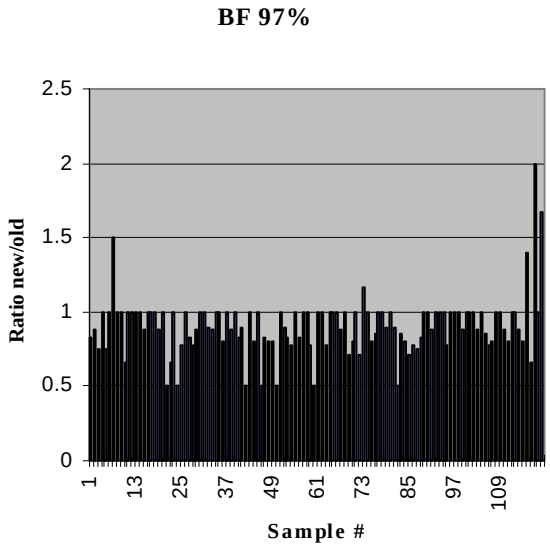

Figure 7.

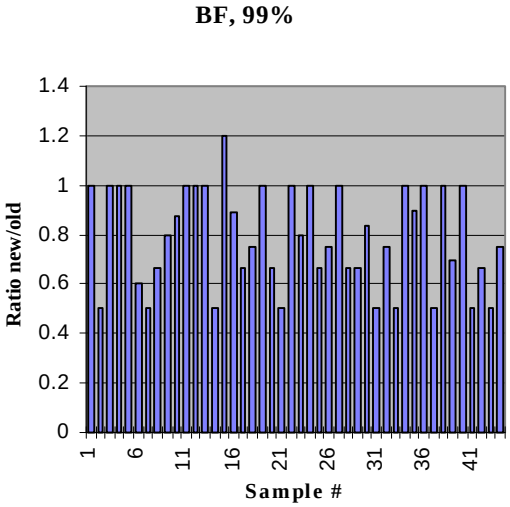

Figure 8.

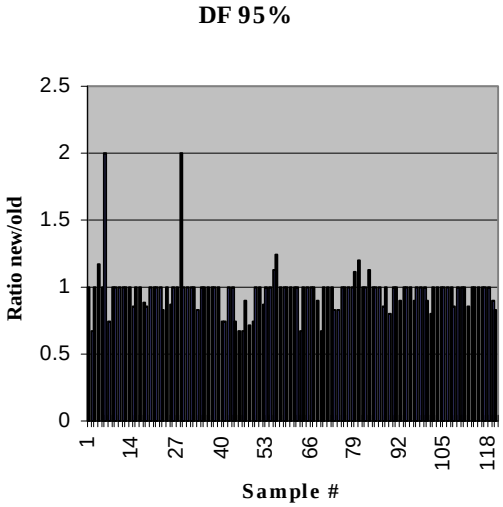

Figure 9.

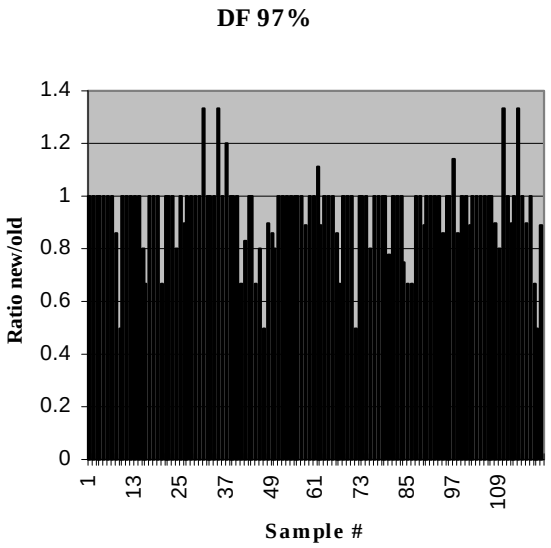

Figure 10.

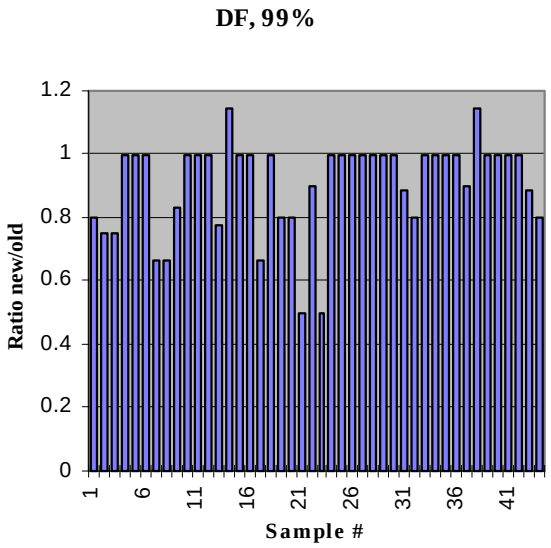

Figure 11.

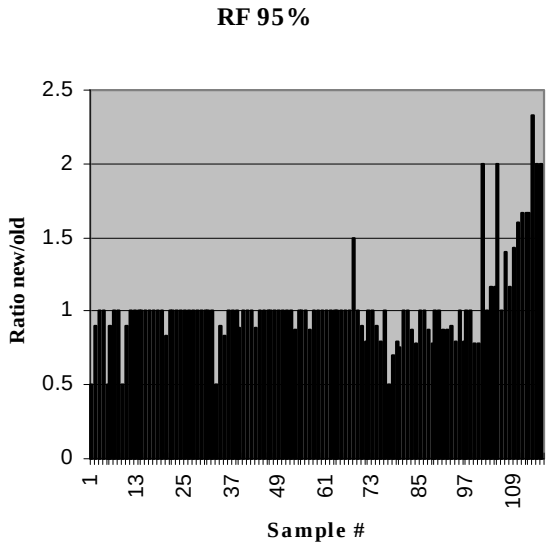

Figure 12.

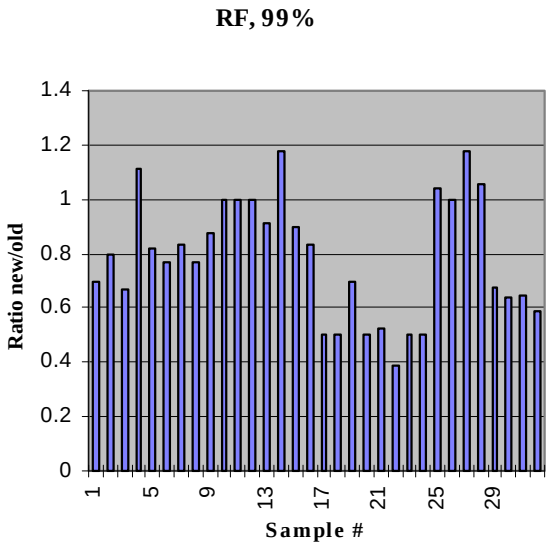

Figure 13.

Table 1. Cumulative frequencies for exposure factor parameters, with a comparison of data values (from the *Exposure Factors Handbook* tables cited in the text) and values predicted from the best fitting lognormal distributions used in the Monte Carlo analysis. This table is for variability of the ingestion rate per unit body mass for home produced beef, and corresponds to Figure 1. The values are EFH/log, where EFH (in the upper row) is the numerical value in the *Exposure Factors Handbook* and log (in the lower row) is the numerical value from the best-fitting lognormal distribution. All values in a row are the ratio of the percentile value over the median value in the same row, as described in the text.

	Cumulative Percentile								
Age Group (years)	**1**	**5**	**10**	**25**	**50**	**75**	**90**	**95**	**99**
6-11	0.17	0.31	0.36	0.62	1.00	2.10	5.43	5.95	6.33
	0.10	0.12	0.22	0.44	1.00	2.20	4.50	6.60	6.80
12-19	0.25	0.32	0.34	0.60	1.00	1.62	2.34	2.36	2.83
	0.25	0.30	0.40	0.60	1.00	1.60	2.50	3.10	3.20
Adult	0.17	0.22	0.25	0.43	1.00	1.72	3.07	4.09	5.19
	0.15	0.30	0.40	0.60	1.00	1.70	2.80	4.00	5.50

Table 2. Cumulative frequencies for exposure factor parameters, with a comparison of data values (from the *Exposure Factors Handbook* tables cited in the text) and values predicted from the best fitting lognormal distributions used in the Monte Carlo analysis. This table is for variability of the ingestion rate per unit body mass for home produced milk, and corresponds to Figure 2. The values are EFH/log, where EFH (in the upper row) is the numerical value in the *Exposure Factors Handbook* and log (in the lower row) is the numerical value from the best-fitting lognormal distribution. All values in a row are the ratio of the percentile value over the median value for the measurements, as described in the text.

	Cumulative Percentile								
Age Group (years)	**1**	**5**	**10**	**25**	**50**	**75**	**90**	**95**	**99**
All	0.03	0.06	0.07	0.29	1.00	1.87	2.38	3.01	3.56
	0.07	0.11	0.20	0.35	0.70	1.50	2.70	3.79	3.85

Table 3. Cumulative frequencies for exposure factor parameters, with a comparison of data values (from the *Exposure Factors Handbook* tables cited in the text) and values predicted from the best fitting lognormal distributions used in the Monte Carlo analysis. This table is for variability of the ingestion rate per unit body mass for recreational fishing, and corresponds to Figure 3. The values are EFH/log, where EFH (in the upper row) is the numerical value in the *Exposure Factors Handbook* and log (in the lower row) is the numerical value from the best-fitting lognormal distribution. All values in a row are the ratio of the percentile value over the median value for the measurements, as described in the text.

	Cumulative Percentile								
Age Group (years)	**1**	**5**	**10**	**25**	**50**	**75**	**90**	**95**	**99**
All	NA*	NA	0.11	0.36	1.00	1.93	2.38	3.00	NA
	NA	NA	0.25	0.42	0.84	1.77	3.19	4.53	NA

NA* = Measurements not available at these percentiles

Table 4. Cumulative frequencies for exposure factor parameters, with a comparison of data values (from the *Exposure Factors Handbook* tables cited in the text) and values predicted from the best fitting lognormal distributions used in the Monte Carlo analysis. This table is for variability of the occupancy periods for farming populations (the only population for which this factor applies in the present analysis, and corresponds to Figure 4. The values are EFH/log, where EFH (in the upper row) is the numerical value in the *Exposure Factors Handbook* and log (in the lower row) is the numerical value from the best-fitting lognormal distribution. All values in a row are the ratio of the percentile value over the median value in the same row, as described in the text.

	Cumulative Percentile								
Age Group (years)	**1**	**5**	**10**	**25**	**50**	**75**	**90**	**95**	**99**
All	NA	NA	NA	0.25	1.00	2.67	4.83	5.8	NA
	NA	NA	NA	0.50	1.00	2.20	4.60	7.00	NA

NA* = Measurements not available at these percentiles

Table 5. Cumulative frequencies for exposure factor parameters, with a comparison of data values (from the calculations reported in the text) and values predicted from the best fitting lognormal distributions used in the Monte Carlo analysis. This table is for variability of the age crossing correction factor, and corresponds to Figure 5. The values are EFH/log, where EFH (in the upper row) is the numerical value in the *Exposure Factors Handbook* and log (in the lower row) is the numerical value from the best-fitting lognormal distribution. All values in a row are the ratio of the percentile value over the median value for the measurements, as described in the text.

	Cumulative Percentile								
Age Group (years)	**1**	**5**	**10**	**25**	**50**	**75**	**90**	**95**	**99**
All	NA*	NA	0.82	0.92	1.00	1.20	1.30	1.45	NA
	NA	NA	0.80	0.90	1.00	1.13	1.25	1.30	NA

NA* = Simulations not available at these percentiles

Table 6. Summary of variability of exposure parameters for the three pathways and four age groups. All measures of variability are the geometric standard deviations associated with a lognormal distribution. All medians are 1.0 (including the median of the composite distribution for EF, given in the last column). The four entries are Ingestion Rate per Unit Body Mass (IR/BW); Occupancy Period or Exposure Duration (ED); Age Crossing Correction Factor (CF); and the Composite Geometric Standard Deviation (COMP). The mean for any of these distributions may be obtained from the formula (remembering that the median is 1.0): Mean = $\exp((\ln^2(GSD))/2)$

Receptor Population	IR	OP	ACF	COMP
Commercial Beef Farmer				
0-5 year age-group	3.3	3.2	1.2	5.3
6-11 year age-group	3.3	3.2	1.2	5.3
12-19 year age-group	2.0	3.2	1.2	3.9
>20 year age-group	2.3	3.2	1.0	4.2
Commercial Dairy Farmer				
0-5 year age-group	2.8	3.2	1.2	4.8
6-11 year age-group	2.8	3.2	1.2	4.8
12-19 year age-group	2.8	3.2	1.2	4.8
>20 year age-group	2.8	3.2	1.0	4.7
Recreational Fisher				
0-5 year age-group	2.8	NA*	NA	2.8
6-11 year age-group	2.8	NA	NA	2.8
12-19 year age-group	2.8	NA	NA	2.8
>20 year age-group	2.8	NA	NA	2.8

*NA=Not Applicable due to the factor being irrelevant for noncancer endpoints.

Table 7. Analysis of the fractional error (FE) introduced into the estimate of percentiles of the aggregated variability distribution for risk (or HI) as a result of numerical approximation of the sector-specific variability distribution PDFs.

N	f	FE (95th)	FE (97th)	FE (99th)
5				
	0.5	2.3*	2.4	2.5
	1	2.5	2.9	3.2
10				
	0.5	0.70	0.75	0.85
	1	0.82	0.90	0.95
20				
	0.5	0.12	0.14	0.17
	1	0.14	0.16	0.19
30				
	0.5	0.10	0.12	0.15
	1	0.12	0.13	0.17
40				
	0.5	0.09	0.10	0.12
	1	0.10	0.12	0.14

* a fractional error of 2.3 indicates a 230% error.

REFERENCES

EPA's (U.S. Environmental Protection Agency). 1997. *Guiding Principles for Monte Carlo Analysis*.

Morgan, M. and M. Henrion. 1990. *Uncertainty: A Guide to Dealing with Uncertainty in Quantitative Risk and Policy Analysis*. Cambridge University Press, pp. 88-90.

Crawford-Brown, D. 1997. *Theoretical and Mathematical Foundations of Human Health Risk Analysis*. Kluwer Academic Press.

EPA (U.S. Environmental Protection Agency). 1997. *Exposure Factors Handbook*.

Appendix J

Ecotoxicological Profile for Ecological Receptors

Ecotoxicological Profile for Selected Ecological Receptors 2,3,7,8-TCDD

This ecotoxicological profile on 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) contains five sections: (1) background, (2) geochemistry of the constituent in various ecological media, (3) effects characterization, (4) bioaccumulation potential, and (5) criteria development. The first four sections are intended to provide an overview of the environmental factors that influence the toxicological potential of TCDD so that the limitations of the criteria may be better understood. The fifth section presents the rationale and development of criteria for the suite of ecological receptors used to represent aquatic and terrestrial ecosystems. The profile is intended to present the ecotoxicological criteria in a broader environmental context, so the ecological significance of the criteria may be properly interpreted.

I. Introduction

The persistent, bioaccumulative, and hydrophobic nature of TCDD strongly influences this constituent's environmental behavior in ecological systems. Sediments and biota act as the primary sinks for TCDD. The movement of TCDD in the environment closely corresponds with sediment transport because TCDD is readily adsorbed to organic particulates. TCDD is also bioaccumulated through food chain mechanisms; however, evidence to support biomagnification has only been confirmed in aquatic food chains. The toxicity of TCDD has been narrowed to particularly sensitive vertebrate species, especially mammals. TCDD appears to exert toxicity through a receptor-specific mode of action, the aryl-hydrocarbon (Ah) receptor, that is found primarily in vertebrates. The characteristic dose-response curve of TCDD is steep with a narrow concentration range between no effects and lethal levels. Species particularly at risk include mammals and birds that could potential have high TCDD exposure from consuming contaminated prey species (e.g., fish and invertebrates) (U.S. EPA, 1993a).

TCDD is commonly found in the environment as mixtures of polychlorinated dibenzo-*p*-dioxins (PCDDs), dibenzofurans (PCDF), and dioxin-like polychlorinated biphenyls (PCBs). Multiple congeners within each constituent class have been measured in these mixtures. PCDDs have been identified as 75 congeners, PCDF as 135 congeners, and dioxin-like PCBs as 209 congeners. Assessing the potential for adverse toxic effects in ecosystems becomes increasingly difficult because congeners display varying toxicity and bioaccumulative potential. The approach implemented to assess toxicity and bioaccumulation of the mixture uses toxicity equivalency factors (TEFs) and bioaccumulative equivalency factors (BEFs). TEFs are adjustment factors that express the relative toxicity of each congener with respect to TCDD toxicity; BEFs determine the relative bioaccumulative potential congeners with respect to TCDD. When the mixture

composition is known and converted into TCDD equivalents, the sum of all toxicity equivalent concentrations, TEqCs, can be expressed additively as toxicity equivalents (TEqs). The TEqC for surface water, soil, or sediment can be compared directly to a 2,3,7,8- TCDD criteria to estimate the potential for adverse effects. The specific dioxin congeners are listed in Attachment 1.

II. Environmental Behavior of TCDD in Various Ecological Media

Overall, the movement of sediments, particulates, and soils via erosion closely mimics the mobility and fate of TCDD. For example, in surface water, TCDD is associated primarily with suspended organic matter which eventually settles into sediments. Concentrations in sediments range from 6.0E-05 to 7.6E-03 mg/kg sediment with the latter being related to sediments in areas of high industrial activity. In addition to the movement of TCDD via abiotic means, TCDD is also mobile through biotic means. Concentrations in fish range from below detection, 5.0E-07, to 1.0E-04 mg/kg fish tissue (whole body, wet weight). In a few cases, fish tissues have exceeded 1.0E-04 µg/kg fish tissue; however, this is rare. Over time, concentrations in sediment and biota decrease as TCDD is slowly metabolized or transported elsewhere through sediment movement. Similar chemical behavior is observed in terrestrial systems; however, TCDD is adsorbed to organic content in the soil and is somewhat less mobile (Eisler, 1986).

III. Effects Characterization

This section, along with the bioaccumulation potential section, is subdivided to evaluate receptors of the freshwater and terrestrial ecosystems separately. These sections summarize the range of effects data for receptors of concern.

Freshwater Ecosystems

Binding of TCDD to the Ah receptor has been identified as the primary mode of toxic action. Interestingly, this biochemical receptor appears to be present in some species and absent in others. In fish, adverse effects such as mortality, inhibited reproduction, and tissue damage have been noted during short-term exposures. In contrast, long-term studies exposing aquatic invertebrates (e.g., snails, worms, daphnids) and aquatic plants indicate no adverse toxic effects. Vertebrate species have characteristically indicated higher sensitivity to TCDD exposures than invertebrates. The difference between vertebrate and invertebrate toxicity ranges can be as high as four orders of magnitude. Several studies indicate that no adverse effects are suggested at TCDD concentrations of 1.3 µg TCDD/L for freshwater species of algae, aquatic plants, and invertebrates. In sharp contrast, experiments exposing early lifestages of fish to TCDD have reported LC_{50}s as low as 0.000046 µg TCDD/L (U.S. EPA, 1993a).

A large amount of ecotoxicity data has been generated for fish species because of their sensitivity to TCDD exposures. Interestingly, toxicity tests indicate latent threshold responses of species exposed to TCDD. When this occurs, a typical toxicity test indicates no observable adverse effects during exposures, but, up to 100 days after exposure to TCDD, lethality within the test group is observed. For example, observations of juvenile salmon following acute 4-day exposures to 5.6 ng TCDD/L indicated minimal effects; however, these same test species showed 100% lethality 56 days after exposures had ceased. To contrast, similar experiments exposing juvenile salmon to concentrations of 0.56 ng TCDD/L indicated no adverse effects during both

the 4-day exposure period and the extended observational period after exposure (i.e., 114 days). These studies indicate the unpredictability of latent lethal effects in fish species. Chronic exposure durations of 21 days reported an LC_{50} in rainbow trout sac fry at 1.8 ng TCDD/L. Rainbow trout swim-up fry appeared more sensitive to TCDD exposure with a NOEC of 0.001 ng/L and an LC_{50} of 0.046 ng/L. Adverse effects to reproductive, developmental, and growth endpoints during chronic exposures of variable length are noted in juvenile fish from 0.038 to 0.1 ng/L. The trend in TCDD toxicity to fish species is that the concentration range between no effects, low effects, and lethality is relatively narrow, indicating a steep dose-response curve. Further, latent effects from acute exposure can result in unexpected high mortality within fish populations. Given this finding, a conservative approach for deriving protective concentration for vertebrate species appears appropriate (U.S. EPA, 1993a). Ecotoxicity data reporting effects levels for freshwater invertebrates indicate that these receptors are relatively tolerant to TCDD exposures. No effects to reproduction or growth were evident in annelids (*Paranais sp.*), molluscs (*Physa sp.*), and arthropods (*Aedes aegypti*) at 200 ng TCDD/L.

The ecotoxicity database at higher trophic levels of aquatic ecosystems indicated elevated sensitivity in species of mammals and birds also. Studies characterizing the toxicity of TCDD to mink indicated adverse effects to receptors at single doses of 4,200 pg/g body weight with latent mortality occurring 28 days after exposures have ceased. Avian receptors that prey within the aquatic ecosystem, such as the mallard, appear less sensitive than the mink. A single ingestion dose to mallards resulted in an LD_{50} of 15,000 pg TCDD/g body weight after 37 days of observation.

