APPENDIX F

EQUATIONS FOR COMPUTING COPC CONCENTRATIONS AND COPC DOSE INGESTED TERMS

Screening Level Ecological Risk Assessment Protocol

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TABLE F-1-1

COPC CONCENTRATIONS IN TERRESTRIAL PLANTS FOR TERRESTRIAL FOOD WEBS

Description

This equation calculates the COPC concentration in plants due to: (1) *Pd* - wet and dry deposition of COPCs onto plant surfaces, (2) *Pv* - uptake of vapor phase COPCs onto plant surfaces, (3) *Pr* uptake of COPCs from soil through plant roots. Uncertainties associated with the use of this equation include the following:

Uncertainties introduced by this variable include the following:

(1) Some of the variables in the equations in Tables B-3-7, B-3-8, and B-3-9—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. Uncertainties associated with these variables are site-specific.

(2) In the equation in Table B-3-7, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), *kp* (estimation process does not consider chemical degradation). All of these uncertainties contribute to the overall uncertainty associated with C_{TP}.

Equation

$$C_{TP} = (Pd + Pv + Pr)$$

Variable	Description	Units	Value
C_{TP}	COPC concentration in terrestrial plants	mg COPC/kg WW	

TABLE F-1-1

COPC CONCENTRATIONS IN TERRESTRIAL PLANTS FOR TERRESTRIAL FOOD WEBS

Variable	Description	Units	Value
Pd	Plant concentration due to direct deposition	mg COPC/kg WW	**Varies** This variable is calculated with the equation in Table B-3-1. This variable represents the COPC concentration in plants due to wet and dry deposition of COPCs onto plant surfaces. The limitations and uncertainty introduced in calculating this variable include the following: (1) Variables *Q*, *Dydp*, and *Dywp* are COPC- and site-specific. Uncertainties associated with these variables are site-specific. (2) In calculating the variable *Fw*, values of *r* assumed for most organic compounds—based on the behavior of insoluble polystyrene microspheres tagged with radionuclides— may accurately represent the behavior of organic compounds under site-specific conditions. (3) The empirical relationship used to calculate the variable *Rp*, and the empirical constant for use in the relationship, may not accurately represent site-specific plant types. (4) The recommended procedure for calculating the variable *kp* does not consider chemical degradation processes. This conservative approach contributes to the possible overestimation of plant concentrations.
Pv	Plant concentration due to air-to-plant transfer	mg COPC/kg WW	**Varies** This variable is calculated with the equation in Table B-3-2. Uncertainties associated with the use of this equation include the following: (1) The algorithm used to calculate values for the variable F_v assumes a default value for the parameter S_T (Whitby's average surface area of particulates [aerosols]) of background plus local sources, rather than an S_T value for urban sources. If a specific site is located in an urban area, the use of the latter S_T value may be more appropriate. The S_T value for urban sources is about one order of magnitude greater than that for background plus local sources and would result in a lower *Fv* value; however, the F_v value is likely to be only a few percent lower.
Pr	Plant concentration due to root uptake	mg COPC/kg WW	**Varies** This variable is calculated with the equation in Table B-3-3. *Cs* is the COPC concentration in soil due to deposition. This variable is calculated using emissions data, ISCST3 air dispersion and deposition model, and soil fate and transport equations (presented in Appendix B). Uncertainties associated with the use of this equation include the following: (1) The availability of site-specific information, such as meteorological data, will affect the accuracy of *Cs* estimates.

TABLE F-1-2

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Description

This equation calculates the COPC concentration in herbivorous mammals through the ingestion of plants, soil, and water in the forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) Variables: C_{TP}, C_S, and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables are site-specific.
(2) Variables: $BCF_{TP\text{-}HM}$, $BCF_{S\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations in site-specific herbivorous mammals.

Equation

$$C_{HM} = (C_{TP} \cdot BCF_{TP\text{-}HM} \cdot P_{TP} \cdot F_{TP}) + (C_S \cdot BCF_{S\text{-}HM} \cdot P_S) + (C_{wctot} \cdot BCF_{W\text{-}HM} \cdot P_W)$$

Variable	Description	Units	Value
C_{HM}	COPC concentration in herbivorous mammals	mg COPC/kg FW tissue	
C_{TP}	COPC concentration in terrestrial plants	mg COPC/kg WW	**Varies** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-1. Uncertainties introduced by this variable include the following: (1) Some of the variables in the equations in Tables B-3-1, B-3-2, and B-3-3—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. (2) In the equation in Table B-3-1, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), and *kp* (estimation process does not consider chemical degradation). All of these uncertainties contribute to the overall uncertainty associated with C_{TP}. (3) In the equation in Table B-3-3, COPC-specific soil-to-plant bioconcentration factors (BCF_{TP}) may not reflect site-specific conditions.

TABLE F-1-2

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
$BCF_{TP\text{-}HM}$	Bioconcentration factor for terrestrial plant-to-herbivorous mammal	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in herbivorous mammals through dietary exposure. $BCF_{TP\text{-}HM}$ values are provided in Appendix D.
P_{TP}	Proportion of terrestrial plant in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{TP}	Fraction of diet comprised of terrestrial plants	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of terrestrial plants. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-2

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_S	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. This variable is calculated using emissions data, ISCST3 air dispersion and deposition model, and soil fate and transport equations (presented in Appendix B). C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs*. (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$BCF_{S\text{-}HM}$	Bioconcentration factor for soil-to-herbivorous mammal	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW soil)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in herbivorous mammals through soil exposure. $BCF_{S\text{-}HM}$ values are provided in Appendix D.
P_S	Proportion of ingested soil that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-1-2

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, the uncertainty associated with using default *OC* values may be significant in specific cases.
$BCF_{W\text{-}HM}$	Bioconcentration factor for water-to-herbivorous mammal pathways	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in herbivorous mammals through indirect water exposure (total water body concentration). $BCF_{W\text{-}HM}$ values are provided in Appendix D.

TABLE F-1-3

COPC CONCENTRATIONS IN INVERTEBRATES IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1.0** This OSW variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA recommend that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

Description

This equation calculates the COPC concentration in invertebrates through exposure to soil in the forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) C_S values are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) $BCF_{S\text{-}INV}$ values are intended to represent "generic invertebrate species", and therefore may over- or under-estimate exposure for site-specific organisms.

Equation

$$C_{INV} = C_S \cdot BCF_{S\text{-}INV}$$

Variable	Description	Units	Value
C_{INV}	COPC concentration in invertebrates	mg COPC/kg FW	

TABLE F-1-3

COPC CONCENTRATIONS IN INVERTEBRATES IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

(Page 2 of 2)

Variable	Description	Units	Value
C_S	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. This variable is calculated using emissions data, ISCST3 air dispersion and deposition model, and soil fate and transport equations (presented in Appendix B). C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs*. (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$BCF_{S\text{-}INV}$	Bioconcentration factor for soil-to-invertebrate	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW soil)]	**Varies** This variable is COPC-, site- and species-specific, and is provided in Appendix C. The following uncertainties are associated with this variable: (1) The COPC specific $BCF_{S\text{-}INV}$ values may not accurately represent site-specific soil conditions which could influence the bioavailability of COPCs, therefore over-or under-estimating C_{INV} to an unknown degree. (2) The data set used to calculate $BCF_{S\text{-}INV}$ is based on a limited number of test organism. The uncertainty associated with calculating concentrations using $BCF_{S\text{-}INV}$ in site-specific organisms is unknown and may over- or under-estimate C_{INV}.

TABLE F-1-4

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Description

This equation calculates the COPC concentration in herbivorous birds through the ingestion of plants, soil, and water in the forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) Variables: C_{TP}, C_S, and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) Variables: $BCF_{TP\text{-}HB}$, $BCF_{S\text{-}HB}$, and $BCF_{W\text{-}HB}$ are calculated based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations in site-specific herbivorous birds.
(3) The use of a single $Ba_{chicken}$ value for each COPC may not accurately reflect site-specific conditions. The default values may under- or overestimate C_{HB}.

Equation

$$C_{HB} = (C_{TP} \cdot BCF_{TP\text{-}HB} \cdot P_{TP} \cdot F_{TP}) + (C_S \cdot BCF_{S\text{-}HB} \cdot P_S) + (C_{wctot} \cdot BCF_{W\text{-}HB} \cdot P_W)$$

Variable	Description	Units	Value
C_{HB}	COPC concentration in herbivorous birds	mg COPC/kg FW tissue	
C_{TP}	COPC concentration in terrestrial plants	mg COPC/kg WW	**Varies** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-1. Uncertainties introduced by this variable include the following: (1) Some of the variables in the equations in Tables B-3-1, B-3-2, and B-3-3—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. (2) In the equation in Table B-3-1, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), and *kp* (estimation process does not consider chemical degradation). All of these uncertainties contribute to the overall uncertainty associated with C_{TP}.

TABLE F-1-4

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
$BCF_{TP\text{-}HB}$	Bioconcentration factor for plant-to-herbivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in herbivorous birds through dietary exposure. $BCF_{TP\text{-}HB}$ values are porvided in Appendix D.
P_{TP}	Proportion of terrestrial plant in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{TP}	Fraction of diet comprised of terrestrial plants	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of terrestrial plants. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces significant uncertaintiy and may over-estimate exposure from ingestion of a single dietary item. (3) The defalut value for an equal diet introduces significant uncertainity and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-4

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_S	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs*. (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$BCF_{S\text{-}HB}$	Bioconcentration factor for soil-to-herbivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW soil)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in herbivorous birds through soil exposure. $BCF_{S\text{-}HB}$ values are provided in Appendix D.
P_S	Proportion of ingested soil that is contamanted	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-1-4

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, the uncertainty associated with using default *OC* values may be significant in specific cases.
$BCF_{W\text{-}HB}$	Bioconcentration factor for water-to-herbivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in herbivorous birds through indirect exposure to water. $BCF_{W\text{-}HB}$ values are provided in Appendix D.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Description

This equation calculates the COPC concentration in omnivorous mammals through ingestion of plants, soil, and water in the forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) Variables C_S, and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) Variables: $BCF_{W\text{-}OM}$ and $BCF_{S\text{-}OM}$ are calculated based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and may introduce significant uncertainty when used to compute concentrations in site-specific omnivorous mammals.
(3) *FCMs* are COPC- and site-specific and may introduce uncertainty when applied to terrestrial environments to account for COPC bioaccumulation between trophic level (see Chapter 5 for further discussion).

Equation

$$C_{OM} = \left(C_{INV} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{INV} \cdot F_{INV} \right) + \left(C_{TP} \cdot BCF_{TP\text{-}OM} \cdot P_{TP} \cdot F_{TP} \right) + \left(C_{HM} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{HM} \cdot F_{HM} \right)$$

$$+ \left(C_{HB} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{HB} \cdot F_{HB} \right) + \left(C_S \cdot BCF_{S\text{-}OM} \cdot P_S \right) + \left(C_{wctot} \cdot BCF_{W\text{-}OM} \cdot P_W \right)$$

Variable	Description	Units	Value
C_{OM}	COPC concentration in omnivorous mammals	mg COPC/kg FW tissue	

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{INV}	COPC concentration in invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-3)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-3. Uncertainties associated with this variable include: (1) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil used to calculate the COPC concentration in invertebrates may be under- or overestimated to an unknown degree. (2) $BCF_{S\text{-}INV}$ values may not accurately represent site-specific soil conditions and therefore, may over- or under-estimate C_{INV}.
$\frac{FCM_{TL3}}{FCM_{TL2}}$	Food chain multiplier for trophic level 3 predator consuming trophic level 2 prey	unitless	**Varies** This variable is COPC- and trophic level-specific and are provided in Chapter 5. The following uncertainties are associated with this variable: (1) *FCMs* do not account for metabolism, thus for COPCs with significant metabolism concentrations may be over-estimated to an unknown degree. (2) The application of *FCMs* for computing concentration in terrestrial food webs may introduce significant uncertainty (see Chapter 5) *FCMs* are obtained from the U.S. EPA (1995) "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors."
P_{INV}	Proportion of invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
F_{INV}	Fraction of diet comprised of invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces significant uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces significant uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{TP}	COPC concentration in terrestrial plants ingested by the animal	mg COPC/kg WW	**Varies** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-1. Uncertainties introduced by this variable include the following: (1) Some of the variables in the equations in Tables B-3-1, B-3-2, and B-3-3—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. (2) In the equation in Table B-3-1, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), *kp* (estimation process does not consider chemical degradation), and *Yp* (estimated on the basis of national harvest yield and area planted values). All of these uncertainties contribute to the overall uncertainty associated with C_{TP}. (3) In the equation in Table B-3-3, COPC-specific soil-to-plant bioconcentration factors (BCF_{TP}) may not reflect site-specific conditions.
$BCF_{TP\text{-}OM}$	Bioconcentration factor for terrestrial plant-to-omnivorous mammal	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in omnivorous mammals through dietary exposure. $BCF_{TP\text{-}OM}$ values are provided in Appendix D.

