Date: March 24, 2009
Calculator: James Schmidt (updated GMAVs due to species variability)

SECONDARY VALUES FOR 2,4-D (CAS No. 94-75-7)

A search was conducted for information on the chemical properties and toxicity of 2,4-D to human health and to fish and aquatic life using the following databases and search engines: ECOTOX (toxicity to fish and aquatic life), IRIS (Integrated Risk Information System; toxicity to human health), CHEMFATE (environmental fate), BIODEG (degradation), HSDB (Hazardous Substances Data Bank), CCRIS (Chemical Carcinogenesis Research Info System), ATSDR ToxFAQs (Agency for Toxic Substances and Disease Registry chemical fact sheets), and EXTOXNET (Extension Toxicology Network's pesticide information project). This search yielded some useful information on 2,4-D's properties and toxicity.

Fish and Aquatic Life Secondary Values

To derive an acute toxicity criterion for fish and aquatic life, acute toxicity test results are required for at least one species in each of eight different families. Specific requirements and the data available to meet these requirements are found in Table 1. Following a search for information on the toxicity of 2,4-D to fish and other aquatic life, it was determined that data are available to meet all eight of the requirements. Although all requirements for calculation of criteria have been met, and no adjustment factors were used, the calculated acute criteria will be referred to as secondary values until such time that NR 105 can be revised to reflect the update.

Cold Water

Genus mean acute values (GMAV; geometric mean of SMAVs), ordered from high to low and ranked (1 for the lowest, and 21 for the highest) are found below. The cumulative probability (P) was calculated for each GMAV as P=R/(N+1).

Rank (R)	Species	GMAV (μg/L)	P
21	*Tinca tinca*	800,000	
20	*Ceriodaphnia dubia*	315,582	
19	*Anguilla rostrata*	300,600	
18	*Carassius auratus*	193,873.67	
17	*Lumbriculus variegatus*	122,200	
16	*Lepomis* sp.	7,400	
15	*Salvelinus namaycush*	67,788.23	
14	*Morone* sp.	52,952.81	
13	*Cyprinus carpio*	35,189.07	
12	F*undulus diaphanus*	26,700	
11	*Poecilia reticulata*	24,305.74	
10	*Acanthocyclops vernalis*	8,720	
9	*Ictalurus punctatus*	7,000	

8	*Chironomus* sp.	6,538.93	
7	*Simocephalus serrulatus*	4,900	
6	*Pteronarcys californicus*	4,898.98	
5	*Oncorhynchus* sp.	3,922.40	
4	*Pimephales promelas*	3,789.82	0.1818
3	*Daphnia* sp.	3,200	0.1364
2	*Micropterus dolomieui*	3,100	0.0909
1	*Gammarus fasciatus*	2,400	0.0454

Using the four GMAVs with Ps closest to 0.05 (*Gammarus*, *Micropterus*, *Daphnia*, and *Pimephales*), the acute toxicity criterion (to be called a secondary acute value until promulgated) is calculated as follows:

Let EV = sum of the four ln GMAVs
= ln 2400 + ln 3100 + ln 3200 + ln 3789.82
= 7.7832 + 8.0391 + 8.0709 + 8.2401
= 32.1334

Let EW = sum of the four squares of the ln GMAVs
$= (7.7832)^2 + (8.0391)^2 + (8.0709)^2 + (8.2401)^2$
= 60.5782 + 64.6271 + 65.1395 + 67.8988
= 258.2450

Let EP = sum of the four Ps
= 0.0454 + 0.0909 + 0.1364 + 0.1818
= 0.4545

Let EPR = sum of the four square roots of P
= 0.2131 + 0.3015 + 0.3693 + 0.4264
= 1.3103

Let JR = square root of 0.05
= 0.2236

$S = ((EW - (EV)^2/4)/(EP-(EPR)^2/4))^{0.5}$
$= ((258.2450 - (32.1334)^2/4)/(0.4545 - (1.3103)^2/4))^{0.5}$
$= ((258.2450 - 258.1388)/(0.4545 - 0.4292))^{0.5}$
$= (0.1062/0.0253)^{0.5}$
$= (4.1976)^{0.5}$
= 2.0554

L = (EV - S(EPR))/4
= (32.1334 – 2.0554(1.3103))/4
= (32.1334 – 2.6932)/4
= 7.3600

A = (JR)(S) + L
= (0.2236)(2.0554) + 7.3600
= 7.8196

Final Acute Value (FAV) = e^{A}
= $e^{7.8196}$
= 2488.91

ATC = FAV/2
=2,488.91/2
=1,244.45

ATC for Cold Water = 1,244 µg/L

To derive a chronic toxicity criterion for fish and aquatic life, chronic toxicity test results are required for at least one species in each of eight different families. Specific requirements and the data available to meet these requirements are found in Table 2. Following a search for information on the toxicity of 2,4-D to fish and other aquatic life, it was determined that data are available to meet only one out of the eight requirements. However, it is still possible to calculate a secondary chronic value for 2,4-D.