Terrestrial Ecosystems

Terrestrial vertebrate receptors portray similar sensitivities to TCDD exposure. Acute mammalian toxicity occurs in exposure ranges of approximately 2 to 115 µg TCDD/kg body weight following single-dose exposures (Eisler, 1986). In avian receptors characteristic of the terrestrial receptors, lethality (LC_{50}s) ranges from approximately 15 to greater than 810 µg/kg body weight with the Northern bobwhite quail and the domestic chicken being the more sensitive receptors. Ovo injections to developing ring-necked pheasants indicated LD_{50}s of 1,354 to 2,182 pg TCDD/g egg (Nosek et al., 1993). Chronic exposures of 0.001 µg/kg-d to rats indicated no effects to reproductive endpoints after a 2-year duration. Other terrestrial receptors such as plants and earthworms do not indicate sensitivity to TCDD exposure.

IV. Bioaccumulation Potential

A second issue related to the overall impact of TCDD is its ability to be transferred through the food chain to higher trophic levels. Given the lipophilic nature of TCDD, the potential for bioaccumulation and biomagnification is high. TCDD is quickly mobilized into fat tissue where it is minimally metabolized and eliminated. Since vertebrates predominate at higher trophic levels and these receptors appear to be highly sensitive, TCDD poses a significant threat to upper trophic level predators. This section presents biological uptake measures (e.g., BCFs, and BAFs) used to derive protective surface water and soil concentrations for constituents considered to bioconcentrate and/or bioaccumulate in the generic aquatic ecosystems.

Freshwater Ecosystems

Bioaccumulation of TCDD has been widely observed in freshwater systems. The BCFs for algae estimated from tissue residue studies ranged from 300 to 1,200 after 32-day exposures. Duckweed (*Lemna sp.*), a submersed macrophyte, bioconcentrates TCDD also with BCFs reported at approximately 4,000. Bioconcentration has also been indicated in species of aquatic invertebrates. Initially, BCFs were reported at 380 and 1,200 for snails and daphnids, respectively; however, upon exposing the same receptors to lower concentrations of TCDD, higher BCFs were indicated. Following lower exposures, snails indicated BCFs ranging from 1,040 to 2,310 whereas daphnids indicated BCFs from 2,830 to 4,070 (U.S. EPA, 1993a). Early life stage tests of amphibians have also indicated bioconcentration; however, the magnitude is not as high as for other freshwater receptors. Amphibian eggs and tadpoles exposed to TCDD have indicated that bioconcentration factors range from 0.6 to 4 for eggs and 0.7 to 19 for tadpoles. The lower potential for bioaccumulation is probably related to the high elimination rates of TCDD in amphibian species. Once amphibians are removed from surface water contaminated with TCDD, the half-life of TCDD in tissues can range from 1 to 7 days (Jung and Walker, 1997).

Bioaccumulation of TCDD in fish has been extensively documented. The discussion of TCDD bioaccumulation in fish will consistently present bioaccumulation factors on a lipid basis since TCDD is predominantly stored in the adipose tissue of organisms. Bioconcentration factors for fish species range from 81,300 to 4,300,000 L/kg based on surface water exposures (U.S. EPA, 1993a). Continued research suggests that BCFs and BAFs based on surface water concentrations may not be reliable because of interfering substances and minimum detection level in measurement. For extremely hydrophobic constituents, such as TCDD, EPA has stated that reliable measurements of ambient water concentrations (especially dissolved concentrations) are not available for TCDD and that accumulation of these constituents in fish or other aquatic organisms cannot be referenced to a water concentration as required for a BCF or BAF (U.S. EPA, 1993a). Problems in calculating a BCF/BAF occur because TCDD levels below detection can also bioaccumulate in fish even though concentrations of TCDD in the water column cannot be measured. Given these limitations, the accuracy of TCDD measurement and BAF estimation using surface water concentrations may misrepresent actual bioaccumulation. Fortunately, extremely hydrophobic constituents can be measured in sediments and aquatic life and, because these chemicals tend to partition to lipids and organic carbon, a biological uptake factor that reflects the relationship between sediment concentrations and organism concentrations may be more appropriate. Consequently, the biota-sediment accumulation factor (BSAFs) is the preferred metric for accumulation for extremely hydrophobic chemicals (e.g., chemicals with $\geq$ log K_{ow} of ~ 6.5). Concentrations in sediment are more readily measured at detectable levels and can be used to determine BSAFs in freshwater species. BSAFs in fish range from 0.03 to 0.2 kg sediment/kg tissue while invertebrate species indicate BSAFs of 0.48 kg sediment/kg tissue for the sandworm, 0.73 kg sediment/kg tissue for shrimp, and 0.93 for clams (U.S. EPA, 1993a). When partitioning of constituents between sediment particles, pore water, and surface water are accounted for, good correlation between BSAFs and surface-water-derived BAFs is noted.

In freshwater ecosystems, the method used to assess exposure of TCDD to receptors further up the food chain applied BSAFs. Several sources were identified to derive BSAF values representative of fish across the nation. BSAFs in [mg congener/kg LP]/[mg congener/kg

sediment OC] were calculated from measured data identified in the references. A description of the database, scope, and methodology implemented in each report is outlined under each reference.

- *Interim Report on Data and Methods for Assessment of 2,3,7,8- Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife* (U.S. EPA, 1993a)

  This report calculated BSAFs for TCDD based on measured TCDD residues in fish tissues and estimated TCDD sediment concentrations collected in Lake Ontario (U.S. EPA, 1990 as cited in U.S. EPA, 1993a). Five fish species were sampled over a 2-year period. In this study, BSAFs were derived only for TCDD residues in trophic levels 2, 3, and 4 of aquatic receptors. When this report was published, U.S. EPA (1993a) data were the most comprehensive study data available. This study reported that BSAFs varied depending on the age of the species, the primary habitat (i.e., near shore, deep water), and feeding preferences of fish species. Because of the continued loading of TCDD compounds to Lake Ontario, the sediment, surface water, and fish tissue concentrations were not predicted to be at equilibrium. This disequilibrium may underpredict BSAF values. Conversations with Phil Cooke confirmed this uncertainty.

- *Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors* (U.S. EPA, 1995a).

  This document utilized the same data set from the Lake Ontario study for TCDD BSAF derivation along with data collected by Niimi and Oliver (1989). Additional analysis of original samples was undertaken to measure concentrations of other PCDD, PCDF, and PCB in sediments and fish tissues. These data were added to the analysis to determine trophic level 3 BSAFs for fish of multiple dioxin and furan congeners. Because these data were derived from the same sample pool the uncertainties regarding disequilibrium remain.

- CT DEP (Connecticut Department of Environmental Protection). 1992. *Report to the Connecticut General Assembly Department Summary of the Dioxin Monitoring program 1987 to 1991*. Connecticut Department of Environmental Protection.

  Bauer, K. 1992. *Multivariate Statistical Analyses of Dioxin and Furan Levels in Fish, Sediment, and Soil Samples Collected Near Resource Recovery Facilities*. Final Report. Compiled for Connecticut Department of Environmental Protection, Water Compliance Unit. Prepared by Midwest Research Institute. December.

  These documents reported measurements of dioxin and furan congeners in sediment and fish tissue collected in waterbodies in the vicinity of five resource recovery facilities (RRFs). The results were assessed by the State of Connecticut's Department of Environmental Protection to assess whether emissions from RRFs may influence background concentrations of dioxin compounds in ecological receptors and media. Residues of PCDDs and PCDFs were measured in fish, sediment, and soil. Samples were collected over a 4-year period between sites that were grouped as control, preoperational, and operational. The primary objective of the study was to determine whether RRF

incineration would influence PCDD and PCDF levels. The important elements reported in the study were obviously the fish tissue concentrations and the sediment concentrations. The issue of equilibrium is also in question in this study due to the continued loading of dioxin congeners to the waterbodies from facilities operation during the study. However, because the duration of sampling was longer, a greater likelihood of observing levels closer to equilibrium is indicated.

The State of Connecticut values were used to determine food chain exposures to receptors that forage in the freshwater ecosystem. Calculated BSAF values are provided in Section 5.4.1.6. These data were more comprehensive, reporting over 200 fish tissue concentrations in six species and over 150 sediment concentrations for both preoperational and operational sites. Samples were collected from multiple waterbodies surrounding each facility over a 4-year period. Further, the variability in fish lipid content and sediment organic content was characterized by 550 and 343 samples, respectively. Unfortunately, the report pooled the data across sites rather than reporting on a site-specific basis. This prohibited the relative comparison across sites.

Terrestrial Ecosystem

Terrestrial receptors also indicate levels of bioaccumulation; however, data are somewhat limited to adequately characterize the potential for bioaccumulation in mammalian receptors. Bioaccumulation factors and in small mammals have been measured from 0.3 to 7.2 (Sample et al., 1998a). The BCFs in insects and other invertebrates of 1.3 have been reported (Sample et al., 1998b; Abt and Associates, 1993). One specific group of invertebrates, earthworms, which have been more extensively investigated, accumulates TCDD in the range of 5 to 22 kg soil/kg tissue (Sample et al., 1998b). The bioconcentration of TCDD in plant tissues has not been sufficiently characterized. Because TCDD has been associated with acute toxicity, further investigations are required before sufficient data are available to characterize this source of exposure to consuming terrestrial organisms especially herbivores.

V. Criteria Development

Mammals: Murray et al. (1979) exposed three generations of Sprague-Dawley rats to diets containing 0, 0.001, 0.01, or 0.1 µg TCDD/kg-day. At the 0.01 µg/kg-day dose, Murray et al. (1979) observed no effect on fertility among the f_0 rats, but a significant reduction in fertility was observed among the f_1 and f_2 rats. Thus, through three successive generations, the reproductive capacity of rats ingesting TCDD was clearly affected at dose levels of 0.01 and 0.1 µg/kg-day, but not at 0.001 µg/kg-day. This study was selected for benchmark derivation because it consists of a multigenerational exposure scenario that demonstrates a clear dose-response for reproductive effects attributable to TCDD.

Other studies that were considered for benchmark identification include one subchronic study documenting TCDD exposure to mammalian wildlife species. Hochstein et al. (1988) administered TCDD dietary concentrations of 0, 0.001, 0.01, 0.1, 1.0, 10, and 100 ppb to mink for 125 days. While no significant adverse effects were observed on mink fed dietary concentrations of 0.1 ppb or less, mortality was noted in groups fed 1 and 10 ppb. Several studies have documented subchronic and chronic exposure of TCDD to laboratory animals. Khera and Ruddick (1972) (as cited in U.S. EPA, 1995b) assessed the postnatal effect of TCDD on pregnant

Wistar rats. In this experiment, rats were given 0, 0.125, 0.25, 0.5, or 1.0 µg TCDD/kg-day from days 6 through 15 of gestation. Dose-related decreases in the average litter size and pup weight at birth were noted in all but the 0.125-µg/kg-day dose. Bowman et al. (1989a, 1989b) studied the reproductive effects of Rhesus monkeys exposed to diets containing 5 ppt and 25 ppt TCDD for 7 and 24 months. The female monkeys exposed to 25 ppt had a significantly lower Index of Overall Reproductive Success (IORS), while the 5-ppt group did not differ from the control. The 5 ppt was converted to a dose of 0.00013 µg/kg-day using the study's daily allotment of 200 grams of monkey feed and the typical female monkey's body weight outlined in *Recommendations for and Documentation of Biological Values for Use in Risk Assessment* (U.S. EPA, 1988).

The 125-day test performed by Hochstein et al. (1988) was not considered as appropriate for deriving a benchmark since the study was subchronic rather than chronic and the perceived endpoints focus more on mortality than reproductive effects. The Murray et al. (1979) study was chosen over the Khera and Ruddick study (as cited in U.S. EPA, 1995b) because of a lower reported NOAEL for rats. The reproduction study by Bowman et al. (1989a, 1989b) on Rhesus monkeys (which produced a lower NOAEL) was not selected because the Murray et al. (1979) study incorporated a multigenerational exposure regime and contained stronger dose-response information.

The NOAEL of 1.0E-6 mg/kg-d from the Murray et al. (1979) was scaled for species representative of freshwater and terrestrial ecosystems using a cross-species scaling algorithm adapted from Sample et al. (1997)

$$Benchmark_w = NOAEL_t \; x \left(\frac{bw_t}{bw_w} \right)^{1/4}$$

where $NOAEL_t$ is the NOAEL (or LOAEL/10) for the test species, BW_w is the body weight of the wildlife species, and BW_t is the body weight of the test species. This is the default methodology EPA proposed for carcinogenicity assessments and reportable quantity documents for adjusting animal data to an equivalent human dose (57FR 24152). Since the Murray et al. (1979) study documented reproductive effects from TCDD exposure to three generations of male and female rats, the mean male and female body weight for each representative species was used in the scaling algorithm to obtain the toxicological benchmarks.

Data were available on the reproductive, developmental, and growth effects of TCDD. In addition, the data set contained studies that were conducted over chronic and subchronic durations and during sensitive life stages. Most of the studies identified were conducted using laboratory mammals and, as such, interspecies differences among wildlife were not identifiable. Therefore, the data set does not support an uncertainty factor to account for interspecies differences in toxicological sensitivity. The reproductive NOAEL selected from Murray et al. (1979) was within an order of magnitude of the lowest identified NEL or LEL, and, therefore, the benchmarks developed for mammals representative of freshwater and terrestrial ecosystem were categorized as **adequate**.

Birds: In many field studies, reduced reproduction levels in avian species have been correlated to TCDD equivalents; however, the dose-response relationship specific to TCDD itself cannot be determined from the effects of other contaminants. The only identified research investigating the subchronic toxicity of TCDD among avian species was performed by Nosek et al. (1992). Ring-necked pheasants were dosed weekly for 10 weeks by ip injection at an equivalent rate of 0.14, 0.014, and 0.0014 µg TCDD/kg-day (weekly dose was divided by 7 for the equivalent daily dose). Cumulative egg production was significantly reduced among pheasants exposed to 0.14 µg TCDD/kg-day, but not among those pheasants exposed to the two lower doses.

The pheasant reproductive effect NOAEL of 0.014 µg/kg-day for TCDD (Nosek et al., 1992) was used in calculating avian wildlife benchmarks. The Nosek et al. (1992) study demonstrates a clear dose-response to a critical reproductive endpoint and is based on an exposure lasting more than 28 days. This study should be interpreted judiciously since it involves an ip injection rather than an oral route of administration. Assuming 100% absorption from ip injection, the ip exposure route may overestimate the absorption rate of TCDD via oral ingestion by a factor of 1 to 5 depending upon diet composition (Abt & Associates, 1993).

The principles for allometric scaling were assumed to apply to birds, although specific studies supporting allometric scaling for avian species were not identified. Thus, for avian species representative of a freshwater ecosystem, the NOAEL of 0.014 µg/kg-d from Nosek et al. (1992) was scaled using the cross-species scaling method of Sample et al. (1997). Since the Nosek et al. (1992) study documented reproductive effects from TCDD exposure to female pheasants, female body weights for each representative species were used in the scaling algorithm to obtain the toxicological benchmarks. Although there is no formal designation for benchmarks developed from ip exposure route studies, the benchmarks derived from Nosek et al. (1992) were categorized as **interim** based on the absorption uncertainties surrounding the intraperitoneal injection of TCDD to pheasants.

Freshwater Community: Since an AWQC for TCDD was not available and a Secondary Chronic Value (SCV) could not be calculated because of limited ecotoxicity data, a benchmark protective of the freshwater community was not established. Numerous fish studies documenting the effects of chronic TCDD exposure were identified. The rainbow trout is one of the most extensively studied aquatic organisms for effects from TCDD exposure. The lowest identified toxicity values for TCDD exposure to rainbow trout were a 4-day LC_{50} of 1.83 ng/L (U.S. EPA, 1993a) and a LOAEL of 0.038 ng/L based on 45% mortality during a 28-day exposure (Mehrle et al., 1988). Based on the current data set, TCDD appears highly toxic to aquatic organisms. This concern has prompted further research to characterize the toxicity of TCDD in fish and aquatic invertebrates species creating a database sufficient to calculate a Final Chronic Value (FCV) or SCV. A narrative criteria of 0.6 pg/L in surface water has been proposed for fish. This concentration approximates a level at which the potential for adverse effects is low for most fish species. Adverse effects to sensitive fish species are indicated at 1.0 pg/L (U.S. EPA, 1993a).

Algae and Aquatic Plants: The toxicological benchmarks for aquatic plants were either: (1) a no observed effects concentration (NOEC) or a lowest observed effects concentration (LOEC) for vascular aquatic plants (e.g., duckweed) or (2) an effective concentration (EC_{xx}) for a species of freshwater algae, frequently a species of green algae (e.g., *Selenastrum*

capricornutum). Aquatic plant data were not identified for TCDD and, therefore, no benchmark was developed.

Benthic Community: Benchmarks for the protection of benthic organisms were determined using the Equilibrium Partition (EQ_P) method. The EQ_P method uses a Final Chronic Value (FCV) or other chronic water quality measure, along with the fraction of organic carbon and the octanol-carbon partition coefficient (K_{oc}) to determine a chemical concentration that may be present in the sediment while still protecting the benthic community (U.S. EPA, 1993b). The EQ_P number is the best recommendation of a chemical concentration that may be present in the sediment while still protecting the benthic community from harmful effects resulting from possible chemical exposure. Since there is no AWQC, FCV, or SCV, the benchmark for the benthic community was not calculated for TCDD. Preliminary screening values currently being reviewed include the sediment TRV proposed by EPA Region 6 of 0.032 µg 2,3,7,8-substituted dioxin congeners/kg sediment (dry weight). In comparison, recent studies have indicated no adverse effects to amphipods exposed for 10 days to 25 µg TCDD/kg sediment (Barber et al., 1998). Overall these results support previous findings that benthic invertebrates are not acutely sensitive to 2,3,7,8- TCDD exposure. The general consensus among researchers is that insufficient toxicological data are available to develop a community-based sediment criteria for TCDD.

Terrestrial plants: Adverse effects levels for terrestrial plants were identified for endpoints ranging from percent yield to root length. As presented in Efroymson et al. (1997), phytotoxicity benchmarks, were selected by rank-ordering the LOEC values and then approximating the 10^{th} percentile. If there were 10 or fewer values for a chemical, the lowest LOEC was used. If there were more than 10 values, the 10^{th} percentile LOEC was used. Such LOECs applied to reductions in plant growth, yield reductions, or other effects reasonably assumed to impair the ability of a plant population to sustain itself, such as a reduction in seed elongation. However, terrestrial plant studies were not identified for TCDD and, as a result, a benchmark could not be developed.

Soil Community: Adequate data with which to derive a benchmark protective of the soil community were not identified.

Attachment 1. List of Furan and Dioxin Congeners of Ecological Concern

Furans

1, 2, 3, 4, 6, 7, 8-Heptachlorodibenzofuran (1, 2, 3, 4, 6, 7, 8-HpCDF)
1, 2, 3, 4, 7, 8, 9-Heptachlorodibenzofuran (1, 2, 3, 4, 7, 8, 9-HpCDF)
1, 2, 3, 7, 8, 9-Hexachlorodibenzofuran (1, 2, 3, 7, 8, 9-HxCDF)
1,2, 3, 4, 7, 8-Hexachlorodibenzofuran (1,2, 3, 4, 7, 8-HxCDF)
1, 2, 3, 6, 7, 8-Hexachlorodibenzofuran (1, 2, 3, 6, 7, 8-HxCDF)
2, 3, 4, 6, 7, 8-Hexachlorodibenzofuran (2, 3, 4, 6, 7, 8-HxCDF)
1, 2, 3, 7, 8-Pentachlorodibenzofuran (1, 2, 3, 7, 8-PeCDF)
2, 3, 4, 7, 8-Pentachlorodibenzofuran (2, 3, 4, 7, 8-PeCDF)
2, 3, 7, 8-Tetrachlorodibenzofuran (2, 3, 7, 8-TCDF)
Octochlorodibenzofuran (OCDF)

Dioxins

1,2, 3, 4, 6, 7,8- Heptachlorodibenzodioxin (1, 2, 3, 4, 6, 7,8- HpCDD)
1, 2, 3, 4, 7, 8-Hexachlorodibenzodioxin (1, 2, 3, 4, 7, 8-HxCDD)
1, 2, 3, 6, 7, 8-Hexachlorodibenzodioxin (1, 2, 3, 6, 7, 8-HxCDD)
1, 2, 3, 7, 8, 9-Hexachlorodibenzodioxin (1, 2, 3, 7, 8, 9-HxCDD)
1, 2, 3, 7, 8-Pentachlorodibenzodioxin (1, 2, 3, 7, 8-PeCDD)
2, 3, 7, 8-Tetrachlorodibenzodioxin (2, 3, 7, 8-TCDD)
Octochlorodibenzodioxin (OCDD)

References

Abt (Abt Associates, Inc.). 1993. *Revision of Assessment of Risks to Terrestrial Wildlife from TCDD and TCDF in Pulp and Paper Sludge*. Prepared for U.S. Environmental Protection Agency, Office of Pollution Prevention and Toxics, by Abt Associates, Inc., Bethesda, MD.

Barber, T.R., D.J. Chappie, D.J. Duda, P.C. Fuchsman, and B.L. Finley. 1998. Using a spiked sediment bioassay to establish a no-effect concentration for dioxin exposure to the amphipod *Ampelisca abdita*. *Environmental Toxicology and Chemistry* 17(3):420-424.

Bauer, K.M. 1992. *Multivariate Statistical Analyses of Dioxin and Furan Levels in Fish, Sediment, and Soil Samples Collected Near Resource Recovery Facilities. Final Report.* Prepared for Connecticut Department of Environmental Protection. Midwest Research Institute, Kansas City, MO.

Bowman, R.E., S.L. Schantz, M.L. Gross, and S.A. Ferguson. 1989a. Behavioral effects in monkeys exposed to 2,3,7,8-TCDD transmitted maternally during gestation and four months of nursing. *Chemosphere* 18(1-6):235-242.

Bowman, R.E., S.L. Schantz, N.C.A. Weerasinghe, M.L. Gross, and D.A. Barsotti. 1989b. Chronic dietary intake of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) at 5 or 25 parts per trillion in the monkey: TCDD kinetics and dose-effect estimate of reproductive toxicity. *Chemosphere* 18(1-6):243-252.