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
P_{TP}	Proportion of terrestrial plant in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{TP}	Fraction of diet comprised of terrestrial plants	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of terrestrial plants. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{HM}	COPC concentration in herbivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-2)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-2. Uncertainties associated with this variable include: (1) Variables: C_{TP}, C_S, and C_{wctot} are COPC- and site-specific. (2) Variables: $BCF_{TP\text{-}HM}$, $BCF_{S\text{-}HM}$, and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations in site-specific mammals.

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
P_{HM}	Proportion of herbivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HM}	Fraction of diet comprised of herbivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous mammal. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces significant uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces significant uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{HB}	COPC concentration in herbivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-4)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-4. Uncertainties associated with this variable include: (1) Variables: C_{TP}, C_S, and C_{wctot} are COPC- and site-specific. (2) Variables: $BCF_{TP\text{-}HB}$, $BCF_{S\text{-}HB}$, and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{Chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous birds.

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
P_{HB}	Proportion of herbivorous birds in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HB}	Fraction of diet comprised of herbivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_S	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs.* (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs*. (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$BCF_{S\text{-}OM}$	Bioconcentration factor for soil-to-omnivorous mammal	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW soil)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in omnivorous mammals through indirect soil exposure. $BCF_{S\text{-}OM}$ values are provided in Appendix D.
P_S	Proportion of ingested soil that is contamanted	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default *OC* content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, the uncertainty associated with using default *OC* values may be significant in specific cases.
$BCF_{W\text{-}OM}$	Bioconcentration factor for water-to-omnivorous mammal pathways	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in herbivorous mammals through indirect water exposure (total water body concentration). $BCF_{W\text{-}OM}$ values are provided in Appendix D.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-1-5

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA (1995) "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors."

TABLE F-1-6

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Description

This equation calculates the COPC concentration in omnivorous birds through the ingestion of plants, soil, and water in the forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) Variables C_S, and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) Variables: $BCF_{W\text{-}OB}$, and $BCF_{S\text{-}OB}$ are calculated based on biotransfer factors for chicken ($Ba_{Chicken}$), and receptor specific ingestion rates, and may introduce uncertainty when used to compute concentrations in site-specific omnivorous birds.
(3) *FCMs* are COPC- and site-specific and may introduce uncertainty when applied to terrestrial environments to account for COPC bioaccumulation between trophic (see Chapter 5).

Equation

$$C_{OB} = \left(C_{INV} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{INV} \cdot F_{INV} \right) + \left(C_{TP} \cdot BCF_{TP\text{-}OM} \cdot P_{TP} \cdot F_{TP} \right)$$

$$+ \left(C_S \cdot BCF_{S\text{-}OB} \cdot P_S \right) + \left(C_{wctot} \cdot BCF_{W\text{-}OB} \cdot P_W \right)$$

Variable	Description	Units	Value
C_{OB}	COPC concentration in omnivorous birds	mg COPC/kg FW tissue	
C_{INV}	COPC concentration in invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-3)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-3. Uncertainties associated with this variable include: (1) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil used to calculate the COPC concentration in invertebrates may be under- or overestimated to an unknown degree. (2) $BCF_{S\text{-}INV}$ values may not accurately represent site-specific soil conditions and therefore, may over- or under-estimate C_{INV}.

TABLE F-1-6

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
$\frac{FCM_{TL3}}{FCM_{TL2}}$	Food chain multiplier for trophic level 3 predator consuming trophic level 2 prey	unitless	**Varies** This variable is COPC- and trophic level-specific and is provided in Chapter 5 Table 5-2. The following uncertainties are associated with this variable: (1) *FCMs* do not account for metabolism, thus for COPCs with metabolism concentrations may be over-estimated to an unknown degree. (2) The application of *FCMs* for computing concentration in terrestrial food webs may introduce uncertainty (see Chapter 5) *FCMs* are obtained from the U.S. EPA 1995 "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors."
P_{INV}	Proportion of invertebrates in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-1-6

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

(Page 3 of 7)

Variable	Description	Units	Value
F_{INV}	Fraction of diet comprised of invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{TP}	COPC concentration in terrestrial plants	mg COPC/kg WW	**Varies** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-1. Uncertainties introduced by this variable include the following: (1) Some of the variables in the equations in Tables B-3-1, B-3-2, and B-3-3—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. (2) In the equation in Table B-3-1, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), *kp* (estimation process does not consider chemical degradation). All of these uncertainties contribute to the overall uncertainty associated with C_{TP}. (3) In the equation in Table B-3-3, COPC-specific soil-to-plant bioconcentration factors (BCF_{TP}) may not reflect site-specific conditions.
$BCF_{TP\text{-}OB}$	Bioconcentration factor for plant-to-omnivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in omnivorous birds through indirect dietary exposure. $BCF_{TP\text{-}OB}$ values are provided in Appendix D.

TABLE F-1-6

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
P_{TP}	Proportion of terrestrial plant in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommend that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{TP}	Fraction of diet comprised of terrestrial plants	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of terrestrial plants. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-6

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_S	COPC soil concentration	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs*. (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$BCF_{S\text{-}OB}$	Bioconcentration factor for soil-to-omnivorous bird pathways	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW soil)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in omnivorous birds through indirect soil exposure. $BCF_{S\text{-}OB}$ values are provided in Appendix D.
P_S	Proportion of ingested soil that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-1-6

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, the uncertainty associated with using default *OC* values may be significant in specific cases.
$BCF_{W\text{-}OB}$	Bioconcentration factor for water-to-omnivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in omnivorous birds through indirect exposure to water. $BCF_{W\text{-}OB}$ values are provided in Appendix D.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-1-6

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FOREST, TALLGRASS PRAIRIE, SHORTGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA 1995 “Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors.”

TABLE F-1-7

COPC CONCENTRATIONS IN AQUATIC VEGETATION IN THE FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in aquatic vegetation through direct sediment exposure in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) C_{sed} values are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) $BCF_{W\text{-}AV}$ values are intended to represent "generic benthic invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.

Equation

$$C_{AV} = C_{sed} \cdot BCF_{S\text{-}AV}$$

Variable	Description	Units	Value
C_{AV}	COPC concentration in aquatic vegetation	mg COPC/kg WW	
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of contaminants sorbed to bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with variables θ_{bs}, C_{sed}, d_{wc}, and d_{bs} is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wctot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.

TABLE F-1-7

COPC CONCENTRATIONS IN AQUATIC VEGETATION IN THE FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

(Page 2 of 2)

Variable	Description	Units	Value
$BCF_{S\text{-}AV}$	Bioconcentration factor for sediment-to-aquatic vegetation	unitless [(mg COPC/kg WW)/(mg COPC/kg DW sediment)]	**Varies** This variable is COPC-, site- and species-specific, and is provided in Appendix C. This variable is calculated using laboratory and field measured values as discussed in Appendix C. The following uncertainties are associated with this variable: (1) The COPC specific $BCF_{S\text{-}AV}$ values may not accurately represent site-specific sediment conditions which could strongly influence the bioavailability of COPCs, therefore over-or under-estimating C_{AV} to an unknown degree. (2) The data set used to calculate $BCF_{S\text{-}AV}$ is based on soil-to-plant bioconcentration studies. The uncertainty associated with calculating concentrations using $BCF_{BS\text{-}AV}$ in site-specific organisms is unknown and may over- or under-estimate C_{AV}.

TABLE F-1-8

COPC CONCENTRATIONS IN ALGAE IN THE FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in algae through direct water exposure in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) C_{dw} values are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) $BCF_{W\text{-}AL}$ values are intended to represent "generic algae species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.

Equation

$$C_{AL} = C_{dw} \cdot BCF_{W-AL}$$

Variable	Description	Units	Value
C_{AL}	COPC concentration in algae	mg COPC/kg WW	
C_{dw}	Dissolved phase water concentration	mg COPC/ L water	**Varies** This variable is COPC- and site-specific, and is calculated by using the equation in Table B-2-18. Uncertainties associated with this variable include the following: (1) The variables in the equation in Table B-2-18 are site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{dw}. The degree of uncertainty associated with *TSS* is expected to be relatively small, because information regarding reasonable site-specific values for this variable is generally available or can be easily measured. (2) The uncertainty associated with the variables C_{wctot} and Kd_{sw} is dependent on estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using different *OC* content values may be significant in specific cases.

TABLE F-1-8

COPC CONCENTRATIONS IN ALGAE IN THE FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

(Page 2 of 2)

Variable	Description	Units	Value
BCF_{WAL}	Bioconcentration factor for water-to-algae	unitless [(mg COPC/kg WW)/(mg COPC/L water)]	**Varies** This variable is COPC-, site- and species-specific, and is provided in Appendix C. This variable is computed using laboratory and field measured values as discussed in Appendix C. The following uncertainties are associated with this variable: (1) The COPC specific $BCF_{W\text{-}AL}$ values may not accurately represent site-specific sediment conditions, therefore over-or under-estimating C_{AL} to an unknown degree. (2) The data set used to calculate $BCF_{W\text{-}AL}$ is based on a limited number of test organisms. The uncertainty associated with calculating concentrations using $BCF_{W\text{-}AL}$ in site-specific organisms is unknown and may over- or under-estimate C_{AL}.

TABLE F-1-9

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in aquatic herbivorous mammals through the ingestion of plants, sediment, and water in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) Variables: C_{AV}, C_{sed}, and C_{wtot} are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) Variables: $BCF_{TP\text{-}HM}$, $BCF_{bS\text{-}HM}$, and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations in site-specific herbivorous mammals.
(3) The use of single Ba_{beef} value for each COPC may not accurately reflect site-specific conditions, and may under- or overestimate C_{HM}.

Equation

$$C_{HM} = (C_{AV} \cdot BCF_{HM} \cdot P_{AV} \cdot F_{AV}) + (C_{AL} \cdot BCF_{HM} \cdot P_{AL} \cdot F_{AL}) + (C_{sed} \cdot BCF_{BS\text{-}HM} \cdot P_{BS}) + (C_{wctot} \cdot BCF_{W\text{-}HM} \cdot P_{W})$$

Variable	Description	Units	Value
C_{HM}	COPC concentration in herbivorous mammals	mg COPC/kg FW tissue	
C_{AV}	COPC concentration in aquatic vegetation	mg COPC/kg WW	**Varies (calculated - Table F-1-7)** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-7. Uncertainties associated with this variable include: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{BS\text{-}AV}$ values are intended to represent "generic aquatic vegetation species", and therefore may over- or under-estimate exposure when applied to site-specific vegetation.
$BCF_{AV\text{-}HM}$	Bioconcentration factor for aquatic vegetation -to-aquatic herbivorous mammals	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous mammals through indirect dietary exposure. $BCF_{AV\text{-}HM}$ values are provided in Appendix D.

TABLE F-1-9

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
P_{AV}	Proportion of aquatic vegetation in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AV}	Fraction of diet comprised of aquatic vegetation	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic vegetation. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{AL}	COPC concentration in algae	mg COPC/kg WW	**Varies (calculated - Table F-1-8)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-8. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}AL}$ values are intended to represent "generic algae species", and therefore may over- or under-estimate exposure when applied to site-specific species.

TABLE F-1-9

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
$BCF_{AL\text{-}HM}$	Bioconcentration factor for algae - to-aquatic herbivorous mammals	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous mammals through indirect dietary exposure. $BCF_{AL\text{-}HM}$ values are provided in Appendix D.
P_{AL}	Proportion of algae in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AL}	Fraction of diet comprised of algae	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of algae. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-9

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of contaminants sorbed to bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with variables θ_{bs}, C_{sed}, $_{wtotc}$, and d_{bs} is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wtot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
$BCF_{BS\text{-}HM}$	Bioconcentration factor for bed sediment-to-aquatic herbivorous mammal	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW sediment)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous mammals through indirect sediment exposure. $BCF_{BS\text{-}HM}$ values are provided in Appendix D.
P_{BS}	Proportion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of sediment ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-1-9

COPC CONCENTRATIONS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainty associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, the uncertainty associated with using default *OC* values may be significant in specific cases.
$BCF_{W\text{-}HM}$	Bioconcentration factor for water-to-aquatic herbivorous mammal pathways	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous mammals through indirect water exposure. $BCF_{W\text{-}HM}$ values are provided in Appendix D.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-1-10

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in aquatic herbivorous birds through ingestion of contaminated plants, sediment, and water in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) Variables: C_{AV}, C_{sed}, and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) Variables: $BCF_{AV\text{-}HB}$, $BCF_{BS\text{-}HB}$, and $BCF_{W\text{-}HB}$ are calculated based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous birds.
(3) The use of single $Ba_{chicken}$ value for each COPC may not accurately reflect site-specific conditions; and may under- or overestimate C_{HB}.