To calculate a secondary chronic value (SCV), the final acute value (FAV) is divided by the secondary acute to chronic ratio (SACR). The FAV is equal to two times the acute toxicity criterion (ATC). The SACR is equal to the geometric mean of three species mean acute-chronic ratios (SMACRs), where each SMACR is equal to the species mean acute value (SMAV) divided by the species mean chronic value (SMCV).

Because chronic toxicity data are available for *Ceriodaphnia dubia*, the SACR was calculated using these data and two default ratios.

SMAV for *C. dubia* = 315,582 µg/L
SMCV for *C. dubia* = 33,720.02 µg/L

SMACR for *C. dubia* = 315,582/33,720.02 = 9.36
SMACR 2 = 18 (default)
SMACR 3 = 18 (default)

SACR = geometric mean of 9.36, 18, and 18 = 14.47

Cold Water ATC for 2,4-D = 1,224 µg/L

FAV = (2)(1,224 µg/L) = 2,448 µg/L

SCV = FAV/SACR
= 2,488.91 µg/L / 14.47
SCV = 172 µg/L

For the other classifications, the most sensitive genera are offset by the reduced number of genera in the database such that the calculated criteria are lower than the coldwater criterion. As a result, no relaxed acute criteria or chronic values are allowable for those waters, and the coldwater numbers shall be applied to all Wisconsin waters.

Table 1. Requirements for calculation of an acute toxicity criterion for protection of aquatic life for 2,4-D, and corresponding acute toxicity data.

Species Name	Common Name	Duration/ Endpoint	Value µg/L	Reference #[a]	Source
1. At least one salmonid fish in the family Salmonidae, in the class Osteichthyes.					
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**64,000**	**15**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**41,500**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**64,000**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**41,500**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**67,000**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**130,000**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**40,000**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**43,500**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**169,000**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**172,000**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**44,000**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**37,000**	**17**	**AQUIRE**
Oncorhynchus clarki	**cutthroat trout**	**96-h/LC50**	**24,500**	**17**	**AQUIRE**
Species Mean Acute Value (SMAV) = 59,759.17					
SMAV was excluded because it was more than 10 times the SMAV for rainbow trout (see below)					
# ***Oncorhynchus mykiss***	**rainbow trout**	**96-h/LC50**	**358,000**	**16**	**AQUIRE**
Oncorhynchus mykiss	**rainbow trout**	**96-h/LC50**	**3,100**	**15**	**AQUIRE**
Oncorhynchus mykiss	**rainbow trout**	**96-h/LC50**	**3,200**	**15**	**AQUIRE**
Oncorhynchus mykiss	**rainbow trout**	**96-h/LC50**	**1,400**	**15**	**AQUIRE**
Oncorhynchus mykiss	**rainbow trout**	**96-h/LC50**	**7,600**	**15**	**AQUIRE**
# ***Oncorhynchus mykiss***	**rainbow trout**	**96-h/LC50**	**47,000**	**15**	**AQUIRE**
# ***Oncorhynchus mykiss***	**rainbow trout**	**96-h/LC50**	**358,000**	**12**	**AQUIRE**
# ***Oncorhynchus mykiss***	**rainbow trout**	**96-h/LC50**	**110,000**	**17**	**AQUIRE**

 # Results were excluded because there was more than 10 times variability within the database. Based on results for other species, it is assumed the lower LC50 values are more accurate and/or representative.