CT DEP (Connecticut Department of Environmental Protection). 1992. *Report to the Connecticut General Assembly Department Summary of the Dioxin Monitoring Program 1987 to 1991*. As cited in Bauer, 1992.

Efroymson, R.A., M.E. Will, G.W. Suter, II, and A.C. Wooten. 1997. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. ES/ER/TM-85/R3. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Lockheed Martin Energy Systems, Inc., Oak Ridge, TN.

Eisler, R. 1986. Dioxin hazards to fish, wildlife, and invertebrates: a synoptic review. In: *Contaminant Hazard Reviews, Report No. 8*. U.S. Fish and Wildlife Service, U.S. Department of the Interior, Laurel, MD.

Hochstein, J.R., R.J. Aulerich, and S.J. Bursian. 1988. Acute toxicity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin to mink. *Archives of Environmental Contamination and Toxicology* 17:33-37.

Jung, R.E., and M.K. Walker. 1997. Effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) on development of anuran amphibians. *Environmental Toxicology and Chemistry* 16(2):230-240.

Khera, K.S., and J.A. Ruddick. 1973. Polychlorodibenz-*p*-dioxins: perinatal effects and the dominant lethal test in wistar rats. In: *Chlorodioxins - Origin and Fate. A Symposium Sponsored by the Division of Pesticide Chemistry at the 162nd Meeting of the American Chemical Society,* E.H. Blair (ed.), 8th Edition. pp. 70-84. American Chemical Society, Washington, DC. September 16-17, 1971.

Mehrle, P.M., D.R. Buckler, E.E. Little, L.M. Smith, J.D. Petty, P.H. Peterman, D.L. Stalling, G.M. De Graeve, J.J. Coyle, and W.J. Adams. 1988. Toxicity and bioconcentration of 2,3,7,8-tetrachlorodibenzodioxin and 2,3,7,8,-tetrachlorodibenzofuran in rainbow trout. *Environmental Toxicology and Chemistry* 7:47-62.

Murray, F.J., F.A. Smith, K.D. Nitschke, C.G. Humiston, R.J. Kociba, and B.A. Schwetz. 1979. Three-generation reproduction study of rats given 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in the diet. *Toxicology and Applied Pharmacology* 50:241-252.

Niimi, A.J., and B.G. Oliver. 1989. Assessment of the relative toxicity of chlorinated dibenzo-p-dioxins, dibenzofurans, and biphenyls in Lake Ontario salmonids to mammalian systems using toxic equivalent factors (TEFs). *Chemosphere* 18(7/8):1413-1423.

Nosek, J.A., S.R. Craven, J.R. Sullivan, S.S. Hurley, and R.E. Peterson. 1992. Toxicity and reproductive effects of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in ring-necked pheasant hens. *Journal of Toxicology and Environmental Health* 35:187-198.

Nosek, J.A., J.R. Sullivan, S.R. Craven, A. Gendron-Fitzpatrick, and R.E. Peterson. 1993. Embryotoxocity of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin in the ring-necked pheasant. *Environmental Toxicology and Chemistry* 12:1215-1222.

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter, II, and C.J.E. Welsh. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*. ORNL/TM-13391. Prepared for Office of Environmental Policy and Assistance, U.S. Department of Energy. Prepared by Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1998a. *Development and Validation of Bioaccumulation Models for Small Mammals*. ES/ER/TM-219. Prepared for Office of Environmental Management, U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter, II, and T.L. Ashwood. 1998b. *Development and Validation of Bioaccumulation Models for Earthworms*. ES/ER/TM-220. Prepared for Office of Environmental Management, U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN.

U.S. EPA (Environmental Protection Agency). 1988. *Recommendations for and Documentation of Biological Values for Use in Risk Assessment*. EPA/600/6-87/008. Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA (Environmental Protection Agency). 1990. *Assessment of Risks from Exposure of Humans, Terrestrial, and Avian Wildlife, and Aquatic Life to Dioxins and Furans from Disposal and Use of Sludge from Bleached Kraft and Sulfite Pulp and Paper Mills*. EPA-560-/5-90-013. Prepared by Abt Associates, Inc., for the Office of Pesticides and Toxic Substances, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1993a. *Interim Report on Data and Methods for Assessment of 2,3,7,8-Tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife*. EPA/600/R-93/055. Office of Research and Development, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1993b. *Technical Basis for Deriving Sediment Quality Criteria for Nonionic Organic Contaminants for the Protection of Benthic Organisms by Using Equilibrium Partitioning*. EPA-822-R-93-011. Office of Water, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1995a. *Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors*. EPA-820-B-95-005. Office of Water, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1995b. *Great Lakes Water Quality Initiative Criteria Documents for the Protection of Wildlife: DDT, Mercury, 2,3,7,8-TCDD, and PCBs*. EPA-820-B-95-008. Office of Water, Washington, DC.

Ecotoxicological Profile for Ecological Receptors

Lead

This ecotoxicological profile on lead contains five sections: (1) background (e.g., background concentrations), (2) geochemistry of the constituent in various ecological media, (3) effects characterization, (4) bioaccumulation potential, and (5) criteria development. The first four sections are intended to provide an overview of the environmental factors that influence the toxicological potential of lead so that the limitations of the criteria may be better understood. The fifth section presents the rationale and development of criteria for the suite of ecological receptors used to represent aquatic and terrestrial ecosystems. This profile is intended to present the ecotoxicological criteria in a broader environmental context, so the ecological significance of the criteria may be properly interpreted.

I. Background

Lead is a nonessential, highly toxic heavy metal for which all known effects on biological systems are deleterious. Lead is present in low concentrations throughout the environment as a result of geologic weathering, with an average abundance in the earth's crust of 16 ppm. Human activities have resulted in a widespread increase in lead residues in the environment. In soils, natural background concentrations are generally on the order of 10 to 30 ppm, but, near lead emissions sources such as roadways, concentrations of up to 2,000 ppm have been found.

Naturally occurring lead has three oxidation states: elemental (0), divalent (+2), and tetravalent (+4). In its inorganic forms, lead is found primarily in the divalent state. Organolead compounds, the most important of which are tetramethyl and tetraethyl lead, are formed predominantly by lead in the tetravalent state, and are considered to be the more toxic forms. In most of its forms, except for some lead salts, lead is relatively insoluble in water and tends to accumulate in sediments. The majority of lead ingested by biota is rapidly egested (Eisler, 1988). Inhaled lead, though, is absorbed quickly by blood (ATSDR, 1997). Lead does bioconcentrate, and older organisms tend to have the highest body burdens. Biomagnification of lead in the food chain, though, has been found to be negligible (Eisler, 1988).

II. Geochemistry of Lead in Various Ecological Media

Lead in Soils

- Lead speciation in soils is dependent on physico-chemical processes including adsorption, precipitation, and complexation.
- Most lead in soils is strongly sorbed to organic matter and very little is transported to surface or groundwater.

The speciation of lead in soils is dependent on physicochemical processes including adsorption, precipitation, and complexation with solid and aqueous inorganic and organic phases within the soil. These processes are themselves determined by such factors as soil pH, organic matter concentrations, lead concentrations, and the presence of other inorganic components (NSF, 1977, cited in ASTDR, 1997). The atmospheric deposition rate for lead is the primary factor defining its accumulation in most soils (ASTDR, 1997).

Most of the lead in soils is strongly sorbed to organic matter and very little is transported to surface water or ground water (ASTDR, 1997). Ion exchange processes with hydrous oxides or clays, or chelation with humic or fulvic acids can remove lead from solution in soil (Olson and Skogerboe, 1975, cited in ASTDR, 1997). In soils with pH $\geq$ 5 and $\geq$ 5% organic matter content, atmospheric lead is retained within the uppermost 2-5 cm of undisturbed soil (ASTDR, 1997). In soils with pH 6-8 and a high organic matter content, lead can form insoluble organo-complexes. Within the same pH range but with a lower organic matter content, hydrous lead oxide complexes may form or lead may precipitate out with carbonate or phosphate ions (ASTDR, 1997). At lower pHs of 4-6 organo-lead complexes may be soluble (U.S. EPA, 1986, cited in ASTDR, 1997).

Lead in Surface Waters

- The behavior of lead is primarily controlled by the balance between complexation with dissolved organic matter and association with SPM and colloids.
- In a study of three U.S. rivers, lead was found to be partitioned between particulate, colloidal, and "truly" dissolved phases. Partitioning between filter-retained and filtrate lead showed a dependence on the concentration of total SPM.

A review of trace elements in rivers by Hart and Hines (1995) tabulated typical dissolved (i.e., <0.4 μm) lead concentrations ranging from 87 to 1,800 ng/l. The behavior of lead in rivers is primarily controlled by the balance between complexation with dissolved organic matter and association with suspended particulate matter (SPM) and colloidal matter (Hart and Hines, 1995). Particles settling through surface waters can control the behavior of elements such as lead that are removed from the dissolved phase (usually < 0.4 μm) by forming nuclide/particle surface site complexes (Santschi, 1988 and references therein). Reactions with dissolved and particulate organic carbon can also regulate the concentration of organically complexed elements such as lead. These reactions can be particularly important in coastal waters that have high organic loadings and in estuarine environments that have large ionic strength gradients (Santschi, 1988).

Benoit (1995) determined lead concentrations in fresh water from three rivers in the northeast United States and investigated the relationship between lead in particulate, colloidal, and "truly" dissolved (i.e., occurring as individual solvated ions) phases. Partitioning between (0.45 μm) filter-retained and filtrate (< 0.45 μm) fractions exhibited a dependence on the concentration of total suspended solids (Benoit, 1995). This phenomenon, called the particle concentration effect, can be explained by the contribution of lead bound to colloids, which are included in the filter-passing fraction of conventionally "dissolved" trace elements (Benoit, 1995 and references therein). Benoit (1995) calculated the "true" partition coefficient for lead to be greater than $10^{7.4}$ (compared to partition coefficients of ~10^5 to 10^8 for filter retained/filtrate lead), indicating that truly dissolved lead concentrations were extremely low.

Lead in Sediments

In anaerobic lake sediments, relatively volatile organo- (tetramethyl) lead may form through biological alkylation of organic and inorganic lead compounds (U.S. EPA, 1979, cited in ASTDR, 1997).

III. Effects Characterization

This section, along with the bioaccumulation potential section, is subdivided to evaluate receptors of the freshwater and terrestrial ecosystems separately. Figure J-1 summarizes the range of effects data for receptors of concern illustrating the sensitivity of various taxa to exposure. For reference, the water quality standards for freshwater communities (NAWQC or secondary values) are included for both acute and chronic endpoints. These values can be disregarded for receptors in the terrestrial community, because the NAWQC only provides protection for aquatic receptors not predators of aquatic biota. NAWQC provide a context for effects ranges in the aquatic community.

Freshwater Ecosystem

Lead is toxic to aquatic biota, though effects are significantly modified by various factors. Waterfowl suffering from lead intoxication exhibit symptoms such as lethargy and emaciation (chemical form unknown). In birds, death usually is indirectly caused by starvation and vulnerability to predation (Eisler, 1988). Acute exposures of lead to aquatic invertebrates and fish of 1 to 500 mg/L have lethal effects; chronic exposures of 0.007 to 0.020 mg/L can have lethal effects (chemical form unknown) (Demayo et al., 1982). Aquatic invertebrate species in general show a wide range of sensitivity to lead exposures (Demayo et al., 1982). Some studies have found populations that have acclimated to high levels of lead (Demayo et al., 1982). Evidence suggests that populations growing in water with lead concentrations greater than 0.08 mg/L are sensitive to episodic acute exposures, as found in industrial discharges and mining discharges (Demayo et al, 1982). Chronic exposures of 0.019 mg/L have been found to increase mortality rate in the marsh snail *(Lymnaea palustris)* (Demayo et al., 1982). Adverse effects on daphnid reproduction have been observed at 0.001 mg Pb^{2+}/L (Eisler, 1988). In fish, lethal solutions of lead promote the formation of increased mucus, which coagulates over the entire body and gills, resulting in eventual suffocation (Eisler, 1988b). Developmental defects are reported in rainbow trout at levels of 7.6 µg/L for a 19-month exposure period (Davies et al., 1976). Effects of lead poisoning in amphibians include the alteration of blood chemistry,

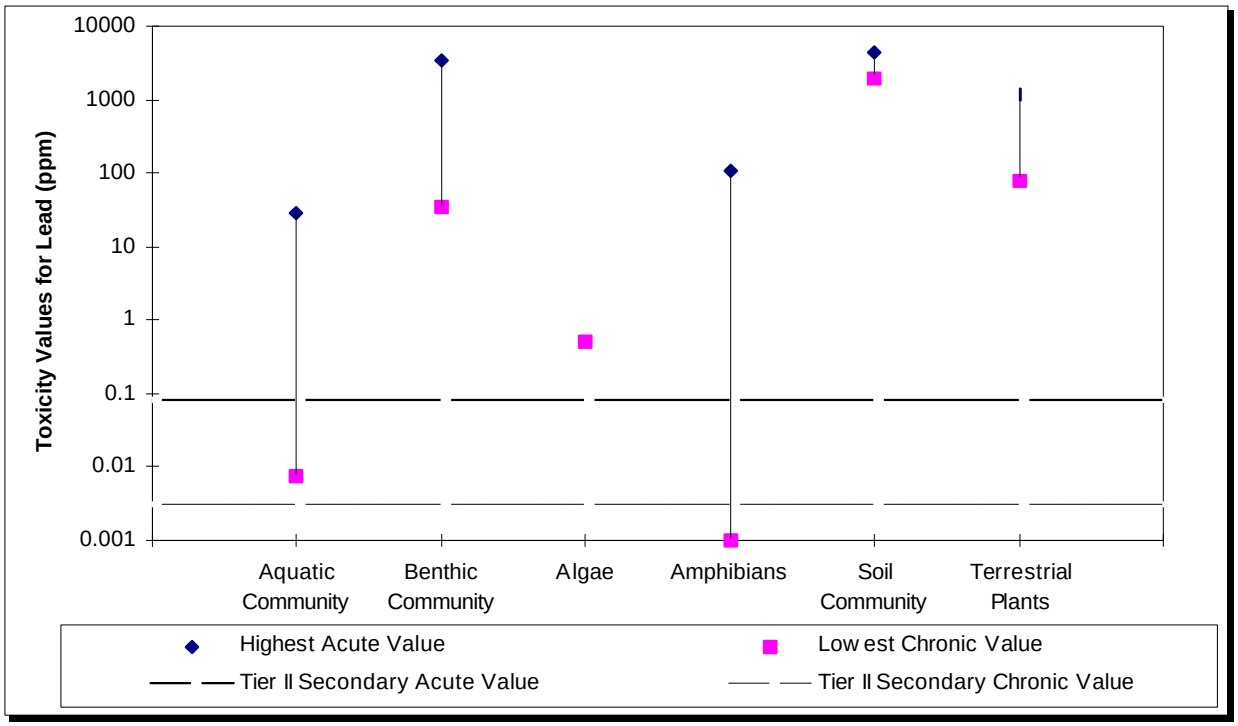

Figure J-1. Lead: effects ranges for selected ecological receptors.

sluggishness, vision impairment, and sloughing of skin (Eisler, 1988; Pain, 1995). Exposure of embryonic toads, *Xenopus laevis*, to static concentrations of 0.001 mg/L resulted in deformation of 82% of the population and 18% mortality, whereas 10 mg/L resulted in 100% mortality (Power et al., 1989).

Terrestrial Ecosystem

Lead acts at the molecular level to inhibit enzymes necessary for normal biological function in a variety of biota. In mammals, lead toxicity may affect the hematological system, the brain and nervous system, learning and behavior, and reproduction (Pain, 1995). In cattle, studies suggest that acute sublethal or lethal poisoning generally occurs at doses of 5 to 7 mg/kg-day (Pain, 1995). Decreases in survival rates in mice have been reported at drinking water exposures of 5 mg/L (Demayo et al., 1982). In rats, oral doses of 0.01 to 0.02 mg/kg-day have been associated with reproductive impairment and neurological problems (Hilderbrand et al., 1973 ; Krasovskii et al., 1979). Lead may also weaken an organism's immune system, even when no other signs of lead toxicity are observed (Pain, 1995). In birds, reproductive and developmental effects include decreases in egg production at 1.53 mg/kg-day oral exposures in Japanese quail and inhibited growth rates at 125 mg/kg-day in the American kestrel (Edens and Garlich, 1983; Pain, 1985).

Damage to plants with elevated lead contents is often negligible, but does vary among species (Eisler, 1988). Lead can have deleterious effects on plants at current lead levels in urban areas (Eisler, 1988). The decline of some European spruce forests has been attributed to

excessive concentrations of atmospheric lead (Pain, 1995). Reported effects include inhibition of plant growth and reductions in pollen germination, seed viability, and rates of photosynthesis and transpiration (Pain, 1995).

IV. Bioaccumulation Potential

Freshwater Ecosystems

Lead inhibits photosynthesis and ATP synthesis in plants and has been found to affect algal growth (Demayo et al., 1982). When grown in a diluted nutrient medium in the presence of 0.1 mg Pb/L, algal growth was reduced by 64%. Water quality parameters (e.g., pH) may all affect aquatic plants' sensitivity to lead (Demayo et al., 1982). Lead is bioconcentrated by aquatic organisms, but there is little evidence of biomagnification through the food chain (ATSDR, 1997). Lead concentrations tend to decrease with increasing aquatic trophic level, with the highest levels found in benthic organisms and algae and the lowest in upper trophic level predators (Eisler, 1988). A bioaccumulation factor (BAF) of 45.7 L/kg for fish was used to predict food chain exposures for piscivorous mammals and birds (unspecified chemical form) (Stephan, 1993). The value is based on a whole-body measured BAF of bluegill sunfish (*Lepomis macrochirus*).

Terrestrial Ecosystems

Sufficient data were not identified to determine bioconcentration factors (BCFs) for terrestrial vertebrates or terrestrial invertebrates. The uptake factors of soil to worm of 4.0E-2, and 3.0E-2 (kg soil/kg tissue) were used to arrive at a geometric mean of 3.5E-2 kg soil/kg tissue. These values are the ratios of lead in the earthworm, *Eisenia foetida*, to the concentration in sludge (Hartenstein et al., 1980). Davies (1983) reported values of 0.01 to 2.7 kg soil/kg tissue; however, the study from Davies (1983) was not used because the soil and sludge applied to the earthworms contained multiple chemical stressors. A soil-to-whole plant uptake value of 4.5E-2 was taken from an empirical study of lead uptake in natural forage; it is calculated by multiplying the plant uptake slope by a factor to convert the plant uptake slope to (µg constituent/g-plant tissue)/(kg-constituent/g-soil) (U.S. EPA, 1992).

V. Criteria Development

The benchmark values presented in this section for mammals and birds were used to derive protective media-specific criteria as outlined in the stressor-response profile methodology (i.e., analysis phase of ERA). By scaling the benchmark study by body weight to a representative wildlife receptor (e.g., rat study extrapolated to a shrew) and determining the dietary preferences of wildlife receptor and the potential bioconcentration in prey, a protective concentration (i.e., criteria) in soil, plants, or surface water was developed. Since criteria for receptors other than mammals and birds were already in media concentrations, this same derivation process was not required. A summary of criteria is provided in Table J-1. Although criteria were developed for numerous wildlife receptors of both the aquatic (e.g., otter, mink, and great blue heron) and terrestrial ecosystems (e.g. shrew, fox, and hawk), only the lowest criterion is presented in Table J-1. It is assumed that by protecting the more sensitive species, the other receptors are protected as well.

Table J-1. Lead Criteria in Soil, Sediment, Surface Water, and Plant Tissue Developed for Each Representative Receptor

Receptor	Criteria	Units	Exposure Pathway	Representative Species	Reference
Aquatic					
Mammals	3.0E-04	mg/L water	Food web	River Otter	Krasovskii et al., 1979
Birds	9.0E-04	mg/L water	Food web	Kingfisher	Edens and Garlich, 1983
Algae and Aquatic Plants	5.0E-01	mg/L water	Direct contact	*Chlorella vulgaris* and others	Suter and Tsao, 1996
Freshwater Community					
Total	3.2E-03	mg/L water	Direct contact	Aquatic biota	U.S. EPA, 1985
Dissolved	2.5E-03	mg/L water	Direct contact	Aquatic biota	U.S. EPA, 1985; 60FR22229
Benthic Community	3.0E+01	mg/kg sediment	Direct contact	Benthos	MacDonald, 1994
Amphibians (acute effects)	2.1E+00	mg/L water	Direct contact	Various amphibian species	Power et al., 1989; Schuytema and Nebekar, 1996
Terrestrial					
Mammals	4.7E-01*	mg/kg soil	Food web	Raccoon	Krasovskii et al., 1979
Birds	1.6E-01*	mg/kg soil	Food web	American woodcock	Edens and Garlich, 1983
Mammals	2.4E-02	mg/kg plant tissue	Food web	Meadow vole	Krasovskii et al., 1979
Birds	2.9E-01	mg/kg plant tissue	Food web	Northern bobwhite	Edens and Garlich, 1983
Plant Community	5.0E+01	mg/kg soil	Direct contact	Sycamore, red oak	Efroymson et al., 1997
Soil Community	2.8E+01	mg/kg soil	Direct contact	Soil invertebrates	a

* This criterion should not be used because it is below soil background concentrations (lowest mean background concentration 16 mg lead/kg soil) . This may be an artifact of our backcalculation method (i.e., calculating media-specific criteria from the benchmark study).

[a] Bengtsson et al., 1985; Bengtsson et al., 1986; Denneman and van Straalen, 1991; Marigomez et al., 1986; van de Meent et al., 1990.

