Technical Supporting Information for Proposed Revisions to the Connecticut Water Quality Standards: Ambient Water Quality Criteria

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Bureau of Water Protection and Land Reuse
Planning & Standards Division
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Water Quality Criteria (WQC) for individual chemicals are included in the Water Quality Standards and represent concentrations for each parameter in surface water that are supportive of attaining the designated uses for a water body. They are derived in accordance with EPA guidance and are generally based either on toxicity testing (aquatic life criteria) or risk assessment (human health based criteria). The criteria are not adjusted to address any analytical concerns. Such adjustments are more appropriately made within various regulatory actions such as permit issuance.

Criteria are available to protect aquatic life uses for the water body. The criteria for aquatic life protection are provided for both freshwater and marine organisms and separate values are specified for protection from short term (acute) and long term (chronic) toxic impacts. These criteria address direct toxicity that could result in mortality or impair growth or reproduction. They do not include protection of aquatic life from potential food chain exposures, address emerging issues such as endocrine disruption or prevent potential contamination of sediment resources.

Human health based criteria are also included for protection of recreational uses, such as fishing and swimming, for all waters, through the consideration of exposure from consuming fish. Additionally, criteria for Class AA and A surface waters also include potential exposures from drinking the water since these water bodies are designated as existing and potential drinking water resources.

Each criterion is expressed in terms of magnitude, duration, and frequency. The magnitude of the criteria is provided in terms of an acceptable concentration, typically expressed in ug/L. The duration is the exposure period associated with each criterion. For aquatic life, the exposure period for the acute criteria is one hour while the exposure period for the chronic criteria is 4 days. The acceptable frequency for occurrence of this exposure for aquatic life is once over a three year period. For human health criteria, the exposure period is dependent upon the mode of action of the toxicant. For substances that can interact with DNA, such as carcinogens, the risk assessments are conducted by evaluating the potential for increased risk over a life time (70 years). For non-carcinogenic compounds, the risk is evaluated over a shorter time period, typically set at 30 years.

Proposed Criteria

Revisions are proposed for the water quality criteria included in the Water Quality Standards based on updated scientific and technical information, updated EPA guidance on deriving water quality criteria and to support water quality based activities with Connecticut.

Chemical Constituents

The list of chemical constituents for which criteria are proposed within these revisions has been expanded to include chemicals for which EPA has published water quality criteria as well as additional substances that may affect water quality within the State due to their use and potential for release at various sites within the State. Inclusion of these chemicals within the Water Quality Standards will provide a numerical translator for narrative standards, including Water Quality Standard 14, which states that

> Surface waters and sediments shall be free from chemical constituents in concentrations or combinations which will or can reasonably be expected to: result in acute or chronic toxicity to aquatic organisms or otherwise impair the biological integrity of aquatic or marine ecosystems outside of any dredged material disposal area or areas designated by the Commissioner for disposal or placement of fill materials or any zone of influence allowed by the Commissioner, or bioconcentrate or bioaccumulate in tissues of fish, shellfish and other aquatic organisms at levels which will impair the health of aquatic organisms or wildlife or result in unacceptable tastes, odors or health risks to human consumers of aquatic organisms or wildlife unless such sediments are capped with material suitable for unconfined, open water disposal as an appropriate means of ensuring consistency with this standard as approved by the Commissioner in writing. In determining consistency with this Standard, the Commissioner shall at a minimum consider the numeric criteria listed in Appendix D and any other information he or she deems relevant.

Additionally, these criteria will provide support for designated uses of the water bodies. Expansion of the list of chemicals for which water quality criteria are provided within the WQS is consistent with both federal and state objectives for establishing water quality criteria. EPA develops and publishes new criteria and methodologies for developing water quality criteria to guide states as information becomes available.

Aquatic Life Criteria

Aquatic life-based surface water criteria are selected from available current ambient water quality criteria established by CTDEP (CTDEP 2002) or EPA (USEPA 2008). Aquatic Life Criteria presented in these sources were derived using the procedures developed in 1985 by the USEPA (USEPA, 1985). The Connecticut water quality criteria for copper were developed based on statewide reference conditions (CTDEP 1990a) and the site-specific Connecticut criteria for copper included in the 2002 WQS were developed using the Water Effect Ratio procedures for criteria amendment (CTDEP 1990b). The list of water bodies to which these site-specific copper criteria apply is proposed to be expanded to include two additional waters:

Pootatuck River	From the Newtown POTW to the confluence with the Housatonic River (note: in the proposed amendments, the POTW was identified at the Sandy Hook POTW)
Indian Lake Creek	From the Sharon POTW to the confluence with an unnamed tributary near Sharon Valley Road

Substances for which chronic aquatic water quality criteria are not available from published EPA sources, water quality benchmarks for aquatic life were obtained using the Tier 2 procedures established in the Water Quality Guidance for the Great Lakes System (USEPA 1995). Tier 2 criteria were either derived using the USEPA 1995 protocols or were obtained from other states that had used those protocols (EPA 2008). The criteria derived by CTDEP utilized aquatic toxicity information available from the USEPA EcoTox Database (EPA 2007) and or Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota: 1996 Revision (Suter and Tsao 1996) and are presented in Appendix B to this document.

Other considerations to note for aquatic life based criteria include:

1. For metals, hardness continues to be set at 50 ppm.

2. Criteria for metals will continue to be expressed as dissolved fraction except where such distinction is not made by EPA.

3. The footnotes for the table were be expanded to indicate that, in the absence of criteria for saltwater organisms, criteria for freshwater organisms may be used.

4. The table was expanded to include the procedures for calculating water quality criteria for additional substances.

Human Health Risk-based Water Quality Criteria

Standard risk assessment practices were used to calculate health-protective concentrations of chemicals in surface water in support of the designated uses for the water bodies. These calculations take into account which groups of people could be exposed to the contamination including sensitive populations, the degree of exposure to the various media and the toxicity of each substance.

Updated Equations for WQC Calculation

Two types of water quality criteria are applicable to ambient surface water bodies to protect humans from exposures, based on either the consumption of fish or the consumption of fish and water. The table of criteria in the WQS was amended to more clearly identify which human health based criteria are applicable to each surface water body, consistent with the designated uses for the water body.

Applicability of Human Health Based Water Quality Criteria to Connecticut Surface Water Bodies	
Surface Water Classification	Exposure Pathways for WQC Derivation
Class A and AA	Fish and Water Consumption
All other Waters	Fish Consumption

Prior to these proposed revisions to the WQS, the equations to derive water quality criteria had not been changed since their origin in 1980, although toxicity values have been updated in the interim. EPA has published updated guidance for the derivation of human health based water quality criteria in Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health (2000) and Water Quality Standards Handbook: Second Edition (updated 2007). These documents have been reviewed and used to revise the human health based water quality criteria proposed.

These documents represent the first major update to the calculation methodology for human health based criteria since 1980 and address many aspects of criteria derivation, including:

Toxicological Values:

Updated toxicity values were obtained from several sources and selected to reflect the most current understanding of the toxicology for each substance. Values from United States Environmental Protection Agency (USEPA) Integrated Risk Information System (IRIS) database, California Environmental Protection Agency, the Agency for Toxic Substances and Disease Registry (ATSDR) of the United States Department of Health and Human Services, USEPA Superfund Health Effects Assessment Summary Tables (HEAST) and other derivations by USEPA program offices were considered. In a few cases where toxicology evaluations were not available from national sources, assessments were conducted by the Connecticut Department of Public Health. While the USEPA IRIS database has traditionally been thought of as the primary source of toxicity information for risk assessment, it has not been updated on a regular basis and there are numerous cases where other sources have more current assessments for particular chemicals. (USGAO 2008) Therefore, a rigid hierarchy of source information was not established for toxicity values; rather a chemical-specific determination was made for each substance as to the most current and robust source. Non-cancer toxicity values take into account major uncertainties and gaps in a chemical's database, including uncertainties regarding potential carcinogenicity. In certain cases, these uncertainties warranted modification of a toxicity value available on IRIS or elsewhere. Additional information in support of toxicity values selected from sources other than the IRIS database for in calculating water quality criteria is presented in Appendix E.

For substances with criteria in the current WQS, proposed changes to the toxicity values may result in a calculated risk-based criterion that is either more or less restrictive than the current criterion contained in the regulations. The magnitude and degree of change will depend upon the nature of the change to the toxicity value (indicating a greater or lesser degree of toxicity) as well as any other changes in the calculation of the proposed criteria values.

Fish consumption Rates:

The fish consumption rate used in the calculation of the current Connecticut Water Quality Criteria is 6.5 gms/day based on the EPA requirements established in 1980 for deriving water quality criteria.

EPA is currently recommending the use of state-specific fish consumption rates or the use of an updated default fish consumption rate of 20 gm/day for general consumers.

Fish consumption rates for other populations, such as subsistence fishing populations, would be expected to be higher than this value. However, additional protection can be afforded to these populations through site specific actions, if warranted, when applicable water quality evaluations are conducted within affected water bodies. In addition to the EPA recommendations, we reviewed the 2002 update to the National Study (1994-1996 CSFII Report) and a Connecticut-specific study (Balcolm et al).

CT Fish Consumption Study

The CT Study provides data on fish consumption in Connecticut and contains information for both consumers and nonconsumers of seafood from a wide variety of sources (caught, bought at stores, restaurants, etc.). The study also provides separate data for consumption of freshwater and saltwater species for various population groups. The study predominantly focused on consumption of marine fish, but did provide information on freshswater fish consumption also. In order to evaluate these data for use in supporting potential changes to the CT WQS, the raw data from the CT Study was obtained. Data representing the grams/day estimates of cooked seafood for each consumer were separately evaluated to provide an estimate of total consumption rate for fish potentially caught in Connecticut.

CT Seafood	GDayCooked=Amt consumed/individual
25 percentile	7.34711
50 percentile (Median)	19.47004
75 percentile	43.13448
80 percentile	51.34023
90 percentile	80.54278
95 percentile	112.73604
MAX	522.09848
MIN	0.01314
Average (Mean)	34.80493
n=1780	

The median value from the Connecticut study, 19.5 grams/day, closely approximates the recommended fish consumption rate default value of 20 gm/day proposed by EPA. Therefore, 20 gm/day is proposed as the fish consumption rate for deriving water quality criteria.

Relative Source Contribution Factor: In the 2000 update to the Human Health Criteria Method, EPA proposed to include a Relative Source Contribution Factor (0.2 - 0.8) for non-carcinogens, similar to that used in the federal drinking water program and the risk-based criteria in the Remediation Standards Regulations (RSR). The Relative Source Contribution Factor is used to consider additional sources of exposures and risk in addition to exposures through a surface water pathway. A Relative Source Contribution Factor (RSC) of 0.2 for non-carcinogens is proposed.

Bioconcentration/Bioaccumulation: The current Connecticut water quality criteria model the movement of contaminants into fish tissue using a bioconcentration factor. The current EPA guidance recognizes that for certain chemicals, reliance on a bioconcentration factor could under-estimate the potential for a chemical to accumulate and proposes the use of a bioaccumulation factor. A model to calculate bioaccumulation factors from bioconcentration factors is provided in EPA guidance. The bioconcentraction factor for each chemical is multiplied by the appropriate food chain multiplier (FCM) based on the octanol/water partition coefficient for is chemical. The octanol/water partition coefficient provides an estimate of the propensity for a substance to migrate from a water-based to a lipid-based environment.

Octanol Water Partition Coefficient	FCM	Octanol Water Partition Coefficient	FCM	Octanol Water Partition Coefficient	FCM
3.5	1.0	4.5	1.2	5.6	16.0
3.6	1.0	4.6	1.3	5.7	23.0
3.7	1.0	4.7	1.4	5.8	33.0
3.8	1.0	4.8	1.5	5.9	47.0
3.8	1.0	4.9	2.0	6.0	67.0
3.9	1.0	5.0	2.6	6.1	75.0
4.0	1.0	5.1	3.2	6.2	84.0
4.1	1.1	5.2	4.3	6.3	84.0
4.2	1.1	5.3	5.8	6.4	84.0
4.3	1.1	5.4	8.0	6.5	100.0
4.4	1.1	5.5	11.0	>6.5	100.0

Bioconcentration Factors were obtained from EPAwater quality criteria publications for individual chemicals (EPA 2002) or were derived using structure activity relationships based on the octanol/water partition coefficient for each chemical. Octanol/water partition coefficients were obtained from the ChemIDplus database (US National Library of Medicine 2007). Bioconcentration Factors were calculated using the BCFwin

module (Meylan *et al* 1999) of the USEPA Estimation Programs Interface Suite software (USEPA 2007a).

Updated Equations for Calculating Human Health Based Water Quality Criteria:

Based on the information provided above, the equations used to develop water quality criteria have been proposed for revision.

The current formulas for calculating human health criteria are:

Fish Consumption Only:

Non-Carcinogens: WQC = (RfD x W x LCR) / (FC x LC x BCF)

Carcinogens WQC = (RL x W x LCR) / (CSF x FC x LC x BCF)

Fish and Water Consumption:

Non-carcinogens: WQC = (RfD x W x LCR) / (WC + (FC x LC x BCF))

Carcinogens: WQC = (RL x W x LCR) / (CSF x (WC +(FC x LC x BCF))

Where:

W = Weight of Adult (70 kg)
LC = Lipid content of fish fillets (3.0%)
LCR = Lipid content of fish (whole body) (7.6%)
BCF = Bioconcentration Factor (chemical specific)
FC = Fish Consumption Rate (6.5 grams/day)
WC = Water Consumption Rate (2 L/day)

The proposed equations for deriving water quality criteria are:

Fish Consumption Only:

Non-Carcinogens: WQC = (RfD x RSC x BW x 1000) / (FC x BCF x FCM)

Carcinogens WQC = (RL x BW x 1000 ug/mg) / (CSF x FC x BCF x FCM)

Fish and Water Consumption:

Non-carcinogens: WQC = (RfD x RSC x BW x 1000) / (WC+(FC x BCFx FCM))

Carcinogens: WQC = (RL x BW x 1000 ug/mg) / (CSF x (WC + (FC x BCF x FCM))

Where:

W = Weight of Adult (70 kg)
BCF = Bioconcentration Factor (chemical specific, adjusted for lipid content)
FC = Fish Consumption Rate (20 grams/day)
FCM = Food Chain Multiplier (chemical specific
RSC = Relative Source Contribution (0.2 unitless)
WC = Water Consumption Rate (2 L/day)

The table of water quality criteria in the WQS was amended to include the formulas for calculating human health based water quality criteria.

Application of Human Health Based Criteria

Human health-based surface water criteria are designed for application at longer duration flows than standard low flow conditions, such as the 7-day-10 year flow statistic used to represent low flow conditions in freshwater streams. EPA recommends the use of the 30-day-5-year flow rate for non-carcinogenic substances and the mean harmonic flow, a 70-year average flow, for carcinogenic substances (EPA 1994), to better correspond to the exposure periods associated with the various types of toxicity estimates. The stream flow rates are greater than 7Q10 flows. Flow factors of 2 and 3 are used to approximate the increase in these design flows over 7Q10 flows. As in the current WQS, human health criteria are adjusted using these flow factors to allow application of the criteria at low flow conditions.

Application of Human Health Based Water Quality Criteria in an Allocated Zone of Influence (ZOI) in Connecticut Surface Water Bodies		
Health Designation	Design Flow	Factor for Application at 7Q10 Flows in Allocated ZOI
Threshold Toxicant (TT)	30Q5	2
Potential Carcinogen (C)	Mean Harmonic Flow	3

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Appendices:

A Proposed Revisions to Connecticut Aquatic Life Criteria

B Connecticut Tier 2 Aquatic Life Criteria

C Proposed Revisions to Connecticut Aquatic Life Criteria – Criteria Obtained from GLI Clearinghouse

D Proposed Revisions to Connecticut Human Health Based Water Quality Criteria

E Toxicological Monographs

Appendix A:
Proposed Revisions to Connecticut Aquatic Life Water Quality Criteria

(provided as a separate electronic document)

Appendix B:
Connecticut Tier 2 Aquatic Life Criteria

Derivation of Freshwater Aquatic Life Criteria

Chemical Acetonitrile (CAS#75058) **Date 06/18/2007**

Criteria (ug/L)	
Acute:	73704.61
Chronic:	8189.40

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes							
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	1850000	1850000	1850000	1	923
		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	1640000				12448
	Pimephales promelas	96 hour LC50	1000000				923
	Pimephales promelas	96 hour LC50	1000000	1179273.708			923
	Poecilia reticulata	96 hour LC50	1650000	1650000			923
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	3600000				13070
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Asellus intermedius	96 hour LC50					
	Gammarus fasciatus	96 hour LC50					
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Limbriculus variegatus	96 hour LC50					
	Helisoma trivolvis	96 hour LC50					
H: A family in any order of insect or any phylum not already represented	Dugesia tigrina	96 hour LC50					

Lowest GMAV	1179273.708
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	147409.2135
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Chemical Acrolein (107028) **Date 6/18/2007**

Criteria (ug/L)	
Acute:	0.81
Chronic:	0.09

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	16				12665
	Oncorhynchus mykiss	96 hour LC50	31				344
	Oncorhynchus mykiss	96 hour LC50	80				14413
	Oncorhynchus mykiss	96 hour LC50	74				45758
	Oncorhynchus mykiss	96 hour LC50	29	38.55141084			12182
	Oncorhynchus kisutch	96 hour LC50	68	68	51.20054626	3	561
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	33				12665
	Lepomis machrochirus	96 hour LC50	70				14413
	Lepomis machrochirus	96 hour LC50	22				344
	Lepomis machrochirus	96 hour LC50	90				5590
	Lepomis machrochirus	96 hour LC50	100	53.95794909	53.95794909	5	2092
	Micropterus salmoides	96 hour LC50	160	160	160	8	2092
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	17.4				14314
	Pimephales promelas	96 hour LC50	61				45758
	Pimephales promelas	96 hour LC50	14				3217
	Pimephales promelas	96 hour LC50	27				14754
	Pimephales promelas	96 hour LC50	27				14754
	Pimephales promelas	96 hour LC50	14				12665
	Pimephales promelas	96 hour LC50	20				12859
	Pimephales promelas	96 hour LC50	29.7				14314
	Pimephales promelas	96 hour LC50	45				45758
	Pimephales promelas	96 hour LC50	84	28.39318373	28.39318373	2	632
	Catostomus commersoni	96 hour LC50	14				12665
	Jordanella floridae	96 hour LC50	51				14754
	Jordanella floridae	96 hour LC50	60	55.31726674	55.31726674	6	14754
	Xenopus laevis	96 hour LC50	7	7	7	1	12665
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	51				12665
	Daphnia magna	48 hour EC50	31				344
	Daphnia magna	48 hour EC50	93				2193
	Daphnia magna	48 hour EC50	30				14413
	Daphnia magna	48 hour EC50	57				632
	Daphnia magna	48 hour EC50	83	52.4704558	52.4704558	4	5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Gammarus minus	96 hour LC50	180	180	180	9	14396
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)	Tallaperla maria	96 hour LC50	5920	5920	5920	11	14396
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Aplexa hypnorum	96 hour LC50	151	151	151	7	12665
	Physa heterostropha	96 hour LC50	368	368	368	10	14396
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	7
Number of data requirements satisfied	7
Select Secondary Acute Factor	4.3
Secondary Acute Value	1.627906977
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Chemical Acrylonitrile (107131) **Date 6/18/2007**

Criteria (ug/L)	
Acute:	368.98
Chronic:	41.00

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	9300				7398
	Lepomis machrochirus	96 hour LC50	23600				7398
	Lepomis machrochirus	96 hour LC50	10000				5590
	Lepomis machrochirus	96 hour LC50	11800	12685.8403			923
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	8400				17132
	Pimephales promelas	96 hour LC50	34000				17132
	Pimephales promelas	96 hour LC50	10100				923
	Pimephales promelas	96 hour LC50	14300				923
	Pimephales promelas	96 hour LC50	18100	14949.23049			923
	Cyprinus carpio	96 hour LC50	21360	21360			16884
	Poecilia reticulata	96 hour LC50	33500				923
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	10250				16884
	Daphnia magna	48 hour EC50	7380				16884
	Daphnia magna	48 hour EC50	10950				2193
	Daphnia magna	48 hour EC50	10000				13070
	Daphnia magna	48 hour EC50	7600	9115.942722			5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Limnodrilus hoffmeisteri	96 hour LC50	15870				16884
	Limnodrilus hoffmeisteri	96 hour LC50	17880				16884
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	5165.733249
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	737.9618927
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Chemical Alachlor (15972608) **Date 6/10/2007**

Criteria (ug/L)	
Acute:	294.06
Chronic:	32.67

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	9100				18805
	Oncorhynchus mykiss	96 hour LC50	1400				6797
	Oncorhynchus mykiss	96 hour LC50	2400				6797
	Oncorhynchus mykiss	96 hour LC50	100000				344
	Oncorhynchus mykiss	96 hour LC50	104000				344
	Oncorhynchus mykiss	96 hour LC50	1000				344
	Oncorhynchus mykiss	96 hour LC50	1800				344
	Oncorhynchus mykiss	96 hour LC50	240				344
	Oncorhynchus mykiss	96 hour LC50	3600				344
	Oncorhynchus mykiss	96 hour LC50	3700				344
	Oncorhynchus mykiss	96 hour LC50	4200	4226.377614			344
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	3200				6797
	Lepomis machrochirus	96 hour LC50	4300				6797
	Lepomis machrochirus	96 hour LC50	12400				344
	Lepomis machrochirus	96 hour LC50	2800				344
	Lepomis machrochirus	96 hour LC50	5600				344
	Lepomis machrochirus	96 hour LC50	6200				344
	Lepomis machrochirus	96 hour LC50	6400				344
	Lepomis machrochirus	96 hour LC50	7600	5474.524821			344
	Ictalurus punctulatus	96 hour LC50	16700				18805
	Ictalurus punctulatus	96 hour LC50	6500	10418.73313			344
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	5000				15031
	Pimephales promelas	96 hour LC50	5000				12858
	Pimephales promelas	96 hour LC50	5000	5000			10635
	Cyprinus carpio	96 hour LC50	4600	4600			5742
	Bufo americanus	96 hour LC50	3300				18805
	Bufo americanus	96 hour LC50	3900	3587.478223			18805
	Rana pipens	96 hour LC50	11500				18805
	Rana pipens	96 hour LC50	3500	6344.28877			18805
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	95000				344
	Daphnia magna	48 hour EC50	21000				6797
	Daphnia magna	48 hour EC50	7700				6797
	Daphnia magna	48 hour EC50	104000				344
	Daphnia magna	48 hour EC50	10000				344
	Daphnia magna	48 hour EC50	22000				344
	Daphnia magna	48 hour EC50	27000				344
	Daphnia magna	48 hour EC50	35000	27552.7646			344
	Daphnia pulex	48 hour EC50	10400				11433
	Daphnia pulex	48 hour EC50	9000	9674.709298			11433
	Ceriodaphnia dubia	48 hour EC50	7900				3590
	Ceriodaphnia dubia	48 hour EC50	14360	10651.00934			13689
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Gammarus italicus	96 hour LC50	19700	19700			18621
	Procanbarus sp	96 hour LC50	19500	19500			344
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)		96 hour LC50					
G: A faimly in a phylum other than Arthropoda or Chordata		96 hour LC50					
(e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	3587.478223
Number of data requirements satisfied	5
Select Secondary Acute Factor	6.1
Secondary Acute Value	588.1111841
ACR	18

Derivation of Freshwater Aquatic Life Criteria **Date 6/19/2007**

Chemical Aldicarb (116063)

Criteria (ug/L)	
Acute:	11.39
Chronic:	1.27

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	560				6797
	Oncorhynchus mykiss	96 hour LC50	660				6797
	Oncorhynchus mykiss	96 hour LC50	560	591.5253073	591.5253073	4	18085
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	450				942
	Lepomis machrochirus	96 hour LC50	71				6797
	Lepomis machrochirus	96 hour LC50	52	118.4380919	118.4380919	1	6797
	Ictalurus punctulatus	96 hour LC50	45000	45000	45000	8	18085
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	1370				15169
	Pimephales promelas	96 hour LC50	861				3217
	Pimephales promelas	96 hour LC50	1370	1173.4955	1173.4955	5	344
	Carassius auratus	96 hour LC50	7400	7400	7400	6	12840
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	75				18476
	Daphnia magna	48 hour EC50	410.7				344
	Daphnia magna	48 hour EC50	583	261.8694526	261.8694526	2	18996
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Gammarus italicus	96 hour LC50	420	420	420	3	18621
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)		96 hour LC50					
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Lymnaea acuminata	96 hour LC50	7500				917
	Lymnaea acuminata	96 hour LC50	11500	9287.087811	9287.087811	7	917
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	118.4380919
Number of data requirements satisfied	6
Select Secondary Acute Factor	5.2
Secondary Acute Value	22.77655613
ACR	18

Derivation of Freshwater Aquatic Life Criteria **Date 6/19/2007**
Chemical Aldrin (309002)