Equation

$$C_{HB} = (C_{AV} \cdot BCF_{HB} \cdot P_{AV} \cdot F_{AV}) + (C_{AL} \cdot BCF_{HB} \cdot P_{AL} \cdot F_{AL}) + (C_{sed} \cdot BCF_{BS\text{-}HB} \cdot P_{BS}) + (C_{wctot} \cdot BCF_{W\text{-}HB} \cdot P_{W})$$

Variable	Description	Units	Value
C_{HB}	COPC concentration in herbivorous birds	mg COPC/kg FW tissue	
C_{AV}	COPC concentration in aquatic vegetation	mg COPC/kg WW	**Varies (calculated - Table F-1-7)** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-7. Uncertainties associated with this variable include: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{BS\text{-}AV}$ values are intended to represent "generic aquatic vegetation species", and therefore may over- or under-estimate exposure when applied to site-specific vegetation.
$BCF_{AV\text{-}HB}$	Bioconcentration factor for aquatic vegetation -to-aquatic herbivorous birds	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous birds through indirect dietary exposure. $BCF_{AV\text{-}HB}$ values are provided in Appendix D.

TABLE F-1-10

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
P_{AV}	Proportion of aquatic vegetation in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AV}	Fraction of diet comprised of aquatic vegetation	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic vegetation. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{AL}	COPC concentration in algae	mg COPC/kg WW	**Varies (calculated - Table F-1-8)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-8. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}AL}$ values are intended to represent "generic algae species", and therefore may over- or under-estimate exposure when applied to site-specific species.

TABLE F-1-10

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
$BCF_{AL\text{-}HB}$	Bioconcentration factor for algae -to-aquatic herbivorous birds	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous birds through indirect dietary exposure: $BCF_{AL\text{-}HB}$ values are provided in Appendix D.
P_{AL}	Proportion of algae in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AL}	Fraction of diet comprised of algae	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of algae. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-10

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of COPSs in bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with variables θ_{bs}, $C_{sed,\ wtotc}$, and d_{bs} is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wtot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
$BCF_{BS\text{-}HB}$	Bioconcentration factor for bed sediment-to-aquatic herbivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW sediment)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous birds through indirect sediment exposure. $BCF_{BS\text{-}HB}$ values are provided in Appendix D.
P_{BS}	Proportion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-1-10

COPC CONCENTRATIONS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default *OC* content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainty associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$BCF_{W\text{-}HB}$	Bioconcentration factor for water-to-aquatic herbivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous birds through indirect exposure to water. $BCF_{W\text{-}HB}$ values are provided in Appendix D.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-1-11

COPC CONCENTRATIONS IN BENTHIC INVERTEBRATES IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in benthic invertebrates through direct exposure to benthic sediment in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) C_{sed} values are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) $BCF_{BS\text{-}BI}$ values are intended to represent "generic benthic invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.

Equation

$$C_{BI} = C_{sed} \cdot BCF_{BS-BI}$$

Variable	Description	Units	Value
C_{BI}	COPC concentration in benthic invertebrates	mg COPC/kg FW tissue	
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of COPCs in bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with variables θ_{bs}, C_{sed}, d_{wc}, and d_{bs} is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wtot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.

TABLE F-1-11

COPC CONCENTRATIONS IN BENTHIC INVERTEBRATES IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

(Page 2 of 2)

Variable	Description	Units	Value
$BCF_{BS\text{-}BI}$	Bioconcentration factor for sediment-to-benthic invertebrate	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW sediment)]	**Varies** This variable is COPC-, site- and species-specific, and is provided in Appendix C. This variable is calculated using laboratory and field measured values as discussed in Appendix C. The following uncertainties are associated with this variable: (1) The COPC specific $BCF_{BS\text{-}BI}$ values may not accurately represent site-specific sediment conditions which could strongly influence the bioavailability of COPCs, therefore over-or under-estimating C_{BI} to an unknown degree. (2) The data set used to calculate $BCF_{BS\text{-}BI}$ is based on a limited number of test organisms. The uncertainty associated with calculating concentrations using $BCF_{BS\text{-}BI}$ in site-specific organisms is unknown and may over- or under-estimate C_{BI}.

TABLE F-1-12

COPC CONCENTRATIONS IN WATER INVERTEBRATE IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in water invertebrates through direct water exposure in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) C_{dw} values are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) BCF_{WI} values are intended to represent "generic water invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.

Equation

$$C_{WI} = C_{dw} \cdot BCF_{W-WI}$$

Variable	Description	Units	Value
C_{WI}	COPC concentration in water invertebrates	mg COPC/kg FW tissue	
C_{dw}	Dissolved phase water concentration	mg COPC/L water	**Varies (calculated - Table B-2-18)** This variable is COPC- and site-specific. This equation calculates the concentration of COPC dissolved in the water column. Uncertainties associated with this equation include the following: (1) The variables in the equation in Table B-2-18 are site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{dw}. The degree of uncertainty associated with *TSS* is expected to be relatively small, because information regarding reasonable site-specific values for this variable are generally available or it can be easily measured. On the other hand, the uncertainty associated with the variables C_{wctot} and Kd_{sw} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, using default *OC* values may result in significant uncertainty in specific cases.

TABLE F-1-12

COPC CONCENTRATIONS IN WATER INVERTEBRATE IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

(Page 2 of 2)

Variable	Description	Units	Value
$BCF_{W\text{-}WI}$	Bioconcentration factor for water-to-invertebrate	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site- and species-specific, and should be determined using Appendix C. This variable is calculated using laboratory and field measured values as discussed in Appendix C. The following uncertainties are associated with this variable: (1) The COPC specific $BCF_{W\text{-}WI}$ values may not accurately represent site-specific conditions, therefore over-or under-estimating C_{WI} to an unknown degree. (2) The data set used to calculate $BCF_{W\text{-}WI}$ is based on a limited number of test organisms. The uncertainty associated with calculating concentrations using $BCF_{W\text{-}WI}$ in site-specific organisms is unknown and may over- or under-estimate C_{WI}.

TABLE F-1-13

COPC CONCENTRATIONS IN HERBIVOROUS AND PLANKTIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in herbivorous/planktivorous fish through ingestion of contaminated food and direct water exposure in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) C_{dw} values are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) The data set used to calculate BCF_f is based on a limited number of test organisms and therefore may over- or under-estimate exposure when applied to site-specific organisms.

Equation

$$C_{HF} = C_{dw} \cdot BCF_f \cdot FCM_{TL2}$$

Variable	Description	Units	Value
C_{HF}	COPC concentration in herbivorous and planktivorous fish	mg COPC/kg FW tissue	
C_{dw}	Dissolved phase water concentration	mg COPC/L water	**Varies (calculated - Table B-2-18)** This variable is COPC- and site-specific. This equation calculates the concentration of COPC dissolved in the water column. Uncertainties associated with this equation include the following: (1) The variables in the equation in Table B-2-18 are site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{dw}. The degree of uncertainty associated with *TSS* is expected to be relatively small, because information regarding reasonable site-specific values for this variable are generally available or it can be easily measured. On the other hand, the uncertainty associated with the variables C_{wctot} and Kd_{sw} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, using default *OC* values may result in significant uncertainty in specific cases.

TABLE F-1-13

COPC CONCENTRATIONS IN HERBIVOROUS AND PLANKTIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

(Page 2 of 3)

Variable	Description	Units	Value
BCF_f	Bioconcentration factor for water-to-fish pathways	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site- and species-specific, and is provided in Appendix C. This variable is calculated using laboratory and field measured values as discussed in Appendix C. The following uncertainties are associated with this variable: (1) The COPC specific BCF_f values may not accurately represent site-specific conditions, therefore over-or under-estimating C_{HF} to an unknown degree. (2) The data set used to calculate BCF_f is based on a limited number of test species. The uncertainty associated with calculating concentrations using BCF_f in site-specific organisms is unknown and may over- or under-estimate C_{HF}.
FCM_{TL2}	Food chain multiplier for trophic level 2 predator	unitless	**Varies** This variable is COPC- and trophic level-specific and is provided in Chapter 5, Table 5-2. The following uncertainties are associated with this variable: (1) *FCMs* do not account for metabolism, thus for COPCs with significant metabolism concentrations may be over-estimated to an unknown degree. (2) The application of *FCMs* for computing concentration in terrestrial food webs introduce uncertainty (see Chapter 5). *FCMs* are obtained from the U.S. EPA (1995) "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors."

TABLE F-1-13

COPC CONCENTRATIONS IN HERBIVOROUS AND PLANKTIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1995. *Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors*. Office of Water. EPA-820-B-95-005.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in aquatic omnivorous mammals through ingestion of plants, sediment, and water in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) Variables: C_{sed}, and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) Variables: $BCF_{BS\text{-}OM}$, and $BCF_{W\text{-}OM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations in site-specific omnivorous mammals.

Equation

$$C_{OM} = \left(C_{BI} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{BI} \cdot F_{BI}\right) + \left(C_{WI} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{WI} \cdot F_{WI}\right) + \left(C_{HM} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{HM} \cdot F_{HM}\right)$$

$$+ \left(C_{HB} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{HB} \cdot F_{HB}\right) + \left(C_{AL} \cdot BCF_{AL\text{-}OM} \cdot P_{AL} \cdot F_{AL}\right) + \left(C_{AV} \cdot BCF_{AV\text{-}OM} \cdot P_{AV} \cdot F_{AV}\right)$$

$$+ \left(C_{sed} \cdot BCF_{BS\text{-}OM} \cdot P_{BS}\right) + \left(C_{wctot} \cdot BCF_{W\text{-}OM} \cdot P_{W}\right)$$

Variable	Description	Units	Value
C_{OM}	COPC concentration in omnivorous mammals	mg COPC/kg FW tissue	

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{BI}	COPC concentration in benthic invertebrates	mg COPC/kg FW tissue	**Varies** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-11. Uncertainties associated with this variable include the following: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{BS\text{-}BI}$ values are intended to represent "generic benthic invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.
FCM_{TL3} FCM_{TL2}	Food chain multiplier for trophic level 3 predator consuming trophic level 2 prey	unitless	**Varies** This variable is COPC- and trophic level-specific and is provided in Chapter 5, Table 5-2. The following uncertainties are associated with this variable: (1) *FCMs* do not account for metabolism, thus for COPCs with significant metabolism, concentrations may be over-estimated to an unknown degree. (2) The application of *FCMs* for computing concentration in terrestrial food webs may introduce uncertainty (see Chapter 5) *FCMs* are obtained from the U.S. EPA 1995 "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors."
P_{BI}	Proportion of benthic invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
F_{BI}	Fraction of diet comprised of benthic invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of benthic invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{WI}	COPC concentration in water invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-12)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-12. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}WI}$ values are intended to represent "generic water invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{WI}	Proportion of water invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
F_{WI}	Fraction of diet comprised of water invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of water invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{HM}	Concentration of COPC in herbivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-9)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-9. Uncertainties associated with this variable include: (1) Variables: C_{AV}, C_{AL},C_{sed}, and C_{wctot} are COPC- and site-specific. (2) Variables: $BCF_{BS\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous mammals.
P_{HM}	Proportion of aquatic herbivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
F_{HM}	Fraction of diet comprised of aquatic herbivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic herbivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{HB}	COPC concentration in herbivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-10)** This variable is site-specific and chemical-specific; it is calculated using the equation in Table F-1-10. Uncertainties associated with this variable include: (1) Variables: C_{AV}, C_{AL},C_{sed}, and C_{wctot} are COPC- and site-specific. (2) Variables: $BCF_{BS\text{-}HB}$ and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous birds.
P_{HB}	Proportion of herbivorous birds in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
F_{HB}	Fraction of diet comprised of herbivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic herbivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{AL}	COPC concentration in algae	mg COPC/kg WW	**Varies (calculated - Table F-1-8)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-8. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}AL}$ values are intended to represent "generic algae species", and therefore may over- or under-estimate exposure when applied to site-specific species.
$BCF_{AL\text{-}OM}$	Bioconcentration factor for algae-to-omnivorous mammal	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic omnivorous mammals through indirect dietary exposure. $BCF_{AL\text{-}OM}$ values are provided in Appendix D.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
P_{AL}	Proportion of algae in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AL}	Fraction of diet comprised of algae	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of algae. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{AV}	COPC concentration in aquatic vegetation ingested by the animal	mg COPC/kg WW	**Varies (calculated - Table F-1-7)** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-7. Uncertainties associated with this variable include: (1) C_{sed} values are COPC- and site-specific. Uncertainties associated with this variable may be significant, and should be summarized as part of each SLERA report. (2) $BCF_{BS\text{-}AV}$ values are intended to represent "generic aquatic vegetation species", and therefore may over- or under-estimate exposure when applied to site-specific vegetation.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
$BCF_{AV\text{-}OM}$	Bioconcentration factor for aquatic vegetation-to-aquatic omnivorous mammal	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic omnivorous mammals through indirect dietary exposure. $BCF_{AV\text{-}OM}$ values are provided in Appendix D.
P_{AV}	Proportion of aquatic vegetation in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AV}	Fraction of diet comprised of aquatic vegetation	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic vegetation. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration sorbed to bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of contaminants sorbed to bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wtot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
$BCF_{BS\text{-}OM}$	Bioconcentration factor for bed sediment-to-aquatic omnivorous mammal pathways	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW sediment)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic omnivorous mammals through indirect sediment exposure. $BCF_{BS\text{-}OM}$ values are provided in Appendix D.
P_{BS}	Portion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-1-14