Mammals: Numerous studies were identified that addressed the effects of lead in mammals. In an experiment lasting 20 to 30 days, rats were administered lead in oral doses of 0.05, 0.005, and 0.0015 mg/kg-d (Krasovskii et al., 1979). Impairment of the functional capacity of the male rat's spermatozoa was observed in rats receiving the maximum dose of 0.05 mg/kg-day. The gonadotoxic effects at 0.05 mg/kg-day resulted in an inferred NOAEL of 0.005 mg/kg-day. In another experiment in the same study, male and female rats were given the same doses of lead as above for 6 to 12 months. Neurological deficits, including disruption of conditional responses and motor activity, were observed at 0.05 and 0.005 mg/kg-day.

The NOAEL for gonadotoxic effects from the Krasovskii et al. (1979) study was chosen to derive the toxicological benchmark for the following reasons: (1) doses were administered over a chronic duration and via oral ingestion, an ecologically significant exposure pathway; (2) it focused on irregularities in the male rat's reproductive system as a critical endpoint; (3) it contained dose response information; and (4) it resulted in the lowest toxicity value for a critical endpoint.

In another investigation, dogs that were given a single dietary dose of 0.32 mg/kg-day for an unspecified period of time exhibited clinical signs of chronic lead toxicity (Demayo et al., 1982). Also, Hilderbrand et al. (1973) treated male and female rats with oral doses of lead of 5 and 100 µg/day for 30 days. Gonadotoxic effects in both the male and female rats were observed at the 100-µg/day dose resulting in an inferred NOAEL of 5 µg/day. To obtain the NOAEL as a daily dose, the reported dose was divided by the geometric mean (0.235 kg) of the male and female rats' reported body weights, resulting in a daily dose of 0.02 mg/kg-day.

The study by Hilderbrand et al. (1973) was not selected for the derivation of a benchmark because it did not report the lowest toxicity value for a critical endpoint. The Demayo et al. (1982) study was not chosen because of the absence of sufficient dose-response information and lack of critical endpoints.

The same surrogate-species study (Krasovskii et al., 1979) was used to derive the lead benchmark for mammalian species representing the terrestrial ecosystem.

Birds: There were several studies that investigated the effects of lead toxicity on birds. In a series of experiments, Edens and Garlich (1983) monitored the egg production of chickens and Japanese quail. Results showed that Japanese quail are more sensitive than chicken hens. When the lowest dose of 1 mg Pb/kg feed was administered for 5 weeks from day of hatch, egg production in Japanese quail was significantly reduced. This resulted in a reported LOAEL of 1 mg/kg-feed. This corresponds to a daily dose of 0.21 mg/kg-day based on a body weight value of 0.150 kg and a food intake value of 0.031 kg/day, both obtained from the study. In the absence of an experimental NOAEL, the NOAEL used is extrapolated from LOAEL of 0.21 mg/kg-day by a factor of 10 to arrive at an estimated NOAEL of 0.021 mg/kg-day.

The LOAEL reported by Edens and Garlich (1983) for Japanese quail was selected to derive the avian benchmark value for the freshwater ecosystem. This study was chosen for the following reasons: (1) doses were administered via oral ingestion, an ecologically significant exposure pathway; (2) it focused on reproductive toxicity as a critical endpoint; (3) it contained dose response information; and (4) it resulted in the lowest toxicity value for a critical endpoint.

Growth rate suppression occurred in chickens exposed to 1,850 ppm of dietary lead for 4 weeks (Franson and Custer, 1982). Conversion of this dose into units of mg/kg-day required the use of an allometric equation for chickens (U.S. EPA, 1988):

$$Food\ consumption\ (kg/day) = 0.075(W^{0.8449})$$

where W is body weight in kilograms. Based on the geometric mean of reported body weights of 0.110 kg for the control birds and the derived food consumption rate of 0.012 kg/day, the 1,850-ppm dose corresponds to a daily dose of 202 mg/kg-day. In another study, American kestrels exposed to doses of 10 and 50 ppm for 6 months exhibited no impairment of survival, egg laying, fertility, or eggshell thickness, suggesting a NOAEL of 50 ppm (Pattee, 1984). Conversion of this dose into units of mg/kg-day required the use of an allometric equation for birds (Nagy, 1987):

$$Food\ consumption\ (g/day) = 0.648(W^{0.651})$$

where W is body weight in grams. Using a reference kestrel body weight of 120 g (U.S. EPA, 1993) and a calculated food consumption rate of 15 g/day, the 50-ppm dose was converted to a daily dose of 6.3 mg/kg-day. In another study, Pain (1985) examined the growth of 1-day-old American kestrel nestlings exposed orally to 25, 125, and 625 mg/kg-day of dietary lead. The authors reported a NOAEL of 25 mg/kg-day and a LOAEL of 125 mg/kg-day.
The other studies mentioned above were not selected, either because they did not focus on a reproductive endpoint or because they lacked sufficient dose-response information.

Freshwater Community: Two sources were evaluated in selecting criteria for the protection of aquatic biota: (1) Final Chronic Values (FCV) derived under the Great Lakes Water Quality Initiative (GLWQI) (U.S. EPA, 1995) and (2) National Ambient Water Quality Criteria (NAWQC) published by the EPA Office of Water. The FCV of 3.2E-03 mg/L for lead and developed under the NAWQC was selected as the appropriate criteria to use in this analysis because no criteria were available for lead under GLWQI work (U.S. EPA, 1985). The GLWQI value was considered preferable to the NAWQC because: (1) the GLWQI value is based on the same methodology used to develop NAWQC (i.e., Stephan et al., 1985); (2) the NAWQC data set was augmented with previously unavailable acute and chronic toxicity data; and (3) species taxa used to generate the GLWQI values are suitable for national application since they include species and taxa found throughout the United States. But lacking the GLWQI value for lead, the NAWQC was used. It should be noted that the toxicity of lead is hardness dependent; therefore, the FCV (in µg/L) was calculated using the following equation (U.S. EPA, 1995), assuming a water hardness of 100 mg/L as calcium carbonate ($CaCO_3$):

$$e^{(1.273(\ln hardness)-4.705)}.$$

Although total concentrations of metals are still deemed scientifically defensible by EPA, recent EPA guidance recommends the use of dissolved metal concentrations to better reflect the bioavailability of metals (e.g., Prothro, 1993). Consequently, the FCV for lead was adjusted to provide dissolved concentrations as described in 60 FR 22231 (*Water Quality Standards...Revision of Metals Criteria*). The lead FCV was adjusted using a conversion factor (CF) of 0.791 for chronic effects to give a dissolved surface water criterion of 2.5E-03 mg/L.

This adjustment reflects the current EPA position on criteria development and regulatory application of metals; however, the issue of metal bioavailability in surface waters is the topic of intensive research (e.g., Bergman and Dorward-King, 1997). For example, the relationship between water characteristics (e.g., dissolved organic matter), copper bioavailability, and toxicity has been investigated in some detail (e.g., Allen and Hansen, 1996). For completeness, the total and dissolved surface water criteria are presented in Table 1 even though the values are identical.

Amphibians: No suitable subchronic or chronic studies were identified for criteria development that studied the effects of lead toxicity on reproductive or developmental endpoints in amphibian species. The variability between experimental designs and test endpoints made consistent comparisons between chronic data prohibitive; however, both acute and chronic data were identified to characterize the toxicity of lead to amphibian species. Review of data collected from six experiments indicate that the acute toxicity of lead ranges from 0.04 to 105 mg/L, with a geometric mean of 2.1 mg/L. Acute and chronic studies were conducted on various amphibian species (i.e., 11 amphibian species represented) during embryo, tadpole, and adult lifestages. Developmental deformities were noted in embryos of *Xenopus laevis* exposed to lead concentrations of 1 to 3 mg lead/L. Other behavioral responses to lead exposure are indicated at concentrations ranging from 0.5 to 1 mg lead/L The observation that the lowest acute amphibian value approximates (i.e., within a factor of 2) the FAV of 0.082 mg lead/L determined for the freshwater community indicates that a large percentage of amphibian species may be protected at concentrations protective of the aquatic community. Investigations are ongoing to review the possibility of incorporating amphibian data into the NAWQC. Since amphibian species are more likely to breed in standing waters such as wetlands or ponds, the appropriateness of combining protective levels of amphibian receptors and the freshwater community is unclear at this time (Power et al., 1989; Schuytema and Nebekar, 1996).

Algae and Aquatic plants: Relevant endpoints for aquatic plants focused on the ability of plants to support higher trophic levels as well as the ability to provide habitat for other species in the freshwater ecosystem. The benchmarks for aquatic plants were either: (1) a no observed effects concentration (NOEC) or a lowest observed effects concentration (LOEC) for vascular aquatic plants (e.g., duckweed) or (2) an effective concentration (EC_{xx}) for a species of freshwater algae, frequently a species of green algae (e.g., *Selenastrum capricornutum*). For lead, the benchmark value was determined to be 5.0E-01 mg/L based on the growth inhibition of *Chlorella vulgaris*, *Scenedesmus quadricauda*, and *Selenastrum capricornutum* (Suter and Tsao, 1996). Moderate confidence is placed in this criterion since it is only based on several studies.

Benthic Community: The premier source of field sediment data is the National Oceanic and Atmospheric Administration (NOAA), which annually collects and analyzes sediment samples from sites located in coastal marine and estuarine environments throughout the United States as part of the National Status and Trends Program (NSTP). From the range of adverse effects data, criteria are developed estimating the 10th percentile effects concentration (ER-L) and a median effects concentration (ER-M) for adverse effects in the sediment community (Long et al., 1995). These values are not NOAA standards; rather, they are used to rank sites based on the potential for adverse ecological effects. A second criteria document evaluated for sediment criteria development was the *Approach to the Assessment of Sediment Quality in Florida Coastal Waters Volume 1- Development and Evaluation of Sediment Quality Assessment Guidelines)* (MacDonald et al., 1994) published by the Florida Department of Environmental Protection

(FDEP). The criteria developed by FDEP were also based on the NOAA data; however, the method of derivation of the criteria was changed. FDEP calculated the criteria (i.e., threshold effects level, TEL) from the geometric mean of the 50th percentile of no effects data and the 15th percentile of the low effects data. The NOAA data, used in both documents, are based on total metal concentrations in sediments, and the toxicity endpoints were measured on species of amphipods, arthropods, and bivalves in addition to a variety of community-based endpoints (e.g., abundance, mortality, species composition, species richness). The FDEP criterion was chosen above the NOAA criterion for the following reasons; (1) the same database was used for both the NOAA criteria and the FDEP criteria development, only different derivation methods were used; (2) in most cases, the FDEP criterion was more conservative than the NOAA criteria because a larger portion of the low effects data was used in benchmark development; and (3) the marine TELs developed by the FDEP were found to be analogous to TELs observed in freshwater organisms (Smith et al., 1996).

The criterion for lead was derived from 402 toxicity data points for low and no effects levels. For the screening level analysis of lead, the TEL of 3.0E+01 mg lead/kg sediment was selected as an appropriate sediment criterion. Based on the quality and quantity of lead sediment data, the degree of confidence in the TEL value for lead was considered high (MacDonald, 1994).

Terrestrial Plants: As presented in Efroymson et al. (1997), phytotoxicity benchmarks were selected by rank-ordering the lowest observable effects concentration (LOEC) values and then approximating the 10th percentile. If fewer than 10 studies were available, the lowest LOEC was selected as the benchmark. Such LOECs applied to reductions in plant growth, yield, or seed elongation, or other effects reasonably assumed to impair the ability of a plant population to sustain itself. The selected benchmark for phytotoxic effects of lead in soils is 50 mg lead/kg soil (Efroymson et al., 1997). The derivation of the criterion is based on 17 phytotoxicity data points on various agricultural (e.g., barley, ryegrass) and silverculture (e.g., spruce) species measuring growth endpoints such as height and weight of shoots and roots, yield, and germination success. Considering this criterion was based on multiple studies over a range of species, confidence in this benchmark is high.

Soil Community: A community-based soil criteria was developed for lead using the methods presented in section 9.2.2.2 of the background document. The ecotoxicity data applied to the method are presented in Table J-6.

The value generated from this method resulted in a soil criterion of 28 mg lead/kg soil. This value, developed from no effect concentrations to various soil-based organisms, is more appropriate than criteria based on a single soil species such as earthworms. The criterion was derived to protect 95% of the species in the soil community providing protection to the long-term sustainability of a functioning soil community. Because five studies were used to derive this criteria, confidence in this criterion is moderate.

Table J-6. Data Set Used to Derive Soil Fauna Benchmark for Lead

Species	LOEC/ NOEC	Endpoint	Soil concentration (mg/kg)	Geometric mean (mg/kg)	Taxonomic grouping	Reference
Platynothrus peltifer	NOEC	reproduction	252		group 2	Denneman and van Straalen, 1991
Onychiurus armatus	NOEC	growth & reproduction	643		group 4	Bengtsson et al., 1985
Lumbricus rubellus	NOEC NOEC	reproduction growth	241 1133	523	group 5	van de Meent et al., 1990 van de Meent et al., 1990
Dendrobanea ribida	NOEC NOEC	reproduction reproduction	797 803	800	group 6	Bengtsson et al., 1986 Bengtsson et al., 1986
Porcellio scaber	NOEC	reproduction	23.4		group 7	van de meent et al., 1990
Arion ater	NOEC	litter breakdown	586		group 8	Marigomez et al., 1986

References

Allen, H.E., and D.J. Hansen. 1996. The importance of trace metal speciation to water quality criteria. *Water Environ Res* 68(1):42-54.

ATSDR (Agency for Toxic Substances and Disease Registry). 1997. *Toxicological Profile for Lead* (Update). Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA.

Bengtsson, G., T. Gunnarsson, and S. Rundgren. 1985. Influence of metals on reproduction, mortality and population growth in *Onychiurus armatus* (Collembola). *Journal of Applied Ecology* 22:967-978.

Bengtsson, G., T. Gunnarsson, and S. Rundgren. 1986. Effects of metal pollution on the earthworm *Dendrobaena rubida* (Sav.) in acidified soils. *Water, Air, and Soil Pollution* 28:361-383.

Benoit, G. 1995. Evidence of the particle concentration effect for lead and other metals in fresh waters based on ultraclean technique analysis. *Geochimica et Cosmochimica Acta* 59(13):2677-2687.

Bergman, H.L., and E.J. Dorward-King (eds). 1997. *Reassessment of Metals Criteria for Aquatic Life Protection: Priorities for Research and Implementation*. SETAC Press, Pensacola, FL.

Davies, B.E. 1983. Chapter 14: Heavy metal contamination from base metal mining and smelting: implications for man and his environment. In: *Applied Environmental Geochemistry*, I. Thornton (ed.), Academic Press, London. pp. 425 to 462.

Davies, P.H., J.P. Goettl, Jr., J.R. Sinley, and N.F. Smith. 1976. Acute and chronic toxicity of lead to rainbow trout *Salmo gairdneri*, in hard and soft water. *Water Research* 10:199-206.

Demayo, A., M.C. Taylor, K.W. Taylor, and P.V. Hodson. 1982. Toxic effects of lead and lead compounds on human health, aquatic life, wildlife plants, and livestock. *CRC Critical Reviews in Environmental Controls* 12(4):257-305.

Denneman, C.A.J., and N.M. van Straalen. 1991. The toxicity of lead and copper in reproduction tests using the oribatid mite *Platynothrus peltifer*. *Pedobiologia* 35:305-311.

Edens, F.W., and J.D. Garlich. 1983. Lead-induced egg production decrease in Leghorn and Japanese quail hens. *Poultry Science* 62:1757-1763.

Efroymson, R.A., M.E. Will, G.W. Suter, II, and A.C. Wooten. 1997. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. ES/ER/TM-85/R3. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Lockheed Martin Energy Systems, Inc., Oak Ridge, TN.

Eisler, R. 1988. Lead hazards to fish, wildlife, and invertebrates: a synoptic review. In: *Contaminant Hazard Reviews, Report No. 14*. U.S. Fish and Wildlife Service, U.S. Department of the Interior, Laurel, MD.

Franson, J.C., and T.W. Custer. 1982. Toxicity of dietary lead in young cockerels. *Vet.Hum.Toxicol.* 24(6):421-423.

Hart, B.T., and T. Hines. 1995. Trace elements in rivers. In: *Trace Elements in Natural Waters*, B. Salbu and E. Steinnes (eds.), CRC Press, Boca Raton, FL. pp. 203 to 221.

Hartenstein, R., E.F. Neuhauser, and J. Collier. 1980. Accumulation of heavy metals in the earthworm *Eisenia foetida*. *Journal of Environmental Quality* 9(1):23-26.

Hilderbrand, D.C., R. Der, W.T. Griffin, and M.S. Fahim. 1973. Effect of lead acetate on reproduction. *Am.J.Obstet.Gynecol.* 115(8):1058-1065.

Krasovskii, G.N., L.Y. Vasukovich, and O.G. Chariev. 1979. Experimental study of biological effects of lead and aluminum following oral administration. *Environmental Health Perspectives* 30:47-51.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management* 19(1):81-97.

MacDonald, D.D. 1994. *Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Volumes I & II.* Prepared for Florida Department of Environmental Protection, Office of Water Policy. Prepared by MacDonald Environmental Sciences Ltd., Ladysmith, British Columbia.

Marigomez, J.A., E. Angulo, and V. Saez. 1986. Feeding and growth responses to copper, zinc, mercury, and lead in the terrestrial gastropod *Arion ater* (Linne). *Journal of Molluscan Studies* 52:68-78.

Nagy, K.A. 1987. Field metabolic rate and food requirement scaling in mammals and birds. *Ecological Monographs* 57(2):111-128.

Pain, D.J. 1995. Lead in the environment. In: *Handbook of Ecotoxicology*, D.J. Hoffman, B.A. Rattner, G.A. Burton, Jr., and J. Cairns, Jr. (eds.), Lewis Publishers, Boca Raton, FL. pp. 356 to 391.

Pattee, O.H. 1984. Eggshell thickness and reproduction in American kestrels exposed to chronic dietary lead. *Archives of Environmental Contamination and Toxicology* 13:29-34.

Power, T., K.L. Clark, A. Harfenist, and D.B. Peakall. 1989. A review and evaluation of the amphibian toxicological literature. In: *Technical Report Series No. 61*. Canadian Wildlife Service.

Prothro, M.G. 1993. Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. Memorandum. U.S. Environmental Protection Agency,

Santschi, P.H. 1988. Factors controlling the biogeochemical cycles of trace elements in fresh and coastal marine waters as revealed by artificial radioisotopes. *Limnology and Oceanography* 33(4, part 2):848-866.

Schuytema, G.S., and A.V. Nebeker. 1996. *Amphibian Toxicity Data for Water Quality Criteria Chemicals*. EPA/600/R-96/124. National Health and Environmental Effects Research Laboratory, Western Ecology Division, U.S. Environmental Protection Agency, Corvallis, OR.

Smith, S.L., D.D. MacDonald, K.A. Keenleyside, C.G. Ingersoll, and L.J. Field. 1996. A preliminary evaluation of sediment quality assessment values for freshwater ecosystems. *J.Great Lakes Res.* 22(3):624-638.

Stephan, C.E. 1993. *Derivation of Proposed Human Health and Wildlife Bioaccumulation Factors for the Great Lakes Initiative*. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Duluth, MN.

Stephan, C.E., D.I. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman, and W.A. Brungs. 1985. *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*. PB85-227049. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Duluth, MN.

Suter, G.W., II, and C.L. Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*. ES/ER/TM-96/R2. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Health Sciences Research Division, Oak Ridge National Laboratory Risk Assessment Program, Oak Ridge, TN.

U.S. EPA (Environmental Protection Agency). 1985. *Ambient Water Quality Criteria for Lead - 1984*. EPA 440/5-84-027. Criteria and Standards Division, Office of Water, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1988. *Recommendations for and Documentation of Biological Values for Use in Risk Assessment*. EPA/600/6-87/008. Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA (Environmental Protection Agency). 1992. *Technical Support Document for Land Application of Sewage Sludge. Volume I* . EPA 822/R-93-001a. Office of Water, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1993. *Wildlife Exposure Factors Handbook. Volumes I and II*. EPA/600/R-93/187. Office of Health and Environmental Assessment and Office of Research and Development, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1995. *Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water*. EPA-820-B-95-004. Office of Water, Washington, DC.

van de Meent, D., T. Aldenberg, J.H. Canton, C.A.M. van Gestel, and W. Slooff. 1990. *Desire for Levels: Background Study for the Policy Document "Setting Environmental Quality Standards for Water and Soil"*. RIVM report no. 670101 002. National Institute of Public Health and Environmental Protection.

Ecotoxicological Profile for Ecological Receptors

Mercury

This ecotoxicological profile on mercury contains five sections: (1) background (e.g., background concentrations), (2) geochemistry of the constituent in various ecological media, (3) effects characterization, (4) bioaccumulation potential, and (5) criteria development. The first four sections are intended to provide an overview of the environmental factors that influence the toxicological potential of mercury so that the limitations of the criteria may be better understood. The fifth section presents the rationale and development of criteria for the suite of ecological receptors used to represent aquatic and terrestrial ecosystems. The profile is intended to present the ecotoxicological criteria in a broader environmental context, so the ecological significance of the criteria may be properly interpreted.

I. Background

Mercury occurs naturally as a mineral and is distributed throughout the environment by natural and anthropogenic processes. Natural processes include weathering of mercury-containing rocks and volcanic eruptions. Anthropogenic releases are primarily to the atmosphere. Major anthropogenic sources of mercury include mining; industrial processes involving the use of mercury, including chloralkali manufacturing facilities; combustion of fossil fuels, primarily coal; production of cement; and medical and municipal waste incineration. Background concentrations in soils range from less than 0.01 to 4.6 mg/kg soil (Dragun and Chiasson, 1991). Typical concentrations in uncontaminated river waters range from 0.1 to 0.5 µg/L with groundwater sources demonstrating the high end of this range. Sediments that can act as a sink for mercury contain background concentrations of 0.02 to 0.06 mg Hg/kg, although polluted sediments may have 0.1 to 746 mg Hg/kg (Eisler, 1987).