Criteria (ug/L)	
Acute:	0.45
Chronic:	0.05

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	18				70421
	Oncorhynchus mykiss	96 hour LC50	31				2871
	Oncorhynchus mykiss	96 hour LC50	2.6				6797
	Oncorhynchus mykiss	96 hour LC50	3.2				6797
	Oncorhynchus mykiss	96 hour LC50	8.2				6797
	Oncorhynchus mykiss	96 hour LC50	9.3	8.410898415			6797
	Oncorhynchus tshawytscha	96 hour LC50	14.3				6797
	Oncorhynchus tshawytscha	96 hour LC50	7.5	10.35615759			522
	Oncorhynchus kisutch	96 hour LC50	45.9	45.9	15.8714976	7	522
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	13				70421
	Lepomis machrochirus	96 hour LC50	10				6797
	Lepomis machrochirus	96 hour LC50	12				6797
	Lepomis machrochirus	96 hour LC50	5.6				6797
	Lepomis machrochirus	96 hour LC50	6.2				6797
	Lepomis machrochirus	96 hour LC50	7.7				6797
	Lepomis machrochirus	96 hour LC50	9.7				6797
	Lepomis machrochirus	96 hour LC50	13				936
	Lepomis machrochirus	96 hour LC50	7.8				936
	Lepomis machrochirus	96 hour LC50	13	9.390631706			878
	Lepomis gibbosus	96 hour LC50	20	20	13.70447497	5	859
	Micropterus salmoides	96 hour LC50	5	5	5	2	6797
	Morone americana	96 hour LC50	42	42			859
	Morone saxatilis	96 hour LC50	10				859
	Morone saxatilis	96 hour LC50	10	10	20.49390153	11	2012
	Ictalurus punctulatus	96 hour LC50	53	53	53	17	6797
	Anguilla rostra	96 hour LC50	16	16	16	8	859
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	18				10339
	Pimephales promelas	96 hour LC50	28				70421
	Pimephales promelas	96 hour LC50	8.2				6797
	Pimephales promelas	96 hour LC50	33				878
	Pimephales promelas	96 hour LC50	28	20.71969089	20.71969089	10	878
	Cyprinus carpio	96 hour LC50	4				859
	Cyprinus carpio	96 hour LC50	3.7	3.847076812	3.847076812	1	2077
	Poecilia reticulata	96 hour LC50	33				878
	Poecilia reticulata	96 hour LC50	20				859
	Poecilia reticulata	96 hour LC50	17	22.38708865	22.38708865	13	10646
Ameiurus	Ictalurus melas	96 hour LC50	19	19	19	9	6797
	Carassius auratus	96 hour LC50	20				10339
	Carassius auratus	96 hour LC50	28	23.66431913	23.66431913	14	878
	Fundulus diaphanus	96 hour LC50	21	21	21	12	859
	Clarias batrachus	96 hour LC50	1.52				14634
	Clarias batrachus	96 hour LC50	1.2				11522
	Clarias batrachus	96 hour LC50	1700	14.58225153	14.58225153	6	12968
	Bufo woodhousei fowleri	96 hour LC50	68				6797
	Bufo woodhousei fowleri	96 hour LC50	150	100.9950494	100.9950494	18	2891
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	1000	1000			2881
	Daphnia pulex	48 hour EC50	28	28			6797
	Daphnia sp	48 hour EC50	270	270	196.2639786	21	58990
	Simeocephalus serrulatus	48 hour EC50	12	12	12	4	
	Palomenectes kadiakensis	96 hour EC50	50	50	50	16	6797
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Gammarus faciatus	96 hour LC50	4300				6797
	Gammarus faciatus	96 hour LC50	5600	4907.137659			6797
	Gammarus lacustris	96 hour LC50	38500				528
	Gammarus lacustris	96 hour LC50	9800				885
	Gammarus lacustris	96 hour LC50	38500	24399.58904			2094
	Gammarus pseudolimnaeus	96 hour LC50	4500	4500	8137.189354		6615
	Asellus brevicadus	96 hour LC50	8	8			887

Derivation of Freshwater Aquatic Life Criteria **Date 6/19/2007**

Chemical Aldrin (309002)

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)		96 hour LC50					
	Drunella Ephemerella grandis	96 hour LC50	9		9	3	528
	Pteronarcys californicus	96 hour LC50	180				528
	Pteronarcys californicus	96 hour LC50	180	180	180	20	2667
	Hesperoperla Acroneuria pacifica	96 hour LC50	143				528
	Hesperoperla Acroneuria pacifica	96 hour LC50	143	143	143	19	2667
G: A family in a phylum other than Arthropoda or Chordata		96 hour LC50					
(e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented	Ranatra elongata	96 hour LC50	43.31		43.31	15	4596

Lowest GMAV	3.847076812
Number of data requirements satisfied	7
Select Secondary Acute Factor	4.3
Secondary Acute Value	0.894669026
ACR	18

Derivation of Freshwater Aquatic Life Criteria **Date 6/19/2007**

Chemical Aniline (62533)

Criteria (ug/L)	
Acute:	11.35
Chronic:	1.26

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	10600				15588
	Oncorhynchus mykiss	96 hour LC50	33500				3485
	Oncorhynchus mykiss	96 hour LC50	36200				10688
	Oncorhynchus mykiss	96 hour LC50	40500				12665
	Oncorhynchus mykiss	96 hour LC50	30000				58703
	Oncorhynchus mykiss	96 hour LC50	30000				58703
	Oncorhynchus mykiss	96 hour LC50	20000				5089
	Oncorhynchus mykiss	96 hour LC50	41000	28058.9444			5089
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	49000	49000			12665
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	114000				3217
	Pimephales promelas	96 hour LC50	134000				12448
	Pimephales promelas	96 hour LC50	75500				3217
	Pimephales promelas	96 hour LC50	77900				12665
	Pimephales promelas	96 hour LC50	114000				57532
	Pimephales promelas	96 hour LC50	32000	83034.41841			11951
	Poecilia reticulata	96 hour LC50	115000	115000			19263
	Catostomas commersoni	96 hour LC50	78400	78400			12665
	Carassius auratus	96 hour LC50	187000	187000			12665
	Leuciscus idus	96 hour LC50	78000	78000			11037
	Xenopus laevis	96 hour LC50	150000				6325
	Xenopus laevis	96 hour LC50	550000				6325
	Xenopus laevis	96 hour LC50	940000	426442.6178			6325
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	250				12665
	Daphnia magna	48 hour EC50	160				55961
	Daphnia magna	48 hour EC50	300				846
	Daphnia magna	48 hour EC50	170				11961
	Daphnia magna	48 hour EC50	350				2017
	Daphnia magna	48 hour EC50	360				2017
	Daphnia magna	48 hour EC50	630				2017
	Daphnia magna	48 hour EC50	660				2017
	Daphnia magna	48 hour EC50	680				2017
	Daphnia magna	48 hour EC50	80	299.535575			5375
	Daphnia pulex	48 hour EC50	100	100			2017
	Daphnia cucullata	48 hour EC50	680				2017
	Daphnia cucullata	48 hour EC50	690	684.9817516	273.7636634	2	2017
	Ceriodaphnia dubia	48 hour EC50	132				58703
	Ceriodaphnia dubia	48 hour EC50	44				58703
	Ceriodaphnia dubia	48 hour EC50	119				16043
	Ceriodaphnia dubia	48 hour EC50	146				16043
	Ceriodaphnia dubia	48 hour EC50	146				16043
	Ceriodaphnia dubia	48 hour EC50	184	118.081769	118.081769	1	16043
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)		96 hour LC50					
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)		96 hour LC50					
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Aplexa hypnorum	96 hour LC50	219000				12665
	Lymnaea stagnalis	96 hour LC50	692000				19263
H: A family in any order of insect or any phylum not already represented	Dugesia tigrina	96 hour LC50	31600				11951

Lowest GMAV	118.081769
Number of data requirements satisfied	6
Select Secondary Acute Factor	5.2
Secondary Acute Value	22.7083249
ACR	18

Derivation of Freshwater Aquatic Life Criteria **Date 6/19/2007**

Chemical Atrazine (1912249)

Criteria (ug/L)	
Acute:	14.53
Chronic:	1.61

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	870				19124
	Oncorhynchus mykiss	96 hour LC50	5350				80976
	Oncorhynchus mykiss	96 hour LC50	20500				18805
	Oncorhynchus mykiss	96 hour LC50	17000				546
	Oncorhynchus mykiss	96 hour LC50	8800				546
	Oncorhynchus mykiss	96 hour LC50	24000				6797
	Oncorhynchus mykiss	96 hour LC50	14700				344
	Oncorhynchus mykiss	96 hour LC50	4500				344
	Oncorhynchus mykiss	96 hour LC50	4500	7759.516787	7759.516787	8	12999
	Salmo trutta	96 hour LC50	27000				62367
	Salmo trutta	96 hour LC50	25000	25980.76211	25980.76211	16	19224
	Salvelinus fontinalis	96 hour LC50	6300				631
	Salvelinus fontinalis	96 hour LC50	4900				344
	Salvelinus fontinalis	96 hour LC50	4900	5328.163828	5328.163828	4	631
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	24000				80976
	Lepomis machrochirus	96 hour LC50	8000				631
	Lepomis machrochirus	96 hour LC50	16000				546
	Lepomis machrochirus	96 hour LC50	50000				546
	Lepomis machrochirus	96 hour LC50	42000				6797
	Lepomis machrochirus	96 hour LC50	24000				344
	Lepomis machrochirus	96 hour LC50	54510				344
	Lepomis machrochirus	96 hour LC50	6700				344
	Lepomis machrochirus	96 hour LC50	69000	25062.7072	25062.7072	15	344
	Ictalurus punctulatus	96 hour LC50	23800				18805
	Ictalurus punctulatus	96 hour LC50	2200	7236.021006	7236.021006	7	19124
	Perca sp.	96 hour LC50	50000	50000	50000	20	7199
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	15000				631
	Pimephales promelas	96 hour LC50	15000				344
	Pimephales promelas	96 hour LC50	4900	10330.61554	10330.61554	8	81782
	Cyprinus carpio	96 hour LC50	18800	18800	18800	12	6681
	Poecilia reticulata	96 hour LC50	4300	4300	4300	3	546
Bullhead	Ictalurus sp	96 hour LC50	7600				546
Bullhead	Ictalurus sp	96 hour LC50	35000	16309.50643			546
Ameiurus	Ictalurus melas	96 hour LC50	35000	35000	23892.10592	14	7199
	Carassius auratus	96 hour LC50	60000				344
	Carassius auratus	96 hour LC50	56000	57965.50698	57965.50698	21	80976
	Notropis atherinodes	96 hour LC50	15600	15600	15600	11	344
	Leuciscus idus	96 hour LC50	44000	44000	44000	19	7199
	Bufo americanus	96 hour LC50	10700				18805
	Bufo americanus	96 hour LC50	26500				18805
	Bufo americanus	96 hour LC50	48000	23875.74671	23875.74671	13	19124
	Rana pipens	96 hour LC50	14500				18805
	Rana pipens	96 hour LC50	47600	26271.65773			18805
	Rana catesbeiana	96 hour LC50	410	410	3281.978012	2	19124
	Xenopus laevis	96 hour LC50	24500				81751
	Xenopus laevis	96 hour LC50	25600				81751
	Xenopus laevis	96 hour LC50	100000	39731.53554			63246

Chemical Atrazine (1912249)

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	49000				344
	Daphnia magna	48 hour EC50	6900				631
	Daphnia magna	48 hour EC50	54000				8970
	Daphnia magna	48 hour EC50	9400				50679
	Daphnia magna	48 hour EC50	30000				17289
	Daphnia magna	48 hour EC50	39000				13154
	Daphnia magna	48 hour EC50	115000				344
	Daphnia magna	48 hour EC50	6900				344
	Daphnia magna	48 hour EC50	39000	26392.76612			13154
	Daphnia pulex	48 hour EC50	36500				11433
	Daphnia pulex	48 hour EC50	46500	41197.69411			11433
	Daphnia carinata	48 hour EC50	22400				74233
	Daphnia carinata	48 hour EC50	23100				74233
	Daphnia carinata	48 hour EC50	24600				74233
	Daphnia carinata	48 hour EC50	25300				74233
	Daphnia carinata	48 hour EC50	26700	24371.67497	29813.5985	17	74233
	Ceriodaphnia dubia	48 hour EC50	8800				71606
	Ceriodaphnia dubia	48 hour EC50	20000				67777
	Ceriodaphnia dubia	48 hour EC50	4600				67777
	Ceriodaphnia dubia	48 hour EC50	30000	12483.83266	12483.83266	9	3590
	Eurytemora affinis	96 hour EC50	125	125	125	1	80951
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Hyella azteca	96 hour LC50	14700	14700	14700	10	17138
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)	Acroneuria sp	96 hour LC50	6700	6700	6700	6	17138
G: A faimly in a phylum other than Arthropoda or Chordata	Glossiphonia complanata	96 hour LC50	6300	6300	6300	5	7186
(e.g. Rotifera, Annelida, Mollusca)	Lumbriculus variegatus	96 hour LC50	37100	37100	37100	18	17138
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	125
Number of data requirements satisfied	7
Select Secondary Acute Factor	4.3
Secondary Acute Value	29.06976744
ACR	18

Derivation of Freshwater Aquatic Life Criteria
Benzidine **June 20, 2007**

Criteria (ug/L)	
Acute:	37.50
Chronic:	4.19

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	7400		7400	
	Salmo trutta lacustris		4350		4350	
B: One other species, warm water, commercially/recreationally important	Notropis lutrensis	96 hour LC50	2500		2500	
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50				
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50				
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magma	48 hour EC50	600		600	
		48 hour EC50				
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)						
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)						
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50				
H: A family in any order of insect or any phylum not already represented		96 hour LC50				

Lowest GMAV	600
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	75
ACR	17.9

Data from Suter and Tsao (1996)

Derivation of Freshwater Aquatic Life Criteria
Bis(2-chloroethoxy)methane (111911) **June 19, 2007**

Criteria (ug/L)	
Acute:	7076.92
Chronic:	786.32

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	184000	184000	184000	1	11961
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	201000	201000	201000	2	11961
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	184000
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	14153.84615
ACR	18

Derivation of Freshwater Aquatic Life Criteria
Bis(2-chloroethyl)ether (111444) **June 19, 2007**

Criteria (ug/L)	
Acute:	9230.77
Chronic:	1025.64

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Lepomis macrochirus	96 hour LC50	600000	600000	600000	2	5590
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	240000	240000	240000	1	5184
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	240000
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	18461.53846
ACR	18

Derivation of Freshwater Aquatic Life Criteria
Bis (2-ethylhexyl) phthalate **June 20, 2007**

Criteria (ug/L)	
Acute:	5.12
Chronic:	1.15

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	>320			
	Oncorhynchus kisutch		>100000			
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	>770000			
	Lepomis machrochirus	96 hour LC50	>100000			
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Gasterosteus aculeatus	96 hour LC50	>300			
	Ictalurus punctatus	96 hour LC50	>100000			
	Pimephales promelas	96 hour LC50	>670			
	Pimephales promelas	96 hour LC50	>160			
	Jordenella floridae	96 hour LC50	>320			
	Rana pipiens	96 hour LC50	4440		4440	
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour LC50	2000			
	Daphnia pulex	48 hour EC50	133		133	
	Gammarus pseudolimnae	96 hour EC50	>32000			
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Chironomus plumosus	96 hour EC50	>18000			
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)						
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)						
H: A family in any order of insect or any phylum not already represented						

Lowest GMAV	133
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	10.23076923
ACR	8.89

Data from Suter and Tsao (1996)

Derivation of Freshwater Aquatic Life Criteria
Bromoform (75252) **June 19, 2007**

Criteria (ug/L)	
Acute:	1115.38
Chronic:	123.93

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50 96 hour LC50	29000	29000	29000	1	5590
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	46000	46000	46000	2	5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	29000
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	2230.769231
ACR	18

Derivation of Freshwater Aquatic Life Criteria
Bromomethane (74839) **September 18,2007**

Criteria (ug/L)	
Acute:	0.04
Chronic:	0.005

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commerciallv/recreationally important	Lepomis macrochirus	96 hour LC50	11000	11000	11000	3	863
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Poecilia reticulata	96 hour LC50	0.6	0.6			5331
	Poecilia reticulata	96 hour LC50	0.8	0.8			5331
		96 hour LC50					
		96 hour LC50		0.692820323	0.692820323	1	
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	2000				5331
	Daphnia magna	48 hour EC50	2600				344
	Daphnia magna	48 hour EC50	2200	2253.246343	2253.246343	2	5331
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	0.692820323
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	0.08660254
ACR	18

Derivation of Freshwater Aquatic Life Criteria
2- Butanone **June 20, 2007**

Criteria (ug/L)	
Acute:	123076.92
Chronic:	13751.61

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV
A: The family Salmonidae in the class Osteichthyes						
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)						
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	3200000			
D: A planktonic crustacean (e.g. cladoceran, copepod) E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Daphnia magna	48 hour EC50	5091000			
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)						
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)						
H: A family in any order of insect or any phylum not already represented						

Lowest GMAV	3200000
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	246153.8462
ACR	19.9

Data from Suter and Tsao (1996)

Derivation of Freshwater Aquatic Life Criteria

Carbazole (86748) **June 19, 2007**

Criteria (ug/L)	
Acute:	47.72
Chronic:	5.30

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important		96 hour LC50		0	0		
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50		0	0		
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	930				17138
	Pimephales promelas	96 hour LC50	1140				17138
	Pimephales promelas	96 hour LC50	1490				17138
	Pimephales promelas	96 hour LC50	1500	1240.698713	1240.698713	1	17138
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	3350	3350	3350	2	17138
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	1240.698713
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	95.43836256
ACR	18

Derivation of Freshwater Aquatic Life Criteria

4-Chloroaniline (106478) **June 19, 2007**

Criteria (ug/L)	
Acute:	8.89
Chronic:	0.99

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorynchus mykiss	96 hour LC50	11000				3485
	Oncorynchus mykiss	96 hour LC50	14000				939
		96 hour LC50		12409.67365	12409.67365	3	
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Ictalurus punctatus	96 hour LC50	23000	23000	23000	4	939
	Lepomis macrochirus	96 hour LC50	2400	2400	2400	2	939
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	32500	32500	32500	5	15031
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	310				846
	Daphnia magna	49 hour EC50	50	124.498996	124.498996	1	5375
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	124.498996
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	17.78557085
ACR	18

Derivation of Freshwater Aquatic Life Criteria
2-Chloronapthalene (91587) **June 20, 2007**

Criteria (ug/L)	
Acute:	79.45
Chronic:	8.83

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	2636				11926
	Daphnia magna	48 hour EC50	6064				11936
	Daphnia magna	48 hour EC50	2636	3479.765688	3479.765688	1	11926
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	3479.765688
Number of data requirements satisfied	1
Select Secondary Acute Factor	21.9
Secondary Acute Value	158.8934104
ACR	18

Derivation of Freshwater Aquatic Life Criteria

3-methyl-4-Chlorophenol (59507) **June 20, 2007**

Criteria (ug/L)	
Acute:	65.50
Chronic:	7.28

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	917	917	917	1	344
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
	Pimephales promelas	96 hour LC50	4050				15031
	Pimephales promelas	96 hour LC50	4050				12447
	Pimephales promelas	96 hour LC50	7380				12447
	Pimephales promelas	96 hour LC50	7560	5500.118557	5500.118557	3	10954
	Poecilia reticulata	96 hour LC50	6710				19263
D: A planktonic crustacean (e.g. cladoceran, copepod)							
	Daphnia magna	48 hour EC50	2300				344
	Daphnia magna	48 hour EC50	1500				19263
	Daphnia magna	48 hour EC50	2000	1903.778262	1903.778262	2	11961
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)		96 hour LC50					
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Lymnaea stagnalis	96 hour LC50	14000		14000	4	19263
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	917
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	131
ACR	18

Derivation of Freshwater Aquatic Life Criteria
4-Chlorotoluene (106434) **June 20, 2007**

Criteria (ug/L)	
Acute:	63.77
Chronic:	7.09

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Danio rerio	96 hour LC50	4400				3279
D: A planktonic crustacean (e.g. cladoceran, copepod)	Ceriodaphnia dubia	48 hour EC50	1658				18991
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	1658
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	127.5384615
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Cyclohexane (110827) **June 20, 2007**

Criteria (ug/L)	
Acute:	2480.00
Chronic:	275.56

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	34720	34720	34720	1	728
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Carassius auratus	96 hour LC50	42330	42330	42330	3	728
	Gambusia affinis	96 hour LC50	15500000	15500000	15500000	7	508
	Pimephales promelas	96 hour LC50	4530				3217
	Pimephales promelas	96 hour LC50	117000				719
	Pimephales promelas	96 hour LC50	32710				728
	Pimephales promelas	96 hour LC50	42330				728
	Pimephales promelas	96 hour LC50	93000	36882.39927	36882.39927	2	719
	Poecilia reticulata	96 hour LC50	57680	57680	57680	5	728
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	135000	135000	135000	6	770
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)		96 hour LC50					
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)	Chironomidae	96 hour LC50	570000	570000	570000	4	770
		96 hour LC50					
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented							

Lowest GMAV	34720
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	4960
ACR	18

Derivation of Freshwater Aquatic Life Criteria
2,4-D (94757) **September 19, 2007**

Criteria (ug/L)	
Acute:	46.51
Chronic:	5.17

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus clarki	96 hour LC50	**130000**				6797
	Oncorhynchus clarki	96 hour LC50	**169000**				6797
	Oncorhynchus clarki	96 hour LC50	**172000**				6797
	Oncorhynchus clarki	96 hour LC50	**37000**				6797
	Oncorhynchus clarki	96 hour LC50	**41500**				6797
	Oncorhynchus clarki	96 hour LC50	**41500**				6797
	Oncorhynchus clarki	96 hour LC50	**43500**				6797
	Oncorhynchus clarki	96 hour LC50	**40000**				6797
	Oncorhynchus clarki	96 hour LC50	**900**				666
	Oncorhynchus clarki	96 hour LC50	**1000**				666
	Oncorhynchus clarki	96 hour LC50	**24500**				6797
	Oncorhynchus clarki	96 hour LC50	**44000**				6797
	Oncorhynchus clarki	96 hour LC50	**64000**				6797
	Oncorhynchus clarki	96 hour LC50	**67000**	32903.13	32903.13		6797
	Oncorhynchus mykiss	96 hour LC50	110000				6797
	Oncorhynchus mykiss	96 hour LC50	1000				666
	Oncorhynchus mykiss	96 hour LC50	3100				666
	Oncorhynchus mykiss	96 hour LC50	2000				666
	Oncorhynchus mykiss	96 hour LC50	1400				
	Oncorhynchus mykiss	96 hour LC50	7600				
	Oncorhynchus mykiss	96 hour LC50	358000				344
	Oncorhynchus mykiss	96 hour LC50	358000	13214.83			11504
	Oncorhynchus tshawytsch	96 hour LC50	4800	4800.00	12779.48	8	666
	Salvelinus namaycush	96 hour LC50	105000				6797
	Salvelinus namaycush	96 hour LC50	45000				666
	Salvelinus namaycush	96 hour LC50	1100				666
	Salvelinus namaycush	96 hour LC50	900				666
	Salvelinus namaycush	96 hour LC50	120000				6797
	Salvelinus namaycush	96 hour LC50	44500				6797
	Salvelinus namaycush	96 hour LC50	62000				6797
	Salvelinus namaycush	96 hour LC50	64000				6797
	Salvelinus namaycush	96 hour LC50	65700	26530.54	26530.54		6797
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Anguilla rostrata	96 hour LC50	300600	300600.00	300600.00		859
	Lepomis gibbosus	96 hour LC50	94600	94600.00			859
	Lepomis macrochirus	96 hour LC50	180000				6797
	Lepomis macrochirus	96 hour LC50	7400				666
	Lepomis macrochirus	96 hour LC50	7500				666
	Lepomis macrochirus	96 hour LC50	600				666
	Lepomis macrochirus	96 hour LC50	1200				666
	Lepomis macrochirus	96 hour LC50	168000				666
	Lepomis macrochirus	96 hour LC50	800				666
	Lepomis macrochirus	96 hour LC50	540				666
	Lepomis macrochirus	96 hour LC50	816000				666
	Lepomis macrochirus	96 hour LC50	263000				344
	Lepomis macrochirus	96 hour LC50	263000	16768.00	39827.78		11504
	Micropterus dolomieui	96 hour LC50	3100				666
	Micropterus dolomieui	96 hour LC50	236000	14900.17	15806.52	10	666
	Morone americana	96 hour LC50	40000	40000.00			859
	Morone saxatilis	96 hour LC50	70100	70100.00	52952.81		859