COPC CONCENTRATIONS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default *OC* content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$BCF_{W\text{-}OM}$	Bioconcentration factor for water-to-aquatic omnivorous mammal	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic omnivorous mammals through indirect water exposure. $BCF_{W\text{-}OM}$ values are provided in Appendix D.
P_W	Portion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in aquatic omnivorous birds through ingestion of plants, sediment, and water in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) Variables: C_{sed}, and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables are site specific.
(2) Variables: $BCF_{BS\text{-}OB}$, and $BCF_{W\text{-}OB}$ are calculated based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific omnivorous birds.

Equation

$$C_{OB} = \left(C_{BI} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{BI} \cdot F_{BI} \right) + \left(C_{WI} \cdot \frac{FCM_{TL3}}{FCM_{TL2}} \cdot P_{WI} \cdot F_{WI} \right) + \left(C_{AV} \cdot BCF_{AV\text{-}OM} \cdot P_{AV} \cdot F_{AV} \right)$$

$$+ \left(C_{AL} \cdot BCF_{AL\text{-}OM} \cdot P_{AL} \cdot F_{AL} \right) + \left(C_{sed} \cdot BCF_{BS\text{-}OB} \cdot P_{BS} \right) + \left(C_{wctot} \cdot BCF_{W\text{-}OB} \cdot P_{W} \right)$$

Variable	Description	Units	Value
C_{OB}	COPC concentration in omnivorous birds	mg COPC/kg FW tissue	
C_{BI}	COPC concentration in benthic invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-11)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-11. Uncertainties associated with this variable include the following: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{BS\text{-}BI}$ values are intended to represent "generic benthic invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
$\underline{FCM_{TL3}}$ FCM_{TL2}	Food chain multiplier for trophic level 3 predator consuming trophic level 2 prey	unitless	**Varies** This variable is COPC- and trophic level-specific and is provided in Chapter 5, Table 5-2. The following uncertainties are associated with this variable: (1) *FCMs* do not account for metabolism, thus for COPCs with significant metabolism, concentrations may be over-estimated to an unknown degree. (2) The application of *FCMs* for computing concentration in terrestrial food webs may introduce uncertainty (see Chapter 5) *FCMs* are obtained from the U.S. EPA 1995 "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors."
P_{BI}	Proportion of benthic invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{BI}	Fraction of diet comprised of benthic invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of benthic invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{WI}	COPC concentration in water invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-12)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-12. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}WI}$ values are intended to represent "generic water invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{WI}	Proportion of water invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{WI}	Fraction of diet comprised of water invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of water invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{AV}	COPC concentration in aquatic vegetation ingested by the animal	mg COPC/kg WW	**Varies (calculated - Table F-1-7)** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-7. Uncertainties associated with this variable include: (1) $C_{sed\text{-}AV}$ values are COPC- and site-specific. (2) $BCF_{BS\text{-}AV}$ values are intended to represent "generic aquatic vegetation species", and therefore may over- or under-estimate exposure when applied to site-specific vegetation.
$BCF_{AV\text{-}OB}$	Bioconcentration factor for aquatic vegetation-to-aquatic omnivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic omnivorous birds through indirect dietary exposure. $BCF_{AV\text{-}OB}$ values are provided in Appendix D.
P_{AV}	Proportion of aquatic vegetation in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
F_{AV}	Fraction of diet comprised of aquatic vegetation	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic vegetation. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{AL}	COPC concentration in algae	mg COPC/kg WW	**Varies (calculated - Table F-1-8)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-8. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}AL}$ values are intended to represent "generic algae species", and therefore may over- or under-estimate exposure when applied to site-specific species.
$BCF_{AL\text{-}OB}$	Bioconcentration factor for algae-to-aquatic omnivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg WW)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic omnivorous birds through indirect dietary exposure. $BCF_{AL\text{-}OB}$ values are provided in Appendix D.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
P_{AL}	Proportion of algae in diet that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommend that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AL}	Fraction of diet comprised of algae	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of algae. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of contaminants sorbed to bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wtot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific. It is the maximum COPC concentration in sediment in the assessment area and is computed from soil and surface water concentrations using the ISCST3 air dispersion and deposition model, and fate and transport equations presented in Chapter 3.
$BCF_{BS\text{-}HB}$	Bioconcentration factor for bed sediment-to-aquatic omnivorous bird pathways	unitless [(mg COPC/kg FW tissue)/(mg COPC/kg DW sediment)]	**Varies** This variable is COPC-, site-, habitat- and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic herbivorous birds through indirect sediment exposure. $BCF_{BS\text{-}OB}$ values are provided in Appendix D.
P_{BS}	Portion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$BCF_{W\text{-}OB}$	Bioconcentration factor for water-to-aquatic omnivorous bird	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site-, and receptor-specific, and is calculated using the following equation to compute the COPC concentration in aquatic omnivorous birds through indirect exposure to water. $BCF_{W\text{-}OB}$ values are provided in Appendix D.
P_W	Portion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1.0** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommend that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor home range, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-1-15

COPC CONCENTRATIONS IN OMNIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1995. *Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors.* Office of Water. EPA-820-B-95-005.

TABLE F-1-16

COPC CONCENTRATIONS IN OMNIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in omnivorous fish through ingestion of contaminated food and water exposure in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) C_{dw} values are COPC- and site-specific.
(2) The data set used to calculate BCF_f is based on a limited number of test organisms and therefore may over- or under-estimate exposure when representing site-specific organisms.

Equation

$$C_{OF} = C_{dw} \cdot BCF_f \cdot FCM_{TL3}$$

Variable	Description	Units	Value
C_{OF}	COPC concentration in omnivorous fish	mg COPC/kg FW tissue	
C_{dw}	Dissolved phase water concentration	mg COPC/L water	**Varies (calculated - Table B-2-18)** This variable is COPC- and site-specific. This equation calculates the concentration of COPC dissolved in the water column. Uncertainties associated with this equation include the following: (1) The variables in the equation in Table B-2-18 are site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{dw}. The degree of uncertainty associated with *TSS* is expected to be relatively small, because information regarding reasonable site-specific values for this variable are generally available or it can be easily measured. On the other hand, the uncertainty associated with the variables C_{wctot} and Kd_{sw} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, using default *OC* values may result in uncertainty in specific cases.

TABLE F-1-16

COPC CONCENTRATIONS IN OMNIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

(Page 2 of 3)

Variable	Description	Units	Value
BCF_f	Bioconcentration factor for water-to-fish	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site- and species-specific, and is provided in Appendix C. This variable is calculated using laboratory and field measured values as discussed Appendix C. The following uncertainties are associated with this variable: (1) The COPC specific BCF_f values may not accurately represent site-specific conditions, therefore over-or under-estimating C_{OF} to an unknown degree. (2) The data set used to calculate BCF_f is based on a limited number of test species. The uncertainty associated with calculating concentrations using BCF_f in site-specific organisms is unknown and may over- or under-estimate C_{OF}.
FCM_{TL3}	Food chain multiplier for trophic level 3 predator	unitless	**Varies** This variable is COPC- and trophic level-specific, and is provided in Chapter 5, Table 5-2. The following uncertainties are associated with this variable: (1) FCMs do not account for metabolism, thus for COPCs with significant metabolism concentrations may be over-estimated to an unknown degree. (2) The application of *FCMs* for computing concentration in terrestrial food webs introduce uncertainty (see Chapter 5). *FCMs* are obtained from the U.S. EPA 1995 "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors."

TABLE F-1-16

COPC CONCENTRATIONS IN OMNIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

(Page 3 of 3)

REFERENCES AND DISCUSSIONS

U.S. EPA. 1995. *Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors.* Office of Water. EPA-820-B-95-005.

TABLE F-1-17

COPC CONCENTRATIONS IN CARNIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the COPC concentration in carnivorous fish through ingestion of contaminated prey and water exposure in the freshwater/wetland, brackish/intermediate marsh, and saltmarsh food webs. The limitations and uncertainty introduced in calculating this variable include the following:

(1) C_{dw} values are COPC- and site-specific.
(2) The data set used to calculate BCF_f is based on a limited number of test organisms and therefore may over- or under-estimate exposure when representing site-specific organisms.

Equation

$$C_{CF} = C_{dw} \cdot BCF_f \cdot FCM_{TL4}$$

Variable	Description	Units	Value
C_{CF}	COPC concentration in carnivorous fish	mg COPC/kg FW tissue	**Varies** Tissue concentration is expressed on a wet weight basis (mg COPC/kg wet tissue).
C_{dw}	Dissolved phase water concentration	mg COPC/L water	**Varies (calculated - Table B-2-18)** This variable is COPC- and site-specific. This equation calculates the concentration of COPC dissolved in the water column. Uncertainties associated with this equation include the following: (1) The variables in the equation in Table B-2-18 are site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, may contribute to the under- or overestimation of C_{dw}. The uncertainty associated with the variables C_{wctot} and Kd_{sw} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, using default *OC* values may result in uncertainty in specific cases.

TABLE F-1-17

COPC CONCENTRATIONS IN CARNIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

(Page 2 of 3)

Variable	Description	Units	Value
BCF_f	Bioconcentration factor for water-to-fish	unitless [(mg COPC/kg FW tissue)/(mg COPC/L water)]	**Varies** This variable is COPC-, site- and species-specific, and is provided in Appendix C. This variable is calculated using laboratory and field measured values as discussed in Appendix C. The following uncertainties are associated with this variable: (1) The COPC specific BCF_f values may not accurately represent site-specific conditions, therefore over-or under-estimating C_{CF} to an unknown degree. (2) The data set used to calculate BCF_f is based on a limited number of test species. The uncertainty associated with calculating concentrations using BCF_f in site-specific organisms is unknown and may over- or under-estimate C_{CF}.
FCM_{TL4}	Food chain multiplier for trophic level 4 predator	unitless	**Varies** This variable is COPC- and trophic level-specific and is provided in Chapter 5, Table 5-2. The following uncertainties are associated with this variable: (1) *FCMs* do not account for metabolism, thus for COPCs with significant metabolism concentrations may be over-estimated to an unknown degree. (2) The application of *FCMs* for computing concentration in terrestrial food webs introduce uncertainty (see Chapter 5). *FCMs* are obtained from the U.S. EPA 1995 "Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors."

TABLE F-1-17

COPC CONCENTRATIONS IN CARNIVOROUS FISH IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1995. *Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors.* Office of Water. EPA-820-B-95-005.

TABLE F-2-1

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Description

This equation calculates the daily dose through exposure to contaminated food or prey, soil, and water in herbivorous mammals in upland forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables *Cs* and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site specific.
(2) Variables $BCF_{S\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute a daily dose for representative site-specific herbivorous mammals.