Mercury exposure has been linked to adverse effects to a multitude of species including plants, fish, aquatic invertebrates, birds, and mammals. In both aquatic and terrestrial plants, decreased growth, lethality, reduced photosynthesis, leaf injury (e.g., necrosis), and inhibition of metabolic enzymes has been reported. Aquatic receptors, such as fish and invertebrates, have demonstrated death, reduced reproduction, impaired growth and development, altered behavior and metabolic function. Avian and mammalian species demonstrate sublethal effects such as organ damage, decreased growth and reproduction, and behavioral modifications.

Mercury in the aquatic system is known to undergo microbially mediated biotransformation to form methylmercury, which is a more bioavailable and toxic compound than inorganic mercury in aquatic systems. Mercury bioaccumulates and biomagnifies up the

food chain creating potentially high exposures to piscivorous mammals and birds. Methylation of mercury results in significant exposure especially for receptors of the aquatic community, including those avian species that consume large quantities of fish in their diet (U.S. EPA, 1997).

II. Geochemistry of Mercury in Various Ecological Media

General

Mercury occurs naturally as a mineral and is distributed throughout the environment by natural and anthropogenic processes. Mercury can exist in three oxidation states, Hg^0 (elemental), Hg^+ (mercurous), and Hg^{2+} (mercuric). The most reduced form is elemental mercury (Hg^0), which is a liquid at ambient temperatures but readily vaporizes. Mercurous and mercuric mercury can form numerous inorganic and organic chemical compounds; however, mercurous mercury is rarely stable under ordinary environmental conditions.

- # Mercury can exist in the environment in three oxidation states: Hg^0, Hg^+, and Hg^{2+}.
- # Elemental mercury (Hg^0) readily vaporizes.
- # Mercurous mercury (Hg^+) is rarely stable under ordinary environmental conditions.
- # The compounds most likely to be found under environmental conditions are: the mercuric salts [$HgCl_2$, $Hg(OH)_2$, and HgS] and the methylmercury compounds [CH_3HgCl and CH_3HgOH].
- # Methylmercury is the most common organic form of mercury. It is soluble, mobile, and quickly enters the food chain.

Mercury is unusual among metals in that it tends to form covalent rather than ionic bonds. Most of the mercury encountered in the water/soil/sediments/biota (all environmental media except the atmosphere) is in the form of inorganic mercuric salts and organomercuries. Organomercuries are defined by the presence of a covalent C-Hg bond. This is thought to differ from the common behavior of inorganic mercury compounds associating with organic material in the environment. The compounds most likely to be found under environmental conditions are: the mercuric salts $HgCl_2$, $Hg(OH)_2$, and HgS; the methylmercury compounds CH_3HgCl and CH_3HgOH; and, in small fractions, other organomercuries (i.e., dimethylmercury and phenylmercury) (ATSDR, 1997).

Mercury in Soils

Average mercury concentrations in virgin and cultivated surface soils range from 20 to 625 ng/g. The highest concentrations are generally found in soils from urban locations and in organic versus mineral soils. The mercury content of most soils varies as a function of depth, with the highest mercury concentrations generally found in the surface layers.

Mercury is readily sorbed to soil substrates. It is strongly sorbed to humic materials in soils characterized by pH values equal to or greater than 4. It is also sorbed to iron oxides and clay minerals. Inorganic mercury sorbed to particulate material is not readily desorbed, and, as a consequence, leaching is relatively insignificant. Adsorption-desorption reactions with organic matter and soil minerals control soil pore water concentrations to very low levels.

- # Mercury is strongly sorbed to soil substrates at pH values equal to or greater than 4.
- # Adsorption-desorption reactions with organic matter and soil minerals control soil pore water concentrations to very low levels.
- # Chloride concentration may be as important as pH in determining mercury mobility.
- # Mercury may also be mobilized through the reduction of ionic mercury to the more volatile elemental mercury and through methylation to form volatile organic compounds such as dimethylmercury.

Although mercury is thought to be strongly sorbed to the soil substrate, adsorption may be decreased, and mercury remobilized, as a function of increasing pH and/or chloride ion content. Mercuric mercury (Hg^{2+}) may form various complexes with chloride and hydroxide ions in soils. It is generally accepted that chloride is the most significant inorganic ligand responsible for increasing the mobility of mercury in the environment. This is due in part to chloride's abundance and persistence and the low affinity of mercury chloride complexes for soil surfaces. It is possible that other ligands, particularly other halides, could also cause a significant increase in mercury mobility. Because mercury concentration is positively correlated to dissolved organic carbon, mercury may also be bound to humic and fulvic acids in soil pore water.

Mercury may also be remobilized through the microbial reduction of Hg^{2+} to the more volatile elemental mercury (Hg^0) as well as the bioconversion to volatile organic forms (dimethylmercury). Because these reactions are generally biologically mediated, temperature and pH are important considerations. For example, volatilization is generally greater in warmer weather when soil microbial activity is greatest. Volatilization is also greater in acidic soils (pH values equal to or less then 3) (ATSDR, 1997).

Mercury in Surface Water

Most chemical analyses yield total mercury concentration for a given sample. Total mercury in water is made up principally of elemental mercury, dissolved complexes of methylmercury and mercuric ion, and particulate forms of methylmercury and mercuric ion. Total mercury is a poor predictor of mercury speciation. For example, methylmercury as a percent of total mercury in water ranges from a few percent to more than 60 percent and is not solely a function of total mercury concentrations in water.

Water samples collected from lakes and rivers in the Ottawa, Ontario, region of Canada had total mercury concentrations ranging from 3.5 to 11.4 ng/L, with organic mercury concentrations ranging from 22% to 37%. Higher concentrations were measured in water samples collected from Crab Orchard Lake in Illinois and from surface waters of lakes and rivers in California. Specifically, mercury measurements ranged from 70 to 281 ng/L for the Illinois samples and from 0.5 to 104.3 ng/L for the California samples.

Reactions with particulates dominate the fate of mercury in aquatic environments. In surface waters having an average concentration of sulfide, mercury will form mercuric sulfide (HgS) at pH ranges of 4 to 9. This compound is relatively insoluble in aqueous solutions and will precipitate out. Under acidic conditions, the activity of the sulfide ion decreases and the formation of mercuric sulfide is inhibited. Under these conditions, the formation of

methylmercury is favored instead. The formation of mercuric sulfide and the adsorption of mercury to particles result in a significant fraction of mercury settling to the bottom sediments.

- # Mercury participates in a dynamic biogeochemical cycle in aquatic environments.
- # In aquatic environments having a pH range typical of environment conditions, the formation of mercuric sulfide (HgS) is favored. Mercuric sulfide precipitates out of solution, thus removing mercury from the water column.
- # Dissolved-phase mercuric complexes ($HgCl_2$) are important in the water column as they increase mobility.
- # Ionic mercury can be reduced to elemental mercury. Once formed, elemental mercury can volatilize, thereby reducing the dissolved phase mercury burden.
- # Ionic mercury can also be methylated to form methylmercury. This reaction is especially prevalent under anoxic conditions. Methylmercury tends to accumulate in the underlying sediments, also decreasing the dissolved phase mercury burden.

Mercury can exist in surface water as both the mercuric (Hg^{2+}) and mercurous (Hg^{+}) states. Because mercurous mercury is unstable, mercuric mercury is the predominant form of the two. Under environmental conditions, mercuric ion forms dissolved organic and inorganic complexes in the water column.

Mercuric ion can be transformed by biological and/or photochemical reduction to elemental mercury (Hg^0) or by biological methylation to methylmercury (CH_3Hg^{+}). Once formed, elemental mercury can volatilize to the atmosphere, whereas methylmercury can be accumulated in the underlying sediments or bioaccumulated in the food web. These reactions are reversible, and mercuric ion can also result from the oxidation of elemental mercury or the demethylation of methylmercury.

Reduction of Hg^{2+} to Hg^0 can occur under both aerobic and anaerobic conditions. It is enhanced by light and inhibited by competition from chloride ions. Surface waters may be saturated with volatile elemental mercury at times; however, production is seasonal and the highest levels generally occur during the warmer summer months. The exchange of elemental mercury with the atmosphere can lower the surface water mercury burdens.

Because of methylmercury's toxicity and tendency to bioaccumulate, it is a very important species of mercury. While some evidence for abiotic methylation exists, mercury methylation in the environment is mediated principally by sulfate-reducing bacteria that occur in freshwater and marine sediments. High rates of methylation have been observed in anoxic sediment and water and at the thermocline of the stratified lakes and estuaries.

As a biologically mediated reaction, methylmercury formation is sensitive to factors that affect biological activity as well as the physicochemical factors that govern the availability of inorganic mercury. The most important of these factors are dissolved oxygen concentration, temperature, lake basin characteristics (e.g., depth, water retention time), pH, sulfate and sulfide concentration, chloride concentration, water hardness, biological productivity, and total mercury concentration. Methylmercury production generally increases under conditions of elevated temperature and reduced dissolved oxygen concentration. In the anoxic hypolimnion of seasonally stratified lakes, methylmercury has been observed to accumulate at levels greater than

10 ng/L. This buildup has been related to in situ methylmercury production and remobilization from particulate matter (ATSDR, 1997).

Mercury in Sediments

Mercury levels in surface sediments of the St. Louis River range from 18 to 500 ng/L. Mercury was detected in sediment samples from Crab Orchard Lake in Illinois at greater then 60 μg/L. Surficial sediment samples from several sites along the Upper Connecting Channels of the Great Lakes had mercury concentrations ranging from below the detection limit to 55.80 μg/g. Mercury concentrations were correlated with particle size fractions and organic matter content.

- Inorganic mercury tends to sorb to particulate matter and settle out. Inorganic mercury is not readily desorbed and the sediments are an important sink for both freshwater and estuarine systems.
- Sediments are also considered to be a sink for methylmercury; however, methylmercury may be released back into the water column under anaerobic/sulfidic conditions.

The dominant process controlling the distribution of mercury compounds in the environment appears to be the sorption of nonvolatile forms to soil and sediment particulates, which settle out of the water column with little resuspension from the sediments back into the water column. Inorganic mercury sorbed to particulate material is not readily desorbed. Thus, sediments are an important repository for inorganic forms of mercury. Sediments tend to be a reservoir for mercury in both freshwater and estuarine systems.

Sediments generally are also considered to be a sink for methylmercury. In contrast to inorganic mercury, however, methylmercury may be released back into the water column under anaerobic/sulfidic conditions. Specifically, methylation is favored under anaerobic conditions, whereas demethylation is favored in oxic waters (ATSDR, 1997).

III. Effects Characterization

This section, along with the bioaccumulation potential section, are subdivided to evaluate receptors of the freshwater and terrestrial ecosystems separately. Figure J-2 summarizes the range of effects data for receptors of concern illustrating the sensitivity of various taxa to exposure. For reference, the water quality standards for freshwater communities (NAWQC or secondary values) are included for both acute and chronic endpoints. These values can be disregarded for receptors in the terrestrial community, because the NAWQC only provides protection for aquatic receptors, not predators of aquatic biota. The NAWQC provide a context for effects ranges in the aquatic community.

Freshwater Ecosystems

Aquatic organisms (e.g., fish and aquatic invertebrates) and predators (e.g., mammals and birds) that characteristically forage in freshwater ecosystems are sensitive to mercury exposures. Because biotransformation of inorganic mercury to methylmercury occurs primarily in sediments, higher concentrations of methylmercury are usually measured in surface water and

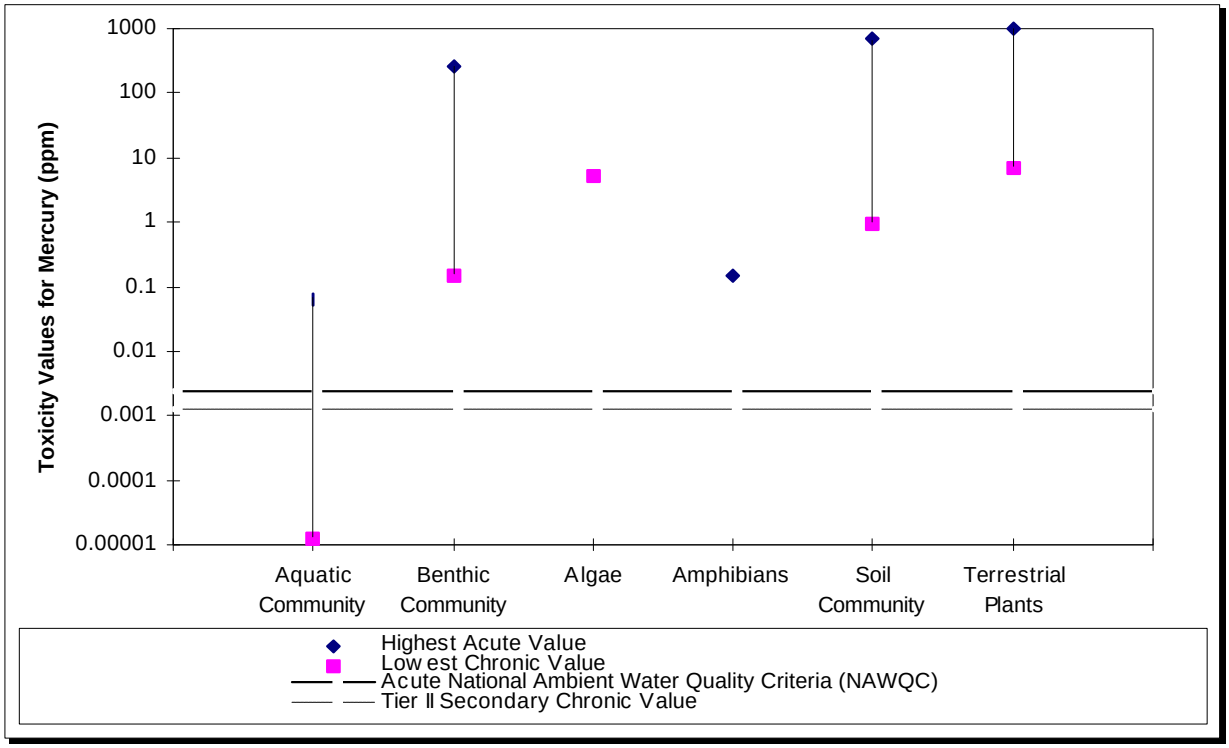

Figure J-2. Mercury: effects ranges for selected ecological receptors.

sediment media. Given that methylmercury is more toxic and bioaccumulative than inorganic mercury, the potential for adverse effects in freshwater ecosystems is high.

Acute toxicity in the aquatic community for inorganic mercury ranges from 5 to 10 µg/L and 155 to 440 µg/L for freshwater invertebrates and fish, respectively. In contrast, for organic methylmercury, acute toxicity has been documented to range from 5.0 to 65 µg/L for yearling brook trout, and, for invertebrates, acute effects have ranged from 0.9 to 3.2 µg/L. In both inorganic mercury and methylmercury, acute effects in fish included behavioral changes and lethality. For chronic effects, concentration at 0.04 µg/L and 0.79 µg/L reduced the growth of rainbow trout and brook trout, respectively (Eisler, 1987). A relative comparison of the acute toxicity observed in fish and aquatic invertebrates from exposure to inorganic mercury and methylmercury reveals that methylmercury is more toxic by approximately an order of magnitude.

Among mercury species, methylmercury is the most toxic to mammals. Daily doses of methylmercury ranging from 0.1 to 0.5 mg/kg-day or 1.0 to 5.0 mg/kg diet were lethal to sensitive mammals (Eisler, 1987). Central nervous system toxicity, weight loss, and mortality were observed among rats fed a diet containing 250 mg/kg methylmercury for 2 weeks (Verschuuren et al., 1976a). Rats consuming 2.5 mg/kg methylmercury in the diet for 2 years displayed adverse impacts to growth and physiological functions (Verschuuren et al., 1976b). No adverse effects to reproductive endpoints were observed in rats fed at 0.5 mg/kg and below over a three-generation experiment, but, at 2.5 mg/kg, offspring survival rate was reduced.

For birds, acute toxicity for methylmercury ranges from 2.2 to 23.5 mg/kg for mallard (*Anas platyrhynchos*), 11.0 to 27.0 mg/kg diet for Japanese quail *(Coturnix japonica*), and 37.9 mg/kg for whistling duck (*Dendrocygna bicolor*). Heinz (1979) fed mallard ducks a diet containing 0.5 mg/kg methylmercury for three generations. Although it did not affect adult weights or weight changes, for those female birds exposed to methylmercury, decrease in clutch number, egg shell thickness, and behavioral modifications in young were noted.

Algae are more resistant to mercury exposure than other aquatic receptors. Toxic effects were evident in algae and submerged aquatic vegetation exposed to inorganic mercury (2+) at concentrations ranging from 53 to 3,400 µg/L. In algae exposed, methylmercury toxicity was reported to range from 0.8 to 6.0 µg/L (U.S. EPA. 1997). In contrast, amphibians demonstrate higher sensitivity. Exposure of developing toad eggs to 3 mg/L mercuric chloride resulted in 100% mortality. Further, developmental effects in *X. laevis* eggs were noted at 0.146 ppm (Power et al., 1989). No chronic studies of extended duration could be identified for amphibian populations. However, given the observed levels of acute toxicity in amphibian species, amphibians are likely to demonstrate sensitivity within the range of fish populations (Figure J-2).

Terrestrial Ecosystems

In evaluating the effects of mammals and birds characteristic of terrestrial ecosystems, the potential ecotoxicological effects resulting from exposure to contaminated prey were assumed to be similar to those discussed for mammals and birds representative of freshwater ecosystems. Although uptake parameters are modified to reflect the different routes of exposure in terrestrial ecosystems, the toxicological response to mercury exposure will be similar across these taxa.

Terrestrial plants and soil invertebrates appear to be less sensitive to mercury exposure than other terrestrial receptors, which may be the direct result of how chemical equilibria in soils will influence mercury speciation (i.e., methylmercury is present in soils but not to the extent that it occurs in sediments). However, ecotoxicity data that fully characterize the effects through soil exposure routes to terrestrial plants and soil biota are limited. A number of studies were available that exposed terrestrial plants via solution; however, this exposure route did not adequately simulate probable environmental exposures; therefore, these data were not used.

IV. Bioaccumulation Potential

Freshwater Ecosystems

The bioaccumulative capacity of mercury in freshwater organisms, as methylmercury and inorganic mercury, is key to evaluating food web exposures. Studies have indicated that mercury bioaccumulates in freshwater ecosystems. In phytoplankton, methylmercury bioconcentration factors (BCFs) of 90,000 to 107,000 (L/kg) have been estimated; whereas, total mercury BCFs have been reported in the range of 2,000 to 40,000. The large variability in total mercury BCFs is likely associated with the percent methylmercury (the more bioavailable chemical species) present in the surface water. Moving through the food web, zooplankton accumulate mercury to a greater degree than phytoplankton. The literature indicates that BAFs range from 11,000 to 12,600,000 when zooplankton are exposed to methylmercury; whereas, zooplankton exposed to total mercury indicate BAFs ranging from 3,100 to 285,000 (U.S. EPA, 1997).

The BAFs reported in the *Mercury Study Report to Congress* (MRTC) (U.S. EPA, 1997) represent the current accepted approach to characterizing bioaccumulation in fish species. The BAFs reported in this document were used in the HWC-SERA analysis to estimate the bioaccumulation potential in trophic level 3 and trophic level 4 fish and subsequent exposures through the food web to piscivorous mammals and birds. The BAF values of 6,800,000 for trophic level 4 fish and 1,600,000 for trophic level 3 fish were used in estimating the mammalian and avian food chain exposures. The MRTC BAF values for fish were derived from field studies, which were preferred over laboratory exposures or modeled estimates. For an expanded explanation of the methodology and rationale for selection of the BAFs, refer to U.S. EPA (1997).

Terrestrial Ecosystem

Mercury bioaccumulation appears to be largely a problem associated with the aquatic ecosystem. Accumulation of total mercury in earthworms has been reported in BCFs ranging from 21.3 to 27.1 (Schuytema and Nebekar, 1996). Mercury bioaccumulation factors have been documented to be 11.1 in mink liver and 7.4 in kidney tissues (WHO, 1989). Average accumulation factors in terrestrial earthworms and small mammals have been reported at 5.2 and 0.12, respectively (Sample et al., 1998a, 1998b). Insufficient data were available to characterize uptake in terrestrial plants and other soil invertebrates.

V. Criteria Development

The benchmark values presented in this section for mammals and birds were used to derive protective media-specific criteria as outlined in the stressor-response profile methodology (i.e., analysis phase of ERA). By scaling the benchmark study by body weight to a representative wildlife receptor (e.g., rat study extrapolated to a shrew), determining the dietary preferences of wildlife receptor and the potential bioconcentration in prey, a protective concentration (i.e., criteria) in soil, plants, or surface water was developed. Since criteria for receptors other than mammals and birds were already in media concentrations, this same derivation process was not required. A summary of criteria is provided in Table J-2. Although criteria were developed for numerous wildlife receptors of both the aquatic (e.g., otter, mink, and great blue heron) and terrestrial ecosystems (e.g. shrew, fox, and hawk), only the lowest criterion is presented in Table J-2. By protecting the more sensitive species, other receptors are likely to be protected as well.

Mammals: Two subchronic studies were identified that reported dose-response data for mammalian wildlife. Rhesus monkeys were exposed to methylmercury chloride by gavage at doses of 0.05, 0.16, or 0.5 mg/kg-day during gestation days 20 through 30. No signs of malformation were seen at the two lower doses (Dougherty et al., 1974). However, the highest dose level was maternally toxic and abortient, suggesting a NOAEL of 0.16 mg/kg-day and a LOAEL of 0.5 mg/kg-day for reproductive effects.