SMAV = 3,205.26 (4 results)

Oncorhynchus tshawytscha	**Chinook salmon**	**95-h/LC50**	**4,800**	**15**	**AQUIRE**

SMAV = 4,800

Genus Mean Acute Value (GMAV), *Oncorhynchus* sp. = 3,922.40

Salvelinus namaycush	**lake trout**	**96-h/LC50**	**45,000**	**15**	**AQUIRE**
Salvelinus namaycush	**lake trout**	**96-h/LC50**	**65,700**	**17**	**AQUIRE**
Salvelinus namaycush	**lake trout**	**96-h/LC50**	**44,500**	**17**	**AQUIRE**
Salvelinus namaycush	**lake trout**	**96-h/LC50**	**64,000**	**17**	**AQUIRE**
Salvelinus namaycush	**lake trout**	**96-h/LC50**	**62,000**	**17**	**AQUIRE**
Salvelinus namaycush	**lake trout**	**96-h/LC50**	**105,000**	**17**	**AQUIRE**
Salvelinus namaycush	**lake trout**	**96-h/LC50**	**120,000**	**17**	**AQUIRE**

SMAV = 67,788.23

2. At least one non-salmonid fish from another family in the class Osteichthyes, preferably a commercially or recreationally important warmwater species.

Ictalurus punctatus	**channel catfish**	**96-h/LC50**	**7,000**	**15**	**AQUIRE**

SMAV = 7,000

Lepomis gibbosus	**pumpkinseed**	**96-h/LC50**	**94,600**	**2**	**AQUIRE**

SMAV = 94,600

SMAV was excluded because it was more than 10 times the SMAV for bluegill (see below)

# ***Lepomis macrochirus***	**bluegill**	**96-h/LC50**	**263,000**	**16**	**AQUIRE**
Lepomis macrochirus	**bluegill**	**96-h/LC50**	**7,400**	**15**	**AQUIRE**
# ***Lepomis macrochirus***	**bluegill**	**96-h/LC50**	**263,000**	**12**	**AQUIRE**
# ***Lepomis macrochirus***	**bluegill**	**96-h/LC50**	**180,000**	**17**	**AQUIRE**

 # Results were excluded because there was more than 10 times variability within the database. Based on results for other species, it is assumed the lower LC50 values are more accurate and/or representative.

SMAV = 7,400

GMAV, *Lepomis* sp. = 7,400

Micropterus dolomieui	**smallmouth bass**	**96-h/LC50**	**3,100**	**15**	**AQUIRE**
SMAV = 3,100					
Morone americana	**white perch**	**96-h/LC50**	**40,000**	**2**	**AQUIRE**
SMAV = 40,000					
Morone saxatilis	**striped bass**	**96-h/LC50**	**70,100**	**2**	**AQUIRE**
SMAV = 70,100					

GMAV, *Morone* sp. = 52,952.81

3. At least one planktonic crustacean (e.g., cladoceran, copepod).

Ceriodaphnia dubia	**water flea**	**48-h/LC50**	**236,000**	**4**	**AQUIRE**
Ceriodaphnia dubia	**water flea**	**48-h/LC50**	**>422,000**	**5**	**AQUIRE**
SMAV = 315,582					
Daphnia magna	**water flea**	**48-h/EC50**	**>100,000**	**11**	**AQUIRE**
Daphnia magna	**water flea**	**48-h/EC50**	**25,000**	**12**	**AQUIRE**

SMAV was excluded because it was more than 10 times the SMAV for *D. pulex* (see below)

SMAV = 50,000

Daphnia pulex	**water flea**	**48-h/EC50**	**3,200**	**13**	**AQUIRE**
Daphnia pulex	**water flea**	**48-h/EC50**	**3,200**	**14**	**AQUIRE**
SMAV = 3,200					

GMAV, *Daphnia* sp. = 3,200

Acanthocyclops vernalis	**cyclopoid copepod**	**96-h/EC50**	**8,720**	**1**	**AQUIRE**

SMAV = 8,720

Simocephalus serrulatus	**water flea**	**48-h/EC50**	**4,900**	**13**	**AQUIRE**

SMAV = 4,900

4. At least one benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish).

Gammarus fasciatus	**scud**	**96-h/LC50**	**2,400**	**15**	**AQUIRE**

SMAV = 2,400

5. At least one insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge).

***Chironomus* sp.**	**midge**	**48-h/LC50**	**11,020**	**6**	**AQUIRE**
***Chironomus* sp.**	**midge**	**48-h/LC50**	**3,880**	**6**	**AQUIRE**

SMAV = 6,538.93

6. At least one fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions.

Carassius auratus	**goldfish**	**96-h/LC50**	**>187,000**	**3**	**AQUIRE**
Carassius auratus	**goldfish**	**96-h/LC50**	**>201,000**	**3**	**AQUIRE**