C: A third family in the phylum Chordata (e.g. fish, amphibian)	Carassius auratus	96 hour LC50	201000				563
	Carassius auratus	96 hour LC50	187000	193873.67	193873.67		563
	Icthalurus punctatus	96 hour LC50	7000				666
	Icthalurus punctatus	96 hour LC50	155000	32939.34	32939.34		666
	Clarius batrachus	96 hour LC50	60000	60000.00	60000.00		17010
	Cyprinus carpio	96 hour LC50	96500				859
	Cyprinus carpio	96 hour LC50	270000				4321
	Cyprinus carpio	96 hour LC50	20000				6386
	Cyprinus carpio	96 hour LC50	134800				268
	Cyprinus carpio	96 hour LC50	15300				6387
	Cyprinus carpio	96 hour LC50	20000				6387
	Cyprinus carpio	96 hour LC50	24150				6387
	Cyprinus carpio	96 hour LC50	31250				6387
	Cyprinus carpio	96 hour LC50	5100	35189.07	35189.07		6387
	Fundulus diaphanus	96 hour LC50	26700	26700.00	26700.00		859
	Pimephales promelas	96 hour LC50	18000				666
	Pimephales promelas	96 hour LC50	3300				666
	Pimephales promelas	96 hour LC50	2700				666
	Pimephales promelas	96 hour LC50	133000				6797
	Pimephales promelas	96 hour LC50	235000				666
	Pimephales promelas	96 hour LC50	320000				344
	Pimephales promelas	96 hour LC50	263000	45786.70	226467.72		11504
	Poecilia reticulata	96 hour LC50	5168				11567
	Poecilia reticulata	96 hour LC50	70700				859
	Poecilia reticulata	96 hour LC50	8356				11567
	Poecilia reticulata	96 hour LC50	14760	14569.90	14569.90	9	11567
	Tinca tinca	96 hour LC50	800000	800000.00	800000.00		20178
	Xenopus laevis	96 hour LC50	270000				63246
	Xenopus laevis	96 hour LC50	254000	261877.83	261877.83		63246
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	25000				11504
	Daphnia magna	48 hour EC50	100000				886
	Daphnia magna	48 hour EC50	25000				344
	Daphnia magna	48 hour EC50	36400				11504
	Daphnia magna	48 hour EC50	135000				2877
	Daphnia magna	48 hour EC50	135000				2877
	Daphnia magna	48 hour EC50	25000				11504
	Daphnia magna	48 hour EC50	6400				666
	Daphnia magna	48 hour EC50	4000				666
	Daphnia magna	48 hour EC50	100000	34864.46			886
	Daphnia pulex	48 hour EC50	3200	3200.00	10562.49	7	888
	Ceriodaphnia dubia	48 hour EC50	236000				3590
	Ceriodaphnia dubia	48 hour EC50	422000	315582.00	315582.00		18961
	Acanthocyclops vernalis	48 hour EC50	37420				550
	Spicodiaptomus chilospin	48 hour EC50	1850	1850.00			5264
	Spicodiaptomus serrulatus	48 hour EC50	4900	4900.00	3010.81	4	888
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Gammarus fasciatus	96 hour LC50	2900				666
	Gammarus fasciatus	96 hour LC50	6100				666
	Gammarus fasciatus	96 hour LC50	100000				
	Gammarus fasciatus	96 hour LC50	2400	8072.07	8072.07	6	666
	Palomonectes sp	96 hour LC50	400	400.00	400.00	1	666
	Ascellus	96 hour LC50	2600	2600.00	2600.00	3	666
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)	Pteronarcys californicus	96 hour LC50	1600				2871
	Pteronarcys californicus	96 hour LC50	2600				666
	Pteronarcys californicus	96 hour LC50	15000	3966.38	3966.38	5	889
	Pteronarcella	96 hour LC50	1500				666
	Pteronarcella	96 hour LC50	2400	1897.37	1897.37	2	666
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Lubriculus variegatus	96 hour LC50	122200	122200.00	122200.00	10	6502

H: A family in any order of insect or any phylum not already represented

Lowest GMAV	400
Number of data requirements satisfied	7
Select Secondary Acute Factor	4.3
Secondary Acute Value	93.02325581
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Dicamba (1918009) **September 18, 2007**

Criteria (ug/L)	
Acute:	1618.72
Chronic:	179.86

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus clarki	96 hour LC50	50000	50000			15145
	Oncorhynchus mykiss	96 hour LC50	28000				6797
	Oncorhynchus mykiss	96 hour LC50	130000				344
	Oncorhynchus mykiss	96 hour LC50	135400				344
	Oncorhynchus mykiss	96 hour LC50	153000	93186.47197	82276.59243	3	344
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	50000				6797
	Lepomis macrochirus	96 hour LC50	135300				344
	Lepomis macrochirus	96 hour LC50	180000	106785.7827	106785.7827	5	344
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Gambusia affinis	96 hour LC50	465000	465000	465000	7	867
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	100000				6797
	Daphnia magna	48 hour EC50	110700				344
	Daphnia magna	48 hour EC50	750000	202489.7114	202489.7114	6	344
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Amphipoda	96 hour LC50	3900				70421
	Asellus brevicaudus	96 hour LC50	100000	100000	100000	4	6797
	Gammarus fasciatus	96 hour LC50	100000				6797
	Gammarus fasciatus	96 hour LC50	100000	100000			6797
	Gammarus lacustris	96 hour LC50	3900				344
	Gammarus lacustris	96 hour LC50	3900	3900	19748.41766	1	885
	Palaemonetes hadiakensis	96 hour LC50	56000	56000	56000	2	6797
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented							

Lowest GMAV	19748.4
Number of data requirements satisfied	5
Select Secondary Acute Factor	6.1
Secondary Acute Value	3237.442623
ACR	18

Derivation of Freshwater Aquatic Life Criteria

3,3-Dichlorobenzidine (91941) **June 20, 2007**

Criteria (ug/L)	
Acute:	40.38
Chronic:	4.49

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)							
	Pimephales promelas	96 hour LC50	2080				17138
	Pimephales promelas	96 hour LC50	1770				17138
	Pimephales promelas	96 hour LC50	1050				17138
	Pimephales promelas	96 hour LC50	1880				17138
	Pimephales promelas	96 hour LC50	2770	1822.941382	1822.941382	2	17138
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	1050	1050	1050	1	17138
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)		96 hour LC50					
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented							

Lowest GMAV	1050
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	80.76923077
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Dichloroprop (120365) **June 19, 2007**

Criteria (ug/L)	
Acute:	105.29
Chronic:	11.70

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	2700				344
	Oncorhynchus mykiss	96 hour LC50	500				344
	Oncorhynchus mykiss	96 hour LC50	5220				344
	Oncorhynchus mykiss	96 hour LC50	6100	2560.551568	2560.551568	2	344
	Salmo trutta	96 hour LC50	78000				62367
	Salmo trutta	96 hour LC50	91000	84249.62908	84249.62908	4	19224
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	2400				344
	Lepomis macrochirus	96 hour LC50	2400				344
	Lepomis macrochirus	96 hour LC50	830	1684.613171	1684.613171	1	344
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	100000				344
	Daphnia magna	48 hour EC50	5400				344
	Daphnia magna	48 hour EC50	6250	15000	15000	3	344
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	1,684.61
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	210.5766464
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Chemical 1 2 dichloropropane (78875) **Date 07/12/2006**

Criteria (ug/L)	
Acute:	846.88
Chronic:	94.10

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
		96 hour LC50					
B: One other species, warm water, commercially/recreationally important	Lepomis macrochirus	96 hour LC50	320000				863
- Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	280000	299330	299330	4	5590
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	140000				11227
	Pimephales promelas	96 hour LC50	127000	133340	133340	3	12447
D: A planktonic crustacean (e.g. cladoceran, copepod)	Ceriodaphnia dubia	48 hour EC50	13550	13550	13550	1	18991
	Daphnia magna	48 hour EC50	52000	52000	52000	2	5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)		96 hour LC50					
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)		96 hour LC50					
G: A family in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	13550
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	1693.75
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Dimethyl phthalate (131113) **June 20, 2007**

Criteria (ug/L)	
Acute:	2788.46
Chronic:	309.83

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	56000	56000	56000	4	15040
B: One other species, warm water, commercially/recreationally impotant - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	50000	50000	50000	3	15040
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Cyprinodon variegatus	96 hour LC50	29000	29000	29000	1	15040
	Pimephales promelas	96 hour LC50	121000				3217
	Pimephales promelas	96 hour LC50	39000				15040
	Pimephales promelas	96 hour LC50	121000	82961.85405	82961.85405	6	15040
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	45900				15040
	Daphnia magna	48 hour EC50	33000	38919.14696	38919.14696	2	5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Americamysis bahia	96 hour EC50	68600	68600	68600	5	15040
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)	Paratanytarsus parthenogenetic	96 hour EC50	377000	377000	377000	7	15040
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	29000
Number of data requirements satisfied	6
Select Secondary Acute Factor	5.2
Secondary Acute Value	5576.923077
ACR	18

Derivation of Freshwater Aquatic Life Criteria **Date 6/19/2007**

Chemical Di-n-butyl phthlate (84742)

Criteria (ug/L)	
Acute:	33.65
Chronic:	3.74

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	1240				6797
	Oncorhynchus mykiss	96 hour LC50	1480				6797
	Oncorhynchus mykiss	96 hour LC50	1600				15040
	Oncorhynchus mykiss	96 hour LC50	2560				6797
	Oncorhynchus mykiss	96 hour LC50	6470	2174.650784			6797
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis machrochirus	96 hour LC50	1550				6797
	Lepomis machrochirus	96 hour LC50	1580				6797
	Lepomis machrochirus	96 hour LC50	2050				6797
	Lepomis machrochirus	96 hour LC50	2100				6797
	Lepomis machrochirus	96 hour LC50	730				6797
	Lepomis machrochirus	96 hour LC50	1200				5590
	Lepomis machrochirus	96 hour LC50	1200				5590
	Lepomis machrochirus	96 hour LC50	480	1232.355666			15040
	Ictalurus punctatus	96 hour LC50	460				6797
	Ictalurus punctatus	96 hour LC50	2910	1156.978824			6797
	Perca flavescens	96 hour LC50	350	350			6797
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	1100				12447
	Pimephales promelas	96 hour LC50	850				12447
	Pimephales promelas	96 hour LC50	920				15040
	Pimephales promelas	96 hour LC50	1300				6797
	Pimephales promelas	96 hour LC50	1540	1114.84041			15040
	Cyprinodon variegatus	96 hour LC50	600	600			15040
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	2990				15040
	Daphnia magna	48 hour EC50	3700				16044
	Daphnia magna	48 hour EC50	3700	3446.340726			10579
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Americamysis bahia	96 hour LC50	500				15040
	Gammarus psuedolimnaeus	96 hour LC50	2100				6797
	Gammarus psuedolimnaeus	96 hour LC50	10000	4582.575695			6615
	Orconectes nais	96 hour LC50	10000	10000			6797
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)	Paratanytarsus parthenogenetic	96 hour LC50	6290	6290			15040
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Aplexa hypnorum	96 hour LC50					
	Lymnaea staqnalis	96 hour LC50					
H: A family in any order of insect or any phylum not already represented	Dugesia tigrina	96 hour LC50					

Lowest GMAV	350
Number of data requirements satisfied	6
Select Secondary Acute Factor	5.2
Secondary Acute Value	67.30769231
ACR	18

Derivation of Freshwater Aquatic Life Criteria **Date September 18, 2007**

Chemical 2,4-Dinitrophenol (51285)

Criteria (ug/L)	
Acute:	199.12
Chronic:	22.12

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	1500				13274
	Oncorhynchus mykiss	96 hour LC50	27100				13274
	Oncorhynchus mykiss	96 hour LC50	1160				12665
	Oncorhynchus mykiss	96 hour LC50	390	2070.836383	2071	1	13274
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Pimephales promelas	96 hour LC50	11100				15031
	Pimephales promelas	96 hour LC50	16000				2189
	Pimephales promelas	96 hour LC50	6580				12447
	Pimephales promelas	96 hour LC50	16000				15031
	Pimephales promelas	96 hour LC50	10600				12447
	Pimephales promelas	96 hour LC50	17000				2189
	Pimephales promelas	96 hour LC50	8390				12665
	Pimephales promelas	96 hour LC50	11000				12859
	Pimephales promelas	96 hour LC50	17000				2189
	Pimephales promelas	96 hour LC50	10600				12447
	Pimephales promelas	96 hour LC50	11000				12859
	Pimephales promelas	96 hour LC50	13300				3217
	Pimephales promelas	96 hour LC50	19400				12447
	Pimephales promelas	96 hour LC50	8150	12008.13274	12008	6	3217
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Cyprinus carpio	96 hour LC50	520				10385
	Cyprinus carpio	96 hour LC50	260000	11627.55348	11628		13451
	Catostomus commersoni	96 hour LC50	4590	4590	4590	4	12665
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	4390				12665
	Daphnia magna	48 hour EC50	4710				2120
	Daphnia magna	48 hour EC50	4100				5184
	Daphnia magna	48 hour EC50	4710	4493.870729	4542	3	15251
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Gammarus pseudolimnaeus	96 hour LC50	25600				13274
	Gammarus pseudolimnaeus	96 hour LC50	600				13274
	Gammarus pseudolimnaeus	96 hour LC50	3080				13274
	Gammarus pseudolimnaeus	96 hour LC50	4400	3798.382113	3798	2	13274
	Orconectes immunis	96 hour LC50	48100	48100	48100	7	12665
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)		96 hour LC50					
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Aplexa hypnorum	96 hour LC50	6490	6490	6490	5	12665
		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	2070.836383
Number of data requirements satisfied	6
Select Secondary Acute Factor	5.2
Secondary Acute Value	398.2377659
ACR	18

Derivation of Freshwater Aquatic Life Criteria

2-Methyl-4,6-dinitrophenol(534521) **June 20, 2007**

Criteria (ug/L)	
Acute:	6.35
Chronic:	0.71

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	66	66	66	1	6797
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	360	360	360	2	6797
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Leuciscus idus	96 hour LC50	1500	1500	1500	4	56301
	Pimephales promelas	96 hour LC50	1540				12447
	Pimephales promelas	96 hour LC50	1540				12447
	Pimephales promelas	96 hour LC50	2720				15031
	Pimephales promelas	96 hour LC50	2200				2189
	Pimephales promelas	96 hour LC50	1900	1932.66831	1932.66831	5	2189
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia pulex	48 hour EC50	145	145			6797
	Daphnia magna	48 hour EC50	2700				846
	Daphnia magna	48 hour EC50	3100				5184
	Daphnia magna	48 hour EC50	3300	3022.825886	662.0496609	3	5675
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Gammarus fasciatus	48 hour EC50	1100	1100			6797
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)	Pteronarcys californicus	48 hour EC50	320	320			6797
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	66
Number of data requirements satisfied	6
Select Secondary Acute Factor	5.2
Secondary Acute Value	12.69230769
ACR	18

Derivation of Freshwater Aquatic Life Criteria

2,4-Dinitrotoluene(121142) **September 19, 2007**

Criteria (ug/L)	
Acute:	393.75
Chronic:	43.75

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Pimephales promelas	96 hour LC50	32500				5087
	Pimephales promelas	96 hour LC50	2.43E+04				3217
	Pimephales promelas	96 hour LC50	3.28E+04				10141
	Pimephales promelas	96 hour LC50	2.43E+04				15031
	Pimephales promelas	96 hour LC50	3.10E+04	28712.18801	28712.18801	5	6021
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Gasterosteus aculeatus	96 hour LC50	6300	6300	6300	1	823
	Danio rerio	96 hour LC50	16000				5390
	Danio rerio	96 hour LC50	24000				5390
	Danio rerio	96 hour LC50	13000	17090.63473	17090.63473	3	5390
	Jordanella floridae	96 hour LC50	22000	22000	22000	4	5336
	Poecilia reticulata	96 hour LC50	16000	16000	16000	2	5336
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	26200				2193
	Daphnia magna	48 hour EC50	35000				5087
	Daphnia magna	48 hour EC50	35000	31779.40731	31779.40731	6	6021
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	6300
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	787.5
ACR	18

Derivation of Freshwater Aquatic Life Criteria

1,2-Diphenylhydrazine(122667) **September 19, 2007**

Criteria (ug/L)	
Acute:	10.38
Chronic:	1.15

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50 96 hour LC50	270	270	270	1	5590
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	2180				2193
	Daphnia magna	48 hour EC50	4100	2989.64881	2989.64881	2	5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	270
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	20.76923077
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Ethanol (64175) **September 19, 2007**

Criteria (ug/L)	
Acute:	20491.80
Chronic:	2276.87

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	6302000				11597
	Oncorhynchus mykiss	96 hour LC50	13000000	9051298.249	9051298.249	3	6797
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)							
	Pimephales promelas	96 hour LC50	13480000				719
	Pimephales promelas	96 hour LC50	14200000	13835317.13	13835317.13	5	12448
		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	9300000				14533
	Daphnia magna	48 hour EC50	10000000				846
	Daphnia magna	48 hour EC50	11853000				12598
	Daphnia magna	48 hour EC50	14136000				12598
	Daphnia magna	48 hour EC50	10860000				12598
	Daphnia magna	48 hour EC50	5680000				49794
	Daphnia magna	48 hour EC50	13248000				12598
	Daphnia magna	48 hour EC50	9268000				12598
	Daphnia magna	48 hour EC50	14221000				12598
	Daphnia magna	48 hour EC50	13470000				12598
	Daphnia magna	48 hour EC50	11967000				12598
	Daphnia magna	48 hour EC50	9300000				7884
	Daphnia magna	48 hour EC50	12820000				12598
	Daphnia magna	48 hour EC50	9248000	10811945.9			212
	Daphnia obtusa	48 hour EC50	10600000	10600000	10705448.45	4	20191
	Ceriodaphnia dubia	48 hour EC50	6772000				12598
	Ceriodaphnia dubia	48 hour EC50	6325000				12598
	Ceriodaphnia dubia	48 hour EC50	6076000				12598
	Ceriodaphnia dubia	48 hour EC50	8808000				212
	Ceriodaphnia dubia	48 hour EC50	6386000				12598
	Ceriodaphnia dubia	48 hour EC50	3715000				12598
	Ceriodaphnia dubia	48 hour EC50	5577000	6069081.78	6069081.78	2	12598
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Palaemonetes kadiakensis	96 hour LC50	250000	250000	250000	1	6797
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A family in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Corbicula manilensis	96 hour LC50	60000000	60000000	60000000	6	418
H: A family in any order of insect or any phylum not already represented							

Lowest GMAV	250000
Number of data requirements satisfied	5
Select Secondary Acute Factor	6.1
Secondary Acute Value	40983.60656
ACR	18

Derivation of Freshwater Aquatic Life Criteria
Ethyl Acetate(141786) **June 22, 2007**

Criteria (ug/L)	
Acute:	14375.00
Chronic:	1597.22

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	425300				12210
	Oncorhynchus mykiss	96 hour LC50	484000				12210
		96 hour LC50		453701.6641	453701.6641	3	
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	230000	230000	230000	1	12448
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia cucullata	48 hour EC50	175000				2017
	Daphnia cucullata	48 hour EC50	154000	164164.5516			2017
	Daphnia pulex	48 hour EC50	230000				2017
	Daphnia pulex	48 hour EC50	295000	260480.3256			2017
	Daphnia magna	48 hour EC50	660000				2017
	Daphnia magna	48 hour EC50	560000				2017
	Daphnia magna	48 hour EC50	698000				2017
	Daphnia magna	48 hour EC50	778000				2017
	Daphnia magna	48 hour EC50	786000				2017
	Daphnia magna	48 hour EC50	819000	711015.2325	312112.435	2	2017
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	230000
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	28750
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Hexachlorobenzene (118741) **September 19, 2007**

Criteria (ug/L)	
Acute:	0.34
Chronic:	0.04

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus kisutch	96 hour LC50	50000	50000			6797
	Oncorhynchus tshawytscha	96 hour LC50	1000	1000	7071.067812	5	6797
	Salmo trutta	96 hour LC50	300				6797
	Salmo trutta	96 hour LC50	500	387.2983346	387.2983346	2	6797
	Salvelinus fontinalis	96 hour LC50	1000	1000	1000	3	6797
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Ictalurus punctatus	96 hour LC50	100000				6797
	Ictalurus punctatus	96 hour LC50	7000				6797
	Ictalurus punctatus	96 hour LC50	13500	21141.8962	21141.8962	8	6797
	Lepomis macrochirus	96 hour LC50	12000				6797
	Lepomis macrochirus	96 hour LC50	7600				69107
	Lepomis macrochirus	96 hour LC50	1000	4501.234229	4501.234229	4	6797
	Micropterus salmoides	96 hour LC50	12000	12000	12000	7	6797
		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	10000	10000	10000	6	6797
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	4.73				11926
	Daphnia magna	48 hour EC50	4.73	4.73	4.73	1	11926
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	4.73
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	0.675714286
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Hexachlorocyclopentadiene (77474) **June 20, 2007**

Criteria (ug/L)	
Acute:	2.82
Chronic:	0.31

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
		96 hour LC50					
		96 hour LC50		#NUM!			
B: One other species, warm water, commercially/recreationally important	Ictalurus punctatus	96 hour LC50	97	97	97	2	17136
- Osteichthyes (e.g.bluegill, channel catfish)	Micropterus salmoides	96 hour LC50	20000	20000	20000	4	2786
	Lepomis macrochirus	96 hour LC50	25000				2786
	Lepomis macrochirus	96 hour LC50	130	1802.775638	1802.775638	3	17136
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	13.9				14339
	Pimephales promelas	96 hour LC50	180				17136
	Pimephales promelas	96 hour LC50	104				17135
	Pimephales promelas	96 hour LC50	59				17135
	Pimephales promelas	96 hour LC50	78				17135
	Pimephales promelas	96 hour LC50	7	45.070691	FALSE		2097
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	39				17136
	Daphnia magna	48 hour EC50	52.2	45.11984043	45.11984043	1	58785
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	45.070691
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	5.633836375
ACR	18

Derivation of Freshwater Aquatic Life Criteria
Isopropylbenzene (98828) **September 19, 2007**

Criteria (ug/L)	
Acute:	192.86
Chronic:	21.43

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	2700	2700	2700	1	13142
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Pimephales promelas	96 hour LC50	6320	6320	6320	3	12858
		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Poecilia reticulata	96 hour LC50	5100	5100	5100	2	13142
		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	10600				7069
	Daphnia magna	48 hour EC50	10600				7069
	Daphnia magna	48 hour EC50	11200				7069
	Daphnia magna	48 hour EC50	10600				7069
	Daphnia magna	48 hour LC50	20300				7069
	Daphnia magna	48 hour LC50	34300				7069
	Daphnia magna	48 hour LC50	30500				7069
	Daphnia magna	48 hour LC50	20300	20300	20300	4	7069
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	2700
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	385.71
ACR	18

Derivation of Freshwater Aquatic Life Criteria

4-Isopropyltoluene (99876) **June 20, 2007**

Criteria (ug/L)	
Acute:	148.40
Chronic:	16.49

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour LC50	6500	6500	6500	1	5184
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	6500
Number of data requirements satisfied	1
Select Secondary Acute Factor	21.9
Secondary Acute Value	296.803653
ACR	18

Derivation of Freshwater Aquatic Life Criteria

4-Methylphenol (106445) **June 20, 2007**

Criteria (ug/L)	
Acute:	499.20
Chronic:	55.47

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	8600	7987.219176	7987.219176	1	59196
		96 hour LC50	7500				10688
		96 hour LC50	7900				569
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Pimephales promelas	96 hour LC50	19000	22503.10273	22503.10273	3	719
	Pimephales promelas	96 hour LC50	16500				12858
	Pimephales promelas	96 hour LC50	28600				59196
	Pimephales promelas	96 hour LC50	28600				569
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	7700	10025.20415	12662.00698	2	846
	Daphnia magna	48 hour EC50	21100				7458
	Daphnia magna	48 hour EC50	21100				15251
	Daphnia magna	48 hour EC50	21100				2120
	Daphnia magna	48 hour EC50	1400				553
	Daphnia pulex	48 hour EC50	22700	22700			59196
	Daphnia pulicaria	48 hour EC50	22700	22700			569
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	7987.219176
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	998.4023969
ACR	18

Derivation of Freshwater Aquatic Life Criteria

2-Nitroaniline (88744) **Date September 19, 2007**

Criteria (ug/L)	
Acute:	188.08
Chronic:	20.90

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Danio rerio	96 hour LC50	19472	19472	19472	2	5436
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magma	48 hour EC50	4890	4890	4890	1	55962
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A family in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	4890
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	376.1538462
ACR	18

Derivation of Freshwater Aquatic Life Criteria

3-nitroaniline (99092) **June 20, 2007**

Criteria (ug/L)	
Acute:	61.25
Chronic:	6.81

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Poecilia reticulata	96 hour LC50	81200	81200	81200	2	19263
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magma	48 hour EC50	980	980	980	1	19263
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Lymnaea stagnalis	96 hour LC50	143000	143000	143000	3	19263
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	980
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	122.5
ACR	18

Derivation of Freshwater Aquatic Life Criteria

4-Nitroaniline (100016) **September 19, 2007**

Criteria (ug/L)	
Acute:	1062.50
Chronic:	118.06

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Pimephales promelas	96 hour LC50	106100	113977.9383	113977.9383	3	2965
	Pimephales promelas	96 hour LC50	101800				2966
	Pimephales promelas	96 hour LC50	125000				15031
	Pimephales promelas	96 hour LC50	125000				3217
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Danio rerio	96 hour LC50	87600	104807.452	104807.452	2	11037
			125395				5436
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magma	48 hour EC50	17000	17000	17000	1	55961
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	17000
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	2125
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Nitrobenzene (98953) **September 20, 2007**

Criteria (ug/L)	
Acute:	1989.34
Chronic:	221.04

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	24270	24270	24270	1	16888
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	43000	43000	43000	3	5590
		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Danio rerio	96 hour LC50	112500	101734.9497	101734.9497	5	11037
	Danio rerio	96 hour LC50	92000				56372
	Pimephales promelas	96 hour LC50	117000	117995.7626	117995.7626	6	10954
	Pimephales promelas	96 hour LC50	119000				12447
	Poecilia reticulata	96 hour LC50	135000	135000	135000	7	19263
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magma	48 hour EC50	35000	36735.22526	36735.22526	2	6629
	Daphnia magma	48 hour EC50	34600				19263
	Daphnia magma	48 hour EC50	27000				5184
	Daphnia magma	48 hour EC50	33000				5375
	Daphnia magma	48 hour EC50	62000				6629
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Lymnaea stagnalis	96 hour LC50	64500	64500	64500	4	19263
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	24270
Number of data requirements satisfied	5
Select Secondary Acute Factor	6.1
Secondary Acute Value	3978.688525
ACR	18