Equation

$$D_{HM} = \left(C_{TP} \cdot IR_{HM} \cdot P_{TP} \cdot F_{TP}\right) + \left(Cs \cdot IR_{S\text{-}HM} \cdot P_S\right) + \left(C_{wctot} \cdot IR_{W\text{-}HM} \cdot P_W\right)$$

Variable	Description	Units	Value
D_{HM}	Dose COPC ingested for herbivorous mammals	mg COPC/kg BW-day	
C_{TP}	COPC concentration in terrestrial plants	mg COPC/kg WW	**Varies** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-1. Uncertainties introduced by this variable include the following: (1) Some of the variables in the equations in Tables B-3-1, B-3-2, and B-3-3—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. (2) In the equation in Table B-3-1, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), *kp* (estimation process does not consider chemical degradation). All of these uncertainties contribute to the overall uncertainty associated with C_{TP}.

TABLE F-2-1

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
IR_{HM}	Food ingestion rate of herbivorous mammal	kg WW/kg BW-day	**Varies** Food ingestion rates (IR_{HM}) are site-, receptor-, and habitat-specific and are provided in Chapter 5, Table 5-1. (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight (U.S. EPA 1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose.
P_{TP}	Proportion of terrestrial plant in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{TP}	Fraction of diet comprised of terrestrial plants	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of terrestrial plants. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-1

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
Cs	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs* (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$IR_{S\text{-}HM}$	Soil ingestion rate of omnivorous mammal	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied for site-specific organisms.
P_S	Proportion of ingested soil that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-1

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and k_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, using default *OC* values may result in uncertainty in specific cases.
$IR_{W\text{-}HM}$	Water ingestion rate of herbivorous mammal	L/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are strongly influenced by animal behavior and environmental factors and may over- or under- estimate $BCF_{W\text{-}HM}$ to an unknown degree.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-2

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Description

This equation calculates the daily dose through exposure to contaminated food/prey, soil, and water in herbivorous birds in upland forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_S, and C_{HB} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific.
(2) Variables $BCF_{S\text{-}HB}$, and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute a daily dose representing site-specific herbivorous birds.

Equation

$$D_{HB} = \left(C_{TP} \cdot IR_{HB} \cdot P_{TP} \cdot F_{TP}\right) + \left(Cs \cdot IR_{S\text{-}HB} \cdot P_S\right) + \left(C_{wctot} \cdot IR_{W\text{-}HB} \cdot P_W\right)$$

Variable	Description	Units	Value
D_{HB}	Dose COPC ingested for herbivorous birds	mg/kg BW-day	
C_{TP}	Concentration of COPC in terrestrial plants ingested by the animal	mg COPC/kg WW	**Varies** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-1. Uncertainties introduced by this variable include the following: (1) Some of the variables in the equations in Tables B-3-1, B-3-2, and B-3-3—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. Uncertainties associated with these variables may be significant, and should be summarized as part of each SLERA report. (2) In the equation in Table B-3-1, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), and *kp* (estimation process does not consider chemical degradation). All of these uncertainties contribute to the overall uncertainty associated with C_{TP}.

TABLE F-2-2

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
IR_{HB}	Food ingestion rate of herbivorous bird	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) IR values may over- or under- estimate exposure when applied to site-specific receptors.
P_{TP}	Proportion of terrestrial plant diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{TP}	Fraction of diet comprised of terrestrial plants	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of terrestrial plants. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertaintiy and may over-estimate exposure from ingestion of a single dietary item. (3) The defalut value for an equal diet introduces uncertainity and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-2

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

(Page 3 of 5)

Variable	Description	Units	Value
Cs	COPC soil concentration	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. This variable is calculated from stack emissions using the ISCST3 air dispersion and deposition model and soil fate and transport equations presented in Appendix B. C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs* and Cs_{tD}. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs* (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$IR_{S\text{-}HB}$	Soil ingestion rate for herbivorous bird	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied for site-specific organisms.
P_S	Proportion of ingested soil that is contamanted	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-2

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

(Page 4 of 5)

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-16)** This variable is COPC- and site-specific and is calculated using Table B-2-16. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-16. are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}HB}$	Water ingestion rate for herbivorous bird	kg WW/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are strongly influenced by animal behavior and environmental factors and may over- or under- estimate $BCF_{W\text{-}HB}$ to an unknown degree.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-2

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a.

TABLE F-2-3

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Description

This equation calculates the daily dose through exposure to contaminated food/prey, soil, and water in omnivorous mammals in upland forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_s and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific.
(2) Variables $BCF_{S\text{-}OM}$, and $BCF_{W\text{-}OM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific omnivorous mammals.

Equation

$$D_{OM} = \left(C_{HM} \cdot IR_{OM} \cdot P_{HM} \cdot F_{HM}\right) + \left(C_{HB} \cdot IR_{OM} \cdot P_{HB} \cdot F_{HB}\right) + \left(C_{INV} \cdot IR_{OM} \cdot P_{INV} \cdot F_{INV}\right)$$
$$+ \left(C_{TP} \cdot IR_{OM} \cdot P_{TP} \cdot F_{TP}\right) + \left(C_s \cdot IR_{S\text{-}OM} \cdot P_S\right) + \left(C_{wctot} \cdot IR_{W\text{-}OM} \cdot P_W\right)$$

Variable	Description	Units	Value
D_{OM}	Dose COPC ingested for omnivorous mammals	mg COPC/kg BW-day	
C_{HM}	Concentration of COPC in herbivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-2)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-9. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous mammals.

TABLE F-2-3

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
IR_{OM}	Food ingestion rate of omnivorous mammal	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) *IR* values may over- or under- estimate exposure when applied to site-specific receptors.
P_{HM}	Proportion of herbivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommend that a default value of 1.0 be used for all food types when site specific information is not available. Uncertainties associated with this variable include: The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HM}	Fraction of diet comprised of herbivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. The application of an equal diet is further discussed in section Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of herbivorous mammals depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. Therefore a default value of 100 percent for the exclusive diet, may over-estimate dietary exposure.

TABLE F-2-3

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
C_{HB}	Concentration of COPC in herbivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-10)** This variable is site-specific and chemical-specific; it is calculated using the equation in Table F-1-10. Uncertainties associated with this variable include: (1) Variables: C_{sed}, and C_{wctot} are COPC- and site-specific. (2) Variables: $BCF_{S\text{-}HB}$ and $BCF_{W\text{-}HB}$ are based on biotransfer factors for beef cattle ($Ba_{chicken}$), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous mammals.
P_{HB}	Proportion of herbivorous birds in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HB}	Fraction of diet comprised of herbivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-3

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
C_{INV}	Concentration of COPC in invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-3)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-3. Uncertainties associated with this variable include: (1) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil used to calculate the COPC concentration in invertebrates may be under- or overestimated to an unknown degree. (2) $BCF_{S\text{-}INV}$ values may not accurately represent site-specific soil conditions and therefore, may over- or under-estimate C_{INV}.
P_{INV}	Proportion of invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{INV}	Fraction of diet comprised of invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-3

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
C_{TP}	COPC concentration in terrestrial plants	mg COPC/kg WW	**Varies** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-1. Uncertainties introduced by this variable include the following: (1) Some of the variables in the equations in Tables B-3-1, B-3-2, and B-3-3—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. (2) In the equation in Table B-3-1, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), and *kp* (estimation process does not consider chemical degradation). All of these uncertainties contribute to the overall uncertainty associated with C_{TP}.
P_{TP}	Proportion of terrestrial plant in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{TP}	Fraction of diet comprised of terrestrial plants	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of terrestrial plants. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-3

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
Cs	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs* (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$IR_{S\text{-}OM}$	Soil ingestion rate of omnivorous mammal	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied for site-specific organisms.
P_S	Proportion of ingested soil that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-3

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may result because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, using default *OC* values may result in uncertainty in specific cases.
$IR_{W\text{-}OM}$	Water ingestion rate for omnivorous mammal	L/kg DW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are influenced by animal behavior and environmental factors and may over- or under-estimate $BCF_{W\text{-}OM}$ to an unknown degree.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-3

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FOREST, SHRUB/SCRUB, SHORTGRASS PRAIRIE, AND TALLGRASS PRAIRIE FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a

TABLE F-2-4

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, TALLGRASS PRAIRIE, AND SHORTGRASS PRAIRIE FOOD WEBS

Description

This equation calculates the daily dose through exposure to contaminated food/prey, soil, and water in omnivorous birds in upland forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_s and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site specific.
(2) Variables $BCF_{S\text{-}OB}$, and $BCF_{W\text{-}OB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute a daily dose for site-specific omnivorous birds.

Equation

$$D_{OB} = \left(C_{INV} \cdot IR_{OB} \cdot P_{INV} \cdot F_{INV}\right) + \left(C_{TP} \cdot IR_{OB} \cdot P_{TP} \cdot F_{TP}\right) + \left(C_s \cdot IR_{S\text{-}OB} \cdot P_S\right) + \left(C_{wctot} \cdot IR_{W\text{-}OB} \cdot P_W\right)$$

Variable	Description	Units	Value
D_{OB}	Dose COPC ingested for omnivorous birds	mg COPC/kg BW-day	
C_{INV}	Concentration of COPC in invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-3)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-3. Uncertainties associated with this variable include: (1) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil used to calculate the COPC concentration in invertebrates may be under- or overestimated to an unknown degree. (2) $BCF_{S\text{-}INV}$ values may not accurately represent site-specific soil conditions and therefore, may over- or under-estimate C_{INV}.

TABLE F-2-4

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, TALLGRASS PRAIRIE, AND SHORTGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
IR_{OB}	Food ingestion rate of omnivorous bird	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) IR values may over- or under- estimate exposure when applied to site-specific receptors.
P_{INV}	Proportion of invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{INV}	Fraction of diet comprised of invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-4

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, TALLGRASS PRAIRIE, AND SHORTGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
C_{TP}	COPC concentration in terrestrial plants	mg COPC/kg WW	**Varies** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-1. Uncertainties introduced by this variable include the following: (1) Some of the variables in the equations in Tables B-3-1, B-3-2, and B-3-3—including *Cs*, *Cyv*, *Q*, *Dydp*, and *Dywp*—are COPC- and site-specific. (2) In the equation in Table B-3-1, uncertainties associated with other variables include the following: F_w (values for organic compounds estimated on the basis of the behavior of polystyrene microspheres), *Rp* (estimated on the basis of a generalized empirical relationship), and *kp* (estimation process does not consider chemical degradation).
P_{TP}	Proportion of terrestrial plant in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{TP}	Fraction of diet comprised of terrestrial plants	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of terrestrial plants. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-4

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, TALLGRASS PRAIRIE, AND SHORTGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
Cs	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. C_S is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs*. (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual
$IR_{S\text{-}OB}$	Soil ingestion rate for omnivorous bird	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied to site-specific organisms.
P_S	Proportion of ingested soil that is contamanted	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site-specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated may be overestimated.

TABLE F-2-4

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, TALLGRASS PRAIRIE, AND SHORTGRASS PRAIRIE FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values and may be significant in specific instances. Uncertainties associated with the variable L_T and K_{wt} may also be significant because of many variable-specific uncertainties. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, default *OC* values will result in uncertainty in specific cases.
$IR_{W\text{-}OB}$	Water ingestion rate for omnivorous bird	L/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are influenced by animal behavior and environmental factors and may over- or under-estimate $BCF_{W\text{-}OB}$ to an unknown degree.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated may be overestimated.

TABLE F-2-4

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN FOREST, SHRUB/SCRUB, TALLGRASS PRAIRIE, AND SHORTGRASS PRAIRIE FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a.

TABLE F-2-5

COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Description

This equation calculates the daily dose through exposure to food/prey, soil, and water in carnivorous mammal in upland forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_s and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific
(2) Variables $BCF_{S\text{-}CM}$, and $BCF_{W\text{-}CM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific carnivorous mammals.

Equation

$$D_{CM} = \left(C_{HB} \cdot IR_{CM} \cdot P_{HB} \cdot F_{HB}\right) + \left(C_{OB} \cdot IR_{CM} \cdot P_{OB} \cdot F_{OB}\right) + \left(C_{OM} \cdot IR_{CM} \cdot P_{OM} \cdot F_{OM}\right) + \left(C_{HM} \cdot IR_{CM} \cdot P_{HM} \cdot F_{HM}\right) + \left(C_s \cdot IR_{S\text{-}CM} \cdot P_S\right) + \left(C_{wctot} \cdot IR_{W\text{-}CM} \cdot P_W\right)$$

Variable	Description	Units	Value
D_{CM}	Dose COPC ingested for carnivorous mammals	mg COPC/kg BW-day	
C_{HB}	Concentration of COPC in herbivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-10)** This variable is site-specific and chemical-specific; it is calculated using the equation in Table F-1-10. Uncertainties associated with this variable include: (1) Variables Cs and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HB}$ and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous birds.