A second study fed adult female mink rations containing methylmercury chloride at doses of 0.18, 0.29, 0.77, 1.3, and 2.4 mg/kg-day (Wobeser et al., 1976a,b). Groups exposed to doses of 0.29 to 2.4 mg/kg-day exhibited clinical signs of toxicity. The 0.18-mg/kg-day exposure group did not show clinical evidence of toxicity but did exhibit pathological alterations of the

Table J-2. Mercury and Methylmercury Criteria in Soil, Sediment, and Surface Water Developed for Representative Receptors

Receptor	Criteria	Units	Exposure Pathway	Representative Species	Reference
Aquatic					
Mammals (total dissolved)	5.4E-07	mg/L water	Food web	River Otter	Wobeser et al., 1976a,b; U.S. EPA, 1997
Birds (total dissolved)	4.2E-07	mg/L water	Food web	Kingfisher	Heinz, 1974; 1975; 1979; U.S. EPA, 1997
Mammals (methylmercury)	4.2E-08	mg/L water	Food web	River Otter	Wobeser et al., 1976a,b; U.S. EPA, 1997
Birds (methylmercury)	3.3E-08	mg/L water	Food web	Kingfisher	Heinz, 1974; 1975; 1979; U.S. EPA, 1997
Algae and Aquatic Plants	5.0E+00	mg/L water	Direct contact	*Microcystis aeruginosa*	
Freshwater Community					
Mercury (II)	9.1E-04	mg/L water	Direct contact	Aquatic biota	U.S. EPA, 1995a
Methylmercury	2.8E-06	mg/L water	Direct contact	Aquatic biota	Suter and Tsao, 1996
Benthic Community	1.3E-01	mg/kg sediment	Direct contact	Benthos	MacDonald, 1994
Terrestrial					
Mammals	3.8E+01	mg/kg soil	Food web	Raccoon	Wobeser et al., 1976a,b
Birds	1.5E-01	mg/kg soil	Food web	American woodcock	Heinz, 1974; 1975; 1979
Soil Community	1.0E-01	mg/kg soil	Direct contact	Soil invertebrates	Efroymson et al., 1997a

Insufficient data to develop a criterion for terrestrial plants

nervous system. The authors stated that clinical signs of toxicity in the 0.18-mg/kg-day exposure group would have probably emerged if the experiment had lasted longer. A LOAEL of 0.18-mg/kg-day was inferred for pathological alterations from this study. The NOAEL derived from this study was 0.055 mg/kg-day (U.S. EPA, 1997).

The NOAEL from the Wobeser et al. (1976a,b) study was selected to derive the toxicological benchmark because: (1) doses were administered over a chronic duration and via oral ingestion, an ecologically significant exposure pathway; (2) the study focused on toxicity endpoints that could impact the reproductive potential of a species; and (3) it contained adequate dose-response information. The Dougherty et al. (1974) study was also an adequate study for selection; however, the premier source of information on mercury's risk to ecological receptors (*Mercury Study Report to Congress,* U.S. EPA, 1997) considered the Wobester et al. (1976a,b) to be a more appropriate benchmark study for criteria derivation.

Birds: Several studies were identified that investigated the effects of methylmercury on avian species. In a series of studies carried over three generations, Heinz (1974, 1975, 1976a, 1976b, 1979) assessed the effects of dietary methylmercury on mallard ducks. Adult mallard ducks given doses of 0.078 and 0.468 mg/kg-day (assuming an uptake rate of 156 g/kg bw/d) for up to 2 years were monitored for egg production, hatching success, and hatchling viability. Based on an assessment of percent cracked eggs, egg production, or number of eggs producing normal hatchlings, no significant reproductive effects were observed in the first generation. However, the survival rate of offspring from the 0.468 mg/kg-day treatment group was significantly lower. Second generation parents on the 0.078-mg/kg-day diet exhibited abnormal egg-laying behavior and impaired reproduction, and their ducklings had a slowed growth rate. Third generation hens in the 0.078-mg/kg-day treatment group laid fewer viable eggs than those in the control group. Behavior tests designed to measure approach response to maternal calls and avoidance response to a frightening stimulus pooled over three generations indicate the cumulative effects over three generations were significant at the lowest dose level. Therefore, a LOAEL of 0.078 mg/kg-day was inferred based on adverse reproductive and behavioral effects across the three generations of mallard ducks.

Ring-necked pheasants were exposed to dietary methylmercury at doses equivalent to 0.18, 0.37, and 0.69 mg/kg-day for 12 weeks (Fimreite, 1970). Reduced hatchability and egg production as well as increased numbers of shell-less eggs were reported at all dose levels. Based on these results, a LOAEL of 0.18 mg/kg-day can be inferred for reproductive effects. In another study by Fimreite (as cited in U.S. EPA, 1993), leghorn cockerel chicks were exposed to dietary methylmercury at concentrations of 1.1, 2.1, and 3.2 mg/kg-day for 21 days. A significant increase in mortality occurred at exposure to 3.2 mg/kg-day, while chicks maintained at 2.1 mg/kg-day exhibited decreases in growth. Although this study reports a NOAEL of 2.1 mg/kg-day for mortality and a LOAEL of 1.1 for growth, it is unclear as to whether these exposure levels would affect an entire population's survival. Reproductive effects were seen in white leghorn laying hens when they were exposed to methylmercury at dietary concentrations of 4.9 and 9.8 mg/kg-day for an unspecified period of time (Scott, 1977). Both dose levels severely impacted egg production and weight, fertility of eggs, hatchability of fertile eggs, and eggshell strength.

Although the studies by Fimreite (1970) and Scott (1977) provide reproductive endpoints in response to multiple, dietary methylmercury dose levels, the results of the Heinz (1974, 1975, 1976a, 1976b, 1979) multigeneration studies were found to be most appropriate for the estimation of a benchmark value for avian species. These studies provide reproductive and behavioral effects due to methylmercury exposure over three generations of mallards. From all the avian studies identified, Heinz (1974, 1975, 1976a, 1976b, 1979), furnish the most conservative dose level that could impair the survival and reproductive potential of an avian population. Therefore, the LOAEL of 0.078 mg/kg-day was used to derive a benchmark value for representative avian species of the freshwater ecosystem. As indicated in the *Mercury Study Report to Congress* (U.S. EPA, 1997), an uncertainty factor of 3 was applied to estimate a NOAEL of 0.026 mg/kg-d.

Data were available on reproductive, developmental, growth, and survival endpoints for methylmercury exposure. In addition, the data set contained studies that were conducted over acute and chronic durations and during sensitive life stages. Other than the studies discussed for the freshwater ecosystem, no avian toxicity data were identified. Therefore, the NOAEL of 0.026 mg/kg-day extrapolated from Heinz (1974, 1975, 1976a, 1976b, 1979) was chosen to calculate a benchmark value for the representative avian species in the terrestrial ecosystem.

Freshwater Community: Two sources were evaluated in selecting criteria for the protection of aquatic biota: (1) Final Chronic Values (FCV) derived under the Great Lakes Water Quality Initiative (GLWQI) (U.S. EPA, 1995a) and (2) National Ambient Water Quality Criteria (NAWQC) published by the EPA Office of Water. The FCV of 9.1E-04 mg/L for mercury (II) developed under the GLWQI was used. The GLWQI values were considered preferable to the NAWQC because: (1) the GLWQI values are based on the same methodology used to develop NAWQC (i.e., Stephan et al., 1985); (2) the NAWQC data set was augmented with previously unavailable acute and chronic toxicity data; and (3) species taxa used to generate the GLWQI values are suitable for national application since they include species and taxa found throughout the United States.

Sufficient data were not available to develop an FCV for methylmercury, rather a Secondary Chronic Value (SCV) of 2.8E-06 mg/L for methylmercury developed by Oak Ridge National Laboratory (Suter and Tsao, 1996) was selected as the appropriate criteria to use in this analysis. SCVs are calculated by methods analogous to those used to derive FCVs for both the GLWQI and NAWQC. However, when the eight data requirements for developing the FCV were not available, the SCV criterion was based on one to seven of the eight required criteria. The SCV for methylmercury was derived from four data points based on toxicity endpoints found in rainbow trout (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*). From these data, an SAV of 9.917E-5 mg/L and SACR of 35.72 were calculated. The resulting ratio of these values (i.e., SAV/SACR) determined the SCV of 2.8E-6 mg/L (Suter and Tsao, 1996).

Although total concentrations of metals are still deemed scientifically defensible by EPA, recent EPA guidance recommends the use of dissolved metals concentrations to better reflect the bioavailability of metals (e.g., Prothro, 1993). Consequently, the FCVs can be adjusted to provide dissolved concentrations as described in 60 FR22229-22237 (*Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants; States' Compliance—Revision of Metals Criteria*, U.S. EPA, 1995b); however, a CF was not available for mercury or

methylmercury. This adjustment (i.e., use of conversion factors) reflects the current EPA position on criteria development and regulatory application of metals; however, the issue of metal bioavailability in surface waters is the topic of intensive research (e.g., Bergman and Dorward-King, 1997). For example, the relationship between water characteristics (e.g., dissolved organic matter), copper bioavailability, and toxicity has been investigated in some detail (e.g., Allen and Hansen, 1996). Aquatic criteria developed in this section are summarized in Table J-2.

Amphibians: No suitable subchronic or chronic studies were identified that studied the effects of mercury toxicity on reproductive or developmental endpoints in amphibian species; however, several acute studies were identified characterizing mercury toxicity. Review of data collected from 67 experiments indicate that the acute toxicity of arsenic ranges from 0.001 to 108 mg mercury/L, with a geometric mean of 0.20 mg/L. Acute studies were conducted on various amphibian species (i.e., 27 amphibian species represented) during embryo, tadpole, and adult lifestages. Chemical exposures were conducted primarily with mercuric chloride. The observation that the lowest acute amphibian value approximates the FAV of 0.0024 mg mercury/L determined for the freshwater community indicates that some amphibian species may be sufficiently protected by the current acute freshwater criteria. A few chronic exposures were identified indicating deformity from 96-hour exposures to 0.0001 to 0.1 depending on the species. Longer exposures of 7 to 10 days indicate deformities at concentrations of 0.0003 to 0.08 mg mercury/L at varying degrees of severity and magnitude. Further, spermatogenesis was inhibited at concentrations of 0.3 mg mercury/L. Investigations are ongoing to review the possibility of incorporating amphibian data into the NAWQC. Since amphibian species are more likely to breed in standing waters such as wetlands or ponds, the appropriateness of combining protective levels of amphibian receptors and the freshwater community is unclear at this time (Power et al.,1989; Schuytema and Nebekar, 1996).

Algae and Aquatic plants: The toxicological benchmarks for aquatic plants were either: (1) a no observed effects concentration (NOEC) or a lowest observed effects concentration (LOEC) for vascular aquatic plants (e.g., duckweed) or (2) an effective concentration (EC_{xx}) for species of freshwater algae, frequently a species of green algae (e.g., *Selenastrum capricornutum*). For mercury the benchmark value was determined to be 5.0 mg/L based on the growth inhibition of *Microcystis aeruginosa*. Low confidence is placed in this criterion since it is only based on one study (Suter and Tsao, 1996).

Benthic Community: The premier source of field sediment data is NOAA, which annually collects and analyzes sediment samples from sites located in coastal marine and estuarine environments throughout the United States as part of the National Status and Trends Program (NSTP). From the range of adverse effects data, criteria are developed estimating the 10th percentile effects concentration (ER-L) and a median effects concentration (ER-M) for adverse effects in the sediment community (Long et al., 1995). These values are not NOAA standards; rather, they are used to rank sites based on the potential for adverse ecological effects. A second criteria document evaluated for sediment criteria development was the *Approach to the Assessment of Sediment Quality in Florida Coastal Waters Volume 1- Development and Evaluation of Sediment Quality Assessment Guidelines)* (MacDonald et al., 1994) published by the Florida Department of Environmental Protection (FDEP). The criteria developed by FDEP were also based on the NOAA data; however, the method of derivation of the criteria was changed. FDEP calculated the criteria (i.e., threshold effects level, TEL) from the geometric

mean of the 50th percentile of no effects data and the 15th percentile of the low effects data. The NOAA data, used in both documents, are based on total metal concentrations in sediments, and the toxicity endpoints were measured on species of amphipods, arthropods, and bivalves in addition to a variety of community-based endpoints (e.g., abundance, mortality, species composition, and species richness). The FDEP criterion was chosen above the NOAA criterion for the following reasons; (1) the same database was used for both the NOAA criterion and the FDEP criteria development only different derivation methods were used; (2) in most cases, the FDEP criterion was more conservative than the NOAA criterion because a larger portion of the low effects data was used in benchmark development; and (3) the marine TEL developed by the FDEP were found to be analogous to TELs observed in freshwater organisms (Smith et al., 1996).

The criterion for mercury was derived from 331 toxicity data points for low and no effects levels. For the screening level analysis of mercury, the TEL of 1.3E-01 mg mercury/kg sediment was selected as an appropriate sediment criterion. Based on the quality and quantity of mercury sediment data, the degree of confidence in the TEL value for mercury was considered high (MacDonald, 1994).

Terrestrial Plants: As presented in Efroymson et al. (1997b), phytotoxicity benchmarks were selected by rank-ordering the LOEC values and then approximating the 10th percentile. If fewer than 10 studies were available, the lowest LOEC was selected as the criteria. Such LOECs applied to reductions in plant growth, yield, or seed elongation, or other effects reasonably assumed to impair the ability of a plant population to sustain itself. The proposed benchmark for phytotoxic effects of mercury in soils is 0.3 mg mercury/kg soil (Efroymson et al., 1997b). Since the criterion was based on a single study reporting unspecified effects and did not indicate the form of mercury applied to test soils or the terrestrial plant species exposed, this benchmark study was not appropriate for criteria development. No further studies were identified, so no criteria could be developed for the terrestrial plant community.

Soil Community: A soil benchmark was derived from the criterion proposed by ORNL (Efroymson et al., 1997a). The proposed criterion of 1.0E-01 mg total mercury/kg soil was the lowest toxicity value based on earthworm endpoints. Additionally, a microbial toxicity value was identified: 30 mg total mercury/kg soil. Value based on earthworm was proposed as the criterion because earthworm is an important component in promoting soil fertility, improving aeration and drainage of soil, and serving as an important food source for many higher trophic animals. Community-based criteria values should be used as they become available. Low confidence is placed in this criteria because of the lack of supporting data.

References

Allen, H.E., and D.J. Hansen. 1996. The importance of trace metal speciation to water quality criteria. *Water Environ Res* 68(1):42-54.

ATSDR (Agency for Toxic Substances and Disease Registry). 1997. *Toxicological Profile for Mercury* (Draft). Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA.

Bergman, H.L., and E.J. Dorward-King (eds). 1997. *Reassessment of Metals Criteria for Aquatic Life Protection: Priorities for Research and Implementation*. SETAC Press, Pensacola, FL.

Dougherty, W.J., F. Coulston, and L. Golberg. 1974. Toxicity of methylmercury in pregnant rhesus monkeys. *Toxicology and Applied Pharmacology* 39: 138. (Abstr.).

Dragun, J., and A. Chiasson. 1991. *Elements in North American Soils*. Hazardous Materials Control Resources Institute, Greenbelt, MD. pp. 117 to 123.

Efroymson, R.A., M.E. Will, and G.W. Suter, II. 1997a. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision*. ES/ER/TM-126/R2. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Lockheed Martin Energy Systems, Inc., Oak Ridge, TN.

Efroymson, R.A., M.E. Will, G.W. Suter, II, and A.C. Wooten. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. ES/ER/TM-85/R3. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Lockheed Martin Energy Systems, Inc., Oak Ridge, TN.

Eisler, R. 1987. Mercury hazards to fish, wildlife, and invertebrates: a synoptic review. In: *Contaminant Hazard Reviews, Report No. 10*. U.S. Fish and Wildlife Service, U.S. Department of the Interior, Laurel, MD.

Fimreite, N. 1970. Effects of methyl mercury treated feed on the mortality and growth of leghorn cockerels. *Canadian Journal of Animal Science* 50:387-389.

Heinz, G.H. 1974. Effects of low dietary levels of methyl mercury on mallard reproduction. *Bulletin of Environmental Contamination and Toxicology* 11(4):386-392.

Heinz, G.H. 1975. Effects of methylmercury on approach and avoidance behavior of mallard ducklings. *Bulletin of Environmental Contamination and Toxicology* 13(5):554-564.

Heinz, G.H. 1976a. Methylmercury: second-generation reproductive and behavioral effects on mallard ducks. *Journal of Wildlife Management* 40(4):710-715.

Heinz, G.H. 1976b. Methylmercury: second-year feeding effects on mallard reproduction and duckling behavior. *Journal of Wildlife Management* 40(1):82-90.

Heinz, G.H. 1979. Methylmercury: reproductive and behavioral effects on three generations of mallard ducks. *Journal of Wildlife Management* 43(2):394-401.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management* 19(1):81-97.

MacDonald, D.D. 1994. *Approach to the Assessment of Sediment Quality in Florida Coastal Waters*. *Volumes I & II*. Prepared for Florida Department of Environmental Protection, Office of Water Policy. Prepared by MacDonald Environmental Sciences Ltd., Ladysmith, British Columbia.

Power, T., K.L. Clark, A. Harfenist, and D.B. Peakall. 1989. A review and evaluation of the amphibian toxicological literature. In: *Technical Report Series No. 61*. Canadian Wildlife Service.

Prothro, M.G. 1993. Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. Memorandum. U.S. Environmental Protection Agency,

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1998a. *Development and Validation of Bioaccumulation Models for Small Mammals*. ES/ER/TM-219. Prepared for Office of Environmental Management, U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter, II, and T.L. Ashwood. 1998b. *Development and Validation of Bioaccumulation Models for Earthworms*. ES/ER/TM-220. Prepared for Office of Environmental Management, U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN.

Schuytema, G.S., and A.V. Nebeker. 1996. *Amphibian Toxicity Data for Water Quality Criteria Chemicals*. EPA/600/R-96/124. National Health and Environmental Effects Research Laboratory, Western Ecology Division, U.S. Environmental Protection Agency, Corvallis, OR.

Scott, M.L. 1977. Effects of PCBs, DDT, and mercury compounds in chickens and Japanese quail. *Federation Proceedings* 36(6):1888-1893.

Smith, S.L., D.D. MacDonald, K.A. Keenleyside, C.G. Ingersoll, and L.J. Field. 1996. A preliminary evaluation of sediment quality assessment values for freshwater ecosystems. *J.Great Lakes Res.* 22(3):624-638.

Stephan, C.E., D.I. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman, and W.A. Brungs. 1985. *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*. PB85-227049. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Duluth, MN.

Suter, G.W., II, and C.L. Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*. ES/ER/TM-96/R2. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Health Sciences Research Division, Oak Ridge National Laboratory Risk Assessment Program, Oak Ridge, TN.

U.S. EPA (Environmental Protection Agency). 1993. *Great Lakes Water Quality Initiative Criteria Documents for the Protection of Wildlife* (Proposed). EPA-822-R-93-007. Office of Water and Office of Science and Technology, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1995a. *Great Lakes Water Quality Initiative Criteria Documents for the Protection of Wildlife: DDT, Mercury, 2,3,7,8-TCDD, and PCBs*. EPA-820-B-95-008. Office of Water, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1995b. Water quality standards: establishment of numeric criteria for priority toxic pollutants; states' compliance - revision of metals criteria. *Federal Register* 60 FR 22229-22237.

U.S. EPA (Environmental Protection Agency). 1997. *Mercury Study Report to Congress. Volume VI - An Ecological Assessment for Anthropogenic Mercury Emissions in the United States*. EPA 452/R-97/008. Office of Air Quality Planning and Standards and Office of Research and Development, Washington, DC.

Vershuuren, H.G., R. Kroes, E.M. Den Tonkelaar, J.M. Berkvens, P.W. Helleman, A.G. Rauws, P.L. Schuller, and G.J. Van Esch. 1976a. Toxicity of methylmercury chloride in rats I: short-term study. *Toxicology* 6:85-96.

Vershuuren, H.G., R. Kroes, E.M. Den Tonkelaar, J.M. Berkvens, P.W. Helleman, A.G. Rauws, P.L. Schuller, and G.J. Van Esch. 1976b. Toxicity of methylmercury chloride in rats III: long-term toxicity study. *Toxicology* 6:107-123.

WHO (World Health Organization). 1989. Mercury - environmental aspects. *Environmental Health Criteria 86.* Geneva.

Wobeser, G., N.O. Nielsen, and B. Schiefer. 1976a. Mercury and mink I. The use of mercury contaminated fish as a food for ranch mink. *Can.J.Comp.Med.* 40:30-33.

Wobeser, G., N.O. Nielsen, and B. Schiefer. 1976b. Mercury and mink II. Experimental methyl mercury intoxication. *Can.J.Comp.Med.* 40:34-45.

Ecotoxicological Profile for Ecological Receptors

Selenium

This ecotoxicological profile on selenium contains five subsections: (1) background (e.g., background concentrations), (2) geochemistry of the constituent in various ecological media, (3) effects characterization, (4) bioaccumulation potential, and (5) criterion development. The first four sections are intended to provide an overview of the environmental factors that influence the toxicological potential of selenium so that the limitations of the criteria may be better understood. The fifth section presents the rationale and development of criteria for the suite of ecological receptors used to represent the aquatic and terrestrial ecosystems. The profile is intended to present the ecotoxicological criteria in a broader environmental context so that the ecological significance of the criteria may be properly interpreted.

I. Background

Selenium is an essential nutrient for many ecological receptors, but it has also been implicated in deleterious effects at high concentrations. The range between beneficial and harmful levels is quite narrow such that concentrations that are required for some species may inhibit physiological processes in other species. For example, the recommended concentration of selenium for freshwater aquatic organisms is approximately 35 ppb; however, concentrations from 60 to 600 ppb result in mortality to sensitive aquatic organisms. Therefore, an increase in 25 ppb of selenium can result in adverse effects to some receptors. The biological response of organisms will vary depending on the species, age, tolerance, and the chemical form of selenium.