Derivation of Freshwater Aquatic Life Criteria
Pentachloronitrobenzene (82688) **June 20, 2007**

Criteria (ug/L)	
Acute:	22.17
Chronic:	2.46

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	310	543.5613719	543.5613719	2	344
	Oncorhynchus mykiss	96 hour LC50	550				344
	Oncorhynchus mykiss	96 hour LC50	1600				344
	Oncorhynchus mykiss	96 hour LC50	320				344
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	750	354.7633884	354.7633884	1	344
	Lepomis macrochirus	96 hour LC50	240				344
	Lepomis macrochirus	96 hour LC50	100				344
	Lepomis macrochirus	96 hour LC50	880				344
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magma	48 hour EC50	770		770	3	344
		48 hour EC50					
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	354.7633884
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	44.34542356
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Pyridine (110861) **September 20,2007**

Criteria (ug/L)	
Acute:	235.97
Chronic:	26.22

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhychus gorbuscha	96 hour LC50	1100	1100			12605
	Oncorhychus keta	96 hour LC50	3700	3700			12605
	Oncorhychus mykiss	96 hour LC50	4600	4600			12605
	Oncorhychus tshawytsha	96 hour LC50	2900	2900			12605
	Oncorhychus nerka	96 hour LC50	6300	6300			12605
	Oncorhychus kisutch	96 hour LC50	3800	3800	3303.536154	1	12605
B: One other species, warm water, commercially/recreationally important	Pimephales promelas	96 hour LC50	106000				12858
- Osteichthyes (e.g.bluegill, channel catfish)	Pimephales promelas	96 hour LC50	93800	99713.58985	99713.58985	3	12858
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Xenopus laevis	96 hour LC50	1090000				6325
	Xenopus laevis	96 hour LC50	2460000				6325
	Xenopus laevis	96 hour LC50	1620000				6325
	Xenopus laevis	96 hour LC50	1050000	1461391.172	1461391.172	7	6325
	Zebra danio	96 hour LC50	512000	512000	512000	4	11037
	Cyprinus carpio	96 hour LC50	26000	26000	26000	2	2077
	Leusiscus idus	96 hour LC50	512000	512000	512000	4	11037
	Gambusia affinis	96 hour LC50	1300000	1300000	1300000	6	508
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	1140000				2017
	Daphnia magna	48 hour EC50	1210000				2017
	Daphnia magna	48 hour EC50	1940000				2017
	Daphnia magna	48 hour EC50	1120000				2017
	Daphnia magna	48 hour EC50	944000				915
	Daphnia magna	48 hour EC50	1570000	1282124.71			2017
	Daphnia pulex	48 hour EC50	630000				2017
	Daphnia pulex	48 hour EC50	520000		1048010.634	5	2017
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)		96 hour LC50					
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented							

Lowest GMAV	3303.536154
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	471.9337363
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Simazine(122349) **June 20, 2007**

Criteria (ug/L)	
Acute:	10.47
Chronic:	1.16

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Salmo trutta	96 hour LC50	70000				62367
	Salmo trutta	96 hour LC50	83000	76223.356	76223.356	15	19224
	Oncorhychus mykiss	96 hour LC50	25000				6615
	Oncorhychus mykiss	96 hour LC50	100000				7199
	Oncorhychus mykiss	96 hour LC50	70500				344
	Oncorhychus mykiss	96 hour LC50	40500				344
	Oncorhychus mykiss	96 hour LC50	60000				344
	Oncorhychus mykiss	96 hour LC50	44600				344
	Oncorhychus mykiss	96 hour LC50	10000				344
	Oncorhychus mykiss	96 hour LC50	100000				344
	Oncorhychus mykiss	96 hour LC50	56000				2871
	Oncorhychus mykiss	96 hour LC50	100000				546
	Oncorhychus mykiss	96 hour LC50	82000	52734.81989			344
	Oncorhychus tshawytsha	96 hour LC50	910000	910000	66861.5018407417	12	89626
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Morone saxitilis	96 hour LC50	180000				5324
	Morone saxitilis	96 hour LC50	822000				2468
	Morone saxitilis	96 hour LC50	250				909
	Morone saxitilis	96 hour LC50	3000				344
	Morone saxitilis	96 hour LC50	180000	28846.66548	28846.6654766937	6	5324
	Lepomis macrochirus	96 hour LC50	9000				546
	Lepomis macrochirus	96 hour LC50	35000				344
	Lepomis macrochirus	96 hour LC50	100000				344
	Lepomis macrochirus	96 hour LC50	100000				6797
	Lepomis macrochirus	96 hour LC50	118000				2871
	Lepomis macrochirus	96 hour LC50	16000				344
	Lepomis macrochirus	96 hour LC50	8100000	90091.82117			10861
	Lepomis microlophus	96 hour LC50	54000	54000			344
	Lepomis gibbosus	96 hour LC50	27000	27000	74445.6719218376	14	344
	Ameiurus melas	96 hour LC50	65000	65000			7199
	Ameiurus natalis	96 hour LC50	110000	110000	84557.6726264389	16	344
	Ictalurus punctatus	96 hour LC50	85000	85000			344
	Ictalurus sp	96 hour LC50	65000	65000	74330.3437365925	13	546
	Micropterus salmoides	96 hour LC50	46000	46000	46000	10	344
C: A third family in the phylum Chordata (e.g. fish, amphibian)							
	Danio sp	96 hour LC50	12600	12600	12600	3	868
	Poecilia reticulata	96 hour LC50	49000				7199
	Poecilia reticulata	96 hour LC50	49000	49000	49000	11	546
	Rana catesbeiana	96 hour LC50	1780000	1780000	1780000	20	89626
	Pimephales promelas	96 hour LC50	510000				6797
	Pimephales promelas	96 hour LC50	10000				6797
	Pimephales promelas	96 hour LC50	6400				344
	Pimephales promelas	96 hour LC50	100000				344
	Pimephales promelas	96 hour LC50	5000	27704.09903			6797
	Pimephales notatus	96 hour LC50	66000	66000	32016.758	8	344
	Notropis atherinoides	96 hour LC50	18000	18000	18000.000	5	344
	Perca sp	96 hour LC50	90	90	90.000	1	7199
	Carassius auratus	96 hour LC50	32000	32000	32000.000	7	344

Derivation of Freshwater Aquatic Life Criteria

Simazine(122349) **June 20, 2007**

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	1000				886
	Daphnia magna	48 hour EC50	3500				13154
	Daphnia magna	48 hour EC50	1100				344
	Daphnia magna	48 hour EC50	10000				6797
	Daphnia magna	48 hour EC50	94000				8970
	Daphnia magna	48 hour EC50	10000	5751.28334			6797
	Daphnia pulex	48 hour EC50	92100				2897
	Daphnia pulex	48 hour EC50	424000	197611.7405	13924.4085978687	4	2897
	Ceriodaphnia dubia	48 hour EC50	72000				67777
	Ceriodaphnia dubia	48 hour EC50	300000	146969.3846	146969.384566991	17	67777
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Hyalella azteca	96 hour LC50	270000	270000	270000	18	89626
	Gammarus fasciatus	96 hour LC50	100000				344
	Gammarus fasciatus	96 hour LC50	130000	114017.5425			6797
	Gammarus lacustris	96 hour LC50	13000				344
	Gammarus lacustris	96 hour LC50	13000	13000	38499.7149681511	9	885
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)	Pteronarcys californicus	96 hour LC50	1900				344
	Pteronarcys californicus	96 hour LC50	1900	1900	1900	2	6797
G: A family in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Branchiura sowerbyi	96 hour LC50	1897000				70292
	Branchiura sowerbyi	96 hour LC50	1090000				70292
	Branchiura sowerbyi	96 hour LC50	1700000				70292
	Branchiura sowerbyi	96 hour LC50	1810000	1588200.51	1588200.51045469	19	70292
H: A family in any order of insect or any phylum not already represented							

Lowest GMAV	90
Number of data requirements satisfied	7
Select Secondary Acute Factor	4.3
Secondary Acute Value	20.93023256
ACR	18

Derivation of Freshwater Aquatic Life Criteria
Styrene (100425) **June 20, 2007**

Criteria (ug/L)	
Acute:	213.57
Chronic:	23.73

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	25050	25050	25050	5	728
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	9900				14339
	Pimephales promelas	96 hour LC50	29000				719
	Pimephales promelas	96 hour LC50	4020				3217
	Pimephales promelas	96 hour LC50	46410				728
	Pimephales promelas	96 hour LC50	32000				719
	Pimephales promelas	96 hour LC50	4080				14339
	Pimephales promelas	96 hour LC50	10000	13202.88097	13202.88097	3	18326
	Poecilia reticulata	96 hour LC50	74830	74830	74830	7	728
	Carassius auratus	96 hour LC50	64740	64740	64740	6	
D: A planktonic crustacean (e.g. cladoceran, copepod)							
	Daphnia magna	48 hour EC50	4700				18326
	Daphnia magna	48 hour EC50	59000				15923
	Daphnia magna	48 hour EC50	23000	18544.96004	18544.96004	4	5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Hyallea azteca	96 hour LC50	9500	9500	9500	2	18326
	Gammarus pseudolimnaeus	96 hour LC50	2990	2990	2990	1	14339
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	2990
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	427.1428571
ACR	18

Derivation of Freshwater Aquatic Life Criteria

Chemical Tert-butyl alcohol (CAS# 75650) **Date 6/19/2007**

Criteria (ug/L)	
Acute:	211692.31
Chronic:	23521.37

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important		96 hour LC50					
- Osteichthyes (e.g.bluegill, channel catfish)		96 hour LC50					
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	6410000	6410000	6410000	2	12858
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	5504000	5504000	5504000	1	846
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)		96 hour LC50					
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)		96 hour LC50					
G: A fairnly in a phylum other than Arthropoda or Chordata		96 hour LC50					
(e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	5504000
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	423384.6154
ACR	18

Derivation of Freshwater Aquatic Life Criteria

1,2,4,5-Tetrachlorobenzene (95943) **June 20, 2007**

Criteria (ug/L)	
Acute:	18.18
Chronic:	2.02

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	10000				11519
	Oncorhynchus mykiss	96 hour LC50	10000				11519
	Oncorhynchus mykiss	96 hour LC50	10000				11519
	Oncorhynchus mykiss	96 hour LC50	1200				11519
	Oncorhynchus mykiss	96 hour LC50	10000	6543.893899	6543.893899	4	11519
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	1600	1600	1600	2	5590
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	460				17138
	Pimephales promelas	96 hour LC50	320				17138
	Pimephales promelas	96 hour LC50	89				17138
	Pimephales promelas	96 hour LC50	320	254.4555623	254.4555623	1	17138
	Jordanella floridae	96 hour LC50	2080				140
	Jordanella floridae	96 hour LC50	2150	2114.710382	2114.710382	3	140
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour LC50 48 hour EC50	530000	530000	530000	5	5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A fairnly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	254.4555623
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	36.35079461
ACR	18

Derivation of Freshwater Aquatic Life Criteria
1,1,2,2-Tetrachloroethane **June 21, 2007**

Criteria (ug/L)	
Acute:	1155.00
Chronic:	129.05

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV
A: The family Salmonidae in the class Osteichthyes						
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Jordanella floridae	96 hour LC50	18480		18480	
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	204000			
		96 hour LC50	203000		20350	
D: A planktonic crustacean (e.g. cladoceran, copepod) E: A benthic crustacean (e.g. ostracod, isopod, amphipod)	Daphnia magna	48 hour EC50	23000		23000	
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)						
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)						
H: A family in any order of insect or any phylum not already represented						

Lowest GMAV	18480
Number of data requirements satisfied	3
Select Secondary Acute Factor	8
Secondary Acute Value	2310
ACR	17.9

Data from Suter and Tsao (1996)

Derivation of Freshwater Aquatic Life Criteria

2,4,5-Trichlorophenol (95954) **June 20, 2007**

Criteria (ug/L)	
Acute:	24.76
Chronic:	2.75

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	460				13037
	Oncorhynchus mykiss	96 hour LC50	460				13042
	Oncorhynchus mykiss	96 hour LC50	249				56474
	Oncorhynchus mykiss	96 hour LC50	274	346.6301965	346.6301965	1	56474
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	600				13042
	Lepomis macrochirus	96 hour LC50	450				5590
	Lepomis macrochirus	96 hour LC50	600	545.1361778	545.1361778	2	13037
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Pimephales promelas	96 hour LC50	902				5313
	Pimephales promelas	96 hour LC50	1268	1069.455936	1069.455936	3	56474
	Poecilia reticulata	96 hour LC50	1200	1200	1200	4	45297
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magna	48 hour EC50	900				846
	Daphnia magna	48 hour LC50	2700	1558.845727	1558.845727	5	5184
	Ceriodaphnia dubia	48 hour LC50	1742	1742	1742	6	56474
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	346.6301965
Number of data requirements satisfied	4
Select Secondary Acute Factor	7
Secondary Acute Value	49.5185995
ACR	18

Derivation of Freshwater Aquatic Life Criteria

2,4,6-Trichlorophenol (88062) **June 20, 2007**

Criteria (ug/L)	
Acute:	29.69
Chronic:	3.30

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes	Oncorhynchus mykiss	96 hour LC50	730				12665
	Oncorhynchus mykiss	96 hour LC50	1991	1205.582847	1205.582847	3	3386
B: One other species, warm water, commercially/recreationally important	Lepomis macrochirus	96 hour LC50	410				12665
- Osteichthyes (e.g.bluegill, channel catfish)	Lepomis macrochirus	96 hour LC50	320	362.2154055	362.2154055	1	5590
C: A third family in the phylum Chordata (e.g. fish, amphibian)	Xenopus laevis	96 hour LC50	1200	1200	1200	2	12665
	Jordanella floridae	96 hour LC50	2207				140
	Jordanella floridae	96 hour LC50	2260	2233.342786	2233.342786	6	140
	Pimephales promelas	96 hour LC50	4550				15031
	Pimephales promelas	96 hour LC50	8600				2189
	Pimephales promelas	96 hour LC50	2800				3217
	Pimephales promelas	96 hour LC50	2740				12665
	Pimephales promelas	96 hour LC50	4550				12859
	Pimephales promelas	96 hour LC50	9160				12447
	Pimephales promelas	96 hour LC50	9700	5324.754363	5324.754363	8	2189
	Poecilia reticulata	96 hour LC50	2200	2200	2200	5	45297
D: A planktonic crustacean (e.g. cladoceran, copepod)	Ceriodaphnia dubia	48 hour EC50	4000				17097
	Ceriodaphnia dubia	48 hour EC50	4000	4000	4000	7	19602
	Daphnia magna	48 hour LC50	3340				12665
	Daphnia magna	48 hour LC50	2200				846
	Daphnia magna	48 hour LC50	330				16674
	Daphnia magna	48 hour LC50	6000	1953.028516	1953.028516	4	5184
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)	Aplexa hypnorum	96 hour LC50	5500	5500	5500	9	
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	362.2154055
Number of data requirements satisfied	5
Select Secondary Acute Factor	6.1
Secondary Acute Value	59.37957468
ACR	18

Derivation of Freshwater Aquatic Life Criteria

1,2,4-Trimethylbenzene (95636) **June 20, 2007**

Criteria (ug/L)	
Acute:	141.50
Chronic:	15.72

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50 96 hour LC50 96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Pimephales promelas	96 hour LC50 96 hour LC50	7720	7720	7720	2	12858
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50 96 hour LC50 96 hour LC50 96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magma	48 hour EC50 48 hour EC50	3679	3679	3679	1	11936
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	3679
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	283
ACR	18

Derivation of Freshwater Aquatic Life Criteria
1,3,5-Trimethylbenzene (108678) **June 20, 2007**

Criteria (ug/L)	
Acute:	237.00
Chronic:	26.33

Data Requirements Data from 8 Different Families including:	Organism	Test Type	Result	SMAV	GMAV	Rank GMAV	Reference
A: The family Salmonidae in the class Osteichthyes		96 hour LC50					
B: One other species, warm water, commercially/recreationally important - Osteichthyes (e.g.bluegill, channel catfish)	Carassius auratus	96 hour LC50 96 hour LC50	12520	12520	12520	2	416
C: A third family in the phylum Chordata (e.g. fish, amphibian)		96 hour LC50					
D: A planktonic crustacean (e.g. cladoceran, copepod)	Daphnia magma	48 hour EC50 48 hour EC50	6162	6162	6162	1	11936
E: A benthic crustacean (e.g. ostracod, isopod, amphipod)							
F: An insect (e.g. may-, dragon-, damsel-, stone-, caddisfly, mosquito, midge)							
G: A faimly in a phylum other than Arthropoda or Chordata (e.g. Rotifera, Annelida, Mollusca)		96 hour LC50					
H: A family in any order of insect or any phylum not already represented		96 hour LC50					

Lowest GMAV	6162
Number of data requirements satisfied	2
Select Secondary Acute Factor	13
Secondary Acute Value	474
ACR	18

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Appendix C:
Proposed Revisions to Connecticut Aquatic Life Criteria –Criteria Obtained from GLI Clearinghouse

Criteria Obtained from GLI Clearinghouse Version 2		
Substance	State	Criteria Date
Volatile Substances		
Acetone	Indiana	5/4/1998
Benzene	Ohio	3/1/2006
Carbon disulfide	Ohio	3/1/2006
Carbon Tetrachloride	Ohio	3/1/2006
Chlorobenzene	Ohio	3/1/2006
Chloroform	Ohio	3/1/2006
Dibenzofuran	Ohio	3/1/2006
Dichlorobenzene, 1,2-	Ohio	3/1/2006
Dichlorobenzene, 1,3-	Ohio	3/1/2006
Dichlorobenzene, 1.4-	Ohio	3/1/2006
Dichloroethane, 1,1-	Ohio	3/1/2006
Dichloroethane, 1,2-	Ohio	3/1/2006
Dichloroethene, 1,2-	Ohio	3/1/2006
Dichloroethylene, 1,1-	Ohio	3/1/2006
Dichloroethylene, cis-1,2-	Indiana	6/26/2001
Dichloroethylene, trans-1,2-	Indiana	1/15/1999
Dichloropropene, 1,3-	Ohio	3/1/2006
Ethylbenzene	Ohio	3/1/2006
Methylene chloride	Ohio	3/1/2006
Methylnaphthalene, 2-	New York	6/1/1998
Nitrophenol, 2-	Ohio	3/1/2006
Tetrachloroethane, 1,1,1,2-	Ohio	3/1/2006
Tetrachloroethylene	Ohio	3/1/2006
Tetrahydrofuran	Ohio	3/1/2006
Toluene	Ohio	3/1/2006
Trichlorobenzene, 1,2,4-	New York	10/11/1984
Trichloroethane, 1,1,1-	Ohio	3/1/2006
Trichloroethane, 1,1,2-	Ohio	3/1/2006
Trichloroethylene	Ohio	3/1/2006
Vinyl chloride	Ohio	3/1/2006
Xylenes	Ohio	3/1/2006

Substance	State	Criteria Date
Semivolatile Substances		
Acenaphthene	Ohio	3/1/2006
Acenaphthylene	Ohio	3/1/2006
Anthracene	Ohio	3/1/2006
Benzo(a)anthracene	Ohio	3/1/2006
Benzo(b)fluoranthene	Ohio	3/1/2006
Butylbenzyl phthalate	Ohio	3/1/2006
Chlorophenol, 2-	Ohio	3/1/2006
Chrysene	Ohio	3/1/2006
Cresol, m-	Ohio	3/1/2006
Dichlorophenol, 2,4-	Ohio	3/1/2006
Diethyl phthalate	Ohio	3/1/2006
Dimethylphenol, 2,4-	Ohio	3/1/2006
Dinitrotoluene, 2,6-	Ohio	3/1/2006
Ethylene glycol	Ohio	3/1/2006
Fluoranthene	Ohio	3/1/2006
Fluorene	Ohio	3/1/2006
Isophorone	Ohio	3/1/2006
Methanol	Indiana	2/16/1999
Methylphenol, 2-	Ohio	3/17/2004
Naphthalene	Ohio	3/1/2006
Nitrosodiphenylamine, N-	Indiana	5/7/1997
Phenanthrene	Ohio	3/1/2006
Phenol	Ohio	3/1/2006
Propylene glycol	Ohio	3/1/2006
Pyrene	Ohio	3/1/2006
Inorganic Substances		
Antimony	Ohio	3/1/2006
Barium	Ohio	3/1/2006
Beryllium	Ohio	7/27/2005
Boron	Ohio	3/1/2006
Cobalt	Ohio	3/1/2006

Substance	State	Criteria Date
Silver	Ohio	3/1/2006
Thallium	Ohio	3/1/2006
Tin	Ohio	3/1/2006
Vanadium	Ohio	3/1/2006
Pesticides		
Lindane	Ohio	1/26/1998

Appendix D:
Proposed Revisions to Connecticut Human Health Based Water Quality Criteria

(provided as a separate electronic document)

Appendix E:
Toxicological Monographs

Source of Toxicity Values for Water Quality Criteria Calculations
April 2009
Connecticut Department of Public Health

The toxicity portion of the Water Quality Standards Water Quality Crieria equations involves the direct use of potency values such as reference doses (RfDs) or cancer slope factors (CSFs). The potency values condense a large amount of toxicity dose response information into a single number from which cleanup criteria can be calculated. While many toxicity values are available from USEPA's Integrated Risk Information System (IRIS), there are numerous chemicals that have not yet been reviewed on IRIS. Fortunately, there are high quality sources of toxicity values in addition to IRIS, most prominently being the Agency For Toxic Substances and Disease Registry's (ATSDR's) Minimum Risk Levels (MRLs), California EPA's Reference Exposure Levels (RELs) for non-cancer effects and CalEPA cancer potency values (these values are used to support California's drinking water Public Health Goals (PHGs and other programs). There are also the toxicity values listed on the USEPA Region III Risk-Based Concentration (RBC) table database. This last database provides a listing of IRIS values, but where these are not available, secondary tier values derived by USEPA but less well supported are also listed. These non-IRIS RBC values were generally developed by a USEPA program office such as the Superfund Office, and may be used by the Agency on a provisional, site-specific or internal basis. HEAST (Health Effects Assessment Summary Tables) values are also listed on the Region III RBC database. These values were well supported by USEPA until the late 1990s at which time the HEAST program was terminated and there was no further attempt to update HEAST. However, for some chemicals, the only toxicity determination can be found on HEAST.

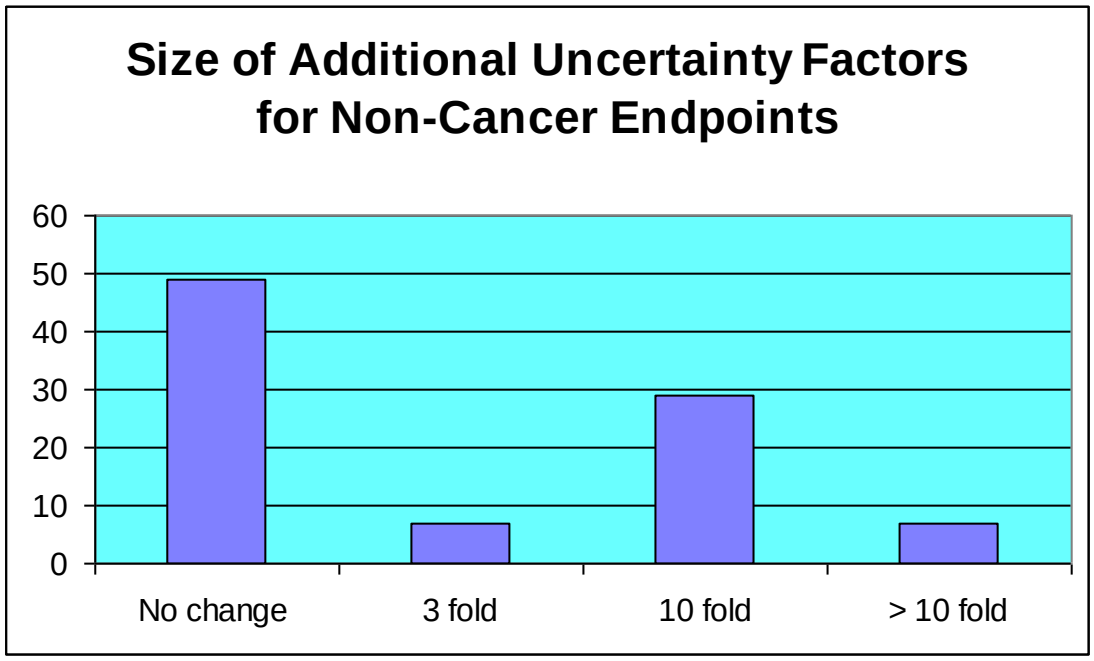
Connecticut DPH evaluated the array of toxicity information available for a particular chemical and selected among the choices mentioned above. Since IRIS has been a highly regarded source for many years, this remains the primary point of reference. However, the IRIS system has not been updated on a regular basis and numerous IRIS files have been superceded by more recent and robust analyses by ATSDR or CalEPA. Therefore, CTDPH selected from among the toxicity values available from USEPA, ATSDR and CalEPA. In addition, toxicity values for non-cancer endpoints (RfDs, MRLs, RELs) were reviewed by DPH with respect to whether there are substantial datagaps for routine non-cancer testing (subchronic, chronic, developmental, reproductive), datagaps for

specialty non-cancer testing that may be pertinent to a given chemical (e.g., endocrine effects, immune effects, neurodevelopmental effects), and datagaps with respect to cancer and genetic toxicology testing.