SMAV = 193,873.67

Cyprinus carpio	**common carp**	**96-h/LC50**	**96,500**	**2**	**AQUIRE**
Cyprinus carpio	**common carp**	**96-h/LC50**	**5,100**	**7**	**AQUIRE**
Cyprinus carpio	**common carp**	**96-h/LC50**	**15,300**	**7**	**AQUIRE**
Cyprinus carpio	**common carp**	**96-h/LC50**	**20,000**	**7**	**AQUIRE**
Cyprinus carpio	**common carp**	**96-h/LC50**	**24,150**	**7**	**AQUIRE**
Cyprinus carpio	**common carp**	**96-h/LC50**	**31,250**	**7**	**AQUIRE**
Cyprinus carpio	**common carp**	**96-h/LC50**	**20,000**	**8**	**AQUIRE**
Cyprinus carpio	**common carp**	**96-h/LC50**	**134,800**	**9**	**AQUIRE**
Cyprinus carpio	**common carp**	**96-h/LC50**	**270,000**	**10**	**AQUIRE**

NOTE: Although the LC50's varied by more than a factor of 10, they were all still within 1/10 – 10X the mean. It wasn't clear which ones to drop out, so rather than exclude data on a forage fish, it was decided to use the SMAV based on all the results.

SMAV = 35,189.07

Anguilla rostrata	**American eel**	**96-h/LC50**	**300,600**	**2**	**AQUIRE**

SMAV = 300,600

Fundulus diaphanus	**banded killifish**	**96-h/LC50**	**26,700**	**2**	**AQUIRE**
SMAV = 26,700					
# *Pimephales promelas*	**fathead minnow**	**96-h/LC50**	**263,000**	**16**	**AQUIRE**
Pimephales promelas	**fathead minnow**	**96-h/LC50**	**2,700**	**15**	**AQUIRE**
Pimephales promelas	**fathead minnow**	**96-h/LC50**	**2,400**	**15**	**AQUIRE**
Pimephales promelas	**fathead minnow**	**96-h/LC50**	**8,400**	**15**	**AQUIRE**
# *Pimephales promelas*	**fathead minnow**	**96-h/LC50**	**320,000**	**12**	**AQUIRE**
# *Pimephales promelas*	**fathead minnow**	**96-h/LC50**	**133,000**	**17**	**AQUIRE**

 # Results were excluded because there was more than 10 times variability within the database. Based on results for other species, it is assumed the lower LC50 values are more accurate and/or representative.

SMAV = 3789.82

Poecilia reticulata	**guppy**	**96-h/LC50**	**70,700**	**2**	**AQUIRE**
Poecilia reticulata	**guppy**	**96-h/LC50**	**8,356**	**19**	**AQUIRE**
SMAV = 24,305.74					
Tinca tinca	**tench**	**96-h/LC50**	**800,000**	**22**	**AQUIRE**
SMAV = 800,000					

7. At least one organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca).

Lumbriculus variegatus	**oligochaete, worm**	**96-h/LC50**	**122,200**	**18**	**AQUIRE**
SMAV = 122,200					

8. At least one organism from a family in any order of insect or any other phylum not already represented in subdivisions 1 through 7.

Pteronarcys californicus	**stonefly**	**96-h/LC50**	**15,000**	**20**	**AQUIRE**
Pteronarcys californicus	**stonefly**	**96-h/LC50**	**1,600**	**21**	**AQUIRE**
SMAV = 4,898.98					

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Table 2. Requirements for calculation of a chronic toxicity criterion for protection of aquatic life for 2,4-D, and corresponding chronic toxicity data.

Species Name	Common Name	Duration/ Endpoint	Value µg/L	Reference #[a]	Source
1. At least one salmonid fish in the family Salmonidae, in the class Osteichthyes.					
2. At least one non-salmonid fish from another family in the class Osteichthyes, preferably a commercially or recreationally important warmwater species.					
3. At least one planktonic crustacean (e.g., cladoceran, copepod).					
Ceriodaphnia dubia	**water flea**	**7-D/MATC**	**48,800**	**1**	**AQUIRE**
Ceriodaphnia dubia	**water flea**	**7-D/MATC**	**23,300**	**1**	**AQUIRE**
SMCV = 33,720.02					
4. At least one benthic crustacean (e.g., ostracod, isopod, amphipod, crayfish).					
5. At least one insect (e.g., mayfly, dragonfly, damselfly, stonefly, caddisfly, mosquito, midge).					
6. At least one fish or amphibian from a family in the phylum Chordata not already represented in one of the other subdivisions.					
7. At least one organism from a family in a phylum other than Arthropoda or Chordata (e.g., Rotifera, Annelida, Mollusca).					
8. At least one organism from a family in any order of insect or any other phylum not already represented in subdivisions 1 through 7.					