The environmental behavior of selenium is complex and not well characterized; however, it is an issue of current research. The bioaccumulation and biomagnification of selenium in aquatic and terrestrial receptors has been observed. Adverse impacts to receptors at high trophic levels (i.e., mammals and birds) has been well documented in case studies conducted at the Kesterson Reservoir, San Joaquin River, and Belews Lake, NC.

II. Geochemistry of Selenium in Various Ecological Media

General

- Selenium can exist in four oxidation states (-2, 0, +4, +6). In aqueous environments, selenium is limited to the -2, +4, and +6 oxidation states.
- Selenium is biologically active and can form organic as well as inorganic compounds.
- The specific oxidation state and chemical form largely determine selenium's behavior in the environment.

Knowledge of selenium speciation and partitioning within various environmental compartments is important in the evaluation of potential risks arising from toxicity. Selenium can exist in a variety of oxidation states (-2, 0, +4, +6), in both organic and inorganic compounds. Since the different oxidation states of selenium are characterized by unique solubilities and affinities for solid phases, changes from one oxidation state to another affect the potential mobility in the environment. Hence, the wide variations in selenium solubility and sorption characteristics among its different forms require that its speciation be understood in order to predict transport between environmental compartments.

The geochemical behavior of selenium in the environment is strongly dependent upon its oxidation state and specific chemical species. Selenium occurs in four oxidation states: -2, 0, +4, and +6. Selenium^{6+} and Se^{4+} occur as the oxyanions selenate (SeO_4^{2-}) and selenite (SeO_3^{2-} and $HSeO_3^-$), respectively. Elemental Se (Se^0) occurs in colloidal form; whereas, selenide (Se^{2-}) occurs as a variety of organic and inorganic selenides, including volatile methylated forms.

The specific chemical species will depend to a large degree on its oxidation state, which, in turn, is influenced by pH and Eh. Thermodynamically, selenate (SeO_4^{2-}) should be the stable selenium species in oxic and alkaline environments; however, data from natural systems indicate that speciation is complex and cannot be predicted based on thermodynamics alone. Specifically, thermodynamics do not take into account biological production of apparently unstable species, nor the apparent stabilities of thermodynamically predicted unstable species due to kinetic hindrances to equilibrium (Doyle et al., 1995).

Selenium in Soils

The amount of selenium in soils is determined primarily by natural geochemical processes such as the weathering of parent bedrock materials or volcanic exhalations; however, anthropogenic sources may also contribute selenium to the soil system. Anthropogenic sources include coal/oil combustion facilities, selenium refining factories, base metal smelting and refining factories, mining and milling operations, as well as fertilizer applications and incineration of tires, paper, and municipal waste (ATSDR, 1996).

Selenium speciation in soils is a function of soil pH and Eh. Selenium may occur in a number of different forms, including elemental selenium, selenides, selenites, selenates, and organic selenium. Elemental selenium (Se^0) is formed by bacteria, fungi, and algae, which are capable of reducing selenites and selenates. Elemental selenium is moderately stable in soils and is essentially insoluble, thus representing an inert sink under anoxic conditions.

Heavy metal selenides and selenium sulfides are also largely insoluble. They predominate in acidic soils and soils characterized by high organic matter content. Heavy metal selenides and selenium sulfides are generally considered immobile in soil. This is due to the low solubility that characterizes metal selenides such as copper and cadmium.

Elemental selenium can be oxidized to form selenites and selenates. The selenites (SeO_3^{2-}) are stable, under moderately reducing conditions, in alkaline to mildly acidic environments (Shamberger, 1983; Tokunaga et al., 1997). Although the selenites are soluble, they can strongly sorb onto surfaces of common soil minerals (iron oxides) and organic matter (Tokunaga et al., 1997). Selenites may also be removed from pore waters through the formation of an insoluble precipitate (basic ferric selenite [$Fe_2(OH)_4SeO_3$]), which can be formed in acidic soils ($4.5 < pH < 6.5$). Geering et al. (1968) indicated that the selenite concentration in solution in soils is governed primarily by this ferric oxide-selenite complex.

- **#** Selenium speciation is a function of soil pH and Eh.
- **#** Depending upon pH and Eh, selenium may occur as elemental selenium, selenides, selenites, selenate, and organic selenium.
- **#** Elemental selenium occurs under anerobic conditions. It is relatively stable and insoluble.
- **#** Selenides predominate in acidic soils and soils with high organic content. They are also relatively stable and insoluble.
- **#** Selenites are thermodynamically stable under reducing conditions, but may exist under oxidizing conditions as well. They are stable in alkaline to mildly acidic environments. Although they are soluble, they sorb onto iron oxides and organic matter, thereby limiting their mobility in the environment.
- **#** Selenate is the predominant species at pH values greater then 6.5 and oxidizing conditions. It is characterized as being soluble and having a low sorption potential. It is readily available for uptake by plants.
- **#** A variety of organic complexes may exist. These complexes are most prevalent in high organic soils.

At pH values greater then 6.5, selenium may be oxidized to the more soluble selenate ions (SeO_4^{2-}). Because of its relatively high solubility and low tendency to sorb onto soil particles, selenates are readily available for transport and uptake by plants. Soluble selenate (principally sodium selenate) appears to be responsible for most of the naturally occurring accumulation of high selenium in plants.

Selenium in organic complexes occurs in varying quantities in soils. Organic species of selenium can be increased by the accumulation of decaying plant residues. Organic selenium is also subject to microbiological breakdown, resulting in alkylselenium compounds, mainly dimethylselenide. In humic temperate regions with the relatively greater accumulation of soil organic matter, organic-selenium forms assume more importance. Organic soils retain selenium more strongly than mineral soils. Studies have shown that the addition of organic matter greatly diminished the evolution of volatile selenium compounds as well as the movement and leaching of selenium through soil columns (Berrow and Ure, 1989).

Based on the behavior of selenium in soils, it is expected that selenium would be concentrated in soil horizons characterized by either high iron contents or high organic matter contents. In New Zealand soil profiles, Wells (1967) as cited in Berrow and Ure (1989) found

that B2 horizons, with their accumulation of iron and clay-sized colloids, were characterized by the greatest selenium concentrations. In another study conducted in the United States, selenium concentrations were found to range from 0.01 to 2.5 mg/kg in 11 soil profiles collected in the United States (Berrow and Ure, 1989). The most ferruginous horizons of the soils were found to be the most seleniferous. In acid ferruginous soils, selenium was bound as a basic ferric selenite or strongly absorbed on ferric oxide. Lateritic soils of the continental United States that have been analyzed also contain 0.5 to 2.4 mg/kg of selenium in the iron-rich horizons (Shamberger, 1983).

An accumulation of selenium in podzolic B horizons and organic surface horizons was found in 54 Canadian profiles by Levesque (1974). In Finnish soils, Koljonen (1975) found that selenium was enriched in the O-A1 horizons rich in organic matter and in the iron-rich B horizons. Multiple regression analyses revealed that the predominant factors involved in selenium distribution were the content of the parent material and the organic carbon content of the upper soil horizons (Berrow and Ure, 1989).

Selenium in Surface Water

The data for selenium in surface water can be divided into two operationally defined fractions: dissolved selenium (passes through filters with 0.45- μm openings), and particulate selenium (trapped by filters having $\geq$0.45-μm openings, typically suspended sediment and other suspended solids). Particulate selenium exists in the same oxidation states as dissolved selenium. Dissolved selenium exists in three oxidation states, including selenide (Se^{2-}), selenite (Se^{4+}), and selenate (Se^{6+}). Although not truly dissolved, colloidal selenium passes through filters having 0.45-μm openings and, as a consequence, is grouped with the dissolved selenium phase. Colloids may consist of elemental selenium (Se^0).

Note that thermodynamic calculations describing selenium geochemistry can be misleading. In fact, thermodynamically unstable species have been measured at significant concentrations in natural waters. The presence of these species is attributed to biological mediation and/or kinetic hindrances to equilibrium.

- Selenate is the thermodynamically stable species under oxic and alkaline conditions.
- Selenite may also exist and should be assumed to be present.
- Elemental selenium and selenides dominate under anoxic conditions.
- Organic selenides may be present under both oxic and anoxic conditions.

Although selenate is the thermodynamically stable species under oxic and alkaline water conditions, both selenite and selenate are common in surface waters (ATDSR, 1996). Selenite exists as $HSeO_3^-$ at pH 6. As the pH increases, the concentration of $HSeO_3^-$ becomes less prevalent and SeO_3^{2-} increases in importance. At a pH of 9, SeO_3^{2-} exceeds $HSeO_3^-$ by a ratio of about 2:1. Dissolved selenate is present as SeO_4^{2-} in oxic waters having a pH range of 6 to 9.

The thermodynamic models predict that elemental selenium and selenide should dominate under anoxic conditions. Selenide may be present as H_2Se and HSe^- in anoxic waters. It

may also be present as organic selenides (primarily selenoamino acids bound in soluble peptides) in oxic and anoxic waters.

Although selenate is expected to be the dominant form of selenium in surface water, significant variability in speciation exists. In the Susquehanna River, which empties into the Chesapeake Bay, selenate is the predominant form of dissolved selenium (69% of the total). In contrast, samples from the St. Lawrence River in Canada show selenite to be the selenium species of highest concentration (67% to 76% of the total). Furthermore, recent data for several rivers in North America show that selenite and organic selenide (Se^{2-} and Se^{0}) are the dominant species. Specifically, it was found that 77% of the inorganic selenium can be classified as colloidal, whereas 70% of the organic selenium is colloidal, in river water collected from the James River in Virginia.

Because selenium is of special concern in the western United States due to widespread areas of selenium-rich source rocks, arid climate, and the potential for evapoconcentration, factors controlling transport and behavior in arid fluvial systems were investigated by Doyle et al. (1995). The three river systems included the Truckee, Walker, and Carson River watersheds, which comprise an area of over 200,000 km^2 in eastern California and western Nevada.

Selenium concentrations of < 1 to ~ 3 nM were measured in the three watershed systems. The source of the selenium appears to be atmospheric input and not geologic weathering. Despite the ability of selenium to evapoconcentrate, evidence indicated that it did not behave conservatively and was, in fact, depleted relative to other conservative species. Possible removal mechanisms include:

- Selenate reduction in anoxic bottom sediments and/or waters of the terminal lakes
- Volatilization to the atmosphere via planktonic biomethylation
- Incorporation of selenium-rich organic matter into sediments and subsequent burial
- Adsorption of thermodynamically unstable selenium onto iron oxides.

Selenium in Sediments

Transport across boundaries between surface waters and the underlying sediments is important in understanding the cycling of selenium. On a total mass basis, most of the selenium in surface water-sediment systems can be found in the sediments (Cutter, 1989). Selenium may be associated with the organic material, iron and manganese oxides, carbonates, or other mineral phases that constitute a sediment particle. This association is attributed to abiotic and biotic

- Most of the selenium in surface water-sediment systems is found in the sedimentary phase.
- Total dissolved selenium decreases more rapidly when organic matter is present in the system.
- Accumulations of selenium within sediments are largely confined to the near surface.
- Reducing conditions in the sediment promote the reduction of selenite and selenate to elemental selenium.

scavenging of dissolved ions from the water column and burial in the underlying sediments. Abiotic scavenging includes selenium adsorption and/or coprecipitation (primarily selenite and selenate). Selenide can be covalently bound in the organic portion of a sediment (the association of selenide with organic materials in sediment reflects the reducing conditions typical of organic matter). In addition, selenium may be found in anoxic sediments as insoluble metal selenide precipitates, as insoluble elemental selenium, or as ferroselite ($FeSe_2$) and selenium-containing pyrite.

In experiments designed to determine trends in inorganic selenium concentrations in water columns associated with sediment and sediment augmented with organic matter, it was found that there was a net decrease in total dissolved selenium in the water columns of both sediment systems (Tokunaga et al., 1997). More rapid decreases were observed in systems having organic matter added to the sediment. By the end of the experiment, 25% of the original selenium in the surface waters was transported into the unamended sediments. For systems, amended with organic matter, 95% of the selenium originally in the ponded water was transported into the sediments. Accumulations of selenium within the sediments were largely confined to the near-surface regions (< 25 mm depth) in both sets of experiments. Reducing conditions in the sediment promoted the reduction of selenate to selenite to elemental selenium, allowing a net accumulation of insoluble selenium species. The highest accumulations of selenium in the sediment occur within the top 1 mm of the columns, indicating a rapid reduction to elemental selenium.

Selenium concentrations in sediment are generally in the range of 1.5 to 4 mg/kg (Cutter, 1989). However, sedimentary accumulation of selenium will depend on a number of factors, including the total dissolved concentration of selenium in the system, sedimentation rate, biological productivity, and sediment type. Sediments in reservoirs that receive fossil fuel combustion products (e.g., fly ash) are characterized by elevated selenium concentrations. Cutter (1986) analyzed the concentration and phase distribution of selenium in sediments from three power plants-receiving waters (coal fly ash was the major source of selenium in the receiving waters). Within the sediments, selenium ranged in concentration from 6.5 to 29 mg/kg. Cutter (1986) indicated that more than 90 percent of the selenium was present in an “organic phase"; however, this organic phase is considered an operational definition and may include both elemental selenium and/or a selenium sulfide phases.

III. Effects Characterization

This section, along with the bioaccumulation potential section, is subdivided to evaluate receptors of the freshwater and terrestrial ecosystems separately. Figure J-3 summarizes the range of effects data for receptors of concern illustrating the sensitivity of various taxa to exposure. For reference, the water quality standards for freshwater communities (NAWQC or secondary values) are included for both acute and chronic endpoints. These values can be disregarded for receptors in the terrestrial community, because the NAWQC only provides protection for aquatic receptors, not predators of aquatic biota. The NAWQC provide a context for effects ranges in the aquatic community.

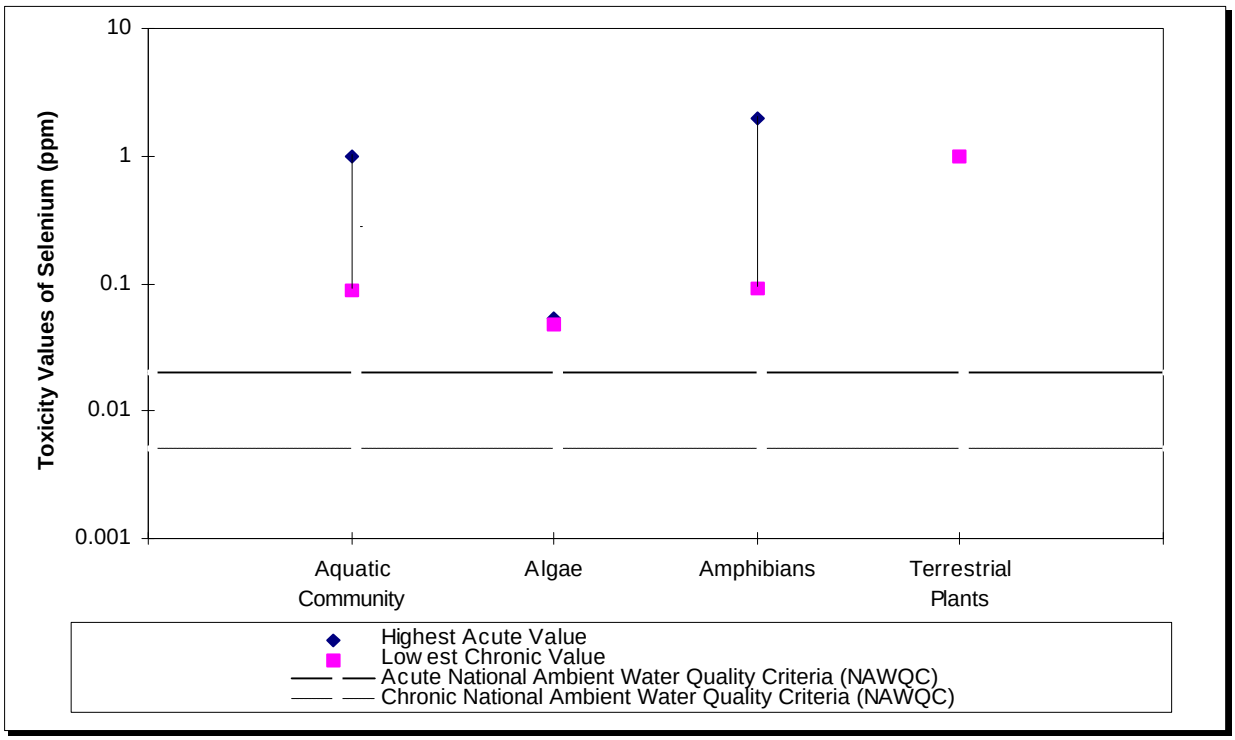

Figure J-3. Selenium: effects ranges for selected ecological parameters.

Freshwater Ecosystems

Sensitive aquatic organisms exhibit increased mortality at water concentrations of selenium between 60 and 600 ppb selenium (chemical form unspecified). Selenium's toxic effects in fish may vary with life stage, but include behavioral changes, altered blood chemistry, and decreased reproductive success (Eisler, 1985). Selenite is significantly more toxic than selenate, and younger life stages are more sensitive than older (Hamilton and Buhl, 1990). For selenite, LC_{50} values of 13.8 mg/L for chinook salmon and 7.8 mg/L for coho salmon were reported; for selenate, the corresponding values were 115 mg/L and 33 mg/L. Aquatic invertebrates demonstrate higher sensitivity to acute exposures than fish, with LC_{50} values ranging from 0.07 to 0.8 mg/L (Eisler, 1985). Amphibians exposed to water concentrations of selenium as sodium selenite have also shown adverse effects. Exposure to 2.0 mg/L and above during the egg stage of *Xenopus laevis* caused developmental malformations (chemical form unknown). Exposure during the tadpole stage resulted in altered behavior and physiological function (Power et al., 1989). Lethality to amphibians was observed in surface water concentrations ranging from 7 to 11 mg selenium/L (as sodium selenate). In algal communities, concentrations between 47 and 53 ppb have resulted in inhibited growth and shifts in representative species. No ecotoxicity data on potential effects to the sediment community could be identified (Power et al., 1989; Schuytema and Nebekar, 1996).

Terrestrial Ecosystems

Both acute and chronic effects have been indicated in terrestrial receptors. Acute selenosis in livestock may result from ingestion of highly contaminated plants and may produce death (Eisler, 1985). Plant materials containing 400 to 800 ppm selenium have been found to produce acutely toxic effects. The minimum orally administered lethal dose, in mg Se/kg body weight, range from 3.3 for horses, to 11 for cattle, to 15 for swine (Eisler, 1985).

Chronic selenosis in mammals may result from dietary exposures ranging from 1 ppm (rat) to 44 ppm (horse) and drinking water exposures of 0.5 to 2.0 ppm (Harr and Muth, 1972). Selenosis has also been associated with reproductive anomalies, including congenital malformations and growth retardation (Eisler, 1985). Rats dosed with selenium as selenate at 0.34 mg/kg-day for two generations demonstrated decreased reproductive success (Rosenfeld and Beath, 1954). In general, studies on rats, mice, swine, and cattle, have found that the young born to females with selenosis were emaciated, were unable to nurse, were part of small litters, and exhibited high mortality rates (Eisler, 1985). Although some studies have reported carcinogenicity, selenium's carcinogenic potential remains unclear (U.S. EPA, 1998).

Limited literature sources were identified to evaluate the direct impacts to terrestrial plant and soil communities; however, overall impacts appear less severe in these receptors. Their role as bioaccumulators and vectors of exposure to higher trophic levels may play a more significant part in the observed ecological impacts of selenium. In plants, the lowest observed effects concentrations have been reported in the range of 1 to 4 ppm; whereas, acutely toxic concentrations of 25 to 50 ppm have been observed (Efroymson et al., 1997b; Eisler, 1985). One study identifying reproductive effects of selenium to cocoon production in earthworms reported no effects at 77 ppm.

IV. Bioaccumulation Potential

Freshwater Ecosystems

Selenium accumulates in the aquatic environment in many kinds of organisms, including algae, periphyton, daphnids, benthic insects, annelids, molluscs, crustaceans, and fish, as well as birds (Besser et al., 1993; Lemly, 1985; Ohlendorf et al., 1990). Ohlendorf et al. (1990) studied accumulation of selenium in aquatic birds living near contaminated waterbodies. They found that selenium concentrations in liver tissues of birds from this site were much higher, often ten times or more, than those of birds living in relatively uncontaminated reference sites. Evidence suggests that accumulation of selenium occurs more readily as organoselenium compounds than as inorganic forms. Preferential uptake of selenomethionine relative to inorganic species has been reported in algae, daphnids, and fish (Lemly, 1985; Besser et al., 1993). Consumption of selenomethionine has also been shown to be more effective than sodium selenite in raising the selenium content of bird tissues and eggs (Eisler, 1985). Low concentrations of Se-methionine could thus contribute significantly to selenium bioaccumulation and toxicity in aquatic biota, although the chemical forms and concentrations of specific organoselenium compounds are not often reported in the literature, making assessments of their toxicological importance difficult (Besser et al., 1993).