RfDs, MRLs and RELs do not attempt to account for potential carcinogenicity as cancer and non-cancer assessment are typically kept separate. However, in the final risk characterization phase, there can be considerable uncertainty associated with possible carcinogens (USEPA former Group C or IARC Group 3) and known animal carcinogens without cancer slope factors (USEPA Group B2 or IARC Group 2B). Specifically, the RfD-based cleanup target is often orders of magnitude higher than a cancer slope factor-based cleanup target. To cover the possibility that the chemical is a carcinogen that would require more stringent cleanup criteria if there were better long-term testing, an additional uncertainty factor has been applied in certain cases. This 3 or 10 fold factor is applied where warranted based upon the evidence of carcinogenicity and genetic toxicity for the chemical or closely related analogues.

Finally, there were a few cases in which none of the sources of toxicity information provided a relevant value but CTDPH found sufficient information to derive a toxicity value for the water quality criteria program.

The following monographs describe the available toxicity information and value selection for chemicals/chemical groups for which the IRIS database was not necessarily the primary data source. This is not the entire list of chemicals. Those not presented in the following monographs received the value presented in the current IRIS file and were not described further because the selection process was straightforward and ended up using the default data source (IRIS). Finally, there are chemicals for which there was insufficient data for a potency determination and so either no value was derived or a value from a close structural analogue was used in its place.


Size of Additional Uncertainty Factors for Non-Cancer Endpoints
60
50
40
30
20
10
0
No change
3 fold
10 fold
> 10 fold

Acetonitrile

Non-cancer -

IRIS RfD: Not available
IRIS RfC: 0.06 mg/m3 (0.017 mg/kg/d)
ATSDR MRL: Not available
CalEPA Chronic REL: Not available

The USEPA RfC (1999) is based upon a NOAEL in 1996 NTP studies in rats and mice. It includes a 1000 fold cumulative uncertainty factor. The NTP inhalation studies showed substantial g.i. tract toxicity (forestomach inflammation and hyperplasia) which was attributed to preening of fur. This suggests that acetonitrile can have more substantial oral toxicity than inhalation toxicity. However, the old RfD that had been on IRIS was withdrawn due to questions regarding interpretation of the unpublished 1983 inhalation study and attendant dose route extrapolation.

Cancer –

IRIS: classified as "D" – equivocal evidence in animals and no evidence in humans; NTP 1996 studies: dose-related increases in hepatocellular and alveolar tumors. However, no slope factor is available. Not a mutagen
CalEPA Unit Risk: Not available;

Conclusion – Base the RfD on the IRIS RfC of 0.017 mg-kg-d with dose route extrapolation and 3x database uncertainty factor due to suggestive evidence that oral is more toxic than inhalation and due to equivocal evidence of cancer. This yields **0.005 mg-kg-d.**

Acrolein:

Non-cancer –

IRIS RfD: 5E-04 mg-kg-d
ATSDR oral MRL(int duration): 0.004 mg-kg-d
(no chronic oral MRL available)
CalEPA Chronic REL: 0.06 ug/m3 (local toxicity)

IRIS RfD derived in 2003 based upon a chronic rat study which saw dose-related increased mortality and 100 fold uncertainty factor from the NOAEL.

Cancer – IRIS: classification – not determined; historically was Group C but downgraded on IRIS in 2003 because of negative bioassay data from in gavage studies in rats and mice from 1992 and questions raised about positive cancer findings in adrenal cortex of female rats from a 1987 drinking water study. A 1992 initiation/promotion assay via injection had positive findings but was unorthodox and difficult to interpret. Acrolein is mutagenic and clastogenic in a wide variety of bacterial and mammalian in vitro systems, although there are a number of negative studies as well. It is highly reactive and transient and so may be difficult to adequately submit to different test systems.

CalEPA Unit Risk: Not available

Conclusion – The IRIS RfD is reasonable for non-cancer effects but does not capture the mutagenic and carcinogenic potential, that in available testing suggests that under certain exposure conditions, acrolein might be a cancer risk (contact sites with depleted cellular defense mechanisms). For this reason, a 10 fold uncertainty factor is used to lower the RfD to **0.00005 mg/kg/d**.

Alachlor:

Non-cancer –

IRIS RfD (1993): 0.01 mg/kg/d based upon RBC effects in dogs from 1 year feeding study
ATSDR MRL: Not available

Cancer –

IRIS: classification – Not Available
Oral Slope Factor = 0.08 – HEAST

CalEPA oral slope: 0.056/mg-kg-d from 1997 Public Health Goal for Drinking Water, based upon rat nasal tumors from 2 yr feeding study with other tumor types also occurring.

Conclusion – Rely upon the CalEPA slope factor (**0.056/mg-kg-d**) as it is better supported and documented than the value on HEAST; although nasal turbinate tumors may be suspected of being derived from the manner in which the rats feed, other tumors of the thyroid and stomach are supportive of a carcinogenic effect. The test material was stabilized with 0.5% epichlorhydrin and so the possibility of a contributing effect from this carcinogen cannot be ruled out. Alachlor has been positive in a wide variety of bacterial and mammalian gene tox studies, although not in all studies.

Aluminum:

Non-cancer –

IRIS : No values available
ATSDR (2009) chronic oral MRL: 1 mg/kg/d

Cancer – Not applicable

Conclusion – Reduce the ATSDR chronic MRL by a factor of 3 to **0.3 mg/kg/d** because ATSDR extrapolated from a LOAEL to NOAEL with a factor of 3, calling it a minimal LOAEL. However, a full 10x factor is more appropriate based upon the number of endpoints affected by aluminum in this dose range and the limited dose response information available in the key chronic study (Golub et al 2000). Further, ATSDR's subchronic MRL is the same as their chronic MRL but aluminum body burden and toxicity should increase with duration. The 10 fold LOAEL to NOAEL approach brings the RfD to a level that is 3 fold below the intermediate MRL, which is still a modest adjustment for going from subchronic to chronic. Also, this brings the overall uncertainty factor to 1000 rather than 300. The adjusted MRL of 0.3 mg/kg/d is within the range of dietary background exposure (0.1 to 0.3 mg/kg/d) (ATSDR, 2009 Toxicological Profile for Aluminum). This minimizes the potential that contaminated media could represent a significant aluminum exposure source relative to the diet.

Ammonia:

Non-cancer –

IRIS RfD: Not available
ATSDR oral MRL: not available
ATSDR inhal chronic MRL: 0.1 ppm

The inhalation MRL is equivalent to 0.02 mg/kg/d which is reasonable for setting an oral RfD given that the inhalation study was a no effect study and so there is nothing obvious about a local respiratory effect that would prevent it from being relevant to oral exposure. One may conclude that oral dosing could be more potent due to bolus nature of gavage dosing. However, the lack of toxicity in the inhalation study provides confidence that additional uncertainty factor is not needed.

Cancer – Non-carcinogen

Conclusion – Since no oral MRL or RfD, use chronic inhalation MRL with dose route extrapolation to yield **0.02 mg/kg/d.**

Atrazine:

Non-cancer –

IRIS RfD: 0.035 mg-kg-d
ATSDR subchronic oral MRL: 0.003 mg-kg-d

IRIS RfD based upon NOAEL for body weight effects in rat 2 yr study. ATSDR subchronic MRL is 100 fold lower and based upon more recent endocrine study that assessed more sensitive developmental and endocrine endpoints. The intermediate MRL derivation is the NOAEL divided by a cumulative UF of 300.

Cancer – IRIS: classification – Not Available, but EPA risk assessments have declared atrazine MOA for mammary tumors is not relevant to humans on basis that hormonal regulation in general and endocrine senescence in particular are very different across species.

CalEPA oral slope: 0.23/mg-kg-d from 1999 Public Health Goal for Drinking Water; they considered the rat mammary tumors relevant. There are human studies suggestive of a mammary tumor risk from atrazine exposed workers or community members, but overall the evidence is equivocal.

Conclusion – The CalEPA slope factor yields a de minimis risk at 4.3E-06 mg-kg-d; The ATSDR subchronic MRL divided by 10 (for subchronic to chronic) yields 3E-04 mg-kg-d, 100 fold less conservative than the cancer based value. It is appropriated to divide the chronic MRL by 10x for possible cancer; however, that produces a cumulative UF from the ATSDR MRL plus subchronic to chronic and for possible carcinogenicity of 30,000 fold. Therefore, the cancer UF is adjusted to 3 fold to yield **1E-04 mg/kg/d** as an RfD for the current purpose.

Benzene:

Non-cancer –

IRIS RfD: 0.004 mg-kg-d
ATSDR chronic oral MRL: 0.0005 mg-kg-d

IRIS RfD based upon benchmark dose analysis of decreased lymphocyte counts in an exposed worker population and a combined 300 fold UF. ATSDR oral MRL is based upon both worker data and rat 2 year NTP study showing hematological effects.

Cancer – IRIS: classification – Known Human Carcinogen
CSF = 1.5 to 5.5E-02 / mg/kg/d
CalEPA oral slope: 0.1/mg-kg-d is a synthesis of 5 oral gavage studies in rats and mice and 6 inhalation worker studies; the slope factor also involves dose route extrapolation.

USEPA provides a range of oral slope factors as derived via dose route extrapolation from an inhalation unit risk range calculated by EPA 1998. The range considers different workplace studies, endpoints and low dose modeling techniques. The CalEPA analysis is as reported in 2002 (Hot Spots Technical Support Document for Cancer Potency Values, Dec, 2002).

Conclusion – The CalEPA slope factor has greater relevance due to the inclusion of numerous gavage studies; It yields a de minimus cancer risk-based target of 1E-05 mg-kg-d which is slightly below the ATSDR chronic MRL. Therefore, base RSR calculations on benzene cancer risk at **a slope factor of 0.1/mg-kg-d**.

Beryllium:

Non-cancer –

IRIS RfD (1998): 0.002 mg-kg-d
ATSDR MRL: not available

IRIS RfD based upon benchmark dose analysis of small intestinal lesions from a 3 yr dog dietary study with a cumulative UF of 300 fold. IRIS RfC is 0.02 ug/m3 based upon airway sensitization in human studies. This calculates to 5.7E-06 mg/kg/d. .

Cancer – IRIS: classification – B1 for inhalation exposure; data insufficient to assess oral exposue. IV study yielded systemic tumors (osteosarcomas) in rabbits.

Conclusion – The IRIS RfC may be protective against certain but not necessarily all endpoints. Beryllium is a sensitizing agent that may produce immunologic reactions in the g.i. tract, systemic circulation or skin. Additionally, beryllium is carcinogenic by the inhalation and i.v. routes, with oral exposure not well studied. Given these toxicities and uncertainties, it is appropriate to lower the RfD 10x to **0.0002 mg/kg/d.**

Bis-2-(Chloroethyl)ether:

Non-cancer – Potent carcinogen and mutagen so non-cancer effects will not be risk driver.

Cancer – IRIS: classification – B2
CSF (1994) = 1.1/ mg/kg/d
CalEPA oral slope: 2.5/mg-kg-d presented in Hot Spots Tech Support Document, 2002

Conclusion – The CalEPA slope factor is more recent and better documented than the value on IRIS and so is selected: **2.5/mg/kg/d**.

Bis(2-chloroisopropyl)ether

Non-cancer –

IRIS RfD: 0.04 mg/kg/d
Based upon hematologic effects in 2 yr gavage study in mice, with 1000 fold UF used to extrapolate from the NOAEL.
ATSDR MRL: not available

Cancer – IRIS: not available
HEAST = 0.07/ mg/kg/d
Based on 2 yr gavage study in mice which found elevated liver and lung tumors.
CalEPA: not available

Conclusion – The HEAST oral slope factor leads to a lower cleanup target and so is the risk driver compared to the RfD. The carcinogenicity of this compound is supported by cancer effects for similar bis-chloroalkyl ethers on IRIS. Therefore, the HEAST slope factor is appropriate for the current purposes (**0.07/mg-kg-d).**

Bromomethane:

Non-cancer –

IRIS RfD (1991): 0.0014 mg-kg-d
ATSDR chronic oral MRL: 0.0005 mg-kg-d

IRIS RfD based upon subchronic gavage study in rats showing forestomach hyperplasia; 1000x UF from a NOAEL to yield the RfD(chronic value). EPA Superfund Office has since derived a subchronic RfD of 0.005 mg/kg/d.

Cancer – IRIS: classification – Group D

Methyl bromide is a mutagen but was negative in chronic bioassays via inhalation exposure in mice (NTP, 1992). It is also structurally related to ethyl bromide, which had equivocal carcinogen test results in NTP studies.

Conclusion – The Superfund provisional subchronic value is a reasonable starting point for RfD derivation. Subchronic to chronic UF plus uncertainty of possible carcinogenicity (mutagen but negative results in NTP inhalation bioassay, 1992) leads to 10x lowering of the subchronic PPRTV RfD to yield **0.0005 mg/kg/d.** This is also consistent with the ATSDR chronic MRL.

Butyl Benzyl Phthalate

Non-Cancer

IRIS RfD (1993): 0.2 mg/kg/d
(liver wt effects in 6 month rat dietary study; NOAEL with 1000x UF)

Cancer

EPA (1993-IRIS): Group C classification, no slope factor derived
Region III table indicates a Provisional EPA oral slope factor of 1.9E-03.

Conclusion: Uncertainty in BBP RfD is large given that it was derived a long time ago before there was much consideration of endocrine effects of phthalates. More recent studies (e.g., Ema & Miyawaki, 2002 Reprod Toxicol 16: 71-76) demonstrate a BBP effect on male development in utero, consistent with findings for other phthalates. The uncertainties this raises for cumulative and chemical-specific risk has caused the NAS to form a special review panel. This panel determined that cumulative risk assessment is appropriate for phthalates because of common exposure and common modes of action. The combination of uncertainties regarding low dose endocrine disruption effects, possible carcinogenicity and the potential for cumulative endocrine effects causes an additional 10x UF to lower the RfD to **0.02 mg/kg/d**.

Cadmium

Non-Cancer

IRIS RfD (1994): 0.0005 mg/kg/d from drinking water
0.001 mg/kg/d from food
(renal toxicity in human studies: NOAEL/10x UF)

ATSDR chronic oral MRL (1999): 0.0002 mg/kg/d
Based upon lifetime accumulated threshold of cadmium in kidney associated with toxicity in Japanese population study with 10x UF for inter-human variability. ATSDR describes how little margin of safety is built into this MRL and that alternative methods of derivation yield lower targets.

Cancer

IRIS (1992): B1 – limited epidemiological evidence plus positive studies via inhalation and injection. However, 7 oral studies with Cd salts were negative – these all had significant methodological limitations.

CalEPA (1996) – published commentary that Cd likely has carcinogenic action by oral route based upon more recent studies (oncogenicity via oral route in zinc-deficient rats, genetox studies) but no slope factor calculated. (Collins, et al, Reg Toxicol Pharmacol 23: 298-299, 1996).

CalEPA (2006) – drinking water PHG for Cd – concluded that oral cancer data suggestive but inadequate for quantitative derivation of slope factor. They used a 10x UF to lower the RfD for cancer potential via oral route.

Conclusion: ATSDR chronic oral MRL is more up-to-date than IRIS evaluation and it better accounts for low dose effects and lack of safety margin for Cd renal effects in humans; CalEPA has a non-cancer daily exposure dose as part of their PHG that is lower than the ATSDR MRL. The MRL is chosen as a non-cancer toxicity value between the IRIS and CalEPA values and then like CalEPA, a 10x UF is used to account for possible carcinogenicity. This yields an RfD of **0.00002 mg/kg/d.** ((NOTE: This dose is approximately an order of magnitude below average dietary exposure to Cd (ATSDR Tox Profile, 2008))).

Carbazole

Non-Cancer

IRIS: Not available
ATSDR MRL: Not available
CalEPA: Not available

Cancer

IRIS: Not available
USEPA/HEAST: (B-2 classification) CPF = 0.02/mg-kg-d
HEAST slope factor based upon a 96 wk dietary study in mice which yielded elevated levels of liver tumors (Tsuda, et al 1982 - J NATL CANCER INST. 69: 1383-1389)..

CalEPA – not available

Conclusion: Carbazole is a PAH with some genotoxic (e.g., Jha and Bharthi, 2002, Mut Res 500: 97-101) and carcinogenic evidence (Tsuda, et al 1982) that has not been fully evaluated by the IRIS process or by other juridictions. However, the available evidence and HEAST entry is sufficient to set RSR targets based upon the cancer risk using the CPF of **0.02/mg-kg-d**.

4-Chloroaniline

Non-Cancer:

IRIS (1995): 0.004
NOAEL for splenic effects in rat chronic bioassay divided by a 3000 cumulative UF

ATSDR MRL – not available

Cancer:

IRIS: not available
USEPA/Region III RBC table – CSF = 0.054/mg-kg-d (provisional value)
CalEPA: not available

IARC (1993): 2B – animal carcinogen , positive in a variety of genetox studies, including several in vitro mammalian studies. IARC declared it has sufficient evidence of cancer in animals based upon hemangiosarcomas and liver tumors in chronic mouse studies.

Conclusion: Use the provisional oral CSF of **0.054/mg-kg-d** from the Region III table given that this compound is positive in mutagenicity assays, is listed on IARC as a 2B carcinogen, and is part of the class of aromatic amines which has carcinogenicity as a common feature. The IRIS RfD would lead to a cancer risk of 2E-04.

Chloroethane

Non-Cancer

IRIS (1991): RfD – not available
RfC – 10 mg/m3

NOAEL for developmental effect divided by cumulative UF of 300

ATSDR MRLs: only MRL available is an acute inhalation value.

California Chronic REL: 30 mg/m3

Since the chloroethane effect is systemic (fetal development), it is feasible to extrapolate from inhalation to oral exposure, yield an extrapolated RfD of 2.9 mg/kg/d

Cancer

IRIS/USEPA – no published assessments

Cal/OEHHA – Prop 65 Evaluation (2001) – chloroethane is listed as a carcinogen within Prop 65 and California has made a no significant risk determination for its content in products based upon their derived slope factor of 0.0047/mg-kg-d. That derivation is from a 1989 NTP study in mice in which chronic inhalation of a high concentration led to a large increase in uterine tumors.

IARC (1998) – Group 3 – limited evidence of carcinogenicity
Chloroethane is positive in several mutagenicity tests although, overall the results are mixed.

ATSDR Tox Profile describes chloroethane as having positive tumor response in mouse NTP studies, primarily uterine and liver tumors. Further chloroethane is likely an alkylating agent based upon structure.

Conclusion: Utilize the Cal/OEHHA Prop 65 derived CSF of **0.0047/mg-kg-d**. This potency is assumed relevant to both the inhalation and oral route as the target site was systemic. Cal/OEHHA considered the potency independent of dose route for the purposes of Prop 65.

Chloroform

Non-cancer -

IRIS RfD (2001): 0.01 mg-kg-d
ATSDR chronic oral MRL (1998): 0.01 mg-kg-d
CalEPA Chronic REL: Not available

The RfD is based upon a LOAEL for fatty changes in the liver of dogs exposed via orally administered for 7.5 years divided by a 1000x UF. ATSDR selected the same critical study and derived a numerically equivalent MRL as the IRIS RfD.

Cancer –

IRIS (2001): classified as B2
Oral slope factor – not derived
Inhalation unit risk – 2.3E-05/ug-m3 (equiv to 0.08/mg-kg-d)
CalEPA (2002) – 0.019/mg-kg-d

Chloroform testing shows a reproducible kidney tumor response via oral gavage dosing in lab animals. Mechanism of Action (MOA) analysis led USEPA/IRIS to conclude that low dose linear modeling is not appropriate and so the Margin of Exposure (MOE) approach was used. That found that the difference between the low effect level for kidney cancer was 2000 times above the RfD which brought about the conclusion on IRIS that the RfD is adequately protective against cancer. However, a low dose linear slope factor is applied for inhalation exposure on IRIS and this is from a gavage study using dose route extrapolation. Further CalEPA (2002) derived an oral slope factor of 0.019/mg-kg-d based upon animal kidney tumors and pharmacokinetic modeling of chloroform metabolism. This yields a target 1 in a million exposure level of 5E-05 mg/kg/d, a value that is 200 fold lower than the RfD.

Conclusion: Since low dose linear modeling is debatable for chloroform, it is reasonable to utilize the RfD divided by a 10x UF for cancer potential, yielding a modified RfD of 0.**001 mg/kg/d**. The theoretical cancer risk at this chronic exposure level is 2E-05 using low dose linear assumptions.

Chloromethane

Non-cancer -

IRIS RfD: not available
IRIS RfC (2001): 90 ug/m3 (0.026 mg/kg/d)
ATSDR chronic inhal MRL (1998): 100 ug/m3
CalEPA Chronic REL: Not available

The IRIS RfC is based upon a NOAEL for CNS lesions in a mouse 11 day inhalation study with a 1000 fold UF. ATSDR inhalation MRL is essentially the same.

Cancer –

IRIS (2001): acknowledges some carcinogenic and mutagenic evidence but considers its MOA for mouse renal tumors as more cytotoxic than mutagenic and so doesn't use low dose linear approach.
CalEPA – no cancer assessment

Conclusion – Use the IRIS RfC and dose route extrapolation for systemic toxicity of methyl chloride to yield an RfD equivalent of 0.026 mg/kg/d. This is divided by 10 fold UF for possible carcinogenicity given that methyl chloride can form formaldehyde in vivo, is positive in a broad array of mutagenicity studies and has some positive carcinogenicity results (mouse kidney tumors). This approach yields an RfD of **0.0026 mg/kg/d.**

2-Chlorotoluene

Non-cancer -

IRIS RfD (1990): 0.02 mg-kg-d
ATSDR MRL: not available
CalEPA Chronic REL: Not available

The RfD is based upon a NOAEL for body wt effects in a subchronic gavage study in rats with a 1000 fold UF to derive a chronic RfD.

Cancer –

IRIS : not evaluated
IARC: not evaluated

Conclusion – There are many gaps in the chlorotoluene database (reproductive testing, oral developmental – some evidence of teratogenicity by inhalation route – cancer testing, mutagenicity testing – one report of Ames + result). This merits a 10 fold UF for data gaps to lower the RfD to **0.002 mg/kg/d.**

p-Chlorotoluene – database also quite limited – use 2-chlorotoluene as surrogate which results in an RfD of **0.002 mg-kg-d.**

Chromium, Hexavalent

Non-cancer -

IRIS RfD (2001): 0.003 mg-kg-d
ATSDR oral MRL: not available

The RfD is based upon a NOAEL (no LOAEL found) in a 1 year drinking water study in rats from 1958; EPA applied a 300 fold UF. This value matches the ESADDI (estimated safe and adequate daily dietary intake) for total chromium of 0.003 mg-kg-d set in acknowledgement that it is a trace nutrient. Background exposure to total chromium in the diet is approximately 0.001 mg/kg/d (ATSDR, 2000).

Cancer –

IRIS: human carcinogen by inhalation route; not evaluated by oral route
CalEPA (2002) – 0.41/mg-kg-d (stomach tumors from a 1968 dietary study in mice).
Recent NTP study indicates drinking water exposure in rats and mice caused oral cavity and small intestinal tumors. USEPA OPPTS has derived an oral slope of 0.79/mg-kg-d from the NTP data (USEPA, 2008).

Conclusion – Cr VI is a well recognized inhalation carcinogen to the contact site (respiratory tract) and now multiple studies by oral dose route indicate a similar finding at oral contact sites. The 1 in a million dose level based upon the CalEPA and USEPA's slope factors is approximately 2E-06 mg/kg/d, 3 orders of magnitude below the IRIS RfD. Given that the CalEPA and USEPA OPPTS potency values are similar even though based upon very different datasets improves confidence in using the CSF of **0.79/mg-kg-d** for CrVI.

Cobalt

Non-cancer -

IRIS RfD: not available
ATSDR oral MRL (subchronic): 0.01 mg/kg/d

ATSDR's subchronic MRL is based upon a LOAEL (1 mg/kg/d) for RBC abnormalities in a human study involving 6 volunteers exposed orally for up to 22 days (ATSDR, 2004). The LOAEL was divided by 100 fold cumulative UF.

Cancer –

IRIS: not evaluated
CalEPA – not evaluated

NTP (1998) demonstrated pulmonary tumors at doses of 0.38 to 1.14 mg/m3 from chronic inhalation exposure in rats and mice. No oral tumor studies are available.