TABLE F-2-5

COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
IR_{CM}	Food ingestion rate of carnivorous mammal	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) *IR* values may over- or under- estimate exposure when applied for site-specific receptors.
P_{HB}	Proportion of herbivorous birds in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HB}	Fraction of diet comprised of herbivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-5

COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{OB}	Concentration of COPC in omnivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-6)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-6. Uncertainties associated with this variable include: (1) Variables Cs and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific. (2) Variables $BCF_{S\text{-}OB}$ and $BCF_{W\text{-}OB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific omnivorous birds.
P_{OB}	Proportion of omnivorous bird diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommend that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OB}	Fraction of diet comprised of omnivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-5

COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{OM}	Concentration of COPC in omnivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-5)** This variable is site-specific and COPC-specific, and is calculated using the equation in Table F-1-5. Uncertainties associated with this variable include: (1) Variables Cs and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific. (2) Variables $BCF_{S\text{-}OM}$ and $BCF_{W\text{-}OM}$ are based on biotransfer factors for beef (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific omnivorous mammals.
P_{OM}	Proportion of omnivorous mammal diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OM}	Fraction of diet comprised of omnivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-5

COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{HM}	Concentration of COPC in herbivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-9)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-9. Uncertainties associated with this variable include: (1) Variables Cs and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous mammals.
P_{HM}	Proportion of herbivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommend that a default value of 1.0 be used for all food types when site specific information is not available. Uncertainties associated with this variable include: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HM}	Fraction of diet comprised of herbivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of herbivorous mammals depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. Therefore a default value of 100 percent for the exclusive diet, may over-estimate dietary exposure.

TABLE F-2-5

COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
Cs	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. *Cs* is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs* (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$IR_{S\text{-}CM}$	Soil ingestion rate for carnivorous mammal	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5; Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied to site-specific organisms.
P_S	Proportion of ingested soil that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated may be overestimated.

TABLE F-2-5

COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. Uncertainties may also be associated with the variable L_T and K_{wt}. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}CM}$	Water ingestion rate for carnivorous mammal	L/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are strongly influenced by animal behavior and environmental factors and may over- or under- estimate $BCF_{W\text{-}CM}$ to an unknown degree.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated may be overestimated.

TABLE F-2-5

COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a

TABLE F-2-6

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Description

This equation calculates the potential daily dose through exposure to contaminated food/prey, soil, and water in carnivorous birds in upland forest, shortgrass prairie, tallgrass prairie, and shrub/scrub food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables Cs and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific.
(2) Variables $BCF_{S\text{-}CB}$ and $BCF_{W\text{-}CB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific carnivorous birds.

Equation

$$D_{CB} = \left(C_{HB} \cdot IR_{CB} \cdot P_{HB} \cdot F_{HB}\right) + \left(C_{OM} \cdot IR_{CB} \cdot P_{OM} \cdot F_{OM}\right) + \left(C_{HM} \cdot IR_{CB} \cdot P_{HM} \cdot F_{HM}\right)$$
$$+ \left(C_{OB} \cdot IR_{CB} \cdot P_{OB} \cdot F_{OB}\right) + \left(C_{s} \cdot IR_{S\text{-}CB} \cdot P_{S}\right) + \left(C_{wctot} \cdot IR_{W\text{-}CB} \cdot P_{W}\right)$$

Variable	Description	Units	Value
D_{CB}	Dose COPC ingested for carnivorous birds	mg COPC/kg BW-day	
C_{HB}	Concentration of COPC in herbivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-10)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-10. Uncertainties associated with this variable include: (1) Variables Cs and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HB}$ and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous birds.

TABLE F-2-6

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
IR_{CB}	Food ingestion rate of carnivorous bird	kg WW/kg DW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) IR values may over- or under- estimate exposure when applied for site-specific receptors.
P_{HB}	Proportion of herbivorous birds in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HB}	Fraction of diet comprised of herbivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-6

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{OM}	Concentration of COPC in omnivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-5)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-5. Uncertainties associated with this variable include: (1) Variables Cs and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific. (2) Variables $BCF_{S\text{-}OM}$ and $BCF_{W\text{-}OM}$ are based on biotransfer factors for beef (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific omnivorous mammals.
P_{OM}	Proportion of omnivorous mammal diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OM}	Fraction of diet comprised of omnivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-6

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{HM}	Concentration of COPC in herbivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-9)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-9. Uncertainties associated with this variable include: (1) Variables *Cs* and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific. (2) Variables $BCF_{S\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous mammals.
P_{HM}	Proportion of herbivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. Uncertainties associated with this variable include: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HM}	Fraction of diet comprised of herbivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of herbivorous mammals depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. Therefore a default value of 100 percent for the exclusive diet, may over-estimate dietary exposure.

TABLE F-2-6

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{OB}	Concentration of COPC in omnivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-6)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-6. Uncertainties associated with this variable include: (1) Variables Cs and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific. (2) Variables $BCF_{S\text{-}OB}$ and $BCF_{W\text{-}OB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific omnivorous birds.
P_{OB}	Proportion of omnivorous bird diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OB}	Fraction of diet comprised of omnivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-6

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
Cs	COPC concentration in soil	mg COPC /kg DW soil	**Varies** This variable is COPC- and site-specific, and should be calculated using the equation in Table B-1-1. *Cs* is expressed on a dry weight basis. Uncertainties associated with this variable include: (1) For soluble COPCs, leaching might lead to movement to below 1 centimeter in untilled soils, resulting a greater mixing depth. This uncertainty may overestimate *Cs*. (2) Deposition to hard surfaces may result in dust residues that have negligible dilution (as a result of potential mixing with *in situ* materials) in comparison to that of other residues. This uncertainty may underestimate *Cs* (3) Modeled soil concentrations may not accurately represent site-specific conditions. As a result, the actual COPC concentration in soil may be under- or overestimated to an unknown degree.
$IR_{S\text{-}CB}$	Soil ingestion rate for carnivorous bird	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied for site-specific organisms.
P_S	Proportion of ingested soil that is contamanted	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-6

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}CB}$	Water ingestion rate for carnivorous bird	L/kg DW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5.. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are strongly influenced by animal behavior and environmental factors and may over- or under- estimate $BCF_{W\text{-}CB}$ to an unknown degree.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-6

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN FOREST, SHORTGRASS PRAIRIE, TALLGRASS PRAIRIE, AND SHRUB/SCRUB FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a

TABLE F-2-7

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the daily dose through the ingestion of contaminated food/prey, sediment, and water in aquatic herbivorous mammals in freshwater marsh, brackish/intermediate marsh, and saltwater marsh food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific.
(2) Variables $BCF_{BS\text{-}HM}$, and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific herbivorous mammals.

Equation

$$D_{HM} = \left(C_{AV} \cdot IR_{HM} \cdot P_{AV} \cdot F_{AV}\right) + \left(C_{AL} \cdot IR_{HM} \cdot P_{AL} \cdot F_{AL}\right) + \left(C_{sed} \cdot IR_{S\text{-}HM} \cdot P_{S}\right) + \left(C_{wctot} \cdot IR_{W\text{-}HM} \cdot P_{W}\right)$$

Variable	Description	Units	Value
D_{HM}	Dose COPC ingested for aquatic herbivorous mammals	mg COPC/kg BW-day	
C_{AV}	Concentration of COPC in aquatic vegetation	mg COPC/kg WW	**Varies (calculated - Table F-1-7)** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-7. Uncertainties associated with this variable include: (1) C_{sed} values are COPC- and site-specific. Uncertainties associated with this variable will be site-specific. (2) $BCF_{S\text{-}AV}$ values are intended to represent "generic aquatic vegetation species", and therefore may over- or under-estimate exposure when applied to site-specific vegetation.

TABLE F-2-7

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
IR_{HM}	Food ingestion rate of aquatic herbivorous mammal	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) *IR* values may over- or under- estimate exposure when applied for site-specific receptors.
P_{AV}	Proportion of aquatic vegetation in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AV}	Fraction of diet comprised of aquatic vegetation	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic vegetation. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-7

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{AL}	Concentration of COPC in algae	mg COPC/kg WW	**Varies (calculated - Table F-1-8)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-8. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. Uncertainties associated with this variable will be site-specific. (2) $BCF_{W\text{-}AL}$ values are intended to represent "generic algae species", and therefore may over- or under-estimate exposure when applied to site-specific species.
P_{AL}	Proportion of algae in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AL}	Fraction of diet comprised of algae	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of algae. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-7

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of COPCs in bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wctot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
$IR_{S\text{-}HM}$	Sediment ingestion rate for aquatic herbivorous mammal	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied for site-specific organisms.
P_S	Proportion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of sediment ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-7

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. Uncertainties may also be associated with the variable L_T and k_{wt}. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}HM}$	Water ingestion rate for aquatic herbivorous mammal	L/kg-BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5.. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are influenced by animal behavior and environmental factors and may over- or under-estimate $BCF_{W\text{-}HM}$ to an unknown degree.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-7

COPC DOSE INGESTED TERMS IN HERBIVOROUS MAMMALS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbood.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a

TABLE F-2-8

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the daily dose through ingestion of contaminated food/prey, sediment, and water in aquatic herbivorous birds in freshwater marsh, brackish/intermediate marsh, and saltwater marsh food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific.
(2) Variables $BCF_{S\text{-}HB}$ and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific herbivorous birds.

Equation

$$D_{HB} = \left(C_{AV} \cdot IR_{HB} \cdot P_{AV} \cdot F_{AV}\right) + \left(C_{AL} \cdot IR_{HB} \cdot P_{AL} \cdot F_{AL}\right) + \left(C_{sed} \cdot IR_{S\text{-}HB} \cdot P_S\right) + \left(C_{wctot} \cdot IR_{W\text{-}HB} \cdot P_W\right)$$

Variable	Description	Units	Value
D_{HB}	Dose ingested for herbivorous birds	mg/kg BW-day	
C_{AV}	Concentration of COPC in aquatic vegetation	mg COPC/kg WW	**Varies (calculated - Table F-1-7)** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-7. Uncertainties associated with this variable include: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{S\text{-}AV}$ values are intended to represent "generic aquatic vegetation species", and therefore may over- or under-estimate exposure when applied to site-specific vegetation.
IR_{HB}	Food ingestion rate of aquatic herbivorous bird	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) IR values may over- or under- estimate exposure when applied for site-specific receptors.

TABLE F-2-8

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
P_{AV}	Proportion of aquatic vegetation in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AV}	Fraction of diet comprised of aquatic vegetation	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic vegetation. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{AL}	Concentration of COPC in algae	mg COPC/kg WW	**Varies (calculated - Table F-1-8)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-8. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. Uncertainties associated with this variable will be site-specific. (2) $BCF_{W\text{-}AL}$ values are intended to represent "generic algae species", and therefore may over- or under-estimate exposure when applied to site-specific species.

TABLE F-2-8

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
P_{AL}	Proportion of algae in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AL}	Fraction of diet comprised of algae	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of algae. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-8

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of COPCs in bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wctot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
$IR_{S\text{-}HB}$	Sediment ingestion rate for herbivorous bird	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied for site-specific organisms.
P_S	Proportion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-8

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

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Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. Uncertainties may also be associated with the variable L_T and k_{wt}. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}HB}$	Water ingestion rate for aquatic herbivorous bird	L/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5, Section 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are influenced by animal behavior and environmental factors and may over- or under-estimate $BCF_{W\text{-}HB}$ to an unknown degree.
P_W	Proportion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-8

COPC DOSE INGESTED TERMS IN HERBIVOROUS BIRDS IN FRESHWATER/WETLAND, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Description

This equation calculates the daily dose through ingestion of contaminated food/prey, sediment, and water in aquatic omnivorous mammals in freshwater marsh, brackish/intermediate marsh, and saltwater marsh food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific .
(2) Variables $BCF_{S\text{-}OM}$ and $BCF_{W\text{-}OM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific omnivorous mammals.