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HUMAN HEALTH

To calculate a criteria or secondary value for the protection of human health, it is first necessary to determine if the substance has been shown to be carcinogenic (which will result in the calculation of a human cancer criteria or secondary value) or not (which will result in the calculation of a human threshold criteria or secondary value). While increases in malignant tumors have been observed in rats exposed to 2,4-D, there is still insufficient evidence to classify 2,4-D as a carcinogen (National Institutes of Health, Hazardous Substances Database), and no cancer slope factor has been established (U.S. EPA, IRIS database). However, because an oral reference dose and a log octanol water partition coefficient are available, a human threshold secondary value can be calculated for 2,4-D.

There are several steps to calculating a human threshold secondary value: 1) calculation of the fraction of freely dissolved chemical; 2) calculation of the "baseline BAF"; 3) calculation of the "human health BAF"; and 4) calculation of the human threshold secondary value.

1) Calculation of the freely-dissolved fraction = f_{fd}

Given a standard dissolved organic carbon (DOC) concentration of 0.000002 Kg/L and a particulate organic carbon (POC) concentration of 0.00000004 Kg/L in water, the equation

$$f_{fd} = 1/\{1 + [(DOC)(K_{ow})/10] + [(POC)(K_{ow})]\}$$

can be reduced to:

$$= 1/\{1 + [(0.00000024\ Kg/L)(K_{ow})]\}$$

A log K_{ow} of 2.81 (K_{ow} of 645.6542) has been published for 2,4-D (National Institutes of Health, Hazardous Substances Database).

$$f_{fd} = 1/\{1 + [(0.00000024\ Kg/L)(645.6542)]\}$$

$$= 1/1.000155$$

$$\mathbf{= 0.9998}$$

2) Calculation of the baseline BAF

The baseline BAF is calculated according to the equations contained in 40 CFR part 132 (Final Water Quality Guidance for the Great Lakes System), Appendix B, using BAF data that was collected in one of four ways (listed in order of most preferred to least preferred):

a) a measured BAF from a field study

b) a predicted BAF based on field-measured BSAFs

c) a predicted BAF using a laboratory-measured bioconcentration factor (BCF) and a food chain multiplier (FCM)

d) a predicted BAF using a K_{ow} and a FCM

Currently, there are no acceptable BAFs, BSAFs, or BCFs available for 2,4-D; therefore, the baseline BAF was calculated using the K_{ow} and a food chain multiplier (method d above).

Given 2,4-D's log K_{ow} of 2.81 (K_{ow} of 645.6542), the FCMs (taken from table B-1 in GLI) were interpolated to be 1.0208 for trophic level 3 (warm waters) and 1.005 for trophic level 4 (cold waters).

a) Cold Water

Baseline BAF = (FCM)(Kow)

= (1.005)(645.6542)

= 648.8825

b) Warm Waters

Baseline BAF = (FCM)(Kow)

= (1.0208)(645.6542)

= 659.0838

3) Calculation of the human health BAF

a) Cold Water

BAF^{HH}_{TL4} = {[(baseline BAF)(0.044)] + 1} (f_{fd})

where

BAF^{HH}_{TL4} = Human health BAF for trophic level 4 (cold water)

baseline BAF = the baseline BAF (for cold waters) calculated in 2)

0.044 = fraction lipid value for cold water fish and aquatic life communities

f_{fd} = fraction freely dissolved

BAF^{HH}_{TL4} = {[(**648.8825)**(0.044)] + 1} (0.9998)

= **29.5449**

b) Warm Waters

BAF^{HH}_{TL3} = {[(baseline BAF)(0.013)] + 1} (f_{fd})

where

BAF^{HH}_{TL3} = Human health BAF for trophic level 3 (warm waters)

baseline BAF = the baseline BAF (for warm waters) calculated in 2)

0.013 = fraction lipid value for warm water fish and aquatic life communities

f_{fd} = fraction freely dissolved

BAF^{HH}_{TL3} = {[(**659.0838**)(0.013)] + 1} (0.9998)