Bioaccumulation factors (BAFs) for selenium used to determine food chain exposures are based on studies from Lemly (1985). This important field study is based on selenium concentration in fish inhabiting a river basin where selenium enters the reservoir as part of coal ash disposal. Lemly (1985) suggests that selenium not only can biomagnify through the food chain, but that the large amount of selenium accumulated in higher trophic piscivorous fish can shut down their reproductive systems and, in many cases, cause death. Because this is a field study where the fish receive exposures of selenium via food and water, values presented in Lemly (1985) are BAFs. A muscle-based BAF of 1,692 L/kg is used to represent trophic level 4 fish for estimating food chain exposures to piscivorous mammals and birds; this value is based on the geometric mean of the BAFs 1,571, 2,019, and 1,527 L/kg from piscivorous fishes such as crappie (*Pomoxis* sp.), Largemouth bass (*Micropterus salmoides*), and white perch (*Morone americana),* respectively. Additionally, a BAF of 485 L/kg from blueback herring (*Alosa aestivalis*) and threadfin shad (*Dorosoma petenense*) represents BAFs for trophic level 3 fish for estimating food chain exposures to piscivorous wildlife. Because no whole-body BAFs are identified, the muscle-based BAFs are used. As an aside, all BAF values are taken from Table 4 of Lemly (1985); although they are presented in units of L/g, they seem to be too high for even the most bioaccumulative constituents. A closer examination on the concentration of selenium in fishes (Figure 4 and 5) and concentration of selenium strongly suggest that the values in Table 4 are in units of L/kg rather than in L/g.

Terrestrial Ecosystems

Bioaccumulation in terrestrial invertebrates, plants, and small mammals is currently being investigated at Oak Ridge National Labs. Bioaccumulation and bioconcentration factors for terrestrial plants, invertebrates, and small mammals have been proposed from review of primary literature sources. The 90th percentile of the bioaccumulation data for these receptors derived from both laboratory and field studies was used to determine terrestrial food chain exposures. For earthworms, a BAF of 1.3 was proposed for selenium based on 15 data points. For terrestrial plants, a BCF of 26 was proposed based on 237 data points. For small mammals, based on 35 reported values assessing the transfer of selenium from soil to small mammals, a BAF of 1.2 was proposed (Sample et al., 1997, 1998a, 1998b). These values are in the process of being reviewed for use in modeling food chain exposures to terrestrial species, but currently they stand as the most comprehensive collection of bioaccumulation data for terrestrial ecological receptors. Further review of methods and primary literature is currently being conducted on these high-end values (Sample et al., 1997, 1998a, 1998b).

V. Criteria Development

The benchmark values presented in this section for mammals and birds were used to derive protective media-specific criteria as outlined in the stressor-response profile methodology (i.e., analysis phase of ERA). By scaling the benchmark study by body weight to a representative wildlife receptor (e.g., rat study extrapolated to a shrew), determining the dietary preferences of wildlife receptor and the potential bioconcentration in prey, a protective concentration (i.e., criteria) in soil, plants, or surface water was developed. Since criteria for receptors other than mammals and birds were already in media concentrations, this same derivation process was not required. A summary of criteria is provided in Table J-3. Although criteria were developed for numerous wildlife receptors of both the aquatic (e.g., otter, mink, and great blue heron) and

terrestrial ecosystems (e.g. shrew, fox, and hawk), only the lowest criterion is presented in Table J-3. It is assumed that, by protecting the more sensitive species, the other receptors are protected as well.

Mammals: Rosenfeld and Beath (1954) examined the effects of selenium on the reproduction of successive generations of Wistar rats. The authors administered doses of 1.5, 2.5, and 7.5 ppm of selenium as selenate in drinking water. The 2.5-ppm dose was reported to have reduced the number of young reared by the second generation mothers by 50%. This reduction resulted in a LOAEL of 2.5 ppm and a NOAEL of 1.5 ppm. These effects levels correspond to daily doses of 0.34 and 0.20 mg/kg-day, based on the Wistar rat's reference body weight of 0.320 kg and water consumption rate of 0.043 L/day (U.S. EPA, 1988).

The NOAEL of 0.20 mg/kg-day for reproductive effects from the Rosenfeld and Beath (1954) study was chosen to derive the toxicological benchmark for the following reasons: (1) doses were administered over a chronic duration and via oral ingestion, an ecologically significant exposure pathway; (2) it focused on long-term reproductive success as a critical endpoint; (3) it contained dose response information; and (4) it resulted in the lowest toxicity value for a critical endpoint.

Schroeder and Mitchener (1971) assessed the reproductive effects of selenium in three generations of mice. A single dose of 3 ppm selenium as selenate was administered in drinking water. Mice in all three generations produced fewer offspring and a greater percentage of runts than the controls. Conversion of the 3-ppm dose to a daily dose in units of mg/kg-day required the use of an allometric equation for water consumption by laboratory mammals (U.S. EPA, 1988):

$$Water\ Consumption\ (L/day) = 0.10(W^{0.7377})$$

where W is body weight in kilograms. Using a reference body weight for two typical types of laboratory mice (0.035 kg) (U.S. EPA, 1988) and a calculated water consumption rate of 0.008 L/day, a daily dose of 0.69 mg/kg-day was calculated. Nobunaga et al. (1979) exposed mice to two oral doses of selenium as selenite in drinking water for 30 days prior to mating and for the first 18 days of gestation. No significant effects on reproduction or incidences of fetotoxicity were evident at the lower dose of 11.4 nmol/mL (NOAEL), however, the higher dose of 22.8 nmol/mL (LOAEL) resulted in a significant reduction in fetal growth. These effects levels correspond to daily doses of 0.9 mg/kg-day and 1.7 mg/kg-day. To arrive at these figures, the molecular weight of sodium selenite was used to convert the nmol/mL doses to ppm doses. The ppm dose was then converted to the daily dose by using the geometric mean of mice body weights (0.028 kg) given in the study, and a water intake rate of 0.007 L/day, calculated from the allometric equation presented above (U.S. EPA, 1988).

The Schroeder and Mitchener (1971b) study was not chosen for the derivation of the benchmark because it did not contain sufficient dose response information. The Nobunaga (1979) study was not chosen because it did not report the lowest toxicity value for a critical endpoint.

Table J-3. Selenium Criterion in Soil, Sediment, Surface Water, and Plant Tissue Developed for Each Representative Receptor

Receptor	Criteria	Units	Exposure Pathway	Representative Species	Reference
Aquatic					
Mammals	6.0E-03	mg/L water	Food web	River Otter	Ambrose et al., 1976
Birds	1.9E-02	mg/L water	Food web	Kingfisher	Heinz et al., 1987
Algae and Aquatic Plants	1.0E-01	mg/L water	Direct contact	*Scenedesmus obliquus*	Suter and Tsao, 1996
Freshwater Community					
Total	5.0E-03	mg/L water	Direct contact	Aquatic biota	U.S. EPA, 1995
Selenium IV	2.8E-02	mg/L water	Direct contact	Aquatic biota	U.S. EPA, 1995
Selentium VI	9.5E-03	mg/L water	Direct contact	Aquatic biota	U.S. EPA, 1995
Amphibian (acute effects)	1.6E+00	mg/L water	Direct contact	Various amphibian species	Power et al., 1989; Schuytema and Nebeker, 1996
Terrestrial					
Mammals	2.1E+01	mg/kg soil	Food web	Raccoon	Rosenfeld and Beath, 1954
Birds	1.1E+01	mg/kg soil	Food web	American woodcock	Heinz et al., 1987
Mammals	1.1E+00	mg/kg plant tissue	Food web	Meadow vole	Rosenfeld and Beath, 1954
Birds	1.1E+01	mg/kg plant tissue	Food web	Northern bobwhite	Heinz et al., 1987
Plant Community	1.0E+00	mg/kg soil	Direct contact	Sorgrass	Efroymson et al., 1997b
Soil Community	7.0E+01	mg/kg soil	Direct contact	Soil invertebrates	Efroymson et al., 1997a

The same surrogate species study (Rosenfeld and Beath, 1954) was chosen to derive the selenium benchmark for mammalian species representing the terrestrial ecosystem.

Birds: Only one study was identified that investigated the effects of selenium toxicity on avian species. Mallard duck pairs were fed diets containing selenium for 4 weeks prior to egg laying at doses of 1, 5, 10, 25, and 100 ppm selenium as sodium selenite (Heinz et al., 1987). There were no effects on the weight or survival of adults at the 1-, 5-, and 10-ppm dose levels. At the 25-ppm level females took longer to begin laying eggs and intervals between eggs were longer. Survival of ducklings in the 25-ppm group was lower than in the lower exposure groups. Among ducks fed 10 ppm and 25 ppm, there was a significantly greater frequency of lethally deformed embryos, as compared to the lower exposure treatment groups. This resulted in a LOAEL of 10 ppm and a NOAEL of 5 ppm. These effects levels correspond to daily doses of 1.0 and 0.5 mg/kg-day, respectively, converted by using the food intake rate of 105.5 g/day and the geometric mean (1.055 kg) of the control body weights given in the study.

The NOAEL of 0.5 mg/kg-day from the Heinz et al. (1987) study was selected to derive the avian benchmark value for the freshwater ecosystem because: (1) chronic exposures were administered via oral ingestion; (2) reproductive toxicity was one of the primary endpoints examined, and (3) the study contained sufficient dose-response information.

As in the freshwater ecosystem, the study by Heinz et al. (1987) was used to calculate the benchmarks for birds in the generic terrestrial ecosystem.

Freshwater Community: Two sources were evaluated in selecting criteria for the protection of aquatic biota: (1) Final Chronic Values (FCV) derived under the Great Lakes Water Quality Initiative (GLWQI) (U.S. EPA, 1995) and (2) National Ambient Water Quality Criteria (NAWQC) published by the EPA Office of Water. The FCVs of 5.0E-03 mg/L for total selenium, 2.8E-02 mg/L for selenium IV, and 9.5E-03 mg/L for selenium VI developed under the GLWQI were selected as the appropriate criteria to use in this analysis. The GLWQI values were considered preferable to the NAWQC because: (1) the GLWQI values are based on the same methodology used to develop NAWQC (i.e., Stephan et al., 1985); (2) the NAWQC data set was augmented with previously unavailable acute and chronic toxicity data; and (3) species taxa used to generate the GLWQI values are suitable for national application since they include species and taxa found throughout the United States.

Although total concentrations of metals are still deemed scientifically defensible by EPA, recent EPA guidance recommends the use of dissolved metals concentrations to better reflect the bioavailability of metals (e.g., Prothro, 1993). EPA has developed conversion factors (CFs) to estimate probable dissolved concentrations of metals in surface waters given a total metal concentration as described in 60 FR22231 (*Water Quality Standards...Revision of Metals Criteria*). A CF is not yet available for selenium. This adjustment reflects the current EPA position on criteria development and regulatory application of metals; however, the issue of metal bioavailability in surface waters is the topic of intensive research (e.g., Bergman and Dorward-King, 1997). The final surface water criterion for selenium species is presented in Table J-3.

Amphibians: No suitable subchronic or chronic studies were identified that studied the effects of selenium toxicity on reproductive or developmental endpoints in amphibian species Acute toxicity data on selenium were identified to range from 7 to 11 mg/L during embryo exposures of *Xenopus laevis*. Low effects and no effects data were identified in one study with reported values of 1.6 and 0.8 mg selenium/L, respectively (Schuytema and Nebeker, 1996). Using this range as a guide, both of these values fall above the NAWQC; however, lacking sufficient data on various species, exposure durations, and life stages, the assertion of protection under the NAWQC cannot be made. Incorporating the amphibian data into the NAWQC within the data requirement categories is currently under consideration. Since amphibian species are more likely to breed in standing waters such as wetlands or ponds, the appropriateness of combining protection of amphibian receptors with the aquatic community is unclear (Power et al. 1989; Schuytema and Nebeker, 1996).

Algae and Aquatic plants: The benchmarks for aquatic plants were either: (1) a no observed effects concentration (NOEC) or a lowest observed effects concentration (LOEC) for vascular aquatic plants (e.g., duckweed) or (2) an effective concentration (EC_{xx}) for a species of freshwater algae, frequently a species of green algae (e.g., *Selenastrum capricornutum*). The benchmark value for selenium reported by Suter and Tsao (1996) was 1.0E+02 µg/L (selenate) based on the growth inhibition of the green alga *Scenedesmus obliquus* in 14-day chronic toxicity tests. The selection of a benchmark based on selenium as selenate is preferred because plants show preferential uptake of this form. Low confidence is placed in this criterion since it is only based on one study.

Benthic Community: The premier source of field sediment data is NOAA, which annually collects and analyzes sediment samples from sites located in coastal marine and estuarine environments throughout the United States as part of the National Status and Trends Program (NSTP). From the range of adverse effects data, criteria are developed estimating the 10th percentile effects concentration (ER-L) and a median effects concentration (ER-M) for adverse effects in the sediment community (Long et al., 1995). A second criteria document evaluated for sediment criteria development was the *Approach to the Assessment of Sediment Quality in Florida Coastal Waters Volume 1- Development and Evaluation of Sediment Quality Assessment Guidelines)* (MacDonald et al., 1994) published by the Florida Department of Environmental Protection (FDEP). The criteria developed by FDEP were also based on the NOAA data; however, the method of derivation of the criteria was changed. Neither of these documents developed a suitable sediment benchmark for selenium. Therefore, no benchmark on selenium could be developed.

Terrestrial Plants: As presented in Efroymson et al. (1997b), phytotoxicity benchmarks were selected by rank-ordering the LOEC values and then approximating the 10th percentile. If fewer than 10 studies were available, the lowest LOEC was selected as the benchmark. Such LOECs applied to reductions in plant growth, yield, or seed elongation, or other effects reasonably assumed to impair the ability of a plant population to sustain itself. The selected benchmark for phytotoxic effects of selenium in soils is 1.0 mg/kg (Efroymson et al., 1997b). The derivation of the criterion is based on 13 phytotoxicity data points on various agricultural (e.g., barley, ryegrass) species measuring growth endpoints such as height and weight of shoots and roots. Considering this criterion was based on multiple studies over a range of species, confidence in this benchmark is high.

Soil Community: Because no adequate data to develop community-based criteria were identified, criteria for soil from earthworm studies presented in Efroymson et al. (1997a) of 70 mg/kg for selenium was used; it is based on one study reporting effects on growth and reproduction of *Eisenia fetida*. Earthworms have been recognized to play important roles in promoting soil fertility, releasing nutrients, providing aeration and aggregation of soil, as well as being an important food source for higher trophic level organisms. Even though earthworms are important, basing a soil criteria on one species does not ensure protection to the entire soil community given the complex processes and interactions characteristic of functional soil communities.

References

Ambrose, A.M., P.S. Larson, J.F. Borzelleca, and G.R. Hennigar, Jr. 1976. Long term toxicologic assessment of nickel in rats and dogs. *Journal of Food Science and Technology* 13:181-187. As cited in U.S. EPA 1998 (IRIS).

ATSDR (Agency for Toxic Substances and Disease Registry). 1996. *Toxicological Profile for Selenium* (Update). Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA.

Bergman, H.L., and E.J. Dorward-King (eds). 1997. *Reassessment of Metals Criteria for Aquatic Life Protection: Priorities for Research and Implementation*. SETAC Press, Pensacola, FL.

Berrow, M.L., and A.M. Ure. 1989. Chapter 9: Geological materials and soils. In: *Occurrence and Distribution of Selenium,* M. Ihnat (ed.), CRC Press, Boca Raton, FL. pp. 213 to 242.

Besser, J.M., T.J. Canfield, and T.W. La Point. 1993. Bioaccumulation of organic and inorganic selenium in a laboratory food chain. *Environmental Toxicology and Chemistry* 12:57-72.

Cutter, G.A. 1986. *Speciation of Selenium and Arsenic in Natural Waters and Sediment. Volume I: Selenium Speciation.* EA-4641. Prepared for Electric Power Research Institute. Prepared by Old Dominion University, Norfolk, VA. pp. 5-1 to 5-12.

Cutter, G.A. 1989. The estuarine behavior of selenium in San Francisco Bay. *Estuarine, Coastal, and Shelf Science* 28:13-34.

Doyle, G.A., W.B. Lyons, G.C. Miller, and S.G. Donaldson. 1995. Oxyanion concentrations in eastern Sierra Nevada rivers - 1. selenium. *Applied Geochemistry* 10:553-564.

Efroymson, R.A., M.E. Will, and G.W. Suter, II. 1997a. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision.* ES/ER/TM-126/R2. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Lockheed Martin Energy Systems, Inc., Oak Ridge, TN.

Efroymson, R.A., M.E. Will, G.W. Suter, II, and A.C. Wooten. 1997b. *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision*. ES/ER/TM-85/R3. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Lockheed Martin Energy Systems, Inc., Oak Ridge, TN.

Eisler, R. 1985. Selenium hazards to fish, wildlife, and invertebrates: a synoptic review. In: *Contaminant Hazard Reviews, Report No. 5*. U.S. Fish and Wildlife Service, U.S. Department of the Interior, Laurel, MD.

Geering, H.R., E.E. Cary, L.H.P. Jones, and W.H. Allaway. 1968. Solubility and redox criteria for the possible forms of selenium in soils. *Soil Science Society of America Proceedings* 32:35-40.

Hamilton, S.J., and K.J. Buhl. 1990. Acute toxicity of boron, molybdenum, and selenium to fry of chinook salmon and coho salmon. *Archives of Environmental Contamination and Toxicology* 19:366-373.

Harr, J.R., and O.H. Muth. 1972. Selenium poisoning in domestic animals and its relationship to man. *Clinical Toxicology* 5(2):175-186.

Heinz, G.H., D.J. Hoffman, A.J. Krynitsky, and D.M.G. Weller. 1987. Reproduction in mallards fed selenium. *Environmental Toxicology and Chemistry* 6:423-433.

Koljonen, T. 1975. The behavior of selenium in Finnish soils. *Annales Agriculturae Fenniae* 14:240-247.

Lemly, A.D. 1985. Toxicology of selenium in a freshwater reservoir: implications for environmental hazard evaluation and safety. *Ecotoxicology and Environmental Safety* 10:314-338.

Lévesque, M. 1974. Selenium distribution in Canadian soil profiles. *Canadian Journal of Soil Science* 54:63-68.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. *Environmental Management* 19(1):81-97.

MacDonald, D.D. 1994. *Approach to the Assessment of Sediment Quality in Florida Coastal Waters. Volumes I & II.* Prepared for Florida Department of Environmental Protection, Office of Water Policy. Prepared by MacDonald Environmental Sciences Ltd., Ladysmith, British Columbia.

Nobunaga, T., H. Satoh, and T. Suzuki. 1979. Effects of sodium selenite on methylmercury embryotoxicity and teratogenicity in mice. *Toxicology and Applied Pharmacology* 47:79-88.

Ohlendorf, H.M., R.L. Hothem, C.M. Bunck, and K.C. Marois. 1990. Bioaccumulation of selenium in birds at Kesterson Reservoir, California. *Archives of Environmental Contamination and Toxicology* 19:495-507.

Power, T., K.L. Clark, A. Harfenist, and D.B. Peakall. 1989. A review and evaluation of the amphibian toxicological literature. In: *Technical Report Series No. 61*. Canadian Wildlife Service.

Prothro, M.G. 1993. Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria. Memorandum. U.S. Environmental Protection Agency,

Rosenfeld, I., and O.A. Beath. 1954. Effect of selenium on reproduction in rats. *Proceedings of the Society for Experimental Biology and Medicine* 87:295-297.

Sample, B.E., M.S. Aplin, R.A. Efroymson, G.W. Suter, II, and C.J.E. Welsh. 1997. *Methods and Tools for Estimation of the Exposure of Terrestrial Wildlife to Contaminants*. ORNL/TM-13391. Prepared for Office of Environmental Policy and Assistance, U.S. Department of Energy. Prepared by Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, and G.W. Suter, II. 1998a. *Development and Validation of Bioaccumulation Models for Small Mammals*. ES/ER/TM-219. Prepared for Office of Environmental Management, U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN.

Sample, B.E., J.J. Beauchamp, R.A. Efroymson, G.W. Suter, II, and T.L. Ashwood. 1998b. *Development and Validation of Bioaccumulation Models for Earthworms*. ES/ER/TM-220. Prepared for Office of Environmental Management, U.S. Department of Energy. Oak Ridge National Laboratory, Oak Ridge, TN.

Schroeder, H.A., and M. Mitchener. 1971. Toxic effects of trace elements on the reproduction of mice and rats. *Archives of Environmental Health* 23:102-106.

Schuytema, G.S., and A.V. Nebeker. 1996. *Amphibian Toxicity Data for Water Quality Criteria Chemicals*. EPA/600/R-96/124. National Health and Environmental Effects Research Laboratory, Western Ecology Division, U.S. Environmental Protection Agency, Corvallis, OR.

Shamberger, R.J. 1983. Biochemistry of selenium. In: *Biochemistry of the Elements*. Frieden, E. (ed.). 167-183. Plenum Press, New York, NY.

Stephan, C.E., D.I. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman, and W.A. Brungs. 1985. *Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses*. PB85-227049. Environmental Research Laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Duluth, MN.

Suter, G.W., II, and C.L. Tsao. 1996. *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision*. ES/ER/TM-96/R2. Prepared for Office of Environmental Management, U.S. Department of Energy. Prepared by Health Sciences Research Division, Oak Ridge National Laboratory Risk Assessment Program, Oak Ridge, TN.

Tokunaga, T.K., G.E. Brown, Jr., I.J. Pickering, S.R. Sutton, and S. Bajt. 1997. Selenium redox reactions and transport between ponded waters and sediments. *Environmental Science and Technology* 31:1419-1425.

U.S. EPA (Environmental Protection Agency). 1988. *Recommendations for and Documentation of Biological Values for Use in Risk Assessment*. EPA/600/6-87/008. Office of Health and Environmental Assessment, Cincinnati, OH.

U.S. EPA (Environmental Protection Agency). 1995. *Great Lakes Water Quality Initiative Criteria Documents for the Protection of Aquatic Life in Ambient Water*. EPA-820-B-95-004. Office of Water, Washington, DC.

U.S. EPA (Environmental Protection Agency). 1997. *Protocol for Screening Level Ecological Risk Assessment at Hazardous Waste Combustion Facilities. Volumes I and II* (Internal Review Draft). EPA-R6-096-003. Office of Solid Waste, Dallas, TX.

U.S. EPA (Environmental Protection Agency). 1998. Integrated Risk Information System (IRIS) Database. Cincinnati, OH. August.