Equation

$$D_{OM} = \left(C_{HM} \cdot IR_{OM} \cdot P_{HM} \cdot F_{HM}\right) + \left(C_{HB} \cdot IR_{OM} \cdot P_{HB} \cdot F_{HB}\right) + \left(C_{BI} \cdot IR_{OM} \cdot P_{BI} \cdot F_{BI}\right) + \left(C_{WI} \cdot IR_{OM} \cdot P_{WI} \cdot F_{WI}\right)$$
$$+ \left(C_{AV} \cdot IR_{OM} \cdot P_{AV} \cdot F_{AV}\right) + \left(C_{AL} \cdot IR_{OM} \cdot P_{AL} \cdot F_{AL}\right) + \left(C_{sed} \cdot IR_{S\text{-}OM} \cdot P_{S}\right) + \left(C_{wctot} \cdot IR_{W\text{-}OM} \cdot P_{W}\right)$$

Variable	Description	Units	Value
D_{OM}	Dose ingested for omnivorous mammals	mg/kg BW-day	
C_{HM}	Concentration of COPC in aquatic herbivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-9)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-9. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific omnivorous mammals.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
IR_{OM}	Food ingestion rate of aquatic omnivorous mammal	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) IR values may over- or under- estimate exposure when applied for site-specific receptors.
P_{HM}	Proportion of aquatic herbivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HM}	Fraction of diet comprised of aquatic herbivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic herbivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{HB}	Concentration of COPC in aquatic herbivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-10)** This variable is site-specific and COPC-specific, and is calculated using the equation in Table F-1-10. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HB}$ and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific aquatic herbivorous birds.
P_{HB}	Proportion of aquatic herbivorous birds in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HB}	Fraction of diet comprised of aquatic herbivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic herbivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{BI}	Concentration of COPC in benthic invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-11)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-11. Uncertainties associated with this variable include the following: (1) C_{sed} values are COPC- and site-specific. Uncertainties associated with this variable will be site-specific. (2) $BCF_{S\text{-}BI}$ values are intended to represent "generic benthic invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{BI}	Proportion of benthic invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{BI}	Fraction of diet comprised of benthic invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of benthic invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{WI}	Concentration of COPC in water invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-12)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-12. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}WI}$ values are intended to represent "generic water invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{WI}	Proportion of water invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{WI}	Fraction of diet comprised of water invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of water invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{AV}	Concentration of COPC in aquatic vegetation	mg COPC/kg WW	**Varies (calculated - Table F-1-7)** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-7. Uncertainties associated with this variable include: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{S\text{-}AV}$ values are intended to represent "generic aquatic vegetation species", and therefore may over- or under-estimate exposure when applied to site-specific vegetation.
P_{AV}	Proportion of aquatic vegetation in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AV}	Fraction of diet comprised of aquatic vegetation	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic vegetation. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{AL}	Concentration of COPC in algae	mg COPC/kg WW	**Varies (calculated - Table F-1-8)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-8. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}AL}$ values are intended to represent "generic algae species", and therefore may over- or under-estimate exposure when applied to site-specific species.
P_{AL}	Proportion of algae in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AL}	Fraction of diet comprised of algae	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of algae. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of contaminants sorbed to bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wctot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same media. This variable is site-specific.
$IR_{S\text{-}OM}$	Sediment ingestion rate for aquatic omnivorous mammal	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied to site-specific organisms.
P_S	Portion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. Uncertainties may also be associated with the variable L_T and k_{wt} The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}OM}$	Water ingestion rate for aquatic omnivorous mammal	L/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are strongly influenced by animal behavior and environmental factors and may over- or under- estimate $BCF_{W\text{-}OM}$ to an unknown degree.
P_W	Portion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-9

COPC DOSE INGESTED TERMS IN OMNIVOROUS MAMMALS IN FRESHWATER/WETLAND MARSH, BRACKISH/INTERMEDIATE MARSH, AND SALTMARSH FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbood.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a

TABLE F-2-10

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Description

This equation calculates the daily dose through ingestion of contaminated food/prey, sediment, and water in aquatic omnivorous birds in freshwater marsh, brackish/intermediate marsh, and saltwater marsh food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific .
(2) Variables $BCF_{S\text{-}OB}$ and $BCF_{W\text{-}OB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific omnivorous birds.

Equation

$$D_{OB} = \left(C_{BI} \cdot IR_{OB} \cdot P_{BI} \cdot F_{BI}\right) + \left(C_{WI} \cdot IR_{OB} \cdot P_{WI} \cdot F_{WI}\right) + \left(C_{AV} \cdot IR_{OB} \cdot P_{AV} \cdot F_{AV}\right)$$
$$+ \left(C_{AL} \cdot IR_{OB} \cdot P_{AL} \cdot F_{AL}\right) + \left(C_{sed} \cdot IR_{S\text{-}OB} \cdot P_{S}\right) + \left(C_{wctot} \cdot IR_{W\text{-}OB} \cdot P_{W}\right)$$

Variable	Description	Units	Value
D_{OB}	Dose ingested for aquatic omnivorous birds	mg/kg BW-day	
C_{BI}	Concentration of COPC in benthic invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-11)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-11. Uncertainties associated with this variable include the following: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{S\text{-}BI}$ values are intended to represent "generic benthic invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.

TABLE F-2-10

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
IR_{OB}	Food ingestion rate of aquatic omnivorous bird	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) IR values may over- or under- estimate exposure when applied for site-specific receptors.
P_{BI}	Proportion of benthic invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{BI}	Fraction of diet comprised of benthic invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of benthic invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-10

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{WI}	Concentration of COPC in water invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-12)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-12. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}WI}$ values are intended to represent "generic water invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{WI}	Proportion of water invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{WI}	Fraction of diet comprised of water invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of water invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-10

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{AV}	Concentration of COPC in aquatic vegetation ingested by the animal	mg COPC/kg WW	**Varies (calculated - Table F-1-7)** This variable is site- and COPC-specific; it is calculated using the equation in Table F-1-7. Uncertainties associated with this variable include: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{S\text{-}AV}$ values are intended to represent "generic aquatic vegetation species", and therefore may over- or under-estimate exposure when applied to site-specific vegetation.
P_{AV}	Proportion of aquatic vegetation in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{AV}	Fraction of diet comprised of aquatic vegetation	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic vegetation. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-10

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of COPCs in bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wctot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
IR_{SOB}	Sediment ingestion rate for aquatic omnivorous bird	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied to site-specific organisms.
P_S	Portion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-10

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. Uncertainties may also be associated with the variable L_T and k_{wt}. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same media, the uncertainty associated with using default *OC* values may be significant in specific cases.
$I.W.\text{-}OB$	Water ingestion rate for aquatic omnivorous bird	L/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are influenced by animal behavior and environmental factors and may over- or under-estimate $BCF_{W\text{-}HM}$ to an unknown degree.
P	Portion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated may be overestimated.

TABLE F-2-10

COPC DOSE INGESTED TERMS IN OMNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Description

This equation calculates the daily dose through exposure to food/prey, sediment, and water in aquatic carnivorous mammals in freshwater marsh, brackish/intermediate marsh, and saltwater marsh food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific
(2) Variables $BCF_{S\text{-}CM}$, and $BCF_{W\text{-}CM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific carnivorous mammals.

Equation

$$D_{CM} = \left(C_{HB} \cdot IR_{CM} \cdot P_{HB} \cdot F_{HB}\right) + \left(C_{OF} \cdot IR_{CM} \cdot P_{OF} \cdot F_{OF}\right) + \left(C_{CF} \cdot IR_{CM} \cdot P_{CF} \cdot F_{CF}\right) + \left(C_{OB} \cdot IR_{CM} \cdot P_{OB} \cdot F_{OB}\right)$$
$$+ \left(C_{OM} \cdot IR_{CM} \cdot P_{OM} \cdot F_{OM}\right) + \left(C_{HM} \cdot IR_{CM} \cdot P_{HM} \cdot F_{HM}\right) + \left(C_{sed} \cdot IR_{S\text{-}CM} \cdot P_{S}\right) + \left(C_{wctot} \cdot IR_{W\text{-}CM} \cdot P_{W}\right)$$

Variable	Description	Units	Value
D_{CM}	Dose ingested for carnivorous mammals	mg/kg BW-day	
C_{HB}	Concentration of COPC in herbivorous birds	mg COPC/kg FW tissue	**Varies** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-10. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HB}$ and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific herbivorous birds.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
IR_{CM}	Food ingestion rate of carnivorous mammal	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) IR values may over- or under- estimate exposure when applied for site-specific receptors.
P_{HB}	Proportion of herbivorous birds in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HB}	Fraction of diet comprised of herbivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic herbivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{OF}	Concentration of COPC in omnivorous fish	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-16)** This variable is site-specific and COPC-specific; it is calculated using the equation in F-1-16. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) The data set used to calculate BCF_{fish} is based on a limited number of test organisms and therefore may over- or under-estimate exposure when applied for site-specific organisms.
P_{OF}	Proportion of omnivorous fish diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OF}	Fraction of diet comprised of omnivorous fish	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous fish. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{CF}	Concentration in carnivorous fish	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-17)** This variable is site-specific and COPC-specific; it is calculated using the equation in F-1-17. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) The data set used to calculate BCF_{fish} is based on a limited number of test organisms and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{CF}	Proportion of carnivorous fish in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{CF}	Fraction of diet comprised of carnivorous fish	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of carnivorous fish. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{OB}	Concentration of COPC in omnivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-15)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-6. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}OB}$ and $BCF_{W\text{-}OB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific aquatic omnivorous birds.
P_{OB}	Proportion of omnivorous bird diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OB}	Fraction of diet comprised of omnivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic omnivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{OM}	Concentration of COPC in omnivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-5)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-5. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}OM}$ and $BCF_{W\text{-}OM}$ are based on biotransfer factors for beef (Ba_{beef}), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific omnivorous mammals.
P_{OM}	Proportion of omnivorous mammal diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OM}	Fraction of diet comprised of omnivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{HM}	Concentration of COPC in herbivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-9)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-9. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific aquatic herbivorous mammals.
P_{HM}	Proportion of herbivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. Uncertainties associated with this variable include: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HM}	Fraction of diet comprised of herbivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic herbivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of herbivorous mammals depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. Therefore a default value of 100 percent for the exclusive diet, may over-estimate dietary exposure.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of contaminants sorbed to bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wctot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
$IR_{S\text{-}CM}$	Sediment ingestion rate for carnivorous mammal	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied to site-specific organisms.
P_S	Portion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. Uncertainties may also be associated with the variable L_T and k_{wt}. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}CM}$	Water ingestion rate for carnivorous mammal	kg WW/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are strongly influenced by animal behavior and environmental factors and may over- or under- estimate $BCF_{W\text{-}HM}$ to an unknown degree.
P_W	Portion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW rsecommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-11

EQUATIONS FOR COMPUTING COPC DOSE INGESTED TERMS IN CARNIVOROUS MAMMALS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

REFERENCES AND DISCUSSION

U.S. EPA. 1993. *Wildlife Exposure Factor Handbood.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Description

This equation calculates the daily dose through exposure to contaminated food/prey, soil, and water in aquatic carnivorous birds in freshwater marsh, brackish/intermediate marsh, and saltwater marsh food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_{sed}, and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific.
(2) Variables $BCF_{BS\text{-}CB}$, and $BCF_{W\text{-}CB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific carnivorous birds.