Conclusion – Cobalt's database is relatively weak lacking any chronic oral studies. Limited endocrine/reproductive evidence in rodents indicates that cobalt targets the testes. However, the manifestations of this effect at low dose in well designed studies are not known. Further, cobalt's oncogenic potential via the oral route is unexplored. It has mixed mutagenicity data but appears to induce DNA damage and is a clastogen (ATSDR, 2004). Given this, a 10 fold UF to extrapolate the subchronic MRL to a chronic value and an additional 3 fold UF for database deficiencies is appropriate (possible carcinogen; unexplored male gonadal effects) leading to an RfD of **0.0003 mg/kg**/d. Cobalt is a trace nutrient with a Recommended Daily Allowance (RDA) as part of Vitamin B12 of 0.1 ug/d (1.4E-06 mg/kg/d). The modified RfD is 200 fold above the RDA indicating that it will not inappropriately limit intake of this element.

Copper

Non-cancer -

IRIS RfD: not available
ATSDR oral MRL (subchronic) (2004): 0.01 mg/kg/d

ATSDR's subchronic MRL is based upon numerous studies showing gastrointestinal effects in humans from copper-containing beverages with LOAELs generally in the 0.05 to 0.1 mg/kg/d range. The subchronic MRL is the same as ATSDR's acute MRL as length of exposure does not seem to be a major factor. The MRLs are based upon human studies and set with a minimal (3-4 fold) cumulative UF.

Cancer –

IRIS: copper not considered to be carcinogenic

Conclusion – Copper health effects occur in humans upon short-term exposure to 0.1 mg/kg/d. The 2004 ATSDR MRLs are useful for establishing RSR criteria **at 0.01 mg/kg/d.** This is the vicinity of background dietary exposure. Background exposure to copper resulting from water ingestion from natural waters (20 ug/L) is low (0.0006 mg/kg/d) but can be much higher from copper plumbing (over 1000ug/L or 0.029 mg/kg/d). However, levels this high involve extensive leaching and improper management of pH.

m-Cresol

Non-cancer -

IRIS RfD (1990): 0.05 mg-kg-d
ATSDR oral MRL (subchronic): 0.1 mg/kg/d

IRIS RfD from a 90 day rat gavage study that showed body wt and neurotoxicity effects; USEPA used a 1000 fold UF from the NOAEL of 50 mg/kg/d. ATSDR's subchronic MRL is based upon a 1992 NTP study in rats involving mixed m/p-cresol dietary exposure. A variety of toxic effects were found with pathological changes in the nose the most sensitive effect. However, this may be from m/p-cresol offgasing and not a systemic effect. The MRL derivation used benchmark dose analysis and a 100 fold UF from the benchmark dose.

Cancer –

IRIS: Group C (1991
CalEPA – not evaluated

IRIS Group C listing based upon limited evidence of skin tumor promotional activity and mixed results in genetic toxicology studies.

Conclusion – m-Cresol has undergone very limited cancer testing and given some indication of potential genetic toxicity and activity as a skin promoter, a 3 fold UF is applied to yield **0.017 mg/kg/d**.

2,4-Dichlorophenoxy Acetic Acid (2,4-D)

Non-cancer -

IRIS RfD (1988): 0.01 mg/kg/d
ATSDR subchronic MRL: 0.01 mg/kg/d
CalEPA PHG (1997): 70 ug/L – uses same RfD approach as in IRIS

IRIS RfD derived from subchronic oral data in rats in combination with a 1 year interim report of a 2 year rat oral bioassay. The NOAEL for systematic toxicity (hematologic, liver, renal) of 1 mg/kg/d was divided by 100 fold.

ATSDR's subchronic MRL is based upon a LOAEL (1 mg/kg/d) for RBC abnormalities in a human study involving 6 volunteers exposed orally for up to 22 days (ATSDR, 2004). The LOAEL was divided by 100 fold cumulative UF.

Cancer –

IRIS: not evaluated, but USEPA, FR, Aug 8, 2007 decided not to initiate a special review on 2,4-D's pesticidal use on the basis that its weight of evidence conclusion was negative on human carcinogenicity.
CalEPA – negative animal studies, suggestive epidemiological data, no slope factor derived
IARC (1987) – 2B based upon an extensive review of evidence in humans, particularly for NHL and soft tissue sarcoma; and insufficient evidence in animals for which oral and injection studies provided some evidence of tumor effect but animal studies were deemed too limited to draw conclusions. More recent animal study failed to confirm earlier suggestive findings (Charles, et al., FAT 33: 166-172, 1996.

Conclusion – While 2,4-D has largely negative animal test data for oncogenicity, its association with human non-Hodgkin's lymphoma in various epidemiology studies still makes it a suspect human carcinogen. It is negative in bacterial mutagenicity studies but has shown weakly positive responses in a number of genetic damage/cytogenetic studies in human cell lines (GAP database). Further, 2,4-D worker lymphocytes have shown abnormalities in replication index studies (Holland, Mut Res 521(1-2):165-78 2002) and in apoptosis (Kaioumova, Hum Immunol 62: 64-74, 2001). 2,4-D was also found to modulate gene expression at low dose in culture (Bharadwaj L Toxicol in Vitro 19: 603-619, 2005). While several weight of analysis papers have not substantiated the link to human cancer, the equivocal nature of the epidemiology data plus evidence for low dose in vitro perturbation of lymphocytes suggest ongoing uncertainty with regards to carcinogenic potential. Use of a 10x UF for possible carcinogenicity to divide into the IRIS RfD yields a modified value of **0.001 mg/kg/d.**

1,2-Dibromo-3-Chloropropane

Non-cancer -

IRIS RfD (provisional as listed by Region III): 0.0002 mg-kg-d
ATSDR MRL: not available

Cancer –

IRIS: not available, but USEPA has a provisional oral slope of 0.8/mg-kg-d (listed on Region III table)
CalEPA – 7/mg-kg-d (OEHHA Tech Support Doc, 2002)

Conclusion – 1,2-DB-3-CP is a mutagen and carcinogen (B2). USEPA provisional values are not on IRIS and not well peer reviewed. CalEPA CSF is well documented and supported and so is used: **7/mg/kg/d.**

1,3-Dichlorobenzene

Non-cancer -

IRIS RfD: not available
internal EPA value on Region III table is 0.003 mg-kg-d
ATSDR intermediate oral MRL: 0.02 mg/kg/d

Cancer –

IRIS: not available,
CalEPA – not available
IARC – Group 3 – some + genetox but mixed

Conclusion – 1,3-DCB has an MRL and interim EPA RfD that are in agreement if one divides the intermediate MRL by 10x to extrapolate from subchronic to chronic. It has not been tested in cancer bioassays and is not mutagenic in bacterial assays but there is some evidence of genetic toxicity in other tests. It is a structural analogue of 1,4-DCB which is a B2 carcinogen. Therefore, it is appropriate to apply a 3x UF for possible carcinogenicity to yield **0.001mg/kg/d.**

1,4-Dichlorobenzene

Non-cancer -

IRIS RfD: not available
internal EPA value from Region III RBC is 0.03 mg-kg-d
ATSDR chronic oral MRL: 0.07 mg/kg/d

Cancer –

IRIS: not available,
HEAST oral slope = 0.024/mg-kg-d
CalEPA – 0.04 / mg-kg-d (OEHHA Tech Support Doc, 2002)
- 0.0054 / mg-kg-d (OEHHA, 1997 1,4 DCB PHG)

Conclusion – 1,4-DCB has produced renal and liver tumors by the oral route in NTP (1987) rat studies and liver tumors in mouse studies. It was negative in bacterial mutagenicity studies but positive in yeast mutagenicity tests with mixed results in clastogenic assays. CalEPA has derived 2 different oral slope factors that are approximately an order of magnitude apart. The one derived for the air toxics hot spot program (2002, but based upon a Cal DHS 1988 determination) is 0.04/mg/kg/d and the one for the drinking water Public Health Goal (1997) is 0.0054/mg/kg/d. Both are listed on the Cal OEHHA toxicity potency database (http://www.oehha.org/risk/ChemicalDB/index.asp) with the greater potency pertaining to air toxics and the lower potency applicable to drinking water. This is not logical since both values were derived from the same NTP oral mouse dataset and the methodology for calculating the two different values appears to be the similar (body weight scaling from mice to humans only noticeable difference). Given this discrepancy, the HEAST potency value of **0.024/mg-kg-d** is selected instead. It is in between the two California values and, even though not actively supported by USEPA today, it was thoroughly reviewed at the time it was posted on the HEAST database.

Dichlorodifluoromethane

Non-cancer -

IRIS RfD: 0.2 mg/kg/d
HEAST RfC: 0.05 mg/kg/d
ATSDR MRL: not available

IRIS RfD based upon an oral feeding study in which there was only a body wt effect at the high dose (3000 ppm). Given the volatility of this compound, dietary feeding may not be an effective delivery method. An inhalation RfC has been developed (HEAST-alternative list) that is 4 times lower; this is based upon liver lesions in a guinea pig 6 week inhalation study, with a 10,000 fold UF used to extrapolate from a subchronic LOAEL to a chronic RfC.

Cancer –

IRIS: not available
IARC: not available
CalEPA – not available
Negative in several genetic toxicology studies.

Conclusion – Dichlorodifluoromethane had no discernable toxicity in the chronic oral dietary study, but is highly volatile and so some material may have been lost. The inhalation study which found liver lesions from subchronic dosing of guinea pigs may be a more reliable basis in that there is no question about compound delivery and it did find systemic effects. This is also appropriate to use given that dichlorodifluoromethane contamination will likely lead to at least as much inhalation as oral exposure. Therefore, the HEAST RfC is used as a basis for this compound, yielding an RfD (converted from RfC) of **0.05 mg/kg/d**.

1,1-*Dichloroethane*

Non-cancer -

IRIS RfD: not available
HEAST RfD: 0.1 mg/kg/d
ATSDR MRL: not available

USEPA/HEAST RfD based upon dose route extrapolation from a 13 wk inhalation study in rats which found no toxicity at the low dose, equivalent to 115 mg/kg/d. HEAST applied a 1000 fold UF to extrapolate to a chronic RfD.

Cancer –

IRIS: Group C, limited evidence in animals
IARC: not available
CalEPA – not available
Only one genetox study in GAP-2000 database – it was positive. It also binds to DNA. Structurally related to 1,2-dichloroethane, a mutagen and B2 carcinogen.

NTP gavage studies of 1,1-dichloroethane found elevations in mammary and blood vessel tumors in female rats and liver tumors in male mice. However, cancer slope factors have not been calculated (See IRIS summary file for 1,1-DCA).

Conclusion – 1,1-Dichloroethane has carcinogenic potential as evidenced in the 1978 NTP studies. Therefore a 10 fold cancer potential uncertainty factor is applied to the HEAST RfD leading to a modified RfD of **0.01 mg-kg-d.**

1,2-*Dichloroethene(cis/trans/total)*

Non-cancer -

IRIS RfD: 0.02 mg/kg/d (trans isomer)
EPA Provisional: 0.01 mg/kg/d (cis isomer)
HEAST RfD: 0.009 mg/kg/d (mixed isomers)
ATSDR MRL: not available

IRIS RfD is for the trans isomer based upon a 90 day drinking water study in mice using a NOAEL for enzyme leakage into blood divided by 1000 fold UF. HEAST RfD for mixed isomers from 2 yr dietary study in rat based upon LOAEL for liver toxicity divided by 1000 fold UF.

Cancer –

IRIS: Group D for cis isomer;
IARC: not available
CalEPA – not available
GAP database indicates mixed, majority negative gene tox studies for trans isomer.

Conclusion – 1,2-Dichloroethylene isomers and mixture of isomers have very similar toxicity values which supports the individual determinations available on IRIS, HEAST and EPA-Provisional. There is no reason to consider the RfDs listed above to be different from each other. For current purposes, DPH uses the mid-point value (EPA Provisional) of **0.01 mg/kg/d** for all three 1,2-dichloroethylene entries.

1,1-*Dichloroethylene*

Non-cancer -

IRIS RfD (2002): 0.05 mg/kg/d
ATSDR chronic oral MRL: 0.009 mg-kg-d
CalEPA (PHG, 1999): RfD equivalent = 0.003 mg/kg/d

USEPA RfD based upon benchmark dose for fatty changes in the liver from a rat drinking water study and a 100 fold UF. CalEPA's Public Health Goal for drinking water used the same rat study but incorporated a 3000 fold UF, with most of this extra UF (10 fold) due to weaknesses in the carcinogenicity database (18 studies, all deficient). Similarly, the ATSDR chronic oral MRL is based upon the rat liver effects but also uses a larger UF than does EPA/IRIS.

Cancer –

IRIS: Group C, reaffirmed in 2002 file update
IARC: Group 3
CalEPA – not available
Extensively tested in genetic toxicology studies with vast majority positive. Structurally related to vinyl chloride. Animal tumor evidence equivocal but protocols inadequate.

Conclusion – 1,1-Dichloroethene has carcinogenic potential and so DPH applies a 10 fold UF for possible carcinogenicity to the IRIS RfD to yield **0.005 mg/kg/d.** This is approximately midway between the ATSDR and CalEPA determinations.

2,4-Dichlorophenol

Non-cancer -

IRIS RfD (1988): 0.003 mg/kg/d
ATSDR subchronic oral MRL (1999): 0.003 mg-kg-d
CalEPA (PHG, 1999): RfD equivalent = 0.003 mg/kg/d

USEPA RfD based upon impaired immune function (delayed hypersensitivity) in a rat reproductive study with a 100 fold UF used from the NOAEL. ATSDR's MRL is based upon the same study and immunosuppressive effect with the same value set. Neither ATSDR nor EPA felt the need for a subchronic to chronic uncertainty factor given that the available evidence doesn't suggest that chronic exposure leads to a greater cumulative effect. The related 2,4,5-trichlorophenol was positive at all doses tested in the mouse lymph node assay suggesting substantial dermal sensitization potential (ATSDR, 1999). However, classical guinea pig dermal hypersensitivity testing has not been performed for 2,4-dichlorophenol or its higher chlorinated analogues.

Cancer –

IRIS: Not available
IARC: Group 2B, but this based on higher Cl chlorophenols, not 2,4-DCP
CalEPA – not available
Genetic toxicology results have been mostly negative. Cancer bioassays in rats and mice (NTP, 1989) were negative.

Conclusion – 2,4-Dichloroephenol's most sensitive effect is immunotoxicity but it has not been tested in standard dermal hypersensitivity testing. Further, 2,4,5-TCP has sensitizing potential based upon the mouse lymph node assay. This uncertainty warrants a 3 fold UF to the RfD to yield a value of **0.001 mg/kg/d**.

Dichlorprop

Non-cancer / No values available - DPH Assessment

DPH-derived RfD base upon the study by Mitsumori (1984), summarized in CA EPA (2000), which documented effects on kidney function at chronic exposures above 3.6 mg/kg/day; this dose can be considered the NOAEL. This was divided by a combined uncertainty factor of 1000 (10X for animal to human; 10X for sensitive individuals; and 10X for data gaps and possible carcinogenicity). Dichlorprop is related to the herbicide 2,4-D which is equivocal cancer evidence in humans and dichlorprop itself has limited evidence of weak genetic toxicity (clastogenic, not mutagenic) and carcinogenicity (CANTOX). IARC, 1987 considered dichlorprop a 2B carcinogen based upon human rather than animal evidence. However, the extent of testing is limited. The 1000 fold UF leads to a value of **0.0036 mg/kg/d**.

References

CANTOX Review available at:
http://www.forces.gc.ca/site/reports/defoliant/FFReports/Task_3A1_Tier3/CEI_Gagetown_Final_Report_Appendix_B_Tier_3_April_2007/B18-Dichlorprop%20Tox%20Profile.pdf

CA OEHHA (2001). Evidence of the Developmental and Reproductive Toxicity of 2,4-DP (DRAFT). Reproductive and Cancer Hazard Assessment Section, California Environmental Protection Agency.

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Mitsumori (1984). 2,4-DP Acid (2-(2,4-dichlorophenoxy)propanoic acid); 24 month oral chronic dietary study in rats. Institute of Environmental Toxicology (Tokyo) 85/071.

1,2-Dichloropropane

Non-cancer -

IRIS RfD (1988): not available
ATSDR chronic oral MRL (1999): 0.09 mg-kg-d

Cancer –

IRIS: Not available
HEAST: (B2) – 0.068/mg/kg/d
IARC: Group 3
CalEPA – 0.036/mg/kg/d
Genetic toxicology results have been mixed.

HEAST cancer slope factor from mouse liver tumor response in chronic gavage study (NTP, 1986). CalEPA cancer slope factor derived for PHG document, 1999 from same NTP mouse liver data.

Conclusion – The CalEPA slope factor is chosen as it is more recent and better supported than the value in HEAST. However, the two slope factors are very similar. Therefore, the slope factor of **0.036/mg/kg/d** is applied to
RSR calculations.

Diethylphthalate

Non-cancer -

IRIS RfD (1993): 0.8 mg/kg/d
ATSDR subchronic oral MRL (1999): 6 mg-kg-d
CalEPA: not available

USEPA RfD based upon rat subchronic feeding study NOAEL for general toxicity endpoints (growth rate, organ wts, feed consumption) and 1000 fold UF. ATSDR's subchronic MRL is based upon the LOAEL for hepatic effects in rats divided by a cumulative UF of 300.

Cancer –

IRIS: D classification

Conclusion – Diethylphthalate is one of several phthalates recently implicated as having endocrine effects on male development, with evidence from a more recent 2 generation reproductive study showing that DEP can decrease testosterone levels in F0 male offspring (Fujii, et al., 2005, J Tox Sci 30: 97-116). Early life endocrine effects need further exploration and were not assessed as part of the IRIS RfD derivation. Therefore, a 10 fold UF is added to account for database deficiencies that relate to the potential for DEP to have endocrine effects on male development that are not well understood from a dose-response perspective and are not accounted for in the current RfD. This leads to a modified RfD of **0.08 mg/kg/d.**

Dimethylphthalate

Non-cancer -

IRIS RfD: not available
ATSDR MRL: not available
CalEPA: not available

Cancer –

IRIS: D classification

Conclusion – Dimethylphthalate does not have data useful for RfD derivation but is a close structural analogue to diethylphthalate and so the value derived for that chemical is used as a surrogate – **0.08 mg/kg/d.**

Di-n-butylphthalate

Non-cancer -

IRIS RfD (1990): 0.1 mg/kg/d
ATSDR MRL (2001): reviewed but no MRL derived
CalEPA: not available

USEPA RfD based upon rat subchronic/chronic (1 yr) feeding study NOAEL (125 mg/kg/d) for increased mortality from a crude study (1953, males only, limited endpoints). A 1000 fold cumulative UF was applied. EPA has low confidence in this RfD. ATSDR reviewed this rat subchronic/chronic study and had too little confidence in it for use in setting an MRL. Further, they found di-n-butylphthalate-induced developmental toxicity (fetotoxicity and impaired male development post-natally) with a developmental LOAEL of 80 mg/kg/d. ATSDR felt that the developmental LOAEL represents serious toxicity and was not able to extrapolate to a NOAEL or MRL. This underscores the uncertainty in the IRIS RfD

Cancer –

IRIS: D classification

Conclusion – A 10 fold UF is applied to the IRIS RfD to account for database deficiencies with respect to the potential that developmental and male reproductive toxicity are risk drivers but unaccounted for in the IRIS file. This yields a modified RfD of **0.01 mg/kg/d.** This value is 8000 fold below the serious LOAEL for developmental effects as described by ATSDR.

2,4-Dinitrophenol

Non-cancer -

IRIS RfD (1991): 0.002 mg/kg/d
ATSDR MRL (1995): reviewed but data inadequate for MRL derivation
CalEPA: not available

USEPA RfD based upon anectdotal human evidence of cataract formation in humans taking 2,4-dinitrophenol therapeutically for weight loss, with a LOAEL of 2 mg/kg/d representing the low end of the dose range given to people. EPA applied a 1000 fold cumulative UF but has low confidence in the RfD due to meager database and the human toxicity data are from 1942. ATSDR had too little confidence in the toxicology data to set MRLs.

Cancer –

IRIS: no review
IARC: no review

Minimal cancer data, but mostly negative genetic toxicology studies. 2,4-DNP has several metabolites that cause mutations.

Conclusion – 2,4-Dinitrophenol is a highly toxic acute metabolic poison which has not been adequately studied for most toxicity endpoints. Given the weakness in the IRIS RfD and the extensive datagaps, a 10 fold UF is added to create a modified RfD of **0.0002 mg/kg/d**. The IRIS derivation did not include a factor for database defiencies for this compound.

2-Methyl-4,6-Dintrophenol (Dinitro-o-cresol or DNOC)

Non-cancer -

IRIS RfD: not available
ATSDR subchronic oral MRL (1995): 0.004 mg-kg-d
CalEPA: not available

ATSDR MRL based upon a 1936 study in which human subjects swallowed a capsule of DNOC daily for 3-5 days. A LOAEL for fatigue and dizziness was found at 0.35 mg/kg/d. ATSDR applied a 100 fold UF to derive the subchronic MRL.

Cancer –

IRIS: no classification

Conclusion – DNOC is an acutely neurotoxic agent at relatively low doses. Most of the data are quite old and lacks chronic, reproductive and developmental studies. Therefore, a database deficiency factor of 10 is applied to the subchronic MRL to yield a chronic value of **0.0004 mg/kg/d.**

Di-n-Octylphthalate

Non-cancer -

IRIS RfD: not available
ATSDR subchronic oral MRL (1999): 0.4 mg-kg-d
CalEPA: not available

ATSDR's subchronic MRL is based upon the NOAEL for thyroid and liver effects in a rat dietary study, with a 100 fold UF.

Cancer –

IRIS: not classified

Conclusion – Di-n-octylphthalate is potentially endocrine active as are a number of other phthalates. However, this has not been well explored and the ATSDR MRL does not account for this possible effect. Further, the ATSDR MRL is for subchronic duration. A 10 fold factor is used to extrapolate to chronic exposure and a 3 fold factor is used for database deficiencies (possible endocrine effects) to yield an RfD of **0.01 mg/kg/d.**

1,4-Dioxane

Non-cancer -

IRIS RfD: not available
ATSDR subchronic oral MRL (1999): 0.4 mg-kg-d
CalEPA: not available
CTDPH: 0.003 mg/kg/d

CTDPH derived an RfD based upon animal NOAEL (10 mg/kg/d) for metabolic saturation, enzyme induction, promotional effects, and cancer (liver tumors), using 1000x UF for animal to human, intra-human, and possible carcinogen, combined with 3x for database deficiencies → 10000 ug/kg/d / 3000 = 3.3 ug/kg/d as RfD

Cancer –

IRIS (1990): B2 – oral slope 0.011/mg/kg/d
CalEPA oral slope (2002): 0.027/mg/kg/d

IRIS slope factor based upon NCI (1978) drinking water study in rats showing nasal turbinate tumors; However, this endpoint may be an artifact of water splashing in nose. CalEPA slope factor based upon liver tumors in female rats from the same study. CTDPH 2004 risk assessment found low dose linear unlikely given the lack of genotoxicity and demonstration of thresholds for multiple toxicokinetic and mechanistic endpoints involved in 1,4-dioxane tumorigenesis. Therefore, CTDPH built a 10x UF for cancer potential into the RfD shown above.

Conclusion – 1,4-Dioxane cancer potency value on IRIS is dated but being re-evaluated by USEPA. CTDPH assessment acknowledges uncertainty in linear low dose extrapolation and instead uses NOAEL and UF approach with extra factors for possible cancer and database uncertainties. This yields an RfD **of 0.003 mg/kg/d** and a GWPC that is only 3 times different (higher) than the IRIS slope factor. Full DPH March 2004 risk assessment available upon request.

2,3,7,8-Tetrachlorodibenzodioxin (Dioxin)

Non-cancer -

No details provided as criterion driven by cancer risk.

Cancer –

IRIS: unavailable
CalEPA slope (2002): 130,000/mg/kg/d

CalEPA slope based upon mouse liver tumors from NTP studies. This value is very similar to the USEPA value derived on HEAST (150,000/mg-kg-d).

Conclusion – Dioxin's oral potency value from CalEPA – **130,000/mg/kg/d** is used for RSR risk assessments.

Endosulfan (and related congeners)

Non-cancer -

IRIS RfD (1994): 0.006 mg/kg/d
ATSDR chronic oral MRL (2000): 0.002 mg-kg-d
CalEPA: not available

IRIS RfD based upon NOAEL for body wt, kidney, and vascular effects in 2 yr rat feeding study divided by 100 fold UF. ATSDR Tox Profile lists a subchronic MRL of 0.005 mg/kg/d based upon immunotoxic effects in rats and a chronic MRL of 0.002 mg/kg/d based upon hepatic effects in dietary dog (1 yr) dog study using a 100 fold UF from a NOAEL. ATSDR also notes sensitive anti-androgen effects with a LOAEL of 2.5 mg/kg/d (no NOAEL identified).

Cancer –

IRIS (1990): not available
CalEPA: not available

Endosulfan has been tested in several inadequate cancer bioassays, with mostly negative results (ATSDR, 2000). One industry-sponsored study conducted without problems in mice was also negative. However, endosulfan is positive in a variety of genetic toxicity studies, both in vitro and in vivo, and both in mutagenicity and clastogenicity studies. Therefore, there is still considerable uncertainty in this endpoint.

Conclusion – Endosulfan is a prototypic environmental endocrine-active agent (http://www.epa.gov/edrlupvx/inventory/NOAA-SCD.html) and animal testing suggests a specific effect on male gonadal development and function. However, the studies needed to explore this at low doses have not been reported and used for RfD or MRL development. Further, it has limited data regarding tumorigenicity but is positive in genetic assays. Therefore, a 10 fold database deficiency factor is used to modifiy the ATSDR MRL to derive an RfD of **0.0002 mg/kg/d**. The MRL was chosen over the IRIS RfD as a starting point because it is more recent, better supported and is in line with the subchronic MRL also derived by ATSDR.