= **9.5662**

4) Calculation of the human threshold secondary value

Human Threshold Secondary Value = [(ADE)(70 Kg)(RSC)]/[W_H + (F_H)(BAF)]

where

ADE = acceptable daily exposure (= oral reference dose, or RfD; = 0.01 mg/Kg/day for 2,4-D (IRIS 2003))

70 Kg = average weight of an adult

RSC = relative source contribution to account for other routes of exposure (= 0.8 in the absence of other data)

W_H = average per capita daily water consumption (= 2 L/d for public water supplies, and 0.01 L/d for non-public water supplies)

F_H = average consumption of sport-caught fish in Wisconsin (= 0.02 Kg/d)

BAF = appropriate (cold or warm water) human health BAF calculated in 3.

a) Public Water Supply/Cold Water

Human Threshold Secondary Value = [(ADE)(70 Kg)(RSC)]/[W_H + (F_H)(BAF)]

= [(0.01 mg/Kg/d)(70 Kg)(0.8)]/[**2** L/d + (0.02 Kg/d)(**29.5449** L/Kg)]

= 0.2161 mg/L

= 216.1 µg/L

b) Public Water Supply/Warm Water Sportfish

Human Threshold Secondary Value = [(ADE)(70 Kg)(RSC)]/[W_H + (F_H)(BAF)]

= [(0.01 mg/Kg/d)(70 Kg)(0.8)]/[**2** L/d + (0.02 Kg/d)(**9.5662** L/Kg)]

= 0.2555 mg/L

= 255.5 µg/L

c) Non-Public Water Supply/Cold Water

Human Threshold Secondary Value = [(ADE)(70 Kg)(RSC)]/[W_H + (F_H)(BAF)]

= [(0.01 mg/Kg/d)(70 Kg)(0.8)]/[**0.01** L/d + (0.02 Kg/d)(29.5449 L/Kg)]

= 0.9319 mg/L

= 931.9 µg/L

d) Non-Public Water Supply/Warm Waters (Warm Water Sportfish, Warm Water Forage Fish, and Limited Forage Fish designated waters)

Human Threshold Secondary Value = [(ADE)(70 Kg)(RSC)]/[W_H + (F_H)(BAF)]

= [(0.01 mg/Kg/d)(70 Kg)(0.8)]/[**0.01** L/d + (0.02 Kg/d)(9.5662 L/Kg)]

= 2.7819 mg/L

= 2,781.9 µg/L

e) Non-Public Water Supply/Limited Aquatic Life

Note: The Limited Aquatic Life classification applies to water bodies with no (or very few) fish present. Therefore, calculation of a human health threshold value for water bodies with this classification does not include a human health BAF since it is assumed that humans will not be exposed to 2,4-D through consumption of fish in these areas.

Human Threshold Secondary Value = [(ADE)(70 Kg)(RSC)]/[W_H + (F_H)(BAF)]

= [(0.01 mg/Kg/d)(70 Kg)(0.8)]/[**0.01** L/d + (0)]

= 56 mg/L

= 56,000 µg/L

Chemical	CAS #	Category	Type of Secondary Value	Water Body Classification	Value (µg/L)
2,4-D	94-75-7	Fish and Aquatic	Acute	Cold, WWSF	1,224
2,4-D	94-75-7	Fish and Aquatic	Chronic	Cold, WWSF	169
2,4-D	94-75-7	Fish and Aquatic	Acute	WWFF, LFF, LAL	1,268
2,4-D	94-75-7	Fish and Aquatic	Chronic	WWFF, LFF, LAL	175
2,4-D	94-75-7	Human Health	Human Threshold	Public Water Supply/Cold	216
2,4-D	94-75-7	Human Health	Human Threshold	Public Water Supply/WWSF	255
2,4-D	94-75-7	Human Health	Human Threshold	Non-Public Water Supply/Cold	932
2,4-D	94-75-7	Human Health	Human Threshold	Non-Public Water Supply/WWSF, WWFF, LFF	2,782
2,4-D	94-75-7	Human Health	Human Threshold	Non-Public Water Supply/LAL	56,000

Cold = cold water designated water bodies
WWSF = warm water sportfish designated water bodies
WWFF = warm water forage fish designated water bodies
LFF = limited forage fish designated water bodies
LAL = limited aquatic life designated water bodies (includes wetlands)