Equation

$$D_{CB} = \left(C_{OF} \cdot IR_{CB} \cdot P_{OF} \cdot F_{OF}\right) + \left(C_{CF} \cdot IR_{CB} \cdot P_{CF} \cdot F_{CF}\right) + \left(C_{OM} \cdot IR_{CB} \cdot P_{OM} \cdot F_{OM}\right) + \left(C_{HM} \cdot IR_{CB} \cdot P_{HM} \cdot F_{HM}\right)$$
$$+ \left(C_{OB} \cdot IR_{CB} \cdot P_{OB} \cdot F_{OB}\right) + \left(C_{HB} \cdot IR_{CB} \cdot P_{HB} \cdot F_{HB}\right) + \left(C_{sed} \cdot IR_{S\text{-}CB} \cdot P_{S}\right) + \left(C_{wctot} \cdot IR_{W\text{-}CB} \cdot P_{W}\right)$$

Variable	Description	Units	Value
D_{CB}	Dose ingested for carnivorous birds	mg/kg BW-day	
C_{OF}	Concentration of COPC in omnivorous fish	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-16)** This variable is site-specific and COPC-specific; it is calculated using the equation in F-1-16. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) The data set used to calculate BCF_{fish} is based on a limited number of test organisms and therefore may over- or under-estimate exposure when applied to site-specific organisms.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
IR_{CB}	Food ingestion rate of carnivorous birds	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) *IR* values may over- or under- estimate exposure when applied to site-specific receptors.
P_{OF}	Proportion of omnivorous fish diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OF}	Fraction of diet comprised of omnivorous fish	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous fish. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{CF}	Concentration in carnivorous fish	mg COPC/kg FW tissue	**Varies** This variable is site-specific and COPC-specific; it is calculated using the equation in F-1-17. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) The data set used to calculate BCF_{fish} is based on a limited number of test organisms and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{CF}	Proportion of carnivorous fish diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{CF}	Fraction of diet comprised of carnivorous fish	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of carnivorous fish. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{OM}	Concentration of COPC in omnivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-5)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-5. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}OM}$ and $BCF_{W\text{-}OM}$ are based on biotransfer factors for beef (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific aquatic omnivorous mammals.
P_{OM}	Proportion of aquatic omnivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OM}	Fraction of diet comprised of omnivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic omnivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{HM}	Concentration of COPC in herbivorous mammals	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-9)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-9. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HM}$ and $BCF_{W\text{-}HM}$ are based on biotransfer factors for beef cattle (Ba_{beef}), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific aquatic herbivorous mammals.
P_{HM}	Proportion of aquatic herbivorous mammal in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. Uncertainties associated with this variable include: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HM}	Fraction of diet comprised of herbivorous mammals	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic herbivorous mammals. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of herbivorous mammals depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. Therefore a default value of 100 percent for the exclusive diet, may over-estimate dietary exposure.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{OB}	Concentration of COPC in omnivorous birds	mg COPC/kg FW tissue	**Varies** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-6. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}OB}$ and $BCF_{W\text{-}OB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific aquatic omnivorous birds.
P_{OB}	Proportion of omnivorous bird in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OB}	Fraction of diet comprised of omnivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic omnivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{HB}	Concentration of COPC in herbivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-10)** This variable is site-specific and chemical-specific; it is calculated using the equation in Table F-1-10. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}HB}$ and $BCF_{W\text{-}HB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific aquatic herbivorous birds.
P_{HB}	Proportion of herbivorous birds in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{HB}	Fraction of diet comprised of herbivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of aquatic herbivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of COPCs in bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wctot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
$IR_{S\text{-}CB}$	Sediment ingestion rate for carnivorous bird	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied to site-specific organisms.
P_S	Portion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. Uncertainties may also be associated with the variable L_T and k_{wt} The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wtot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}CB}$	Water ingestion rate for aquatic carnivorous bird	L/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are strongly influenced by animal behavior and environmental factors and may over- or under- estimate $BCF_{W\text{-}HM}$ to an unknown degree.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
P_W	Portion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-12

COPC DOSE INGESTED TERMS IN CARNIVOROUS BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Description

This equation calculates the daily dose through exposure to contaminated food/prey, sediment, and water in carnivorous shore birds in freshwater marsh, brackish/intermediate marsh, and saltwater marsh food webs. The limitations and uncertainties introduced in calculating this variable include the following:

(1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. Uncertainties associated with these variables will be site-specific
(2) Variables $BCF_{S\text{-}CSB}$, and $BCF_{W\text{-}CSB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor-specific ingestion rates, and therefore may introduce uncertainty when used to compute a representative daily dose for site-specific carnivorous birds.

Equation

$$D_{CSB} = \left(C_{BI} \cdot IR_{CSB} \cdot P_{BI} \cdot F_{BI}\right) + \left(C_{WI} \cdot IR_{CSB} \cdot P_{WI} \cdot F_{WI}\right) + \left(C_{HPF} \cdot IR_{CSB} \cdot P_{HPF} \cdot F_{HPF}\right)$$
$$+ \left(C_{OF} \cdot IR_{CSB} \cdot P_{OF} \cdot F_{OF}\right) + \left(C_{OB} \cdot IR_{CSB} \cdot P_{OB} \cdot F_{OB}\right) + \left(C_{sed} \cdot IR_{S\text{-}CSB} \cdot P_{S}\right) + \left(C_{wctot} \cdot IR_{W\text{-}CSB} \cdot P_{W}\right)$$

Variable	Description	Units	Value
D_{CSB}	Dose ingested for carnivorous shore birds	mg/kg BW-day	
C_{BI}	Concentration of COPC in benthic invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-11)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-11. Uncertainties associated with this variable include the following: (1) C_{sed} values are COPC- and site-specific. (2) $BCF_{S\text{-}BI}$ values are intended to represent "generic benthic invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
IR_{CSB}	Food ingestion rate of carnivorous shore birds	kg WW/kg BW-day	**Varies** This variable is receptor-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are provided in Chapter 5, Table 5-1. Uncertainties associated with this variable include: (1) Food ingestion rates are influenced by several factors including: metabolic rate, energy requirements for growth and reproduction, and dietary composition. Ingestion rates are also influenced by ambient temperature, receptor activity level and body weight U.S. EPA (1993). These factors introduce an unknown degree of uncertainty when used to estimate daily dose. (2) *IR* values may over- or under- estimate exposure when applied to site-specific receptors.
P_{BI}	Proportion of benthic invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
F_{BI}	Fraction of diet comprised of benthic invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of benthic invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertaintiy and may over-estimate exposure from ingestion of a single dietary item. (3) The defalut value for an equal diet introduces uncertainity and may over- or under- estimate exposure when applied to site-specific receptors.
C_{WI}	Concentration of COPC in water invertebrates	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-12)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-12. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) $BCF_{W\text{-}WI}$ values are intended to represent "generic water invertebrate species", and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{WI}	Proportion of water invertebrate in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
F_{WI}	Fraction of diet comprised of water invertebrates	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of water invertebrates. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertaintiy and may over-estimate exposure from ingestion of a single dietary item. (3) The defalut value for an equal diet introduces uncertainity and may over- or under- estimate exposure when applied to site-specific receptors.
C_{HPF}	Concentration in herbivorous and planktivorous fish	mg/kg	**Varies (calculated - Table F-1-13)** This variable is site-specific and COPC-specific; it is calculated using the equation in F-1-16. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) The data set used to calculate BCF_{fish} is based on a limited number of test organisms and therefore may over- or under-estimate exposure when applied to site-specific organisms.
P_{HPF}	Proportion of herbivorous and planktivorous fish diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
F_{HPF}	Fraction of diet comprised of herbivorous and planktivorous fish	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of herbivorous/piscivorous fish. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertaintiy and may over-estimate exposure from ingestion of a single dietary item. (3) The defalut value for an equal diet introduces uncertainity and may over- or under- estimate exposure when applied to site-specific receptors.
C_{OB}	Concentration of COPC in omnivorous birds	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-6)** This variable is site-specific and COPC-specific; it is calculated using the equation in Table F-1-6. Uncertainties associated with this variable include: (1) Variables C_{sed} and C_{wctot} are COPC- and site-specific. (2) Variables $BCF_{S\text{-}OB}$ and $BCF_{W\text{-}OB}$ are based on biotransfer factors for chicken ($Ba_{chicken}$), and receptor specific ingestion rates, and therefore may introduce uncertainty when used to compute concentrations for site-specific omnivorous birds.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
P_{OB}	Proportion of omnivorous bird in diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OB}	Fraction of diet comprised of omnivorous birds	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous birds. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.
C_{OF}	Concentration of COPC in omnivorous fish	mg COPC/kg FW tissue	**Varies (calculated - Table F-1-16)** This variable is site-specific and COPC-specific; it is calculated using the equation in F-1-16. Uncertainties associated with this variable include: (1) C_{dw} values are COPC- and site-specific. (2) The data set used to calculate BCF_{fish} is based on a limited number of test organisms and therefore may over- or under-estimate exposure when applied to site-specific organisms.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
P_{OF}	Proportion of omnivorous fish diet that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of the dietary food item that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for all food types when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated food ingested by a species depends on food availability, diet composition, and animal behavior. Therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and may overestimate the proportion of contaminated food ingested.
F_{OF}	Fraction of diet comprised of omnivorous fish	unitless	**0 to 1** This variable is species- and site-specific, and depends on the percentage of the diet that is comprised of omnivorous fish. The default value for a screening level ecological risk assessment is 100 percent for computing concentration based on an exclusive diet. For calculating an equal diet, F_{diet} is determined based on the number of dietary components in the total diet. The application of an equal diet is further discussed in Chapter 5. Uncertainties associated with this variable include: (1) The actual proportion of the diet that is comprised of a specific dietary item depends on several factors including: food availability, animal behavior, species composition, and seasonal influences. These uncertainties may over- or under- estimate F_{diet} when applied to site-specific receptors. (2) The default value of 100 percent for an exclusive diet introduces uncertainty and may over-estimate exposure from ingestion of a single dietary item. (3) The default value for an equal diet introduces uncertainty and may over- or under- estimate exposure when applied to site-specific receptors.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{sed}	COPC concentration in bed sediment	mg COPC/kg DW sediment	**Varies (calculated - Table B-2-19)** This equation calculates the concentration of COPCs in bed sediments. Uncertainties associated with this equation include the following: (1) The default variable values recommended for use in the equation in Table B-2-19 may not accurately represent site-specific water body conditions. The degree of uncertainty associated with default variable values is expected to be limited either because the probable ranges for these variables are narrow or because information allowing reasonable estimates is generally available. (2) Uncertainties associated with variables f_{bs}, C_{wctot} and Kd_{bs} are largely associated with the use of default *OC* content values in their calculation. The uncertainty may be significant in specific instances, because *OC* content is known to vary widely in different locations in the same medium. This variable is site-specific.
$IR_{S\text{-}CSB}$	Sediment ingestion rate for carnivorous shorebird	kg DW/kg BW-day	**Varies** This variable is site-, receptor-, and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. Uncertainties associated with this variable include the following: (1) IR_S values may under- or over-estimate BCF_S when applied to site-specific organisms.
P_S	Portion of ingested bed sediment that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of soil ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used for a screening level risk assessment when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated soil ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of soil ingested that is contaminated will likely be overestimated.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

Variable	Description	Units	Value
C_{wctot}	Total COPC concentration in water column	mg COPC/L water (or g COPC/m^3 water)	**Varies (calculated - Table B-2-17)** This variable is COPC- and site-specific and is calculated using Table B-2-17. Uncertainties associated with this equation include the following: (1) All of the variables in the equation in Table B-2-17 are COPC- and site-specific. Therefore, the use of default values rather than site-specific values, for any or all of these variables, will contribute to the under- or overestimation of C_{wctot}. (2) Uncertainty associated with f_{wc} is largely the result of uncertainty associated with default OC content values. Uncertainties may also be associated with the variable L_T and k_{wt}. The degree of uncertainly associated with the variables d_{wc} and d_{bs} is expected to be minimal either because information for estimating a variable (d_{wc}) is generally available or because the probable range for a variable (d_{bs}) is narrow. The uncertainty associated with the variables f_{wc} and C_{wctot} is associated with estimates of *OC* content. Because *OC* content values can vary widely for different locations in the same medium, the uncertainty associated with using default *OC* values may be significant in specific cases.
$IR_{W\text{-}CSB}$	Water ingestion rate for carnivorous shorebird	L/kg BW-day	**Varies** This variable is receptor- and habitat-specific, and is discussed in Chapter 5. Ingestion rates for example measurement receptors are presented in Chapter 5, Table 5-1. The following uncertainty is associated with this variable: (1) Water ingestion rates are strongly influenced by animal behavior and environmental factors and may over- or under- estimate $BCF_{W\text{-}CSB}$ to an unknown degree.
P_W	Portion of ingested water that is contaminated	unitless	**0 to 1** **Default: 1** This variable is species- and site-specific, and depends on the percentage of water ingested that is contaminated. U.S. EPA OSW recommends that a default value of 1.0 be used when site specific information is not available. The following uncertainty is associated with this variable: (1) The actual amount of contaminated water ingested by species depends on site-specific information, receptor homerange, and animal behavior; therefore, the default value of 100 percent may not accurately reflect site-specific conditions, and the proportion of ingested water that is contaminated will likely be overestimated.

TABLE F-2-13

COPC DOSE INGESTED TERMS IN CARNIVOROUS SHORE BIRDS IN BRACKISH/INTERMEDIATE MARSH, SALTMARSH, AND FRESHWATER/WETLAND FOOD WEBS

REFERENCES AND DISCUSSIONS

U.S. EPA. 1993. *Wildlife Exposure Factor Handbook.* Volumes I and II. Office of Research and Development. EPA/600/R-93/187a