Ethanol

Non-cancer -

IRIS RfD: not available
ATSDR MRL: not available
CalEPA: not available
CTDPH: 0.067 mg/kg/d

CTDPH risk assessment (2001) developed for a drinking water comparison value is based upon LOAEL for human neurodevelopmental effects as well as level of exposure needed to increase background blood concentrations. The neurodevelopmental LOAEL was divided by 3000 to account for data gaps, possible carcinogenicity and extrapolations from LOAEL to NOAEL and across individuals. The CTDPH assessment is available upon request.

Cancer –

IRIS: not available
CalEPA: not available
IARC – Group 1 – human carcinogen

Epidemiology studies show association between excessive alcohol consumption and g.i. tract cancer. Animal studies are equivocal. No data are available for quantitative low dose extrapolation. CTDPH analysis uses a 10 fold UF for possible carcinogenicity.

Conclusion – The CTDPH RfD of **0.067 mg/kg/d** is applicable for use in RSR risk assessments.

Ethyl Benzene

Non-cancer -

IRIS RfD (1991): 0.1
ATSDR MRL: not available
CalEPA: not available

IRIS RfD based upon 1956 rat gavage subchronic/chronic (6 months) study in which the NOAEL for liver and kidney effects was divided by 1000, which includes 10 for subchronic to chronic.

Cancer –

IRIS: not available (Group D)
CalEPA (2007): 0.011/mg/kg/d
IARC – B2

CalEPA derived inhalation unit risk factors for 4 positive endpoints in NTP (1996) studies – male rat kidney, female rat kidney, male mouse lung, female mouse liver. The slope factor is derived by dose route extrapolation from these inhalation data for the most sensitive endpoint (male rat kidney). Ethylbenzene is not genetically active based upon a wide range of genotoxicity studies (except for a + result in mouse lymphoma).

Conclusion – Ethylbenzene low dose linear approach is uncertain given the lack of mutagenicity and the fact that it caused tumors only at the highest dose in NTP studies. Its metabolic pathways are considerably different than benzene but CalEPA used similarities to benzene as part of rationale for low dose linear approach. For RSR development A 10 fold factor is applied to the IRIS RfD to derive a value of **0.01 mg/kg/d.**

Formaldehyde

Non-cancer -

IRIS RfD (1991): 0.2 mg-kg-d
ATSDR chronic oral MRL: 0.2 mg-kg-d
CalEPA: not available

IRIS RfD based upon 2 yr drinking water study in rats in which g.i. tract and kidney damage were seen at the high dose and a NOAEL of 15 mg-kg-d was identified. This was divided by 100 to yield the RfD. ATSDR selected the same study, NOAEL and UF to derive their oral MRL.

Cancer –

IRIS: B1 for inhalation – not characterized for oral
CalEPA: oral not characterized
IARC – Group 1 – human carcinogen – however, no determination of risk from oral exposure. IARC (Vol 88, 2006) acknowledges that 4 cancer studies have been conducted in rats via the oral route (drinking water) with 3 of the 4 showing tumor increases: 2 studies showing g.i. tract tumors and one showing hematological cancer.

Conclusion – Formaldehyde may have less cancer potential from the oral as opposed to inhalation dose route because a portion may react in water, food or other matrices (including acid content of stomach) and not react directly with epithelial tissues. However, the evidence of g.i. tract irritation and tumors in drinking water studies as well as limited evidence of leukemia (ATSDR, 1999; IARC, 2006) provides an indication of activity via the oral route. Therefore, this uncertainty (10 fold) is combined with the IRIS RfD to yield **0.02 mg-kg-d.**

n-Hexane

Non-cancer -

IRIS RfD (2005): not available but RfC=0.7mg/m3
Oral equivalent = 0.2 mg/kg/d
ATSDR chronic oral MRL (1999): not available but chronic inhalation MRL = 0.6 ppm (2 mg/m3)
CalEPA: not available

IRIS RfC based upon a rat subchronic inhalation study BMD for peripheral neuropathy with a 300 fold UF

Cancer –

IRIS (2005): Inadequate data although genetic toxicology mostly (-)
CalEPA: not available

Conclusion – The hexane database is deficient with respect to oral exposure studies. Hexane metabolic activation for peripheral neuropathy occurs in the liver (ATSDR, 1999). Oral exposure may be more potent than inhalation because of first pass metabolism in the liver which does not occur from inhalation exposure. Oral exposure may also lead to greater % absorption (50% commonly assumed for inhalation but oral may be closer to 100%). Therefore, a 10 fold UF is applied to account for deficiencies in the database and is used to lower the oral equivalent of the IRIS RfC to yield **0.02 mg/kg/d**.

Indeno(1,2,3-cd)pyrene

Non-cancer -

Risks driven by cancer potential

Cancer –

Well recognized as a member of the group of carcinogenic PAHs (ATSDR, 1995; USEPA B2 classification). CalEPA (2002) has a toxicity equivalency factor TEF of 0.1 for indenopyrene based upon data from 3 different test systems which compare tumorigenicity back to BaP.

Conclusion – The oral slope factor for indenopyrene utilizes the B(a)P slope factor on IRIS (7.3/mg/kg/d) and the TEF of 0.1 to yield **0.73/mg-kg-d.**

Isopropanol

Non-cancer -

IRIS RfD: not available
ATSDR MRL: not
CalEPA: not available
CTDPH RfD: 0.33 mg-kg-d

DPH derived a value based upon the NOAEL of 100 mg/kg/d for general toxicity endpoints (organ wt effects, renal pathology) that were seen at higher doses. DPH applied a cumulate 300 fold UF for variability, animal to human extrapolation + 3 fold for data gaps.

Cancer –

IRIS : not available - not tested in cancer bioassays; unlikely for significant cancer potential based upon alcohol structure

Conclusion – The DPH RfD (**0.33 mg-kg-d)** is the only value available for this low toxicity alcohol. It was tested in several reproductive and developmental studies and DPH used the lowest NOAEL with a modest UF that accounts for the lack of chronic, carcinogenicity data.

4-Isopropyltoluene (p-cymene)

Non-cancer -

IRIS RfD: not available
ATSDR MRL: not
CalEPA: not available
CTDPH RfD: 0.03 mg-kg-d

CTDPH assessment based upon structural similarity to the alkylbenzenes cumene and t-butyltoluene. All 3 alkylbenzenes have neurotoxicity as a leading effect. t-Butyltoluene is one carbon larger than p-cymene, while cumene is one carbon smaller than p-cymene. This has toxicological relevance since chemical penetration to the CNS and neurological effects typically increase with increasing carbon number and lipophilicity. The observation that the toxic potency of t-butyltoluene is 10 fold greater than that of cumene (Lund, Int. J. Psychophysiol. 14: 41-48, 1993; USEPA, IRIS Support Document for Cumene) is consistent with this principle. The toxicity of p-cymene is assumed to lie midway (1/2 log) between t-butyltoluene and cumene. This lowers the RfD for cumene (IRIS 1997: 0.1 mg-kg-d) to 0.03 mg-kg-d. There are limited data to support a neurotoxic effect of p–cymene (Lam, Pharmacol. Toxicol. 79: 225-230).

Cancer –

IRIS: not available
CalEPA: not available

Unlikely to be carcinogenic based upon structural similarity to cumene which, although not tested in cancer bioassays, was mostly negative in a genetic toxicity battery (USEPA IRIS file for cumene).

Conclusion – The p-cymene database is limited but this chemical is not likely to have key toxicological effects aside from those for which at least some data already exist (e.g., neurotoxicity). The DPH assessment found that a RfD of **0.03 mg-kg-d** is supported by the database for p-cymene and related chemicals. However, it should be noted that this RfD is associated with a water concentration of 209 ug/l. This can result in an air concentration due to p-cymene's volatility above its odor threshold during bathing/showering. A variety of studies indicate that cumene and also p-cymene's odor becomes detectable at air concentrations in the 20-40 ppb range (USEPA, 1992: EPA/600/R-92/047). These air concentrations can be reached during a bath or shower if the water p-cymene concentration is in the 15-30 ug/l range. While this would not represent a significant health risk, the p-cymene odor at these water concentrations may be noticeable and lead some individuals to seek an alternative water supply.

Lindane (gamma-Hexachlorocyclohexane)

Non-cancer -

IRIS RfD (1988): 0.0003 mg-kg-d
ATSDR subchronic oral MRL (2005): 0.00001 mg/kg/d

IRIS RfD based upon NOAEL for liver and kidney toxicity in subchronic rat dietary study, with a 1000 fold cumulative UF. ATSDR MRL is 30 times lower and is based upon LOAEL for immunologic effects in mice and a 1000 fold UF.

Cancer –

IRIS Cancer Potency Factor: not available
USEPA HEAST: 1.3/mg-kg-d
CalEPA (2002): 1.1/mg-kg-d

Conclusion – The cancer potency factor derived by CalEPA (**1.1/mg-kg-d**) is selected as it is consistent with the prior value on HEAST and with potency factors developed for other hexachlorocyclohexane isomers: 1.8-6.3/mg-kg-d as listed on IRIS. Lindane has largely negative genetic toxicology database and so is not considered to have a mutagenic MOA.

Lithium

Non-cancer -

IRIS RfD: not available
USEPA Provisional RfD: 0.02 mg/kg/d
ATSDR MRL: not available
CalEPA: not available
CTDPH RfD: 0.002 mg-kg-d

CTDPH assessment based upon evidence of adverse effects on uterine and ovarian endpoints within human therapeutic dose range as evidenced in female rat model (Jana, et al., Reprod Toxicol 15: 215, 2001 – effect level 1.6 mg/kg/d). This LOAEL was divided by a 1000 fold cumulative UF.

Cancer –

IRIS: not available
CalEPA: not available

Unlikely to be carcinogenic or mutagenic – mostly negative genetic toxicology database; mixed evidence of teratogenesis. (Leonard, et al., Mutation Res 339: 131, 1995)

Conclusion – The DPH-derived RfD of **0.002 mg/kg/d** is supportable based upon the clear toxicological effects in the therapeutic dose range; USEPA's internal/provisional RfD is not well documented or supported.

Methanol

Non-cancer -

IRIS RfD (1993): 0.5 mg/kg/d
ATSDR MRL: not available
CalEPA: not available

IRIS RfD based upon the NOAEL for brain wt changes and enzyme leakage into serum from subchronic gavage exposure in rats. EPA applied a 1000 fold UF. However, methanol is also a developmental toxicant (CERHR, 2002) but there is a lack of developmental testing via the oral route. Methanol is activated in the liver to formaldehyde and so oral exposure may lead to greater toxicity. The rat oral LD50 (5600 mg/kg) is approximately 2 times below the oral dose equivalent of the LC50 (64,000 ppm or approximately 12,600 mg/kg over 4 hrs).

Cancer –

IRIS: not available
CalEPA: not available

Unlikely to be carcinogenic or mutagenic – mostly negative genetic toxicology database; inadequate testing for cancer.

Conclusion – Methanol's IRIS RfD is lowered 3 fold to derive a modified RfD of **0.15 mg/kg/d** on the basis of gaps in the oral toxicology database particular with respect to developmental toxicity (most sensitive endpoint) and because oral may be more potent than inhalation, the dose route for which developmental data are currently available.

Methoxyclor

Non-cancer -

IRIS RfD (1991): 0.005 mg-kg-d
ATSDR intermediate oral MRL (2002): 0.005 mg-kg-d
CalEPA: not available

IRIS RfD based upon a NOAEL for teratological effects in a rabbit oral dosing study, with a 1000 fold UF. The ATSDR MRL is based upon a more subtle endpoint (early female sexual maturation) in a developmental study involving oral exposure of rat dams during gestation and lactation. All doses produced an effect so that ATSDR used a 1000 fold UF to extrapolate to a LOAEL, across species and to account for variability.

Cancer –

IRIS: not available
CalEPA: not available

Methoxyclor has been tested in numerous studies including NTP, 1978. Results are equivocal because of inadequacies in study design and conduct, possible increases in liver and testicular cancer, and disagreements between pathologists regarding the interpretation of slides. It is negative in genetic toxicology studies and is a structural analogue of DDT.

Conclusion – The ATSDR intermediate MRL is a firmer basis for RfD development than the older RfD on IRIS given that it is based upon a more subtle but still highly revelant toxicological endpoint. Precocious development of female reproductive organs is an impt endpoint given the known endocrine (estrogenic) activity of methoxyclor. A 3 fold UF is used to extrapolate from the subchronic MRL to chronic exposure (not the usual 10 fold because the most sensitive exposure period was included in the key study used by ATSDR – however, long term exposure would likely lead to greater maternal body burden and transfer across placenta and into breast milk). An additional 3 fold factor is used to account for data gaps and uncertainties surrounding the cancer testing via the oral dose route. This yields **0.0005 mg/kg/d.**

Methyl Methacrylate

Non-cancer -

IRIS RfD (1998): 1.4 mg/kg/d
ATSDR MRL: not available
CalEPA: not available

IRIS RfD based upon a chronic drinking water study in rats in which no effects were seen. The high dose was considered the NOAEL and divided by 100. However, there are no reproductive or developmental toxicity studies by the oral dose route and MMA is a well known dermal sensitizer (Betts, et al. Contact Dermatitis 55: 140-146, 2006), an effect not taken into account in the RfD assessment.

Cancer –

IRIS: not available
CalEPA: not available

Unlikely to be carcinogenic based upon mostly negative findings in inhalation cancer bioassays – any tumorigenic effect likely related to local irritant, cytotoxic damage and regenerative hyperplasia.

Conclusion – Methyl methacrylate is a common workplace irritant and dermal sensitizer, properties that are not typically accounted for in the IRIS Rfd. Its test database is lacking with respect to oral studies and developmental or neurological effects. These factors combine to yield an additional 10 fold UF and an RfD of **0.14 mg/kg/**d.

Methyl-t-Butyl Ether (MTBE)

Non-cancer -

IRIS RfD: not available
USEPA IRIS Inhalation RfC = 0.86 mg/kg/d
ATSDR intermediate oral MRL (1999): 0.3 mg/kg/d
CT DPH Risk Assessment (1999): 0.01 mg/kg/d

ATSDR MRL based upon a minimal LOAEL of 100mg/kg/d for liver and kidney effects in rats gavaged for 90 days, using a 300 fold UF. CTDPH utilized the same study but considered the 100mg/kg/d dose a NOAEL and applied a 1000 fold UF for non-cancer effects and uncertainties (10 for animals to humans, 10 for variability, 10 for subchronic to chronic) and an additional 10 for potential carcinogenicity.

Cancer –

IRIS: not available
USEPA (other value): 0.004/mg/kg/d
CalEPA: 0.0018/mg-kg-d
IARC: Group 3

MTBE was positive in several rat and mouse cancer bioassays at multiple sites (mouse liver, male rat kidney and leydig cell tumors). Mostly negative genetic toxicology data; questionable that low dose linear slope approach is appropriate.

Conclusion – CTDPH risk assessment takes into account MTBE cancer potential with an additional UF appropriate for an IARC Group 3 chemical yields an RfD of **0.01 mg-kg-d.** The risk assessment document is available on request.

Methylene Chloride

Non-cancer -

IRIS RfD (1988): 0.06 mg/kg/d
ATSDR chronic oral MRL (2000): 0.06 mg/kg/d

IRIS RfD based upon liver toxicity in a rat chronic drinking water study, NOAEL divided by 100.

Cancer –

IRIS (1995): 0.0075/mg-kg-d
Group B2

CalEPA (1985): 0.014/mg-kg-d

IRIS slope factor is a composite of the dose-response slope from the NTP inhalation and the Coffee Inst drinking water studies which both showed liver tumors in mice. CalEPA value is 2 fold higher but based upon an outdated assessment from USEPA. Tested in many genetic toxicology studies, majority are positive across a wide range of in vitro and in vivo, prokaryotic and eukaryotic systems.

Conclusion – The USEPA 1995 cancer slope factor of **0.0075/mg-kg-d** is more up-to-date than the California oral value, utilizes a variety of studies and endpoints and PBPK modeling and is therefore most appropriate for the current purposes.

2-and 4-Methylphenols (o- and p-Cresols)

Non-cancer -

IRIS RfD (1990): 0.05 mg/kg/d for o-Cresol
ATSDR intermed oral MRL: 0.1 mg/kg/d for cresol mixtures

IRIS RfD based upon a 90 day gavage rat study in which a neurotoxicity NOAEL was identified and was divided by 1000 fold to extrapolate to chronic and animal to human and inter-individual variability. The ATSDR intermediate oral MRL is based upon 28 day and 90 day dietary studies (NTP, 1992) in which m/p cresol caused histopathological changes to the nasal epithelium as the most sensitive finding. ATSDR applied a 100 fold UF to the benchmark dose.

Cancer –

IRIS (1990/1992): Group C for both o- and p-Cresol
Inadequate testing but the available studies have primarily examined ability to initiate or promote skin tumors with several positive findings. It is also positive in the mouse lymphoma assay and several other genetox or promoter assays, but negative in bacterial mutagenicity studies; on balance not likely to be a mutagen. .

Conclusion – The ATSDR intermediate oral MRL is a more up-to-date basis than the 1990 IRIS RfD. The NTP studies in 1992 considerably added to the o-,m- and p-cresol database. This intermediate MRL is divided by 10 to extrapolate to chronic (no chronic data available so a key datagap) and by 3 for possible carcinogenicity (Group C) to yield **0.003 mg/kg/d**.

Naphthalene

Non-cancer -

IRIS RfD (1998): 0.02 mg/kg/d
IRIS RfC (1998): 0.003 mg/m3 (0.00086 mg/kg/d oral equiv)
ATSDR MRL: not available

IRIS RfD based upon a 90 day gavage rat study in which decreased body wt was the most consistent and sensitive effect. No NOAEL was identified. The LOAEL was divided by 3000 fold. IRIS RfC based upon nasal inflammation in mice LOAEL divided by 3000

Cancer –

IRIS (1998): Group C
NTP (1992) studies found benign respiratory tumors in mouse inhalation studies with one carcinoma detected. Follow-up NTP studies in rats (2000) found increased nasal tumors, with NTP's assessment of clear evidence of carcinogenicity. Naphthalene is negative in genetic toxicology testing.
IARC (2002): Group 2B

CalEPA (2004): 0.12/mg-kg-d (based upon NTP inhalation studies)

Conclusion – The IRIS RfD is lowered 10 fold for possible carcinogenicity as evidenced by the Group C (USEPA)/Group 2B (IARC) designations and the fact that an inhalation slope factor has been developed by CalEPA. Chronic oral studies for naphthalene carcinogenicity have not been conducted with the exception of a 1955 study of limited value. 1-methylnaphthalene is carcinogenic (lung tumors) by the oral dose route and EPA Region III RBC table now has a provisional CSF for this compound of 0.029/mg-kg-d. Lowering the RfD by 10 fold for possible carcinogenicity yields **0.002 mg/kg/d**. It should be recognized that the RfC is well below the RfD due to local effects on respiratory tissues. Since naphthalene is volatile, the standard GWPC RSC may not be sufficient to account for inhalation exposure from bathing/showering and household water use.

Nickel

Non-cancer -

IRIS RfD (1996): 0.02 mg/kg/d
ATSDR MRL (2005): not available but extensively reviewed

IRIS RfD based upon a rat chronic dietary study in which a LOAEL and NOAEL were identified for decreased organ and body weights and a 300 fold UF was applied to derive the RfD. Contributing to the 300 fold UF is a 3 fold factor for data gaps in reproductive testing. However, the IRIS file also mentions that hypersensitive individuals may not be protected from this RfD. ATSDR's review of the oral studies highlights the fact that subchronic (reproductive) studies show evidence of fetotoxicity at 1.3 mg/kg/d and higher. This is nearly 4 fold below the NOAEL used by IRIS in setting the RfD (5 mg/kg/d).

Cancer –

IRIS : Not evaluated for oral exposure to soluble nickel, but IRIS has unit risk values for nickel refinery dust and nickel subsulfide inhalation.
IARC – Group 1 based upon inhalation studies; oral not separately evaluated

Nickel is a mutagen and clastogen but inhalation exposure yields local respiratory tract tumors. The one oral study, chronic drinking water exposure in rats and mice at a single dose level, was negative (ATSDR, 2005).

Conclusion – The IRIS RfD is lowered 10 fold due to a combination of factors: 1) potential for increased risks in those with dermal hypersensitivity (approx 10% of population) for which contact exposure in soil and water may be a special concern; 2) reproductive toxicity issue raised by ATSDR (repro LOAEL 4 times lower than IRIS NOAEL) and, 3) oral carcinogenicity not well explored but possible based upon positive mutagenicity and recent findings with chromium VI showing oral cancer potency. This leads to a modified RfD of **0.002 mg/kg/d**.

2-, 3-, and 4-Nitroanilines

Non-cancer -

IRIS RfD: not available
USEPA Provisional RfDs: 0.003 mg/kg/d – 2-nitroaniline
: 0.0003 mg/kg/d – 3-nitroaniline
: 0.003 mg/kg/d – 4-nitroaniline
Provisional RfDs listed on Region IX RBC table – 2004
ATSDR MRL: not available

Cancer –

IRIS (1998): not evaluated
USEPA Provisional CSFs: 0.021/mg-kg-d – 3-nitroaniline
: 0.021/mg/kg/d – 4-nitroaniline
CalEPA – not available

Conclusion – Apply the provisional cancer slope factor developed by USEPA for the 3- and 4- isomers of **0.021/mg-kg-d** to all three nitroanilines. Aniline is carcinogenic and nitrobenzene is a 2B IARC carcinogen, so nitroanilines can be expected to also be carcinogenic.

N-Nitrosodimethylamine

Non-cancer -

Not relevant – risk driven by cancer potency

Cancer –

IRIS (1991): 51/mg/kg/d Group B2

CalEPA (2002): 16/mg-kg-d

IRIS CPF based upon rat liver tumors from chronic drinking water ingestion. NDMA is a potent carcinogen and mutagen. CalEPA based their calculations upon the same study although they also calculated potency from four additional studies.

Conclusion – The CalEPA CSF of **16/mg-kg-d** is best supported and most recently updated and is used in place of the IRIS cancer potency value.

Pentachloronitrobenzene

Non-cancer -

IRIS RfD (1992): 0.003 mg/kg/d
ATSDR MRL: not available

IRIS RfD based upon a 2 yr dog feeding study in which the NOAEL for liver toxicity was divided by a 300 fold UF to derive the RfD.

Cancer –

IRIS (1998): not available
USEPA (HEAST): 0.26/mg-kg-d
IARC (2002): Group 3
CalEPA: not available

Basis for HEAST slope factor unknown but IARC (1974) reports suggestive animal tumor results in skin and oral studies. NTP 1978 dietary studies were negative in rats and mice.

Conclusion – The IRIS RfD is lowered 3 fold for possible carcinogenicity as evidenced by the slope factor which still exists on HEAST although decreasing the concern are the negative results seen in NTP 1978 dietary studies. Threefold lowering of the RfD yields **0.001 mg-kg-d**.

Phenol

Non-cancer -

IRIS RfD (1998): 0.3 mg/kg/d
IRIS RfC (1998): 0.003 mg/m3 (0.00086 mg/kg/d oral equiv)
ATSDR MRL (2007): not available

IRIS RfD based upon a rat gavage developmental study in which the NOAEL for decreased maternal wt gain was divided by 300.

Cancer –

IRIS (2002): Group D
NCI (1980) drinking water studies found evidence of leukemia in low dose but not high dose male rats, a finding of some consequence given that phenol is a key metabolite of benzene, a known human leukemogen. Phenol is also consistently positive in skin initiation/promotion assays.While negative in the Ames assay, it is positive in a wide range of mammalian in vitro and in vivo gene tox studies involving mutation, chromosome damage, DNA adducts and unscheduled DNA synthesis.
IARC (2002): Group 3

CalEPA (2004): not available

Conclusion – The IRIS RfD is lowered 10 fold for possible carcinogenicity as suggested by the equivocal cancer findings, phenol's metabolic role in benzene carcinogenesis and the extensive positive genetox data. There is also uncertainty with respect to whether the current database adequately captures phenol's immunotoxic effects (ATSDR, 2007). Application of the 10 fold factor yields **0.03 mg/kg/d** for use in RSR calculations.

Polycyclic Aromatic Hydrocarbons – Carcinogenic

The following listing of slope factors is for PAHs with at least some evidence of carcinogenic activity in skin painting studies, initiation/promotion studies, or other protocols that evaluate tumor formation from subchronic or chronic exposure. By analogy with the prototypic PAH, benzo(a)pyrene, these chemicals have a B2 cancer rating and are assigned toxicity equivalency factors (TEFs) which modify the BaP slope factor (7.3/mg-kg-d) for the individual PAH. The TEFs are taken from ATSDR, 1995 unless otherwise noted.

Benzo(a)anthracene:	TEF = 0.145	CSF = 1.1/mg/kg/d
Benzo(b)fluoranthene	TEF = 0.167	CSF = 1.2/mg/kg/d
Benzo(g,h,i)perylene:	TEF = 0.01*	CSF = 0.073/mg/kg/d
Benzo(k)fluoranthene:	TEF = 0.054	CSF = 0.4/mg/kg/d
Chrysene	TEF = 0.0044	CSF = 0.032/mg/kg/d
Dibenzo(a,h)anthracene	TEF = 1.1	CSF = 8.1/mg/kg/d
Indenopyrene:	TEF = 0.1	CSF = 0.73/mg/kg/d

* TEF value from Nisbett and LaGoy, 1992 which is supported by the co-carcinogenicity of this PAH with BaP (synergistic - Cherng, et al., TAP 170: 63-68, 2001) and the DNA adduct evidence (Hughes and Philips, Carcinogen 14: 127-133, 1993).

Propylene Glycol

Non-cancer -

IRIS RfD: not available
USEPA Provisional Value: 0.5 mg/kg/d
ATSDR MRL: not available

USEPA has a provisional value which is one of the higher RfDs listed on the Region III database but it generally comports with its close structural analogue, ethylene glycol, IRIS RfD of 2 mg/kg/d. The reproductive toxicology of propylene glycol has been extensively reviewed and found to not be a developmental or reproductive toxicant (NTP/CERHR, 2003).

Cancer – There are no cancer concerns with this chemical.

Conclusion – USEPA's provisional RfD of **0.5 mg/kg/d** is suitable for RSR risk calculations for propylene glycol.

Pyridine

Non-cancer -

IRIS RfD (1989): 0.001 mg/kg/d
ATSDR MRL (1993): reviewed but no MRL set due to data gaps

IRIS RfD based upon a 90 day gavage rat study in which the main effect was liver wt changes, with the RfD based upon the NOAEL divided by 1000 (10x animal to human, 10 for variability, 10 for subchronic to chronic). There was no UF for data gaps in spite of the recognized gaps in reproductive, developmental and cancer testing.

Cancer – No information available.

Conclusion – The IRIS RfD is lowered 3 fold for extensive datagaps as described in the IRIS file and ATSDR tox profile. The IRIS file expressed specific concern about neurotoxic effects seen in occupational studies, with this also not being characterized in animal experiments. There are no cancer or genetic toxicology data but there are also no structural indicators that would suggest that pyridine might be carcinogenic or endocrine active. The modified RfD is thus **0.0003 mg/kg/d**.

Simazine

Non-cancer -

IRIS RfD (1994): 0.005 mg/kg/d
ATSDR MRL: not available
Cal OEHHA (2001 PHG): 0.0005 mg/kg/d

IRIS RfD based upon a chronic rat dietary study with the NOAEL for hematological effects divided by 100 to yield the RfD. CalOEHHA utilized the same study and point of departure but used a 1000 fold UF to yield a 10 fold lower chronic non-cancer target. The extra 10 fold factor in the Cal assessment was for the uncertainty that simazine may be a carcinogen.

Cancer –

IRIS (1994): No evaluation
USEPA HEAST: 0.12/mg/kg/d
Cal OEHHA (2001) PHG: cancer slope of 0.12/mg/kg/d
IARC Group 3

Simazine caused cancer in the rat mammary gland at mid and high dose levels, with the cancer slopes calculated by EPA HEAST and Cal OEHHA based upon this finding. However, the relevance to humans has been questioned on the basis of this being a hormonal effects (altered estrus cycle leading to prolonged exposure to estrogen), with it claimed that human hormonal systems senesce differently than in rats leading to less risk in women. While CalOEHHA calculated a slope factor, their PHG for drinking water is based upon the modified RfD approach described above. Simazine is not a mutagen or genotoxicant.

Conclusion – The IRIS RfD is lowered 10 for possible carcinogenicity as suggested by the rat mammary findings and slope factors described above. This yields **0.0005 mg/kg/d,** which is the value derived by CalOEHHA as well.

Styrene

Non-cancer -

IRIS RfD (1990): 0.2 mg/kg/d
IRIS RfC (1990): 1 mg/m3 (0.29 mg/kg/d oral equiv)
ATSDR intermediate MRL (1992): 0.2 mg/kg/d

IRIS RfD based upon a gavage study involving groups of 4 dogs exposed for 560 days, with the NOAEL for hematologic and liver effects divided by 1000 (standard 10x factors plus one for subchronic to chronic). ATSDR identified a rat study in which hepatic effects were found at a LOAEL of 200 mg/kg/d, which is the NOAEL from the dog study EPA used as the basis for the RfD. This leads to an intermediate duration MRL of 0.2 mg/kg/d as developed by ATSDR with a 1000 UF to account for extrapolation from a LOAEL to NOAEL in addition to the std factors.

Cancer –

IRIS: not available

IARC (2002): Group 2B, limited evidence in humans and animals
CalEPA: not available

Styrene forms styrene oxide in vivo and this leads to cytogenetic damage, DNA adducts, mixed mutagenicity results and increases in pulmonary tumors in mice chronically exposed via inhalation. However, oral studies in rats have been negative**.**

Conclusion – The ATSDR intermediate MRL of 0.2 mg/kg/d relies upon a more robust test and sensitive endpoint (liver toxicity in rats as opposed to a study of a small number of dogs) to yield an intermediate MRL that is numerically equivalent to the IRIS chronic RfD. Division of the intermediate MRL by 3 to extrapolate to chronic and by 3 for possible carcinogenicity yields a value of **0.02 mg/kg/d.** Styrene has genotoxic potential and limited evidence of tumorigenesis in chronic testing which supports a Group C classification and added UF for possible carcinogenicity. The IARC 2B classification was initially developed in 1994 and reconfirmed in 2002.

t-Butyl Alcohol (TBA)

Non-cancer -

IRIS RfD: not available
ATSDR MRL: not available
CTDPH (2004): 0.017 mg/kg/d

CTDPH value based upon the LOAEL for female rat kidney effects of 175 mg/kg/d as found in an NTP chronic drinking water study. This was divided by uncertainty factors for LOAEL to NOAEL, animal to human, inter-individual variability and 10 fold for possible carcinogenicity.

Cancer –

IRIS: Not available
IARC: Not available
CalEPA: not available

NTP (1995) tested TBA in rats and mice in 2 yr drinking water studies. There were increases in male rat kidney and female mouse thyroid tumors. These tumor target sites are the same as for MTBE; TBA is a metabolite of MTBE. NTP found that this constitutes "some evidence of carcinogenic effect". TBA was not genotoxic in a battery of 5 tests administered by NTP. Slope factors for TBA's carcinogenic potential have not been developed.

Conclusion – The CTDPH risk assessment from 2004 is available upon request. It documents the development of a non-cancer target of **0.017 mg/kg/d**, which is suitable for use in the RSR program. This value is very close to the value derived for MTBE.

Tetrachloroethylene (PERC)

Non-cancer –

IRIS RfD (1988): 0.01 mg/kg/d
ATSDR inhalation chronic MRL (1997): 0.04 ppm
(oral equiv assuming equal oral and inhalation potency = 0.08 mg/kg/d)

IRIS RfD based upon NOAEL for hepatotoxicity in a gavage study in rats with a 1000 fold uncertainty factor. The ATSDR inhalation MRL is based upon evidence of neurotoxicity in a chronically exposed worker population.

Cancer –

IRIS: Not available
USEPA ("Other" as listed on the Region III RBC Table): 0.54/mg/kg/d
IARC: 2B
CalEPA PHG (2001): 0.54 per mg/kg/d

The USEPA cancer slope factor appears on the Region III table but does not have supporting documentation. The CalEPA slope factor takes into account the percent metabolized of PERC on the assumption that only metabolized chemical is involved in the cancer mechanism. CalEPA utilizes pharmacokinetic models of human and mouse (mouse liver cancer is the finding used for slope determination) metabolism, with the upper bound assumption that 79% of an oral dose is metabolized at low environmental doses. This is a point of uncertainty and some issue in the literature. PERC has equivocal mutagenicity/gene tox data but is clearly carcinogenic in both rats and mice in both sexes.

Conclusion – Given that the interim USEPA slope factor and the CalEPA slope factors are in basic agreement (numerical value is the same, one based upon metabolized dose, one on applied dose), the slope factor of **0.54 per mg/kg/d** is recommended for use in RSR calculations.

Tetrahydrofuran

Non-cancer –

IRIS RfD: not available
USEPA internal value as reported in Region III table: 0.2 mg/kg/d
ATSDR MRL: not available

Cancer –

IRIS: Not available
USEPA internal value as reported in Region III table: 0.0076/mg/kg/d
IARC: 2B
CalEPA: not available

The internal USEPA cancer slope factor appears on the Region III table but does not have supporting documentation. However, it is likely based upon the positive NTP inhalation studies (1998) which found some evidence for cancer in the male rat kidney and clear evidence for cancer in the female mouse liver. THF was not genotoxic in a variety of in vitro tests.

Conclusion – Utilize the internal USEPA slope factor, which has been in use for approximately 6 years for RSR calculations**: 0.0076 per mg/kg/d.**

Tin (Inorganic)

Non-cancer –

IRIS RfD: not available
USEPA HEAST: 0.6 mg/kg/d
ATSDR intermediate oral MRL (2005): 0.3 mg/kg/d
DPH Assessment: 0.01 mg/kg/d

ATSDR int MRL based upoin a NOAEL for hematological effects in rats fed tin-containing diets for 13 weeks, using a cumulative 100 fold uncertainty factor (10 for cross-species and 10 for inter-individual extrapolations).

DPH's review identified a chronic drinking water study in rats (Schroeder, et al., 1968, as cited in ATSDR, 2005) in which a single dose level (0.7 mg/kg/d) was examined. This was an unusual study in that it involved complete life observation, out to 42 months of exposure. There was a statistically increased incidence of fatty degeneration of the liver and vacuolar changes in renal cells in the tin-exposed group relative to controls. However, this LOAEL is incompatible with a NOAEL of 164 mg/kg/d for rats and mice in NTP, 1982 studies. That study failed to find any chronic toxicity other than possible carcinogenicity (see below). Differences in length of study and mode of tin administration may have to do with these divergent results.

Cancer – IRIS: Not available
IARC: Not available
CalEPA: not available

An NTP, 1982 dietary study in rats and mice yielded equivocal results as tin was associated with liver cancer and lymphoma in mice and possibly also lung adenomas in rats. However, results were marginal with respect to historical controls and NTP concluded that tin was not carcinogenic in these studies. Genotoxicity studies were mixed but with enough positive findings in mammalian cytogenetic and DNA damage assays to indicate that a potential genetic risk.

Conclusion – There are two different approaches to deriving an RfD for inorganic tin: divide the ATSDR intermediate MRL by 10 which yields 0.03 mg/kg/d. Alternatively, one could divide the chronic LOAEL from Schroeder (0.7 mg/kg/d) by 1000 (10x LOAEL to NOAEL, 10x animal to human, 10 for inter-individual variability). This yields 0.0007 mg/kg/d. However, the latter approach is not supported by the NTP chronic drinking water study or by the ATSDR subchronic MRL. Therefore, the most prudent approach is to factor additional uncertainty into the ATSDR MRL-based RfD and divide it by an additional 3 fold factor due to possibility that chronic toxicity is considerable (Schroeder evidence) and since cancer results are equivocal. This yields **0.01mg/kg/d**. This risk-based value is in a similar range as background exposure to tin in the diet, primarily coming from canned foods (0.005 to 0.1 mg/kg/d) (ATSDR, 2005).

Toluene

Non-cancer –

IRIS RfD (2005): 0.08
USEPA internal value as reported in Region III table: 0.2 mg/kg/d
ATSDR intermediate MRL(2000): 0.02 mg/kg/d

IRIS RfD based upon a BMD calculation (BMDL= 238mg/kg/d) for renal effects in rats in a 13 week gavage study. USEPA applied a 3000 fold cumulative UF to account for subchronic to chronic extrapolation, 3 fold for database deficiencies, especially with regards to neurotoxicity testing, in addition to the standard UFs.

ATSDR's intermediate MRL is based upon the LOAEL (5 mg/kg/d) for neurochemical changes in the brains of mice exposed subchronically via drinking water. USEPA was aware of this study in preparing the IRIS file (2005) but did not use it due to uncertain interpretation of these changes to toxic sequelae.

Cancer –

IRIS: Group D

Toluene has been extensively tested by inhalation and oral routes in cancer bioassays in rats and mice with mostly negative (some equivocal) results. It is generally negative in genetox studies.

Conclusion – Utilize the ATSDR intermediate MRL as the basis as this stems from a more sensitive endpoint, one in which the IRIS file expressed concern over as an outstanding uncertainty. The MRL is divided by 3 for extrapolation from subchronic to chronic (10x not used because of the uncertain nature of the neurochemical changes implications for public health). This yields **0.0067 mg/kg/d.**

Trichloro-1,2,2-trifluoroethane, 1,1,2- (CFC-113)

Non-cancer –

IRIS RfD (1996): 30 mg/kg/d
ATSDR MRL: not available
CalEPA (1997) PHG: 4 mg/kg/d

IRIS RfD based upon an occupational study of 50 workers exposed to an average concentration of 5358 mg/m3 for an average of 2.8 yrs. This exposure level was a NOAEL, which was divided by 10 for variability and extrapolated by dose conversion to the oral RfD.

CalEPA PHG determination based upon a LOAEL for mild hepatotoxicity in rats chronically exposed via inhalation. The LOAEL was divided by 300 by CalEPA.

Cancer –

IRIS: Not available
IARC: Not available
CalEPA: not available

Not expected to be a cancer hazard as CFCs generally devoid of this activity.

Conclusion – The IRIS RfD is divided by 10 based upon extensive datagaps, including the fact that very little testing has been done via the oral route. This yields **3 mg/kg/d,** which is similar to the value derived by CalEPA.

1,2,4-Trichlorobenzene

Non-cancer –

IRIS RfD (1996): 0.01 mg/kg/d
ATSDR MRL: not available

IRIS RfD based upon the NOAEL for adrenal wt and adrenal histopathological changes in a 2 generation drinking water rat reproduction study. EPA divided the NOAEL by 1000, the std UFs and an extra 10 fold to account for the lack of chronic data.

Cancer –

IRIS (1991): Group D
IARC: Not available
CalEPA (1999): 0.0036/mg/kg/d

IRIS review focused on an equivocal skin painting study from 1982. However, CalEPA identified an industry-sponsored dietary study (CMA, 1994) which showed clear evidence of carcinogenicity in male and female mouse liver, but not in rats. The mouse tumor dose response yielded the slope factor indicated above. Negative in most genetic toxicology studies (CalEPA, PHG, 1999).

Conclusion – Use the CalEPA PHG-based oral slope factor of **0.0036/mg/kg/**d for RSR calculations.

1,1,1-Trichloroethane

Non-cancer –

IRIS RfD (2007): 2 mg/kg/d
ATSDR intermediate oral MRL ( ): 20 mg/kg/d
CalEPA PHG (2006): 0.076 mg/kg/d

IRIS RfD based upon the BMDL for reduced body wt in a 90 dietary study in mice and a 1000 fold cumulative UF. The ATSDR MRL is in agreement with the RfD. CalEPA derived a lower point of departure for setting the PHG, a NOAEL in gerbils for neurotoxicity (neurochemical changes indicative of toxicity to astrocytes in the brain) from a 90 day inhalation study, combined with a 1000 fold UF.

Cancer –

IRIS (2007): Group D
CalEPA (2006): not classifiable

1,1,1-TCA did not induce tumors via inhalation and several oral studies were inadequate in design and execution. 1,1,1-TCA is not likely to be mutagenic or genotoxic based upon a battery of gene tox testing.

Conclusion – Use the CalEPA PHG-based toxicity value of **0.076 mg-kg-d** for RSR calculations. It is quite recent, acknowledges the strengths and weaknesses in the ATSDR and IRIS derivations but chooses a more sensitive endpoint (neurotoxicity) to base its risk assessment. 1,1,1-TCA is known to cause neurotoxicity and so based the RfD on this endpoint rather than on body wt (as in the IRIS RfD) is likely a more sensitive and accurate representation of 1,1,1-TCA toxicology.

Trichloroethylene

Non-cancer – IRIS RfD: not available
USEPA/Internal "E"-based value: 0.0003 mg/kg/d
ATSDR intermediate inhalation MRL (1997): 100 ug/m3
CalEPA REL: 600 ug/m3

USEPA "E"-based value comes from the Agency's 2001 Draft risk assessment in which liver effects were found at a LOAEL of 1 mg/kg/d from subchronic dosing in 2 different species. The Agency applied a 3000 fold cumulative UF to capture the standard uncertainties (animal to human and inter-individual variability) plus factors for LOAEL to NOAEL and subchronic to chronic extrapolation. Finally, an UF was applied to account for the likelihood of cumulative TCE (and toxic metabolite) exposure from background sources.

Cancer – IRIS (1989): withdrawn
USEPA/Internal"E"-based value: 0.4/mg/kg/d
USEPA 2001 Draft RA: "Highly likely" to cause human cancer
Cancer slope factor range provided: 0.02 to 0.4/mg/kg/d
IARC: Group 2A
CalEPA (1990, 2002): 0.013 per mg/kg/d

The USEPA 2001 draft RA yielded a slope factor range of 0.02 to 0.4/mg-kg-d based upon a broad analysis of human and rodent studies, picking the central slope factor estimates to create this range (occupational, residential drinking water, and mouse studies). This range is above USEPA's old value that was never more than provisional (0.011/mg-kg-d) as well as the CalEPA slope factor listed above. CalEPA derived this value in 1990 based upon 4 different mouse studies which provided a potency range of 0.006 to 0.098/mg-kg-d. USEPA, 2001 acknowledges this and states that the use of pharmacokinetic models which express the nonlinearity in TCE metabolism are important to capture the greater percentage of toxic TCE metabolites that occur at low environmental exposures in humans; this is in contrast to the less efficient metabolism at the high doses in TCE animal or human occupational studies. The CalEPA analysis assumed fully efficient and equal metabolism at all doses modeled. USEPA's draft assessment recommends the higher end of the range (0.4/mg-kg-d) when considering sensitive subgroups such as young children, the elderly or diabetics.

The 2001 draft RA has yet to be formalized into an IRIS file although it has undergone two major reviews: 1) USEPA's Scientific Advisory Board, 2002 – agreed with the analysis and RfD and cancer potency values; 2) NAS, 2006 – agreed with USEPA's underlying science and methodology but suggested additional analyses to further explore uncertainties and the range of potential risks. USEPA has yet to complete its follow-up work from the NAS, 2006 report.

Conclusion – Adopt the 2001 USEPA RA as it has been through 2 major reviews with the dose response assessment remaining intact. However, due to the lingering uncertainties and its interim nature, CTDPH adopts the mid-point of the cancer risk range presented in the 2001 draft RA, which is **0.089/mg-kg-d**. This value is below the cancer potency listed on USEPA's Region III Risk-based table but is unlikely to significantly underestimate or overestimate the risk value that is finally derived in the next USEPA risk assessment. This value is within the range of values derived by CalEPA from the 4 mouse studies.

2,4,5-Trichlorophenol

Non-cancer –

IRIS RfD (1988): 0.1 mg/kg/d
ATSDR MRL: not available
CalEPA: not available

IRIS RfD based upon the NOAEL for liver and kidney pathology in rats exposed via diet for 90 days. The NOAEL was divided by 1000 fold to derive the RfD.

Cancer –

IRIS: not available
CalEP: not available

2,4,5-TCP has mixed mutagenicity results (positive in one version of the Ames test, negative in others; positive in chromosomal aberrations) and the genetic toxicology database is very limited for this chemical. It is a close structural analogue of the carcinogen 2,4,6-TCP.

Conclusion – The IRIS RfD is lowered by a 10 fold factor to account for extensive database deficiencies and the potential for 2,4,5-TCP oncogenicity. This yields a value of **0.01 mg/kg/d** for use in RSR calculations.

2,4,6-Trichlorophenol

Non-cancer –

IRIS RfD: not available
USEPA Provisional RfD (Region III RBC Table): 0.001 mg/kg/d
ATSDR MRL: not available
CalEPA: not available

Cancer –

IRIS (1994): B2 – 0.011/mg/kg/d
CalEPA (2002): 0.07/mg/kg/d

2,4,6-TCP induces a variety of tumors in rats and mice with the IRIS slope factor based upon the leukemia response in rats exposed chronically via the feed (NTP, 1979). CalEPA evaluated the same database and developed a higher potency value after including a mouse chronic study by Innes, et al. 1969 in which the dose response for reticulum cell sarcoma yielded the greatest potency. CalEPA's value is the geometric mean of 4 values across the tumor endpoints found in Innes, et al., 1969 and the NTP, 1979.
2,4,6-TCP is positive in the majority of genetic toxicology tests it has been submitted to.

Conclusion – Utilize the CalEPA cancer slope factor (**0.07/mg/kg/d**) as it is the most recent and most thorough review and analysis of the data. The reliance on the geometric mean of 4 tumor endpoints across 2 studies is more inclusive that USEPA's approach for this compound.

Trimethylbenzenes (1,2,4- and 1,3,5-)

Non-cancer –

IRIS RfD: not available
USEPA Provisional RfD for both isomers: 0.05 mg/kg/d
USEPA Provisional RfC for both isomers: 6 ug/m3
Or 0.0017 mg/kg/d based upon dose route extrapolation
ATSDR MRL: not available
CalEPA: not available

USEPA provisional oral toxicity value was established based upon the NOAEL for body wt changes and miscellaneous effects from a 1995 gavage study in rats. The NOAEL was divided by a cumulative UF of 3000. The Provisional RfC is 29 times lower, being based upon a 1958 study of 27 workers who reported symptoms in the 10-60 ppm range. However, this was a mixed exposure environment and USEPA assumed the LOAEL to be at the lower end of the reported concentration range (10 ppm or 49 mg/m3). USEPA applied a 3000 fold UF (10 for variability, 10 for extrapolation from a LOAEL, 3 for subchronic to chronic and 10 for database deficiencies). This appears to be excessive since this appears to be a minimal LOAEL, and the low end of the exposure range is chosen as the point of departure. CTDPH utilizes a 1000 fold UF for this derivation, modifying the RfC to 18 ug/m3 (0.005 mg/kg/d).

Cancer – IRIS: not available
CalEPA: not available

Unlikely to be carcinogenic based upon other alkylbenzenes

Conclusion – Two different toxicity values are needed for TMBs: an oral and an inhalation RfD since the potency appears to differ across dose routes and since RSR calculations for GWPC can involve both inhalation and oral exposure routes. The Provisional oral RfD from USEPA of **0.05 mg/kg/d** should be used for RSR calculations in general and the Provisional USEPA inhalation RfD as modified by CTDPH (**0.005 mg/kg/d**) should be used for pathways involving inhalation exposure. The CTDPH analysis of TMBs is available for review upon request.

Vanadium

Non-cancer –

IRIS RfD: not available
USEPA "E"-based internal RfD: 0.001 mg/kg/d
ATSDR intermediate oral MRL (1993): 0.003 mg/kg/d
CalEPA: not available

The ATSDR intermediate MRL is based upon the NOAEL for mild renal effects in a 3 month drinking water study in rats.

Cancer –

IRIS: not available
CalEP: not available

Vanadium has some indication of positive genotoxicity but has been negative in two oral chronic studies in laboratory animals (ATSDR, 1993).

Conclusion – The USEPA internal RfD is supported by the subchronic MRL as it is 3 times higher. Without further information to go on, the USEPA internal RfD of **0.001 mg/kg/d** is suitable for RSR calculations.

Vinyl Acetate

Non-cancer –

IRIS RfD: not available;
USEPA HEAST RfD: 1.0 mg/kg/d
IRIS RfC: 0.2 mg/m3
ATSDR intermediate inhalation MRL (1992): 0.01 ppm (0.035 mg/m3)
CalEPA: inhalation Reference Exp Level = 0.2 mg/m3

The inhalation toxicity values are based upon several VA rodent inhalation studies in which the primary effect was extrathoracic (nasal) toxicity. The IRIS RfC is based upon a 30 fold cumulative uncertainty factor from a NOAEL for respiratory tract toxicity. Documentation to support the HEAST oral RfD value of 1 mg/kg/d could not be found.

Cancer –

IRIS: not available
CalEPA: not available

IARC (1997) has rated VA as a 2B carcinogen based upon positive test data by inhalation (nasal tumors) in a chronic rat inhalation study and the supporting evidence of in vitro and in vivo genotoxicity (systemic sites from in vivo exposure) and the fact that VA is metabolized to acetaldehyde.

Conclusion – The HEAST RfD is less well supported and documented than the IRIS RfC and so the temptation is to use the RfC and dose route extrapolation to construct the RfD. However, caution is required because the RfC is based upon local effects in the nose and the oral studies available suggest less toxicity than inhalation exposure. Further rationale for relying upon the RfC for criteria is the concern that vinyl acetate is highly volatile and so that any contaminated media will involve both oral and inhalation exposure. Therefore, the USEPA RfC, converted to a mg-kg-d basis (0.057 mg/kg/d) is a reasonable toxicity value. It is noted that the ATSDR subchronic inhalation MRL would yield a considerably lower RfD but the IRIS value is chosen because it is of a similar vintage and supported by the California EPA REL. An additional 3 fold UF is applied to the original 30 fold in the IRIS RfC derivation to yield **0.02 mg/kg/d**. This 3 fold is for potential cancer effects of VA by inhalation exposure as documented by IARC, 1997. This UF is 3 fold and not 10 fold since VA has been shown to be carcinogenic only at contact sites by the inhalation route and only part of the environmental exposure to VA will be by inhalation exposure.